WORLD ENVIRONMENT CENTER

UKRAINE

WASTE MINIMIZATION/ENERGY CONSERVATION PROGRAM
POLLUTION PREVENTION SEMINARS

AT

Pridniprovsky University in Dnipropetrovsk
By Professor Marvin Fleischman

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

DECEMBER 1998

A

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Participants	Pridniprovsky University and WEC
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B

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TABLE OF CONTENTS

I INTRODUCTION

In September 1995, the World Environment Center (WEC) initiated the program providing technical assistance, training and information dissemination services related to industrial pollution control and energy conservation in Ukraine This activity is performed within the framework of a much broader assistance program to Ukraine funded by the United States Agency for International Development (USAID) and involves a whole spectrum of large-scale issues

WEC's program in Ukraine is implemented in **two stages** as follows

Stage I - Demonstration Program This stage includes a number of Waste Minimization/Energy Conservation Demonstration Projects (WM/ECDP) implemented at various large industrial plants The main goal of this stage is to demonstrate the beneficial aspects of a Waste Minimization/Energy Conservation Program The intent is, among other things, to show that pollution prevention and energy conservation programs are not just additional expenses, but are essential to improving *production efficiency* and subsequently increase *profitability* of the enterprises A number of demonstration projects were established at selected plants in the Dnipropetrovsk, Donetsk and Lviv regions Most of them are already completed, others are nearing completion

Stage II - Impact Program The intent of this stage is to *disseminate to a much wider audience* energy conservation and waste minimization concepts, and the benefits resulting therefrom To maximize the impact of the demonstration phase, seminars, workshops and study tours in the U S were held for plant managers from major industrial enterprises

In addition, to further publicize the concept of waste minimization and energy conservation, but this time among establishments of higher education, WEC has organized a series of seminars at the Pridniprovsky University in Dnipropetrovsk At the seminars, which took place from October 23 through October 29, Professor Marvin Fleischman presented to the faculty and students from various universities a Pollution Prevention-Waste Minimization-Energy Conservation Program as is being taught at the University of Louisville in the United States

The direct goal of the seminars was to assist universities in the possible modification of their environmental teaching curriculum by adapting some ideas from U S experiences, which can be useful and/or compatible with conditions in Ukraine All seminars were well attended and received good publicity which, among other indications, was reflected by the programs presented on local television A written account from the seminars is provided in Professor Marvin Fleischman's attached report

Acknowledgement

WEC wishes to express its sincere appreciation to Professor Marvin Fleischman, who undertook this task "pro-bono," and made a valuable contribution to the USAID-sponsored technical assistance program for Ukraine His efforts are once more appreciated and acknowledged

Also, we would like to convey our gratitude to Professors Michaylo V Burmistre and Boris G Milnyk, from Dnipropetrovsk State University, for their sincere interest and commendable cooperation, as well as the courtesy and hospitality extended to WEC's team during their visit

2

II. Report of Professor Marvin Fleishman

(Eight Pages)

Visit to Pridneprosky University to Present and Discuss Pollution Prevention/Waste Minimization/Energy Conservation As Part of the Curriculum

by

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Summary

Seminars were presented to faculty and students in various technical institutes of Pridneprosky University, on incorporating pollution prevention/waste minimization/energy conservation (P2/WM/EC) into science and engineering curricula, using the program at the University of Louisville somewhat as a model The audience consisted of Professors, Associate Professors, Deputy Rectors, and students from the Chemical Technological University, Medical Academy, Mining Academy, State University, Transportation University, Agrarian University, Academy of Civil Engineering & Architecture, Metallurgical Academy Various resource materials were left in the Ukraine, for use by the participants

The seminar topics included University of Louisville courses that involve P2, the Industrial Assessment Center, Definitions of waste and P2, Assessment methodology, Interactions of P2 with energy, safety, and health, Economics and benefits of P2, Industrial ecology, Role of regulations, and Barriers to P2 Examples and simple demonstrations were presented A seminar was also given to a management class at Pridneprosky State University

Questions from the participants, the lecturer's responses, viewpoints of the status of P2 in the Ukraine, and recommendations are presented There is strong concern over environmental health, remediation, industry caused pollution worker protection, and P2/"Clean technology" However, there seems to be insufficient understanding or appreciation of the differences between P2/WM and waste management, "end of pipe" waste treatment, pollution control, and waste disposal

Introduction

The U S E P A and industry view P2/WM/EC as the preferred method of managing wastes and pollution All engineers (and many other professions), particularly environmental and chemical engineers, should be educated in these concepts and applications These concepts are front end rather than the usual "end of pipe" approach to waste management pollution treatment and control, and disposal As such, P2 must be incorporated into all

aspects of product life cycle, including process and product design manufacturing, management, and the regulatory process This entire package is sometimes referred to as "cleaner production" What better way to start the inclusion process for stewardship of current and future worker, public, and environmental safety and health, than to expose faculty who in turn can appropriately educate their students

Inclusion in universities of P2/WM/EC, safety and health, and productivity concepts and practices has generally not been initiated in former Soviet nations such as the Ukraine Such inclusion has been underway for several years in many U S engineering colleges For example, at the University of Louisville chemical engineering students are exposed to risk reduction (pollution prevention/waste minimization, safety and health), energy conservation and productivity concepts and practices through elective courses, inclusion in the core curriculum, and participation in the US Department of Energy funded Industrial Assessment Center (IAC)

The IAC provides free engineering faculty-student team based energy, waste, and productivity assessments for small to medium size manufacturers This "hands on" experience is an excellent complement to course work, in training future engineers in pollution prevention and to simultaneously interact with and help industry Engineering students also do full time environmental cooperative internships in industry, government agencies, and with the Kentucky Pollution Prevention Center, where they can also work part time during the school year

Thus, based on this experience it was proposed that the consultant visit the Pridneprovsky Scientific Center, Institute of Nature Management Problems to present and discuss the above concepts with professors and students This would hopefully initiate, develop, and expand inclusion of P2/WM/EC in the curriculum i e , stand-alone courses, existing environmental courses, core engineering courses, and an interactive program with industry such as the IAC

