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TRIP REPORT #3 CHEMKO

STRAZSKE, SLOVAK REPUBLIC

WASTE MINIMIZATION PROJECT

OCTOBER 4 - OCTOBER 8, 1993

**WORLD ENVIRONMENT CENTER
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I. INTRODUCTION

Pursuant to the technical assistance program for Central and Eastern European countries funded by the U.S. Agency for International Development, the World Environment Center (WEC) team conducted a follow-up visit to Chemko Strazske in the Slovak Republic on October 4 - 8, 1993. The WEC team consisted of:

B. Bhushan Lodh, Project Manager

Vladimir Hruby, In-country Coordinator

Sharad Gandbhir, Advanced Engineering Associates, Inc., Engineering Consultant

The purpose of the visit was to review the progress made by Chemko personnel, demonstrate and train the personnel to install and use the diluter kit for the organic vapor analyzer (OVA), and collection and analysis of the sampling data.

II. ITINERARY

- October 3, 1993 - Arrive in Kosice
- October 4 - 8, 1993 - Visit to Chemko Strazske; review the progress of the project; training to use the dilution kit for OVA; presentation and analysis of the data; Waste Minimization Program to neighboring business enterprises.
- October 8, 1993 - Visit to Kosice University; presentation of Waste Minimization Program and briefing of Chemko WMDP to the academic staff of Organic Chemistry and Physical and Analytical Chemistry Department.
- October 8, 1993 - Depart for U.S.A.

III. EXECUTIVE SUMMARY

Pursuant to the technical assistance program for Central and Eastern European countries funded by the U.S. Agency for International Development, the World Environment Center (WEC) had organized a reconnaissance trip to Chemko Strazske, a manufacturer of inorganic and organic chemicals, located in the eastern most part of the Slovak Republic during March 1 - 5, 1993.

The WEC team and Chemko management selected the cyclohexanone plant for the waste minimization demonstration project (WMDP). The consulting engineer and the volunteer expert estimated that the WMDP may result in a reduction of raw material between 50% and 70%, resulting in cost savings of \$78,500 to \$314,000 per year, depending on the factory's operating capacity.

A project implementation trip to Chemko Strazske was made during August 16, 1993 to August 20, 1993. The project team consisted of WEC staff, Dr. Bhushan Lodh and the consultant, Mr. Sharad Gandbhir from Advanced Engineering Associates, Inc.

The following tasks were completed:

- Selection of the members for the Waste Minimization Committee (WMC) from various departments at Chemko.
- Presentation of seminars on Waste Minimization Programs.
- Training of the selected personnel from the WMC for the use of OVA, collection and presentation of the volatile organic compound monitoring data.

A third trip to Chemko was made during October 4 to October 8, 1993 to review the progress of the project. Discussions and training sessions were held regarding the use of the dilution kit for the OVA, the calibration with the diluent gas and analysis of the data.

A waste minimization program and its benefits were presented to the members from other manufacturing facilities and consultants in the same geographic area.

Chemko transmitted two sets of fugitive emission data from the cyclohexanone facility in late September 1993 to the consultant. The data consisted of identification of sampling point, leak measurement prior to corrective action taken, the corrective action taken to control the fugitive emission and the leak

measurement after the corrective action taken. The corrective actions taken are tightening of the flanges, the gasket, tightening of the nuts and bolts, changing of the pump seals to name a few. The consultant and Chemko team had prepared a computer spread sheet to calculate the product savings and economic benefits using the "Stratified Emission Factors for Equipment Leak" compiled by the Chemical Manufacturers Association. Fugitive emission data collected were analyzed using the above mentioned spread sheet and the results show that raw material cost saving of approximately \$88,400 per year has been achieved by the implementation of the waste minimization program so far.

Chemko is still conducting the fugitive emission sampling and the cost saving is expected to be higher.

On October 8, 1993, a waste minimization program presentation was made to the academic staff from the Departments of Organic Chemistry and Physical and Analytical Chemistry of the University of Kosice. They were briefed about the Chemko WMDP program and showed their desire to participate in the program. They were very much impressed with the Waste Minimization Impact Program and showed their willingness to take part in it.

IV. SHARAD GANDBHIR'S REPORT

DISCLAIMER

The opinions expressed in the report is the professional opinion of the author and do not represent the official position of the Government of the United States or the World Environment Center.

