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# WORLD ENVIRONMENT CENTER

## WASTE MINIMIZATION DEMONSTRATION PROJECTS
## RAS "KIVITAR"
## RACKVERE MEAT PROCESSING COMPANY

## WASTE MINIMIZATION IMPACT PROJECTS
## NAKRO TANNERY
## NITROFERT FERTILIZER COMPANY

**JANUARY 16 - 20, 1995**

**World Environment Center**
**419 Park Avenue South, 18th floor**
**New York, N.Y. 10016**

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(2) Files

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Visit Report of James C. Stouch, P.E., Malcolm Pirnie Inc.

# I. INTRODUCTION

## BACKGROUND AND PURPOSE OF TRIP

From January 16 to January 20, 1995 World Environment Center (WEC) personnel and consultants visited Estonia to continue various waste minimization demonstration (WMDP) and waste minimization impact projects (WMIP).

The WEC team for the waste minimization projects was Thomas A. Pluta, Program Manager, WEC and James C. Stouch, P.E., consultant, Malcolm Pirnie, Inc..

This report was prepared by Thomas A. Pluta and includes reports prepared by James C. Stouch.

## II. EXECUTIVE SUMMARY

This report describes the activities of the WEC team of Thomas A. Pluta, WEC Program Manager and James C. Stouch, P.E., Malcolm Pirnie, Inc., which continued the waste minimization demonstration and impact projects in Estonia. A final schedule of the activities was faxed to the USAID Representative on arrival in Estonia.

The two day visit to Nakro Tannery, Narva, was the second trip to follow up on the one day waste minimization training provided by the PPC and local Estonian consultants. More comprehensive training in organizing a Waste Minimization Committee, project selection, and possible equipment selection was provided. Arrangements were completed for the first visit by a U.S. tanning expert in March.

A one day visit to the NitroFert Fertilizer Plant, Kohtla Jarve, was the second visit to discuss preliminary results of the water conservation waste minimization project using the non-contact flowmeter purchased by WEC. Estimated annual savings are $51,000 and more than 270,000 $m^3$ of water based on an investment of about $6000. Additional in-line flowmeters were installed to determine water use by various production units and outside customers. The water conservation program will be extended on a plant-wide basis with the purchase of additional sensors for the flowmeter. Additional projects are being identified including process improvements and fertilizer granulation.

A brief visit was made to RAS "Kiviter" to request additional results information from the retort process optimization project which involved the gas chromatograph purchased by WEC. The unit was just installed and had only been operating for one week. RAS "Kiviter" will prepare a project description for this and other waste minimization projects completed under the WMDP.

A one day follow up visit was made to the Rakvere Meat Plant to monitor progress since the results seminar in May, 1994. Results from the water conservation project and product recovery were reviewed. Initial reductions in water use were significant, but water use levels are increasing, indicating the need for continual emphasis on waste minimization activities with employees. Some progress in recovery of lower value inedible by-products has been made. Recovery of high value consumer meat products has not yet been realized. The company is in the process of privatization which may account for decreased management emphasis on waste minimization. Significant savings potential can be realized with a renewed commitment to waste minimization.

## III. ITINERARY

| | |
|---|---|
| Tuesday, Wednesday<br>January 17-18, 1995 | Nakro Tannery, Narva, Estonia |
| Thursday<br>January 19, 1995 | NitroFert Fertilizer Company<br>Kohtla Jarve, Estonia<br><br>RAS "Kiviter"<br>Kohtla Jarve, Estonia |
| Friday<br>January 20, 1995 | Rakvere Meat Plant<br>Rakvere, Estonia |

**January 17-18, 1995**
**Nakro Tannery, Narva**

Attendees

| | |
|---|---|
| Aleksandr Brokk | Director |
| Galina Krilova | Chief Engineer |
| Aleksander Knjazetski | Chief Power Engineer |
| Ulle Raudmagi | Consultant |
| Tiit Gorelev | Consultant |
| Jaano Ots | Public Relations Consultant |
| Anne Randmer | WEC Coordinator |
| James Stouch, P.E. | Malcolm Pirnie, Inc., Consultant |
| Thomas A. Pluta | WEC Program Manager |

The purpose of this visit was to begin the Waste Minimization Impact Project at Nakro. Nakro previously received some preliminary training by the Estonian consultants in September. The scope and purpose of the program was explained, including the importance of using the local consultants. The plant was toured during which a brief overview of the operations and key areas of concern were discussed. The company appointed a Waste Minimization Committee and identified some initial problem areas to be addressed by the WMIP. These include the following:

- Water conservation
- Chrome use reduction
- Reuse of solid wastes

Other key issues identified by the company were:

- Develop new leather products using wastes, e.g. trimmings, shavings
- Identify new uses for chrome shavings and flesh, e.g. cosmetics, food, agriculture
- Identify new technology for tanning to reduce chrome use
- Identify new raw materials and modernize equipment
- Identify new technology for liming to reduce sulfides
- Develop new treatment protocols and identify associated equipment
- Identify new equipment for liming and hide splitting

The company is in the process of being privatized and is receiving assistance from EBRD consultants on financial and business management practices.

Nakro has been evaluating waste minimization opportunities and has completed a number of initiatives primarily related to recycling of various water and chemical solutions in the process. Some solid wastes are recovered and sold for various purposes including animal feed and wool for yarn.

The questionnaire prepared by Marcel Siegler regarding process and discharge information was reviewed and completed.

Jaano Ots arranged for EESTI - TV in Narva for a taped interview which was aired on the evening news on Tuesday.

Preliminary opportunities for waste minimization noted during the plant tour include operational changes, e.g. "dry" cleanup and water conservation.

Wednesday, January 18, 1995

Attendees

In addition to those listed above, the following participated in a brainstorming session and discussion regarding the waste minimization program at the plant.

| | |
|---|---|
| Helena Arsenyeva | Chief Technologist |
| Larisa Alexandra | Chief, Bating Shop |
| Sergei Chapkin | Chief Liming, Chrome, Tanning Shop |
| Valeri Houstov | Chief Mechanic |
| Ludmilla Smirnova | Engineer Technologist, Water Treatment Plant |

This group constitutes the Waste Minimization Committee. In addition, working teams will be formed in each of the three key areas, Bating, Tanning, and Finish shops. This group was formed overnight by the Director based on our recommendation to expand the committee. The group met early on Wednesday prior to our arrival and was briefed by Ms. Krilova.

The group was instructed on brainstorming techniques and participated in a brainstorming session on how to reduce the use of water in the plant. In a short time they identified 18 possible solutions. Priority setting methods and goal setting were discussed using the options developed by the committee. It was agreed that the WMC will work to reduce water use by 10% over the next two months before the scheduled March visit by volunteer expert, Maurice Siegler. The committee demonstrated a high degree of interest and participation considering their first exposure to the program was less than two hours prior to the session.

The four key steps in implementing a waste minimization program were discussed using the USEPA Waste Minimization Opportunities Manual. A copy was provided with additional copies to be sent for each working group. The preliminary steps to implement the program will follow two tracks, organization and technical activities. Organization measures will include the following:

1. Expansion of the Waste Minimization Committee (completed)
2. Development of a waste minimization policy
3. Development of goals and objectives
4. Orientation of supervisory personnel in each work area.
5. Distribute waste minimization policy to employees

Items 2-5 will be discussed on the return visit of the local Estonian consultants at the end of January.