Activities Prior to Visit

Syllabi for the following courses for students of "Chemical Technology and Engineering", major 7 091611 "Industrial Ecology and Environment Protection "were reviewed prior to the visit

- The Soil Science and Reclamation of Land
- Theoretical Foundations of the Environmental Protection
- Ecological Mentality
- Environment Monitoring
- Purification and Recuperation of Industrial Wastes
- Structure and Activity of International Ecological Organizations
- Water Basin Protection
- Air Basin Protection

5

The above syllabi indicate much greater use of the traditional approach to environmental engineering curricula traditionally associated with U S Civil & Environmental Engineering programs, rather than the Chemical Engineering or process oriented approach Based on this material, little or no P2/WM/EC is evident in the curriculum The courses are generally media specific, e g , soil, air, water, and not multi-media, a basic parameter in P2/WM Such courses focus primarily on "end of pipe" treatment, pollution control, disposal, or waste management in general Neither process not product design (e g , design for disposability, reusability, etc), primary areas for P2/WM, seem to be addressed in the courses

Only one course, "Purification and Recuperation of Industrial Wastes" deals with industrial wastes, and this primarily covers only recycling Otherwise, the courses do not address P2/WM concepts and applications P2/WM concepts and technology could easily be incorporated in these existing environmental courses For example

- Water conservation, reuse, wastewater reduction, and recovery of materials from wastewater in "Water Basin Protection" and "Purification and Recuperation of Industrial Wastes"
- Elimination and/or recovery of volatile organic carbons, ozone depleting compounds, global warmers, in "Air Basin Protection" (along with describing the waste generating processes)
- Regulations, Policies, P2 planning & programs, Industrial Ecology, Life Cycle Assessment, Source reduction, and Toxics Use Reduction/Elimination in "Theoretical Foundations of the Environmental Protection" and "Ecological Mentality"

Activities While in the Ukraine

Five seminars lasting from 2 to 2 5 hours each, were given on 10/24, 26, 27, 28, and 29 **Appendix I** is a summary of the seminars The audience consisted of Professors, Associate Professors, Deputy Rectors, and students from the Chemical Technological University, Medical Academy, Mining Academy, State University, Transportation University, Agrarian University Academy of Civil Engineering & Architecture, Metallurgical Academy A partial list of attendees is given in **Appendix II**

Appendix III is a detailed list of resource materials left in Ukraine for use by the participants These materials cover

- Industrial Assessment Center at the University of Louisville
- Syllabi and course resource materials for the following University of Louisville-courses Safety and Health ', "Industrial Waste Management", and "Pollution Prevention/Waste Minimization"
- Other **resource materials** for teaching P2/WM in stand alone courses or inclusion in core courses
- Waste, energy and productivity assessment procedures
- EPA research briefs on waste minimization assessments

In retrospect, it would have been preferable to provide as much of this information as available on computer diskette This would facilitate dissemination of information amongst participants

Interfaces between P2/WM and productivity, energy, and safety and health were described The primary motivation for P2 was presented as generally being regulatory compliance with motivation for P2 beyond compliance being financial savings or improved productivity Benefits beyond economics were also pointed out Some emphasis was given to simple things such as first improving housekeeping, because a clean and safe plant will improve worker morale and productivity Worker cooperation can go a long way towards reducing waste

It was pointed out that "cleaner production" may not now be realistic in the Ukraine because it is most easily applicable to new plants However, it is doubtful that many new plants will be built in the Ukraine in the near future because of much excess production capacity in many old plants Waste minimization to clean up existing plants seems more appropriate for the current situation in the Ukraine However, "cleaner production" should certainly be taught for future growth and development

One interesting situation that occurred pointed out an area where the Ukraine may be ahead of the US environmentally Not accepting a bag for purchase of a small item such as a candy bar, was given as an example of eliminating an unnecessary waste, e g packaging However, I was not aware that most items purchased in Ukraine are usually not wrapped, e g loaf of bread However, this situation seems to be changing as more westernized stores open

Audience questions and comments, with some of my responses, are summarized below These seem to express some of the concerns of ecology faculty in the Ukraine

- *Inclusion of industrial hygiene and environmental health in the courses and IAC assessments?*
  Yes in "Safety, Health, and Environment" and to a limited extent in "Pollution Prevention" No in IAC assessments, but worker safety and occupational exposure should be included
- *Source of funding for IAC?* (US government), *Cost to client plants* (Free) *Do plants being assessed return part of savings to IAC?* (No) *Do students pay?*(No students get paid and they can use the assessments for their Master's thesis), *Confidentiality of reports?* (Reports do not include anything client doesn't want in report Reports are not made public)
- *Status of clean technology in United States?*
  Emerging, particularly in new plants Focus is on eliminating and reducing toxics and hazardous materials Must be some waste or by-product generation according to second law of thermodynamics
- *How and to what extent is clean technology taught in the US?*
  Emerging effort in United States with new courses and textbooks recently being

initiated and developed Most such courses are currently electives in chemical engineering Clean technology is incorporated into required plant and process design courses Also, in chemical engineering, new separation methods and pinch technology is covered in mass transfer, separations and reactor design courses Considerable research being done in US universities on clean technologies, e g , catalyst design, combined reactor-separators *(See comments below on Prof Zadorsky's work)*

- *How is environmental protection accomplished in the US?* Regulations, fines, penalties, jail sentences, incentives, government assistance, govt - industry partnerships, industry programs such as the Chemical Manufacturer's Responsible Care Program, newspaper coverage, and public awareness and pressure
- *How can this be applied to the Ukraine?* (There seemed to be fear of having to shut down a plant, which would be considered undesirable possibly because of the poor economy) Greater enforcement of regulations, Governmental technical and financial assistance, More interactions/partnerships between industry and government, More public awareness & pressure

Three professors gave me copies of papers describing their interests These are listed in **Appendix IV**, and copies will be provided under separate cover Dr Zadorsky's work is particularly relevant because he really seems to understand and appreciate pollution prevention and cleaner production Some of his research projects mirror important P2/clean technology research being done in the US, namely joint reaction-separation processes, separations and mass transfer, and catalyst design

Discussion and Conclusions

Other than some course descriptions, I didn't have a clear picture of who my audience would be before and during the visit, e g , what institutes would be represented, what the curricula were like It would have been helpful to know what courses the students take in traditional engineering areas, e g , chemical engineering Thus, I tried to make my presentations as general as possible However, some of my presentation may have been clearer or more meaningful to those with a chemical engineering background

Based on my experience, my examples were generally limited to small to medium size industries rather than the large plants common to Ukraine Some of the example industries e g printing, industrial laundries, may not be very common there Thus, generalized concepts that would be common to most plants, regardless of product or size, were emphasized

Generally, the audience appeared to be receptive to my presentations, though translators who are conversant with technical terminology would be highly desirable for future such presentations There appears to be a fertile field for interaction between US scientists and engineers (academic government, and industry) environmental planners and regulators and their Ukrainian counterparts There could be great benefit from student and faculty exchanges between the US and Ukraine To further inclusion of P2 in Ukrainian academic programs, teaching materials are definitely needed and US resources would probably have to

be translated into Ukrainian or Russian Perhaps the faculty could also be encouraged to use transparencies in their lectures This doesn't seem to be widely done in the Ukraine, and favorable comments were received on my use of transparencies

Based on the questions asked and brief conversations **my general impressions of the situation and attitude in the Ukraine towards P2 is**

- Definite concern over environmental health, remediation, industry caused pollution, and worker protection
- Insufficient understanding or appreciation of difference between P2/WM and waste management, "end of pipe" waste treatment, pollution control, and waste disposal
- They want to focus on wastes from specialized industries and may not sufficiently appreciate and understand well enough the broad nature and common applicability of P2/WM approaches to many wastes in many different industries
- It might be difficult to get government funding for an IAC type program
- There seems to be more interest in environmental policy than environmental engineering

Future efforts should include helping the professors to become part of the international P2 sustainable development information network They need to be aware of and have access to newsletters, other publications, videotapes, and computer based resources such as list serves, (e g , p2tech, sewerlist), the many web sites, (e g , Envirosense, Pollution On-line Manufacturer's Marketplace), and simulation tools Additional visits could involve

- Meeting with faculty to review current programs, curriculum, and courses, objectives, etc with emphasis on chemical and environmental engineering
- Sitting in on classes to view how courses are taught

Marvin Fleischman
11/6/1998

Summary of Lectures

A) Lecture 1

- **Purposes of the visit** - Initiate incorporation of P2/WM/EC into engineering and ecological curricula, Orient faculty and students towards P2/WM/EC, Familiarize faculty with some of the resource materials that would be left at the university, Focus on broad, general aspects of P2/WM/EC applicable and common to many industries, rather than focus on specialized industries
- **Background** of lecturer in P2/WM/EC
- **Overview** of P2/WM/EC program at the University of Louisville -
  Courses *"Safety, Health, and Environment"* - 1 semester credit required chemical engineering course, taught at sophomore/junior level, *"Industrial Waste Management"* - 3 semester crs, senior-first year graduate level elective, co-taught between Chemical and Civil Engineering , *"Pollution Prevention"* - 3 sem crs , senior-first year graduate level elective, taken by Chemical, Civil, and Industrial Engineering students
  Industrial Assessment Center - Waste, energy, and productivity assessments at small to medium size manufacturers using engineering faculty-student teams, Free service funded by U S Department of Energy
- **Industrial Assessment Center** - Pointed out both technical and non-technical (management, financial, purchasing, etc) aspects of P2/WM/EC, Emphasized benefits to students and faculty of broad exposure to many different industries and both chemical and non-chemical manufacturing operations, and multi-disciplinary approach using team of chemical, mechanical, and industrial engineers

B) Lecture 2

- Reviewed previous day's lecture to give perspective to those not present at previous presentation
- Definitions and examples of waste to include hazardous and non-hazardous wastes solid wastes, wastewaters, and air emissions, and process, ancillary, and intermediate wastes
- Recommended hierarchy of waste management
- Broad definition of P2 in terms of material utilization and product yield, and productivity, Definitions of source reduction, reuse, recycling, recovery
- Waste minimization assessment methodology
- Interactions of P2 with worker and plant safety and health
- Interactions of P2 with energy conservation
- Examples (emphasis on savings) - Separate sewer meter for wastewater disposal charges to sewer, Blue jeans pre-washing plant - Rinse water reuse, Reduction of solids loading in wastewater and reduction of surcharges from sewer company

C) Lecture 3

- Review of previous lectures
- P2 examples from IAC assessments, with emphasis on potential savings
  + Reduction of chemical losses in blue jeans pre-washing plant
  + Reduction of packaging waste in blue jeans pre-washing plant
  + Removal of foreign objects prior to washing in an industrial laundry
  + **Lithographic printer** Greater utilization of ink from cans, Waste ink recycling, Paper wastes, Solvent recovery from shop towels, Reduction of waste ink volume by evaporation
- Types & levels of economic and other benefits
- Barriers to P2, e g , worker & management resistance, financial limitations, loss of production during testing and startup, heavy production schedules
- Role of cleaner production – new plants vs existing, old plants

D) Lecture 4

- Reviewed previous lectures
- Different levels of assessments
- Integrated productivity, waste, & energy assessments
- Syllabus – "Safety, Health, & Environment" course including demonstration of "Waste Ratio" homework assignment
- Syllabus – "Pollution Prevention" course including sample homework problems, life cycle assessment, and industrial ecology (cascading wastes for lower value uses in a closed loop integrated system)

E) Lecture 5

- Reviewed previous lectures
- Syllabus – "Pollution Prevention" course (continued) Class assessment project, Sample assignments – Wastewater reuse and sewer surcharge reductions, Metal recovery from plating rinsewater
- Simple demonstration of product design for reuseablility, recyclability, Barriers in recycling
- Simple demonstration of improved operating procedures for reducing solid waste, greater product recovery, reduced water consumption, and reuse

III. Appendices

Appendix A

List of Attendees
(Eight Pages)

SATURDAY, October, 24
Professors, Associated Professors, Deputy Rectors
that were present at the Meeting with Prof Marvin Fleischman