Technical activities will include the following:

1. Continue brainstorming sessions to develop preliminary project list
2. Identify possible equipment needs and justification

Possible equipment applications include nozzles and spray heads; combination squeegee and spray heads for cleaning; process measurements (COD, pH, sulfides, moisture); and flowmeters.

The overall schedule was discussed including the preparation of a brochure to be used to publicize the waste minimization program to other companies. A copy of the company description and project description formats were left with Nakro. The next plant visit by U.S. tanning expert Marcel Siegler will be from March 27-29, 1995.

The report of James C. Stouch, P.E., Malcolm Pirnie, Inc. is attached as Appendix A.

**Thursday, January 19, 1995**
**NitroFert Fertilizer Company, Kohtla Jarve**

Attendees

| | |
|---|---|
| Ludmilla Mazur | Chief of Technical Department |
| Tonis Puusepp | Chief Technologist |
| Tatyana Person | Translator |

The purpose of this visit was to discuss the status of the WMIP. No Estonian consultants were present. NitroFert personnel indicated that the consultants were providing helpful assistance. They were developing information regarding new emission limits which would apply to NitroFert.

The artesian water conservation project was discussed. The completed project description report was provided to WEC. Water conservation efforts will continue using the portable flowmeter to determine additional water use patterns in order to find leaks in the piping system. Additional water meters have been permanently installed to monitor water use. Savings of $51,000 per year have been confirmed. The meter price was about $6000. The leak detection program will be continued to further reduce water losses. Increasing costs for water will make the savings even more significant in the future. NitroFert requested information about the cost of additional sensors in the 150 to 510 mm range to monitor larger supply lines from lake water sources. Future price differentiation on water supply sources will increase lake water costs.

NitroFert is establishing an incentive program for additional reductions achieved beyond the current level reached by the initial conservation efforts. The water treatment facility which is responsible for the delivery system as well as individual users will be eligible for the incentive program.

The second phase of the WMIP is the gas condensate project. This is a major technology upgrade initiative being pursued with ICI Catalka. Recycling the ammonia gas stream to maintain a proper natural gas steam ration will eliminate the discharge of 300,000 $m^3$ of nitrogen compound contaminated gas condensate. Initial savings estimates were about $300,000 in water purchase and water treatment costs and discharge fees on an investment of about $620,000. This is a 2-3 year project which may be a good candidate for the EAP. The total investment has not been determined pending a review of the ICI proposal.

Another possible project is related to the reduction of urea dust emissions from the granulation tower. Possible suggestions to address the problem included the optimization of process operating conditions through design changes and the use of instrumentation. This project is under study by a university consultant. Possible equipment needs include an infrared analyzer to determine concentration and mass flow information to make necessary operating condition changes. Specific recommendations can be made after the results of the study are completed. WEC will send equipment specifications for review by the company as part of their evaluation. A similar problem was identified in Lithuania at the Achema Fertilizer plant (formerly Azotas). A copy of the Achema report which described possible solutions to the urea dust emission problem was previously provided to NitroFert with Achema's permission.

Several suggestions were made to increase employee awareness about the waste minimization program including additional brainstorming sessions, increasing publicity regarding the success of the water conservation project, developing an expanded incentives program including non-monetary incentives and holding more frequent meetings of the waste minimization committee. NitroFert acknowledged the

value of such efforts and agreed to implement them. A list of additional projects will be sent to WEC including possible equipment needs.

The report of James C. Stouch, P.E., Malcolm Pirnie, Inc. is attached as Appendix A.

**January 19, 1995**
**RAS "Kiviter", Kohtla Jarve**

Attendees

| | |
|---|---|
| Ivar Rooks | Technical Director |
| Rein Rahe | Head, Environmental Department |
| Olga Pallady | Manager, Retort Unit |

This was a brief visit was to determine the status of the waste minimization projects begun under the Waste Minimization Demonstration Project and to discuss the preparation of reports on project results.

The gas chromatograph for the retort optimization project was installed about one week ago. Data will be collected for one month to develop operating parameters for the retort optimization using the retort process control computer. Data will be collected over the next two months to complete some preliminary confirmation of the estimated benefits of the project.

A copy of the project description format was provided with a request to complete one for each of the fourteen projects. The use of the results of the projects to publicize the waste minimization program was explained. Kiviter was requested to return the reports as they are completed.

The benzoic acid plant is being privatized through a joint venture with an American chemical company.

Mr. Pluta briefly met Mr. Juri Soone, Director, regarding the continuation of waste minimization activities in conjunction with the Camp, Dresser, McKee (CDM) project. CDM is providing additional technical assistance and financial and management training based on a scope of work outline developed by a joint USAID/WEC team in January, 1994.

**January 20, 1995**
**Rakvere Meat Plant, Rakvere**

Attendees

| | |
|---|---|
| Heiko Podersalu | Head, Environmental Department |
| Anatoli Obertun | Chief Mechanic, Sausage Department |
| Erik Lipp | Chief, Slaughterhouse |
| Ani Miller | Engineer, Mechanical Repairs (Translator) |

The purpose of the visit was to discuss the status of the Waste Minimization Demonstration Project results and the continuation of waste minimization activities. A brief discussion of the project reports completed and submitted to WEC was followed by a tour of the plant.

The primary waste minimization focus is on water conservation which also included some benefits in reducing the BOD load on the wastewater treatment plant. Some success in recovering lower value inedible by products has been achieved by improved cleanup procedures and process changes. Operational changes in cleaning procedures appear to be well established. However, water use is rising from the low usage level reached in May, 1994. This represented about a 30% reduction from the start of the program in August, 1994.

Employee awareness appears to be diminishing and is likely attributable to not establishing clear goals and regular reporting and publicizing successful results. Management involvement and support is significantly less compared to the beginning of the program, apparently due to ongoing privatization. No senior management representatives were present during the visit. The Waste Minimization Committee has not met in some time and the entire program appears to be the responsibility of the Environmental Coordinator, with some additional involvement from laboratory personnel.

The tour revealed a number of additional waste minimization opportunities including installation of automatic water shutoff valves in several washing steps in the slaughterhouse, increased recovery of sausage mix from transport carts, reduced use of water in cleaning of shovels and squeegees used in "dry" cleanup, and replacement of missing nozzles on hoses. Many of these measures can be addressed by additional supervisor emphasis with employees.

The sewage pre-treatment plant was visited. The plant operator was enthusiastic and knowledgeable in its operation. Some possibilities exist for equipment to monitor operating conditions which would present opportunities to reduce raw material use and increase treatment efficiency.

Subsequent discussion with the attendees resulted in a commitment to prepare the specifications for automatic shutoff valves in the slaughterhouse lines. There are still funds available to purchase equipment which can be justified on the basis of environmental and economic savings and benefits.

Renewed management emphasis to identify additional projects, publicize results, and provide incentives or rewards for employee suggestions would be beneficial. Management emphasis on waste minimization could yield significant savings to the plant, especially in the area of increased recovery of high value products. A renewed commitment by management would be an asset in demonstrating economic benefits to potential buyers.