1 B I Melnikov-	Chemical-Technological University
2 E A Derkatchev-	Medical Academy
3 G A Miroshnik-	Mining Academy
4 W M Zadorsky-	Chemical-Technological University
5 S P Fomin-	State University
6 V N Plakhotnik	Transport University
7 A V Fedin	Transport University
8 V M Nabivatch-	Chemical-Technological University
9 N N Kharitonov-	Agrarian University
10 L F Checanov-	Academy of Architecture and Construction

Monday, October, 26

LIST

of students and Professors' staff present at the Lecture, delivered by Professor Marvin Fleischman at the Chemical-Technological University

1 Inna Belaya - a Teacher of English- Chemical-Technological University
2 Heken Zhura - a student - Transport University
3 Olga Kravtchenko- a Teacher - Academy of Architecture and Construction
4 Alla Korableva- a Teacher - Academy of Architecture and Construction
5 Lev Gerbilsky- a Professor-International Society of Doctors for Environment Medical Academy
6 Sergey Fomin- a Professor- State University
7 Vitaly Bobylev-Head of the Chair of Engineering Ecology-Metallurgical Academy
8 Yana Stovba- a teacher- Chair of Engineering Ecology-Metallurgical Academy
9 Valery Bykov- a student of ecology - Metallurgical Academy
10 Natalia Cherneta- a student of ecology - Metallurgical Academy
11 Olga Guschina - a student of ecology - Metallurgical Academy
12 Sergey Kravtsov- a student of ecology - Metallurgical Academy
13 Dmitry Korostylev- a student of ecology - Metallurgical Academy
14 Maria Otchich- a student of ecology - Metallurgical Academy
15 Eugeny Bezrukavy- a student of ecology - Metallurgical Academy
16 Eduard Derkatchov- Head of Chair-Hygiene and Ecology-Medical Academy
17 Alexander Shevtchenko- a Teacher- Hygiene and Ecology-Medical Academy
18 Yaroslava Solovieva- a student of ecology-Chem -Technological University
19 Yana Stepash- a student of ecology-Chem -Technological University
20 Oksana Lovinova- a student of ecology-Chem -Technological University
21 Helen Nikishkina- a student of ecology-Chem -Technological University
22 Olga Zhuravel- a student of ecology-Chem -Technological University
23 Roman Lyashenko-a student of ecology-Mining Academy
24 Anna Baranova- a student of ecology-Mining Academy
25 Victoria Vorobiova- a student of ecology-Mining Academy
26 Slava Muzhailo- a student of ecology-Mining Academy
27 Yury Savitskas - a student of ecology-Mining Academy
28 Roman Krasnov- a student of ecology-Mining Academy
29 Kiril Malinin- a student of ecology-Mining Academy
30 Antonina Stelmakh- a student of ecology-Mining Academy
31 Vasily Malashkov- a student of ecology-Mining Academy
32 Oleg Gushenyuk - a student of ecology-Mining Academy
33 Egor Kamissarov- a student of ecology-Mining Academy
34 Alina Rybak - a student of ecology-Mining Academy

15

35 Nikolay Kutsher - a student of ecology-Mining Academy
36 Seymur Babayev- a student of ecology-Mining Academy
37 Viktor Mikurin - a student of ecology-Mining Academy
38 Sergey Knuazev - a student of ecology-Mining Academy
39 Vladimir Oleshko- a student of ecology-Mining Academy
40 Andrey Moskalenko- a student of ecology-Mining Academy
41 Nikolay Kharitonov- Associated Professor- Agrarian University

Tuesday, October, 27

LIST

of students and Professors staff presented at the Lecture delivered by Professor Marvin Fleischman at the Chemical-Technological University

1 Oksana Tkachenko
2 Lyudmila Krasyuk
3 Eugeny Kobelan
4 Antonina Razbegayeva
5 Yulia Osikova
6 Viktoria Tchub
7 Natalia Ryzhko
8 Tatiana Gayduk
9 Yekaterina Otradnova
10 Anna Pyrlik
11 Oksana Koptilaya
12 Igor Tutin
13 Oksana Kobzar
14 Tatiana Boyko
15 Alexander Levushkin
16 Andrey Kornev
17 Natalia Tomilo
18 Valentina Chepikova
19 Ilya Irayko
20 Alina Volkova

----students-ecologist of the Chemical-Technological University

21 Vera Sogolayeva
22 Natalia Rulikova
23 Olga Tcherkay
24 Anna Matyushina
25 Irina Todorova
26 Irina Stepanova
27 Oksana Tselovalnikova
28 Yekaterina Shiposha
29 Sergey Teslenko
30 Yulia Kislyuk
31 Lyuda Voronko

---->students-ecologists of the Metallurgical Academy

32 Sergey Kryshin- a teacher of engineering ecology- Metallurgical Academy
33 Yelena Kotlyarova-
34 Yana Lesnova- -
35 Sabina Varyanitsa
36 Irina Shemetun--
37 Anna Kostromina

}students-ecologists - Metallurgical Academy

19

38 Olga Vovk
39 Anna Prokopchuk } students-ecologists - Metallurgical Academy
40 Tatiana Kapitskaya

41 Vladimir Dovgal- associated professor - State University
42 Oksana Nemchenko
43 Viktoria Kopeyko----------students-ecologists of State University
44 Dmitry Fedin
45 Alexander Peretyatko

Wednesday, October, 28

LIST

of students and Professors' staff presented at the Lecture, delivered by Professor Marvin Fleischman at the Chemical-Technological University

1 Oksana Kobzar
2 Maria Trayko
3 Pavel Gonchar
4 Andrey Korpach
5 Iliya Voloshko
6 Alexander Levushkin
7 Ivan Omelchenko
8 Igor Putin
9 Yury Vironkin
10 Yelena Shevchenko
11 Viktoria Kostyuk
12 Tatiana Gaydul
13 Natalia Ryzhko—students-ecologists - Chemical-Technological University
14 Yekaterina Otradnova
15 Anna Pyrlik
16 Lyudmila Krasyuk
17 Natalia Tomilo
18 Valentina Chepikova
19 Eugenia Kobelan
20 Svetlana Ivanova
21 Tatiana Misyura
22 Irina Mamza
23 Yelena Klass
24 Artem Pavlov
25 Alina Volkova
26 Oksana Koptilaya

27 Inna Revina—post-graduate student - Transport University
28 Yelena Zolotko- associated Professor - State University_____ _____ _____
29 Anna Denshova- - a student-ecologist of State University
30 Dmitry Fedin- a student-ecologist of State University _____ _____ _____
31 Yulia Korsunskaya
32 Olga Melyus
33 Lika Gvozdok- students-ecologists - Chemical-Technological University
34 Tatiana Sheparneva
35 Anna Grishina
36 Alexey Tchebotarev_____ _____ _____ _____ _____ _____
37 V A Dolinsky- a professor of the Mining Academy
38 Vladimir Bondik
39 Valentina Gruntovaya
40 Tatiana Babitcheva - students-ecologists - Mining University
41 Victoria Popova
42 Yelena Konopleva
43 Nina Naydenova_____ _____ _____ _____ _____ _____ _
44 Lev Gerbilsky- a Professor - Medical Academy
45 V V Manyuk - associated professor - Mining Academy_ _____ _____ _
46 Michail Svitlykh
47 Alexander Serbinov
48 A N Kuvotchka
49 Sergey Iotov - students-ecologists - Agrarian University
50 Cvetlata Vakulenko
51 Vladimir Gnun
52 Olga Tebedeva
53 Natalia Garkusha
54 Natalia Magda
55 Nikolay Kharitonov - associated professor - Agrarian University_ _____ _____

Thursday, October, 29

LIST

of students and Professors staff presented at the Lecture, delivered by Professor Marvin Fleischman at the Chemical-Technological University

1 Victoria Chub
2 Antonina Razbegayeva
3 Tatiana Shepmeva- students-ecologists -Chemical-Technological University
4 Anna Grishina
5 Tatiana Bondarenko

6 Yulia Dudka
7 Pavel Gonchar
8 Andtrey Kerkich
9 Iliya Trayko
10 Alina Volkova
11 Igor Lutin
12 Oksana Koptilaya
13 Natalia Ryzhko
14 Tatiana Gayduk
15 Yekaterina Otradnova
16 Anna Pyrlik
17 Oksana Kobzar - students-ecologists - Chemical-Technological University
18 Alexander Levushkin
19 Iliya Voloshko
20 Nataliya Tomilo
21 Valentina Chepikova
22 Victoria Bizhko
23 Tatiana Boiko
24 Natalia Sycheva
25 Tatiana Misyura
26 Irina Lamza
27 Yelena Klass
28 Anna Reut
29 Alexey Chebotarev
30 A X Drabkina - associated professor - Transport University
31 Vladimir Bobrovsky
32 Victor Mischuk
33 Dmitry Fedin
34 Oksana Nemchenko- students-ecologists - State University
35 Marina Tchetverikova
36 Irina Gretskaya
37 Alexander Lednitsky
38 B I Dovgal - associated professor - State University
39 Yelena Zolotko - associated professor - State University
40 [illegible] - Transport University
41 Alexander Kropivko
42 Andrey Naumenko- students-ecologists - Mining University
43 Evgeniia Kobelan
44 Lyudmila Krasyuk
45 Lev Gerbilsky - a professor - Medical Academy
46 Gennady Bondar - scientific-engineer - Mining Academy
47 Olga Kravchenko - teacher - Building Academy

70

48 Yulia Korsunskaya
49 Olga Melyus
50 Olga Serebryanskaya } students-ecologists - Chemical-Technological University
51 Lilia Gvozdok
52 Yelena Shevchenko
53 Victoria Kostyuk

21

Appendix B

Materials Sent in Advance of Visit

(Four Pages)

Appendix B

Materials sent in advance of anticipated visit to the Pridneprovskly Scientific Center, Dnipropetrovsk, Ukraine

- University of Louisville Undergraduate and Graduate Catalogs
- Co-operative internship program
- Industrial Assessment Center
  - + Descriptive brochure, flyer
  - + Pre-site waste assessment questionnaire
  - + Energy audit information outline
  - + Productivity manual - Table of contents, Productivity Toolbox Introduction, Productivity Questionairre, Enhancing Productivity - General Considerations
  - + Sample Report
  - + EPA Environmental Research Briefs based on UL assessments Bourbon distilleries, Steel Fabricator, and Manufacture of Automotive Battery Separators, Paints & Coatings, Automotive Lighting Equipment & Accessories, Rotogravure Printing Cylinders (2), Iron Castings & Fabricated Sheet Metal Parts,
  - + EPA conference proceedings and other publications based on the UL-IAC programs and assessments, e g , Assessments at industrial laundries, printers, and smokeless Tobacco Products Manufacturer", "Learning by Doing U-Louisville's Waste Minimization Assessment Center", Chapter One (AICHE), 6 (1), pp 59-63, Winter 1991/92
- Slides and overheads* related to classroom lectures, Description of IAC, and assessments for use in presentations/seminars at the Institute
- My publications on incorporating p2/wm, safety & health, or more broadly, risk reduction, into the engineering (chemical) curriculum
  - + "Assessment Based Pollution Prevention Problems", 1994 ASEE Ann Conf Proc , Session 3513, Edmonton, AL, Can
  - + Risk Reduction Engineering in the Chemical Engineering Curriculum," Chem Eng Educn , Fall 1991, pp 198-203
  - + "p2@ChE UL edu", ASEE Summer School for Chemical Engineering Educators, Snow Bird, UT, Aug 1997
  - + "A Split Course for Chemical Engineers and Continuing Education", AICHE National Meeting, Denver, CO , Aug 1994
  - + "Rationale for Incorporating Health and Safety into the Curriculum," Chemical Engineering Education, XXII(1), Winter 1988, pp 30-34
- Syllabus and materials (course notes, handouts, assignments) **for "Safety, Health, and Environment"**, ChE401, taught at the sophomore level - A survey of the common regulations that Chemical Engineers deal with in the process industries, e g OSHA, RCRA, TSCA, etc Overview of various aspects of safety, health, and environment that Chemical Engineers and the process industries must consider
- Other **safety and health materials** for stand alone courses or inclusion in core curriculum courses
  - + Safety, Health, and Loss Prevention in Chemical Processing -