The report of James C. Stouch, P.E., Malcolm Pirnie, Inc. is attached as Appendix A.

# APPENDIX

REPORT OF JAMES C. STOUCH, P.E.

MALCOLM PIRNIE, INC.

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

February 3, 1995

Mr. Thomas Pluta
World Environment Center
419 Park Avenue South, Suite 1800
New York, NY 10016

Re: Consultant's Report
Waste Minimization Impact Program (WMIP)
Follow Up Visit #2 with Participating Firms in Estonia
January 16 through 20, 1995

The following report summarizes the objectives, activities, conclusions and action items for a follow up visit to three of the Estonian firms participating in the WMIP. These firms are NAKRO (tannery), NITROFERT (nitrogen fertilizer manufacturing), and RAKVERE (meat processing). This is the second consultant follow up visit since the waste minimization workshop was conducted for participating enterprises in May 1994. In addition, a brief meeting was held at the RAS Kiviter (oil shale processing) plant to discuss performance to date of the instrument which was recently installed as part of their Waste Minimization Demonstration Project (WMDP).

**Background**

The World Environment Center (WEC) is a non-advocacy, not for profit organization which has a Cooperative Agreement with the United States Agency for International Development (USAID) to develop and manage Waste Minimization/Pollution Prevention Programs in Central and Eastern Europe.

WEC established the WMIP to set up waste minimization programs in five industrial plants in each of Estonia, Lithuania, Latvia, and 10 plants in Poland. Additional WMIP's are being conducted in the Czech Republic, Slovakia, Hungary, Romania, and Bulgaria. This report focuses on the WMIP in Estonia.

The WMIP in Estonia to date has consisted of an intensive four day waste minimization training workshop in May 1994 for representatives of the participating plants along with in-country consultants plus a refresher and follow up workshop held in August 1994. The participating plants include:

AS NITROFERT - Khotla Jarve, Estonia (nitrogen fertilizer)

TARTU DAIRY - Tartu, Estonia (milk and dairy products)

PARNU MEAT PLANT - Parnu, Estonia (slaughter house and meat processing)

NORMA - Tallinn, Estonia (metal plating)

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NAKRO - Narva, Estonia (tannery)

It should be noted that the POLUMEER plant which participated in the initial workshop has closed the affected section of their plastics operation and has withdrawn their participation. As a result, the NAKRO tannery has been invited and accepted participation in the program. An introductory visit was made to the NAKRO plant during August 1994 to introduce the program to the General Director and obtain a commitment to participate in the program.

The purpose of this visit was to assess the plants' progress with their specific waste minimization projects and provide technical assistance to the enterprises. Each participating enterprise has agreed to implement a waste minimization project(s) and document project justification in terms of economic, operational, and environmental benefits. As part of the WMIP, WEC is providing instrumentation or other devices valued at approximately USD 10,000, where justified, to assist each plant in the implementation of a Waste Minimization Impact Project. A closing workshop will be held at the conclusion of project implementation by the participating plants in order to publicize the waste minimization concept in general and specifically, the accomplishments of the plants involved in the program.

This visit by WEC (Mr. Thomas Pluta) and Malcolm Pirnie (Mr. Jim Stouch) representatives consisted of meetings at the NAKRO, NITROFERT, and RAKVERE plants. The NORMA, TARTU, and PARNU facilities will be visited by separate teams which focus on plating operations, dairies, and meat plants. Following is a summary of the results of the plant visits.

**NAKRO Visit**

A visit was made to the NAKRO plant at Narva, Estonia on 17 and 18 January 1995. Attendees included:

NAKRO
Aleksandr Brokk, Executive Director
Galine Krilova, Chief Engineer
Aleksander Knjazetski, Chief Power Engineer
Helena Arsenyeva, Chief Technologist (p.t.)
Valeri Houstov, Chief Mechanic (p.t.)
Larissa Alexandrova, Chief of Finishing Shop (p.t.)
Ludmilla Smirnova, Engineer Technologist at Wastewater Treatment Plant (p.t.)
Serge Chapkin, Chief of Liming and Tanning Shops (p.t.)

Consultants (Estonia)
Tiit Gorelov
Ulle Raudmagi

WEC
Tom Pluta, Project Director
Jim Stouch, Consultant - Malcolm Pirnie, Inc.
Anne Randmer (p.t.)
Jan Ots (p.t.)

p.t. = part time attendance

Company Background

NAKRO is one of the largest tanneries in the Baltics. They receive hides from throughout the Baltics and from the CIS. Hides are tanned and finished with the leather used primarily for clothing. A process block flow diagram is included as Attachment 1. NAKRO was invited to participate in the WMIP after one of the original companies withdrew due to shutdown of their process line. As a result of the delayed invitation, an abbreviated waste minimization training session was given to the NAKRO key staff by WEC's in-country consultants in October 1994. The objective of this visit was to assess progress since the last meeting, reinforce waste minimization planning concepts, assist with WMIP project definition, and develop a schedule and milestones for the remainder of the program.

Waste Minimization Project Description

NAKRO stated that their objectives for participation in the WMIP were also to obtain information about:

1) New types of leather (less polluting).
2) Using specific wastes (e.g., use of shavings in cosmetics, the food industry, and agriculture).
3) New tanning technologies to minimize chrome content in wastewater, use of new chemicals, and new tanning equipment.
4) New technology to minimize sulfates in wastewater.
5) Upgrading wastewater treatment equipment and instrumentation.
6) New types of flocculants for wastewater treatment.
7) New equipment for the liming shop and more effective operations.
8) Less polluting dyes (they have converted to German supplier (Bayer))

In parallel with the WEC program, NAKRO is working with the European Bank for Reconstruction and Development (EBRD) on business practice and financial reporting assistance programs. These projects will foster future privatization of the enterprise.

T. Pluta reviewed the four primary steps of the waste minimization process and how they specifically related to NAKRO ( organization & planning, assessment, feasibility/evaluation, and implementation). The WEC team was also given a detailed tour of the facility and each process area. Brainstorming was conducted with the Waste Minimization Committee. Membership of the committee was expanded following the first day's meeting with the Executive Director. Shop-specific teams were also established to promote in-plant program implementation. The three shop-specific teams will focus on: 1) the chemical storage and preparation, liming, splitting, tanning, and pressing departments; 2) the finishing,

or "warm shops"; and 3) the wastewater treatment plant. Finally, a program implementation plan was agreed upon among the NAKRO management, WEC U.S. representatives, and the WEC Estonian consultants. T. Pluta and Director Brokk were interviewed by and appeared on the Narva television station's evening news program. The NAKRO/WEC segment lasted between 5 and 10 minutes.

The Waste Minimization Committee was assembled on 18 January. The full committee was comprised of the following people:

Aleksandr Brokk, Executive Director
Galine Krilova, Chief Engineer
Aleksander Knjazetski, Chief Power Engineer
Helena Arsenyeva, Chief Technologist
Valeri Houstov, Chief Mechanic
Larissa Alexandrova, Chief of Finishing Shop
Ludmilla Smirnova, Engineer Technologist at Wastewater Treatment Plant
Serge Chapkin, Chief of Liming and Tanning Shops

Brainstorming was conducted on the topic of water use reduction to: 1) demonstrate the concept to the group for their continued use among themselves as well as with the shop-specific workgroups, and 2) identify a range of water use reduction options. The 20 minute demonstration exercise resulted in 18 water use reduction options (see Attachment 2). The importance of goal-setting was discussed (a 10% water use reduction goal was set) along with the WEC-furnished equipment procurement assistance and the accountability of the committee for project definition and justification (see Attachment 3, Project Justification Plan).