Undergraduate Instructional Material - Table of contents of homework problems & instructor guide
+ AICHE/SACHE - Industrial Hygiene An Introduction for Chemical Engineers - Slide Package (List of Slides)
+ Safety, Health, & Environment", C A Wentz, McGraw-Hill (Table of Contents)
+ NIOSH Pocket Guide to Chemical Hazards
+ SACHE News
+ Chemical Process Safety Fundamentals with Applications, Crowl & Louvar, Prentice-Hall, Table of Contents

- CHE 534, **"Industrial Waste Management"** (Senior, 1st year graduate level elective) A survey of regulations, generation, control and management of industrial wastes and environmental hazards airborne, aqueous, solids, and hazardous wastes Course includes guests speakers, site visits, and a term project Design of waste treatment facilities
  + **Text** "Hazardous Waste Management", LaGrega, Buckingham, & Evans - Table of contents, Instructors Manual
  + "Hazardous Waste Management", C A Wentz, McGraw-Hill, 1st Ed 1989, text book + answer manual - previous text used
  + Course materials - syllabus, assignments, exams, reprints
- CHE 535 **Pollution Prevention "** (Senior, 1st year graduate level elective) Multi-media pollution prevention and waste minimization of hazardous and non-hazardous wastes and emissions Toxics use reduction, Source reduction, Reuse, reclamation, and recycling, Product life cycle analysis, Economic evaluation, Assessments, Planning and management

  Objectives To familiarize students and practitioners with concepts and applications of pollution prevention and waste minimization, with particular emphasis on technical and economic feasibility Hazardous and non-hazardous wastes and emissions are addressed on a multi-media basis, with emphasis on manufacturing Case studies, videos, guest speakers and plant visits are used, and student teams will do a pollution prevention/waste minimization assessment at a local manufacturing facility
  + EPA Facilities P2 manual, EPA Life Assessment manual - Texts for UL P2/WM course
  + Syllabus, Lecture handouts/course notes Case studies Assignments, Sample class assessment project report
  + Play Doh Fun Factory kit for classroom simulation of P2/WM in manufacturing
  + Demonstration materials
- Other **resource materials** for teaching P2/WM in stand alone courses or inclusion in core courses
  + **Textbook** "Pollution Prevention for Chemical Processes", D T Allen, K S Rosselot, Wiley-Interscience Table of Contents, Preface, Ch1 - Introductory Terms & Concepts, Ch 3- Industrial Ecology, Ch 4 - Life Cycle Assessment, Ch 5 - Waste Audits & Emission Inventories Ch 6- Pollution Prevention for Unit Operations Ch 8 - Flowsheet Analysis for Pollution Prevention, Ch

10 - Pollution Prevention Case Study Problem Modules Ch 11- Microscale Pollution Prevention

+ **Modules** Reducing Emissions of Nitrogen Oxides from Process Heaters, Using Life-Cycle Concepts in Strategic Environmental Planning, Policy Options for Encouraging Silver Recovery, Upgrading Process Water to Prevent Pollution in Petroleum Refining, Waste Exchanges and Material Recovery, Minimizing Chlorine in Chemical Manufacturing, Systematic Design of Substitute Materials A Solvent Case Study, Ranking Pollutants
+ **"Pollution Prevention - Homework & Design Problems for Engineering Curricula**, Allen, Bakshani, Rosselot, AIPP Table of Contents, Preface, Paper or Plastic? A Life Cycle Inventory Comparing Unbleached Paper Grocery Sacks and Polyethylene Grocery Sacks, Estimating and Reducing Fugitive Emissions, Reaction Pathway Optimization for Waste Reduction, Mass Exchange Networks Pairing the Rich & Lean Streams & Determining the Pinch
+ **"Motivating Pollution Prevention Concepts Homework Problems for Engineering Curricula",** Becker, Faraq, & Hayden Table of Contents, Introduction, Countercurrent Rinsing, The Design of a Cryogenic Heat Exchanger to Capture Escaping Volatile Organic Compounds for Return to the Process, Water Based Coating, Determination of Reactor Operating Conditions for Chemical Reactions in Parallel When Process is Redesigned to Reduce Waste Generation, Use of Statistical Process Control to Improve Quality of Shipped Product and Reduce Off-Spec Product (Waste Generation), Economics of In-House Recovery/Reuse Project
+ **National Pollution Prevention Center, Univ of Michigan** Incorporating Pollution Prevention in Facilities Planning, Incorporating Environmental Reviews into Facility Planning, **Case Study** Degreaser Replacement at Ford Motor Company's Climate Control Division
+ EPA - Waste Minimization Environmental Quality with Economic Benefits
+ "Industrial Solid Waste Reduction Workbook"
+ **"Pollution Prevention and Business Management Curricula for Schools of Business & Public Health"** - Table of Contents
+ ChE471, **"Strategy of Design"***, Incorporation of reaction pathways and process hazards, environmental impact relevant to various environmental regulations, and safety and health considerations
+ "Pollution Prevention in Process Development and Design", S Buttner in **Industrial Pollution Prevention Handbook** H Freeman, Ed , McGraw-Hill, 1994
+ **Text Book*** "Pollution Prevention through Process Integration Systematic Design Tools", M M El-Halwagi, Academic Press

"Waste Minimization through Process Design", Rossiter, McGraw-Hill

+ Pennsylvania Life Cycle Costing Manual
+ **Teaching Environmentally Responsible Design (Senior Design Project)** Table of Contents, Designing for Recovery & Re-use of Materials, Project Management, Project Modules, Laboratory Exercises
+ **"Industrial Ecology"**, T E Graedel, B R Allenby - Table of Contents
+ "Identification of P2 Technologies for Possible Inclusion in Enforcement Agreements Using Supplemental Environmental Projects (SEPs) and Injuctive Relief", EPA-3-R-97-001, March 1997
+ **"Incorporating Pollution Prevention Concepts in Higher Education Curricula - A Resource Package"***, Wash State Dept of Ecology, Publicn #91-33, 1991 Case Study - Polaroid's Toxic Use and Waste Reduction Program
+ "Pinch Technology Reduces Wastewater"*, Chem Eng , pp 87-89, Nov 1996
+ **Identification and use of computer based resources*** Web sites (e g , Envirosense, Battelle P2online), List Serves (p2tech, sewerlist, printech, p2energy) and Computer software (e g , P2P, p2edge)
+ **Video tapes***

- **Course syllabi/Curriculum Material**
  + "Pollution Prevention Fundamentals", George Washington Univ
  + "Hazardous Waste Training in the United States", Kummler et al, HMC, pp 16-24, May/June 1991
  + 'A Graduate course on Pollution Prevention in Chemical Engineering", Grant, Overcash, & Beaudoin, Chem Eng Educn , pp 246-251, Fall 1996
  + **National Pollution Prevention Center**, Univ of Michigan Brochure, Fact Sheet, Educational Materials Available, New Curricula on Environmental Marketing Issues, Chemical
  + "Environmental Frameworks", Interdisciplinary course at UL
  + "A Graduate Certificate in Environmental Auditing", Kummler et al, Chem Eng Educn, p 252, Fall 1996
  + **"Incorporating Pollution Prevention Concepts in Higher Education Curricula** - A Resource Package", Wash State Dept of Ecology, 1991* - US academic contacts, Results – National Interviews, Directory of Courses, Syllabi

Appendix C

Papers Provided by Ukrainian Professors

Appendix C
Research Papers Provided by Ukrain Professors

1 Olga Kravchenko, Candidate of Science, Pridnprovsky State Academy of Civil Engineering Architecture "Mining Industry Wastes as Basic Component of Buring Material" - 5 Pages

2 Sergei P Fomin, Head of Environmental & Industrial Safety Department, Dnipropetrovsk State University "Ecological Education for Public Administration" - 9 Pages

3 William Zadorsky, Professor, Academician of the Ukraine Ecological Academy, Pridniprovie Center for Cleaner Production

a "The Program and Experience of Educating Retraining at Theory and Practice on Cleaner Production - 4 Pages

b "Catalyst Impregnation" - 1 Page

c "Impregnation of Electrodes & Other Carbon/Graphite Articles" - 1 Page

d "Solid-Liquid Extraction for Pharmaceutics, Food Processing and Pulp Industry" - 2 Pages

e "Impregnation of Textile Fibers," and "Fiber Reinforcements of Resin-Matrix Composition" - 2 Pages

f "Leaching and Extraction for Winning of Metals " - 1 Page

g "Infiltration of Carbon/Graphite in Making Metal-Carbon Compositions" - Page

h "Impregnation in Making Electrodes for Nickel-Cadmium Cells" - 1 Page

i "Impregnation of Wood and Paper" - 2 Pages

j "Cleaner Production and Industrial Symbiosis-the Base for Pollution Prevention" - 10 Pages

k Information sheets on "Pridniprovsky Scientific-Educational and Information Center for Cleaner Production" - 4 Pages

Note For the purpose of brevity, the above-listed papers have not been included in this report However they are on file at the offices of the World Environment Center New York, NY

Appendix D

Curriculum Vitae of Professor Marvin Fleischman

MARVIN FLEISCHMAN, Prof Eng (Chem & San Eng)
133 Gardiner Lake Road, Louisville, KY 40205
502/852-6357, 6347 (Work), 502/454-6949(Home),
FAXS 502/852-6355
email m0fle101@ULKYVM Louisville edu
website http //www spd louisville edu/dept/chemical/
CURRENT POSITION Professor Emeritus of Chemical Engineering & Co-Director, Industrial Assessment Center, University of Louisville, Louisville, KY 40292

EXPERIENCE

POLLUTION PREVENTION/WASTE MANAGEMENT

Co-Director (Waste), Industrial Assessment Center (1994-Present, Also see Waste Minimization Assessment Center) - Direct & participate in USDOE funded student/faculty integrated full facility energy, multi-media pollution prevention/waste minimization (hazardous & non-hazardous wastes & emissions), & productivity assessments at small to medium size manufacturers (SIC 20-39) Types of plants include industrial laundries/denim jeans pre-washing, printing, steel fabrication, food processing, aluminum extrusions, plastics, distilled spirits, sporting goods, wood industries, tobacco products, & others
Professor of Chemical Engineering (1987-Present)- Courses Developed/teach "Pollution Prevention", "Safety, Health, & Environment", "Industrial Waste Management, "Safety & Health", and "Water and Wastewater treatment" **Research** In addition to assessments, past research includes Molten Salt Bath Oxidation of Paint Wastes (Akzo Coatings,1990-91), Integration of Qualitative Pollution Prevention Attributes into Manufacturing Decision Making (with Ind Eng & Business School faculty), "Use of Food/Agro Industry Residues in Developing Countries (USAID), Ozonation of Wastewater, Membrane Separations **(See separate Publications & Grants listing for additional information)**
Consulting - World Environment Center (1993-1998) Incorporate P2 into engineering curriculum in Ukraine, Assess waste minimization programs in Slovakia (shipyard & manufacture of diesel engines & tractors), Waste minimization assessments in meat packing plants & dairies in Estonia **Dow-Corning** (Carrolton, Ky) Pollution prevention assessment & training (1994, 1996), **U S Air Force Summer Faculty Research Program,** Hill AFB, UT, 1995 – Exptl research on non ozone depleting parts cleaners
U S Army Summer Faculty Research & Engineering Program, Tinker Air Force Base, Okla City, OK, 1994 - Life cycle analysis of radome chemical paint stripping alternatives

3M McKnight Distinguished Visiting Professor in Pollution Prevention, University of Minnesota-Duluth, March-May, 1993 - Initiated interactions with industry & government agencies, Developed P2 course, Made public presentations, Assessments at manufacturers of wood fiber board, photosensitive emulsions, steel castings, & wood furniture P2 workshop with Ind Eng faculty/manufacturing technology outreach to interface P2 & manufacturing engineering