Next steps outlined for the committee included:

- Develop the Waste Minimization Policy statement
- Set waste minimization goals
- Identify a list of waste minimization projects (i.e., water use reduction may only be one of several areas of consideration by the committee)
- Involve workers in the process
- Evaluate the results of the first project(s), set new goals, and repeat the overall process continuously
- Implement and publicize progress measurement and successes.

A meeting was scheduled in two weeks with the WEC in-country consultants to discuss project options and types of equipment for the WMIP. It is understood that equipment information gathering and pricing and final project definition and justification may be an iterative process. However, an initial "stretch goal" for the Waste Minimization Committee was established to identify and justify a piece of equipment or instrument, have WEC order and ship it, and have it installed and running by the time T. Pluta and tannery expert, Mr. Marcel Siegler, visit NAKRO in early April.

Recommendations

The following recommendations were made based on observations made during the plant tour and from the discussions during the visit:

1. Expand the Waste Minimization Committee to include additional representation from various plant operations. (Completed during visit).

2. Observations during plant tour:
   - Use dry clean up or high pressure spray squeegee for floor cleaning around the splitting machine.
   - Improve the effectiveness of the separator pits around dehairing and from the liming effluent for float and solids removal (e.g., larger pits, use of primary and secondary chambers, weirs, etc.).
   - Shut off water valves for water using operations when not in use.
   - Install nozzles on open end hoses.
   - Experiment (include operators) with water volume reduction at the splitting machine.

3. Publicize the Waste Minimization Policy among the workforce.

4. Establish a milestone schedule for the overall Waste Minimization Impact Project (NAKRO TEAM and consultants). The schedule should recognize the following steps:

   . shop-specific program roll out (discussion with employees in the three areas)
   . agree on instrument or project objective
   . ID range of equipment/instrument options
   . define project and justification (economic, environmental, and technical)
   . develop purchase specification for the equipment/instrument
   . develop schedule for equipment purchase, delivery, installation, and start up
   . establish program tracking and results reporting procedures

Action Items

1. WEC expert, Mr. Marcel Siegler is planning to visit NAKRO in early April 1995 in order to provide additional information on new processes being considered by the industry in other locations as well as provide further assistance with project implementation.

2. WEC to provide the Waste Minimization Committee with additional copies of the USEPA Pollution Prevention Manual.
3. Press releases are to be forwarded to Mr. Brokk for review.

4. J. Stouch to provide information regarding spray squeegees to WEC consultants for NAKRO use.

5. NAKRO Waste Minimization Committee to meet to discuss potential projects and, if possible, select an instrument for inclusion in the WMIP.

**AS NITROFERT Visit**

A visit was made to the AS NITROFERT plant at Khotla Jarve, Estonia on 19 January 1995. Meeting attendees included:

NITROFERT
Tonis Puusepp, Technical Director
Ludmilla Mazur, Principal, Technical Dept.

WEC
T. Pluta, Project Director
J. Stouch, Consultant - Malcolm Pirnie, Inc.

Company Background

AS NITROFERT has a total employment of approximately 560 employees and produces ammonia (600 tonnes per day/200,000 TPY) and urea. Approximately 100% of its ammonia production and 80% of its urea production is sold to western customers. The remaining 20% of urea production is sold domestically. The plant is currently running at 95% of capacity. Their key marketing strategy is that they are a reliable supplier, claiming to have had no late shipments and paid no demurrage in the last five years. NITROFERT is 100% owned by the Russian firm, LTG (which also owns 49% of ACHEMA - another WEC program participant - in Lithuania).

Waste Minimization Impact Project Description

Project 1 - Water Use Reduction

NITROFERT began their WMIP activity immediately upon return from the May workshop. They formed their waste minimization committee and published a memo informing all employees of the program. In addition, posters were placed around the plant to promote employee involvement in the waste minimization program and an employee incentive compensation system tied to program success was implemented. The project chosen involved reduction in water usage throughout the plant. This was accomplished by placing water flow recorders at three locations in the plant distribution system, plus purchase through the WEC WMIP of a contactless water meter. Several key results occurred. The first

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is significant water savings. Second, production and resource cost awareness among employees was fostered. And finally, communication has improved among employees.

The plant goal for water conservation is 1% reduction in water usage per month. Steps taken to date include turning off water supply valves during off shifts in areas such as maintenance shops, installing the flow meters, and repairing above ground piping leaks. The results of the project from April through December 1994 are shown in Attachment 4 - Nitrofert Company and Waste minimization Project Description. Water usage has been reduced by 50% with a savings estimated at over $51,000.

The plant has set a goal for an additional 50 % reduction of water use by using the contactless flow meters to isolate underground water line leaks. The 50 % goal was defined by having performed a water balance and calculating the difference between the pumping rate and process consumption. Nitrofert also requested assistance in obtaining an additional flow meter sensor to allow flow measurement in the lake water piping which is 400 - 500 mm dia - beyond the range of the existing sensor. T. Pluta will obtain an updated quote from Controlotron.

Project 2 - Gas Condensate Reuse

Currently approximately 300,000 cu m per year of process gas condensate with high ammonia concentration is discharged to the Gulf of Finland. This was identified as a waste minimization objective in 1994 as a future project once the water use reduction project was underway. Recently, ICI/Catalca has engaged in discussions with Nitrofert regarding process upgrades consisting of a saturator which would combine methane at 380 to 400 C and 30 to 35 atm with the gas condensate to make methane and steam for return to the urea plant. This project would not only eliminate the gas condensate wastewater discharge problem but would also reduce lake water usage (currently at 100,000 cu m per month). Total anticipated savings is 3,000,000 EEK per year with approximately a seven year payback. The project is at the feasibility study stage. T. Pluta mentioned that if financing becomes a key issue in the project moving forward that it may be a candidate for consideration under the Environmental Action Programme (EAP).

Project 3 - Particulate Carryover Reduction from Prilling Tower Operation

Urea dust carryover creates an air emission problem for Nitrofert. This comes as a result of the current prilling tower and centrifuge operation creating too high a fraction of <1mm dia particles at times. The plant has received a proposal to improve the efficiency of the overall operation by adding a screening station to the operation to reduce the amount of fines leaving the process area. For additional process control improvement J. Stouch discussed the application of a scattered light type particle density measuring instrument. An analogous application is in operation at the VISCOSA chemical plant in Hungary, another WEC Waste Minimization Demonstration Project.

Savings/Benefits (Project 1 - Water Use Reduction)

Economic/Operational

- o Savings for the period May, June, July 1994 amounted to EEK 166,363 (USD 13,460). This was broken down as follows: EEK 13,800 (USD 1,117) attributable to Nitrofert operations and EEK 152,563 (USD 12,343) attributable to savings from less water being pumped to the adjacent Kiviter oil shale processing plant.

Environmental

- o Water conservation. During the period May, June, and July 1994, water savings amounted to approximately 19,000 cu m which represents a 13.7% reduction.
- o Wastewater volume reduction. As a result of plant wide water conservation efforts, the total volume of wastewater generated by the plant was also reduced.

Recommendations

1. Nitrofert should publicize the Waste Minimization successes on a monthly basis to employees.
2. Inform employees of goals once established in a clear positive manner (e.g., additional 50% water use reduction and potential gas condensate reuse project).
3. Assemble the Waste Minimization Committee to brainstorm additional opportunities for waste reduction, observing the steps of: identifying the problem, identifying causes, identifying solutions, evaluating the options, selecting the best option, implementing the solution, and continuing this process in an ongoing fashion.

Action Items

1. Nitrofert will assemble the Waste Minimization Committee by the end of January to review the new discharge limits being set by the Environmental Authority and identify additional Waste Minimization Projects. Nitrofert will forward the results of the brainstorming session to WEC (T. Pluta).
2. J. Stouch to forward information to Nitrofert on the scattered light type exhaust gas particle density instrumentation for potential application with the new granulator project.
3. T. Pluta to obtain an updated quote for an additional sensor for the contactless flow meter to permit operation on lake water supply piping which is 400 to 500 mm diameter.

**RAS KIVITER Visit**

T. Pluta and J. Stouch visited RAS Kiviter in Kohtla-Jarve on 20 January. RAS Kiviter processes oil shale for methane and chemical by-product production. The HNu Gas Chromatograph, purchased under the Waste Minimization Demonstration Program was observed in operation. The instrument is being used to measure hydrogen, oxygen, and methane levels in Retort #5. Currently the readings are being recorded on a strip chart and technical staff and operating managers are reviewing the results to gain experience with the instrument and correlation of its output to retort performance. It is planned that in approximately two months, output from the GC will be directly linked with the retort's process control computer. This is expected to lead to improved yield from the retort in that current practice is to retrieve a gas sample once per week for laboratory analysis. The GC takes real time measurements approximately every five minutes.

It was also learned that the Benzoic Acid Plant is being privatized through a joint venture agreement with Velsicol Chemical Corporation of the U.S. We met briefly with Mr. A. N. Scott of Velsicol who was also meeting with Ivar Rooks, Technical Director of Kiviter.

**RAKVERE Visit**

The Rakvere meat processing plant is participating in WEC's Waste Minimization Demonstration Program. The plant is a fully integrated animal staging, slaughtering, cold storage, butchering, and meat processing plant. The normal kill schedule is cattle three days per week and hogs two days per week. The December slaughter included 2,900 head of cattle and 8,800 hogs.

The first visit to Rakvere by a WEC expert occurred in August 1993 and an interim results seminar was held in May 1994. The project involved the purchase and use of a COD meter which was used to measure wastewater COD concentration and identify sources of contamination within the plant. The project was implemented in Rakvere's meat processing and sausage plants. The project proceeded slower than first planned as a result of changes which had to be implemented in their work culture. In addition, other waste minimization opportunities were identified and implemented, including: introduction of dry cleaning; employee training; discharge from the fat separators was given to farmers for pig feed instead of being discharged to the wastewater stream; and a "bird cage" device was introduced for more efficient cleaning of animal internals.

Savings were estimated as follows (based on estimated escalation of water and wastewater costs):

| | 1994 | 1995 |
|---|---|---|
| Water | 1,300,000 EEK | 2,600,000 EEK |
| Wastewater | 1,600,000 EEK | 3,200,000 EEK |
| Product | 32,000,000 EEK | 64,000,000 EEK |
| TOTAL | 34,900,000 EEK | 69,800,000 EEK |

This visit to Rakvere took place on 20 January 1995 and was attended by the following individuals:

RAKVERE
Heiko Podersalu, Environmental Engineer
Ain Niller, Mechanical Equipment Engineer (p.t.)
Anatoli Oberton, Head of Sausage Department Maintenance (p.t.)
Erik Lipp, Supervisor of Slaughter Department (p.t.)

WEC
Tom Pluta, Program Director
Jim Stouch, Malcolm Pirnie, Inc. (consultant)

The primary objective of the visit was to assess the current status of ongoing waste minimization efforts at the Rakvere plant. The waste minimization program is facing several challenges. For example, during the period of WEC's Waste Minimization Demonstration Program (August 1993 through May 1994), water consumption at the plant was reduced by approximately 30% (31 cu m/tonne of live kill weight down to 20 cu m/tonne). However, consumption has been steadily increasing since mid-1994 to within 10% of the May 1993 level to 28 cu m/tonne in December 1994. This upward trend is even more disturbing when rapidly increasing water and sewage rates are factored into the cost impact of the water usage increases.

One of the main reasons for the upward trend is the fact that management has been preoccupied by privatization efforts, thereby overshadowing Mr. Podersalu's efforts at fostering the waste minimization program have been overshadowed. It was apparent from a meeting with several operating and maintenance supervisors that waste minimization was not a priority to them nor was it part of any reward structure within the plant.

Based on the discussions at Rakvere, following is a summary of recommendations and action items for the plant and WEC:

Recommendations:

1. Rakvere should evaluate the use of flow meters in various water using departments to assess where and during what time periods water usage is highest. This will allow both cost identification and in-plant publicity to be more focused as well as the work force can be apprised of their accomplishment and improvements more directly.

2. Focus on SMALL, MANAGEABLE projects first. Examples include repairing leaking valves, identifying running water or overflows which are not essential to the operation or good hygienic practice, and identify additional opportunities for dry cleaning. Use weekly or other periodic "sweep" type inspection tours to identify these opportunities.

3. Waste Minimization projects, starting with the water use reduction project should be publicized throughout the plant. The main bulletin board at the cafeteria is one such place where most employees pass at least once a day. Daily production numbers are also posted at this location. Other locations within individual departments also afford an opportunity to place project results. Employee awareness of the cost of water, the cost of an open hose running for five minutes, and the cost of water use at the Rakvere plant over the last year can comprise one such series of awareness topics presented to employees over several weeks or months. In this way, the plant workforce is empowered with the information that builds awareness about the way in which they can take responsibility for source reduction. Also, senior plant management can be accountable for emphasizing this as a priority for both environmental and economic reasons.

4. H. Podersalu should observe sausage making operations for several days or weeks to assess opportunities for savings from more consistent dry cleaning of bulk sausage meat totes which are used to feed the casing machines. Involve the workforce and supervision in this department in improving the operating practice by providing the employees with the information about savings from every additional kilogram of sausage meat recovered (value of the product plus the value of reduced wastewater treatment cost for BOD). Prepare a WEC Waste Minimization Project Description form and present the results to the General Director.

5. H. Podersalu to investigate why the scald tank in the hog processing line was still full of hot water when it had not operated since the day before and would not operate again until the following week, a period of four to five days.

6. Experiment with water volume and cycle time for rack stick washing. In addition, investigate other configurations of equipment which may more effectively, and with less water, clean the sticks (e.g., a linear spray device instead of the existing tumbler). This is an opportunity to

assemble a team consisting of line workers, cleaning department workers, mechanical engineers, and the hygiene staff to focus on this problem.