Director, Waste Minimization Assessment Center (1989-1993) – Started, developed, & directed USEPA funded faculty/student waste minimization assessment program for small to medium size manufacturers **See EPA research briefs in Publications listing**
American Association for the Advancement of Science/EPA Environmental Science & Engineering Fellow (Summer, 1991)- USEPA Office of Pollution Prevention & Toxics, Wash , D C - Identified & evaluated reaction & process parameters for inclusion of P2 into Toxic Substances Control Act Pre-manufacturing Notice review for new chemicals & attempted to link chemistry & engineering evaluations Identified P2 information needs for product stewardship pilot project
Training Instructor(1992-1997) Ky Pollution Prevention Center, EPA Region IV Hazardous Waste Training Institute (Univ of Louisville), General Electric Appliances, Center for Excellence in Pollution Prevention Training, NSF Undergraduate Faculty Enhancement Program on Pollution Prevention (Manhattan College)
Startup & Technical Director, Ky Pollution Prevention Ctr , State Waste Minimization Technical Assistance & Information Program, (1988-89) - Started statewide pollution prevention information transfer & technical assistance program
Other - EPA & NSF Peer (Proposal) Review Panels, 1997-Present, USEPA Pollution Prevention Information Clearinghouse Advisory Subcommittee (1992), Session Chair Natl Pollution Prevention Roundtable conferences, Participant, Engineering Foundation Conferences, Kentucky Waste Minimization Planning Advisory Board (1987)

INTERNATIONAL (Additional)

World Environment Center (See Consulting)
International Conf on Energy & Environment, Cairo, Egypt(1996) - Invited speaker & session chair (See publications)
SouthEastern Consortium for International Development, University of Sriwijaya, Palembang, Indonesia, Chemical/Environmental Engineering Consultant (Summer, 1988) - Developed curriculum & undergraduate lab experiments, & interfaced with regional industry regarding university/industry collaboration
Project Director, League for International Food Education/USAID Grant, "Utilizing Food & Agro Industry Residues in Developing Countries (1985-87)-Identified & evaluated opportunities for using wastes as food or feed Served as team leader for field trip to several Southeastern Asian countries, & did overall project liaison & coordinating Presented results at UN Conference, Rome, 1987

UNIVERSITY OF LOUISVILLE
(1970-Present)
Department Chairman, Dept of Chemical & Environmental Engineering (1980-85) - Managed department of 12 faculty & 4 staff, with degree programs in chemical & interdisciplinary environmental engineering
Director of Engineering Professional Development (1979-80) - Managed & developed the Engineering School's continuing education program involving short courses & conferences Also served as **Chair**(1985-86) American Institute of Chemical Engineers Continuing Education Committee (member, 1980)
Asst , Assoc , & Professor of Chemical Engineering (1970-Present)

- Developed & taught graduate & undergraduate courses in chemical, biomedical & environmental engineering Also developed chemical & interdisciplinary biomedical & environmental (interdisciplinary) engineering curricula
- Have done research in pollution prevention, waste treatment, membrane separations, carbon monoxide health effects, blood oxygenation, & chemical oxidation of wastewaters
- Recruited several minority graduate students & was active in overall student recruiting

Visiting Professor, University of Cincinnati, Dept of Chem Eng , 1978

INDUSTRY & GOVERNMENT

U S Army Biomedical Research & Development Laboratory, Ft Detrick, MD (Summer Faculty Research Program, 1986, 1987) - Evaluated mechanisms of carbon monoxide toxicity & models for predicting blood concentrations

National Institute for Occupational Safety & Health, Engineering Control Technology Branch, Cincinnati, OH (1985), 3 month assignment as U S Public Health Service Officer - Advised on asbestos removal research, Initiated program for integrating safety & health into chemical engineering curriculum

Amoco Chemicals, Naperville, IL (1977-78) - Research on cooling water treatment (ion exchange, ozonation, ultrafiltration), & design of pilot unit to evaluate wastewater reuse

Exxon Chemical, Baton Rouge, LA (Summer 1974) - Design study on reuse of wastewater as cooling tower makeup

Exxon Engineering, Florham Park, NJ (1968-70) - Research & consulting in fluid flow, separations, pollution control/vapor recovery, & gas transmission pipelines

U S Public Health Service (Commissioned Corps), (1961-63) - Washington, DC & Cincinnati, OH - Exploratory research on chemical oxidation of municipal wastewater & design of a radioactive waste treatment pilot plant Instructor in radiological health training courses

Monsanto Research Corp , Miamisburg, OH (1959-61) - Operated isotopes separations pilot plant Conducted research on radioactive decontamination

GRANTS & CONTRACTS

(see separate list)

Director, co-director & staff on externally funded projects at the University of Louisville Sponsors included **Federal Govt** - Dept of Energy, Environmental Protection Agency, Agency for International Development, Army Corps of Engineers, Dept of Interior, & Natl Science Foundation, **State (KY)**- Dept of Environ Prot , Econ Development Cabinet, Institute of Mining & Minerals Research, **Industry**- Akzo Coatings, Colgate-Palmolive, & others, **Other**- Kentucky Heart Association Initiated funded team research on ozonation of wastewaters & disposal of flue gas desulfurization sludges Initiated & participated in developing 3 waste minimization programs in Kentucky

PUBLICATIONS & PRESENTATIONS

(see separate list)

Over forty published papers, numerous presentations & industrial, government, & contractor reports

PROFESSIONAL & SERVICE ACTIVITIES & HONORS

- American Institute of Chemical Engineers - Evaluator for ABET accreditation, Speakers Bureau, Continuing Education Committee-Past Chair, Environ Div AID/LIFE Committee, Local Section Career Guidance Committee
- Environmental Affairs Committee, Louisville Area Chamber of Commerce
- Kentucky Wastewater Treatment Plant Operators Certification Board (1986-88)
- Council for Chemical Research Departmental Representative (1982-85)
- Member of American Institute of Chemical Engineers, National Pollution Prevention Roundtable, American Society for Engineering Education, Air & Waste Management Association-Ky, Certified Hazardous Materials Managers Association-Ky
- Review papers for Environmental Science & Technology, AIChE Journal, Chemical Engineering Education, Book Reviewer, J Am Chem Soc , Peer reviewer for EPA & NSF
- Listed in Who's Who in Engineering, Who's Who in America, American Men & Women of Science & other directories

EDUCATION

Ph D University of Cincinnati--Chemical Engineering
M S University of Cincinnati--Chemical Engineering
B Ch E City College of New York