Action Items:

1. T. Pluta will send a fax to the Rakvere General Director summarizing our observations regarding the upward trend in water usage, the fact that additional opportunities exist for waste minimization, and emphasizing the economic benefits to the operation and privatization efforts.

2. WEC to consider the possibility of Messrs. Carawan and Denker, WEC meat plant experts, to make a follow up visit in April 1995 to emphasize the additional opportunities for waste minimization.

3. H. Podersalu should present the results of the value of water to the General Director as of May 1993 versus January 1995. Also, the water usage plots and water and sewer cost plots should be presented to the General Director to underscore operating cost increases and the value of cost reduction opportunities.

4. H. Podersalu to prepare a WEC Waste Minimization Project Description form for the manure recovery process in the stomach and intestine processing department. This material is recovered as a technical by-product and given to farmers for fertilizer.

5. H. Podersalu to develop a waste minimization project justification (technical, economic, and environmental) for installation of an automatic carcass spray shut-off on the hog processing line. T. Pluta will have A. Randmer, WEC Country Coordinator, make instrument catalog and Estonian consultant resources available for selection and pricing of photocells, timers, and valves.

6. H. Podersalu to develop a waste minimization project description for the "bird cage" fixture which has reduced the cycle time and the volume of water used to clean digestive organs.

-oOo-

If you have any questions concerning this report or any aspect of this trip, please feel free to call me at (614) 888-4953 at any time.

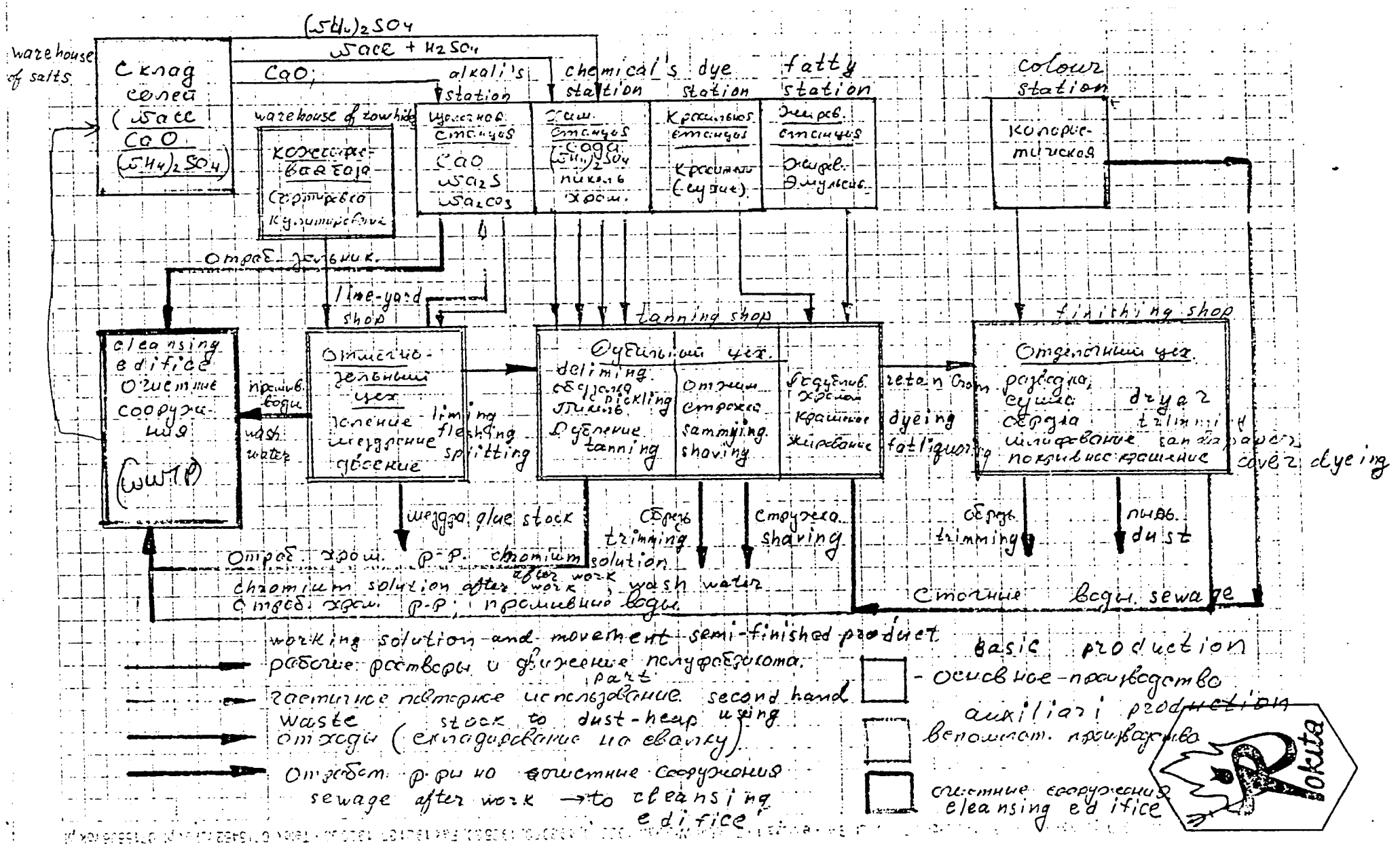
Very truly yours,
MALCOLM PIRNIE, INC.

James C. Stouch, P.E.
Associate

MALCOLM PIRNIE

**ATTACHMENT 1**

**NAKRO - Process Block Flow Diagram**



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**ATTACHMENT 2**

**NAKRO - Results of Brainstorming Demonstration on Water Use Reduction**

MALCOLM PIRNIE

## RESULTS OF NAKRO WASTE MINIMIZATION COMMITTEE BRAINSTORMING DEMONSTRATION

Objective: Reduce factory water usage.

1) Use less water in finishing.

2) Recycle once-through cooling water from compressors.

3) Increase worker awareness of water conservation.

4) Divert rainwater away from wastewater treatment plant (WWTP) for use in the liming plant.

5) Reuse rinse water in local shop (e.g., dye preparation area) rather than sending it to the WWTP.

6) Reduce water usage in fleshing (lower water content in organic waste).

7) Increase use of technical water in place of potable water.

8) Improve the floor cleaning process (use dry or mechanical cleaning and/or chemical additives).

9) Use better nozzles for vat rinsing between process steps.

10) Perform preventive maintenance on valves to reduce leakage.

11) Change water supply pumps (> efficient).

12) Use WWTP effluent for general cleaning purposes.

13) Reduce water usage in toilets (eliminate continuously running water).

14) Reuse liming process water for multiple cycles.

15) Add water meters at each shop and publicize usage to employees.

16) Use technical water instead of potable water for fire water.

17) Acquire new, more efficient filter press for dewatering solid waste.

18) Replace technical water and potable water meters with more accurate instruments.

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**ATTACHMENT 3**

**NAKRO - Project Justification Plan**



RECYCLED PAPER

MALCOLM PIRNIE

## PROJECT JUSTIFICATION PLAN FORMAT

EXECUTIVE SUMMARY (1 paragraph)

Project description (1 sentence each)

Cost

Savings/benefits

Schedule

BACKGROUND (1 - 5 pages)

Current situation

Why do we have to do this project? Describe problems, costs incurred due to the problem,

Process flow diagram

PROJECT DESCRIPTION (details on what described in project summary)

- What is the proposed project? Describe project.
- Describe instrument.
- Problem analysis.
- Details on project cost: instrument, installation labor, other materials necessary. (use tables or figures)
- Project risks: what can go wrong (e.g., unclear data, uncertain subsurface conditions, potential for regulatory changes
- Detailed project schedule

  procurement

  installation

  testing

  start up

  permit submittals

  funding approval

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# ATTACHMENT 4

## NITROFERT - WEC-Estonian Waste Minimization Company Description and Waste Minimization Project Description

# WEC–ESTONIAN WASTE MINIMIZATION COMPANY DESCRIPTION

Company name: AS "Nitrofert"
Date completed: 1994, November

Company Representative and Title: Mrs. Lyudmila Mazur
Principal of Technical Department

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1. " Nitrofert" Joint Stock Company is a property of Russia in the name of RAO "Gazprom" and is located in the territory of Estonia. The company was founded December 1, 1993.

2. AS "Nitrofert" manufactures ammonia, urea, ammonia water, gaseous carbon dioxide, nitrogen, oxygen.

3. Practically all the products manufactured are exported.

4. Number of employees: 560

5. Annual income: USD 30 mln.

6. Since December 1, 1993 newly–formed Technical Department was charged with environmental protection issues.

7. All employees and management in all levels deal in their structural subdivisions with issues of environmental protection.

8. All production personnel follow in their work technological regulations and instructions developed for each working place. In these documents any action of operating personnel is stipulated to provide both safe run of technological process and maintenance works with environmental protection aspects taken into consideration.

9. As soon as "Nitrofert" is quite a newly–developed business, the WEC Project is its first step to minimization of wastes formed.

# WEC–ESTONIAN WASTE MINIMIZATION PROJECT DESCRIPTION

Company name: AS "Nitrofert"

Date completed: 1994, November

Company representative and title: Mrs. Ljudmila Mazur, Principal of Technical Department

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Waste Minimization Project Title: **Reduction of Artesian Water Consumption by AS "Nitrofert" Consumers**

Product(s) Impacted by Waste Minimization Project: Reflects on production cost of ammonia, urea.

Process Description: AS "Nitrofert" owns two artesian water wells. Consumers supplied with artesian water are: Nitrofert's subdivisions, AS "Remex", RAS "Kiviter" subdivisions (See diagram attached). Before introducing waste minimization project artesian water consumption was as high as abt. 80 cu.m per hour.

In April–May 1994 Waste Minimization Commitee was set up and a program was developed for the Ist stage of waste minimization at the AS "Nitrofert" as the result of agreement between WEC, USA, and AS "Nitrofert", Estonia, and under supervision of WEC experts. The program has been planned for half a year period (from May to November). That aimed at reduction in artesian water consumption by both Nitrofert's own users and outside those (AS "Remex" and RAS "Kiviter"). First step planned was installing water meters to all water consumers. Alongside that enormous amount of work has been done to detect and eliminate leakages. Detection of leakages was accompanied with great difficulties for all pipelines are underground. Besides the Committee participants of the Project were consultants appointed by WEC: Mssrs. A. Rätsep, Ü. Kotkas, R. Kuusik. To purchase meters employees from the Supply Dept. were involved, who under consultancy of the Instrumentation Dept. people searched for meters to measure particular water consumption. Management of the Water

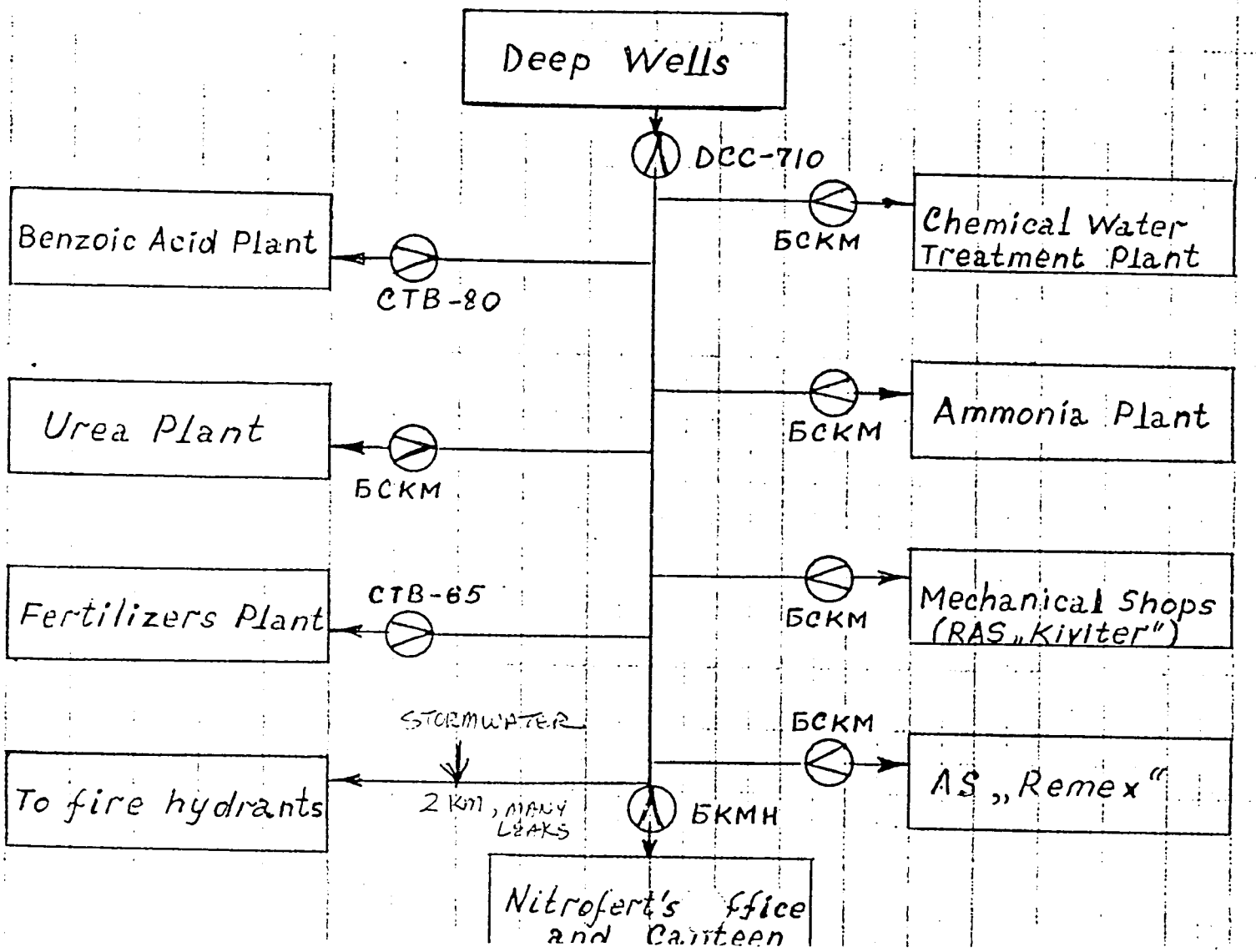
Supply Plant as well as technological and maintenance staff of that actively worked over installation of water meters, over detection and elemination of leakages. Step by step all employees turned to be involved in minimizing artesian water consumption.

As the result artesian water consumption has been reduced by more than 2 fold.

Whereas at the beginning of the Program there was only one water meter to show total consumption of artesian water, to the end of the program measurements were taken at:

| | |
|---|---|
| Benzoic Acid Plant (RAS "Kiviter") | – since May 1994 |
| Mechanical Shops (RAS "Kiviter") | – since June 1994 |
| AS "Remex" | – since October 1994 |
| Chemical Water Treatment Plant (RAS "Kiviter") | – since June 1994 |
| Urea Plant | – since October 1994 |
| Fertilizers Plant | – since October 1994 |
| Ammonia Plant | – since November 1994 |
| Nitrofert's Office and Canteen | – since November 1994 |

# Scheme of artesian water consumption from AS „Nitrofert" deep wells



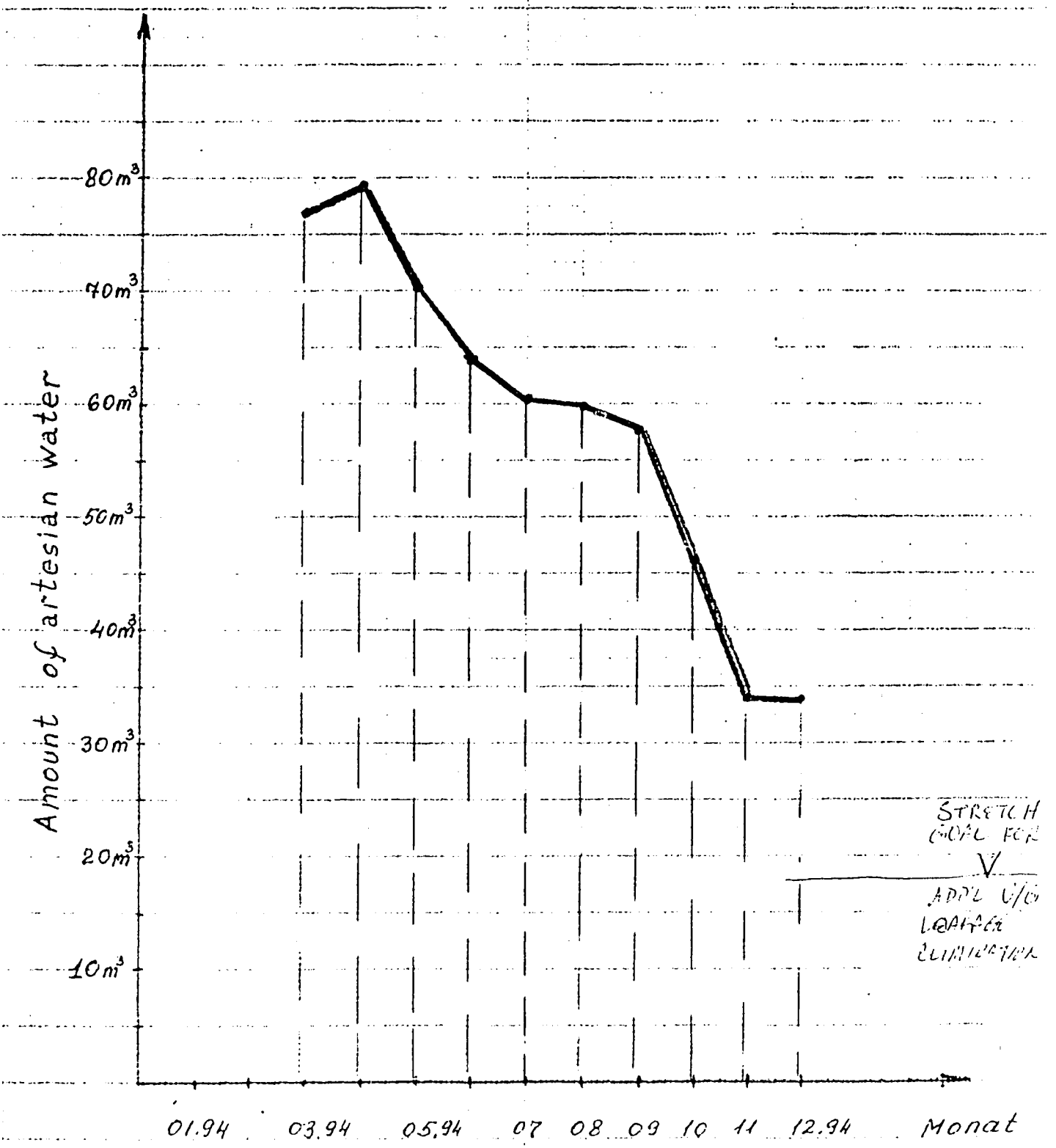



Diagram of reduction in consumption of artesian water

**WEC - Waste Minimization Project Description Worksheet**
**Please Complete for Each Project**

**Company Name:** AS "Nitrofert", Kohtla-Jarve, Estonia

**Date completed:** November 1994

**Company Representative and Title:** Mrs. Lyudmila Mazur, Principal of Technical Dept.

| | | | |
|---|---|---|---|
| 1. Waste Minimization Project Title | REDUCTION OF ARTESIAN WATER CONSUMPTION BY AS "NITROFERT" CONSUMERS | | |
| 2. Waste Minimization Technique* (circle all that apply) | CH (EQ) OP PR PS<br>Other (describe) | | |
| 3. Chemical(s) or Energy Units Effected (use additional sheet if necessary)<br>Role and form of chemical in production process: G = gas, L = liquid, S = solid (circle all that apply) | Chemical Name<br>Raw material G (L) S<br>Product G L S<br>Waste G L S | Chemical Name<br>Raw material G L S<br>Product G L S<br>Waste G L S | Energy Units (check all that apply)<br>Electricity ☐<br>Steam ☐<br>Coal ☐<br>Natural Gas ☐<br>Other (describe) ☐ |
| 4. Quantity of constituent reduced<br>(a) Amount reduced annually as waste | 1 | | |
| (b) Amount of waste reduced per unit of production | - | | |
| (c) Amount reduced annually as raw material or energy<br>artesian water | 272818 cu.m | | |
| (d) Amount of raw material or energy reduced per unit of production | - | | |
| 5. (a) Percent reduction of waste generated | - | | |
| (b) Percent reduction of raw material or energy used | 40 % | | |
| 6. Capital costs for implementation (U.S. dollars) | 800 | | |
| 7. Dollars saved (annually)<br>USD | abt. 51,000. | | |
| 8. Did the product or process yield change due to the activity? (If yes, please give percent change and indicate direction) | 40 %<~~Increased~~ Decreased<br>consumption | % Increased Decreased | |
| 9. How was the minimization project first identified? | Under supervision of WEC, basing on experience of RAS "KIVITER", and assistance of Messrs. Consultants | | |

* CH = chemical substitution, EQ = equipment change, OP = operational change, PR = product change, PS = process change