WASTE MINIMIZATION PROJECT
CHEMKO STRAZSKE
SLOVAK REPUBLIC

REPORT NO. 3

by
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EXECUTIVE SUMMARY

A waste minimization project in the Cyclohexanone Facility at Chemko Strazske was selected during the first visit from March 1, 1993 to March 5, 1993. A waste minimization committee was formed during the second visit and the program was started by conducting a pilot data collection session using organic vapor analyzer. In the third visit, from October 4 to 8, 1993, progress of the project was reviewed, analysis and interpretation of the data was carried out. The results indicate an economic benefit of approximately \$88,400 (SKcs 283,000) by the actions taken through September 1993 under the implementation of the waste minimization program at Chemko.

BACKGROUND

During the first visit in March 1993 by a WEC team and the consultant, a waste minimization project was selected in the cyclohexanone manufacturing facility at Chemko Strazske. An organic vapor analyzer (OVA) was selected for the project, purchased by WEC, and carried to the Chemko facilities during second visit.

After a pilot demonstration session through a selected section of the cyclohexanone facility, a program was established for collection and transmittal of the sampling data from Chemko to the consultant. Two sets of data were received by the consultant.

After the August 1993 visit, WEC had arranged to send a diluter kit for OVA to Chemko for quantitatively measuring leaks with values greater than 1,000 ppm.

OBJECTIVE

Objectives of the visit to Chemko Strazske from October 4, 1993 to October 8, 1993 were

- o To review the progress of the project, answer any questions, solve problems that arise, and assure success of the project by joint efforts
- o Use of diluter kit, calibration, measurement and interpretation of data
- o To analyze and interpret the data jointly with Chemko team
- o To make a presentation on the benefits of a Waste Minimization Program to the members from other manufacturing facilities in the same geographic area

DETAILS OF ACHIEVEMENTS

The reasons for selection of the waste minimization project for cyclohexanone facility at Chemko were discussed in the earlier two reports. The principal reasons were valuable raw material and product cost savings, health benefits enjoyed by the employees and improved environment by reducing organic vapor emissions.

Review of Progress

The following were present for the meeting on October 4, 1993:

For Chemko

Ing. Boris Kudelas
Ing. Milos Marko
Ing. Peter Laca
Ing. Eva Zimanova

For WEC Team

Dr. Bhushan Lodh, WEC
Ing. V. Hruby, Sensor, Inc.
Sharad Gandbhir, Consultant

Other members of the Waste Minimization Committee were not present because the plant personnel were busy with three pressing activities in parallel: a) completion of September 1993 material balances, b) solving problems with product purity, and c) waste minimization project related efforts.

Discussions and training sessions were held regarding the use of diluter kit for the organic vapor analyzer, the calibration with diluent gas, and interpretation of the data. Chemko advised that they did not have the proper calibration gas as they needed to have a lease for the gas cylinder and due to lack of funds such lease was not in place. Chemko also advised that minimum of 10 days are required to get the gas after the order is placed. Chemko further advised that they had gone through leak detection at majority of the flanges, valves and pumps. Chemko claimed to have checked 95 % of the leaks with values equal to or greater than 1,000 ppm.

The consultant emphasized the importance of measuring as many leaks as possible and taking the corrective actions because the additive effect would be significant in terms of economic benefits.

The afternoon session was spent in marking of the P & I Diagrams with monitoring points and assembling the diluter kit.

Waste Minimization Project Presentation

On October 5, 1993, after the introduction of the attendees of the meeting, Mr. Gilani, Managing Director of Chemko, made opening remarks regarding the waste minimization project at Chemko. Then, the consultant made a presentation on waste minimization program to the representatives from the following organizations:

<u>Representative</u>	<u>Organization</u>
Ing. Marek Saxa	Bukoza, A.S.
Ing. Jozef Dobrocky	Bukoza, A.S., Humenne
Ing. Olearnikova Amalia	Chemlon A.S. Humenne
Ing. Stefan Gebel	Benziol A.S. Bratislava
Ing. Zdenek Cervenko	Cercon Consulting

In addition to the above, various representatives from Chemko also were present.

This presentation was based on the Ford Motor Company report on the waste minimization program and was similar to that made to Chemko waste minimization committee members in August 1993 visit.

An open discussion about the waste minimization program followed the consultant's presentation.

Analysis and Interpretation of Data

Chemko transmitted two sets of data from the cyclohexanone manufacturing facility in late September 1993. These are presented in Tables 1 and 2. The data consisted of identification of sampling point, leak measurement prior to corrective action taken by Chemko, corrective action taken, and the leak measurement after the corrective actions. The corrective actions are tightening of the flanges, changing of the gaskets, replacement of pump seals to name a few. Economic data on feed and product values were supplied by Chemko and are presented in Table 3.

In order to convert the leak measurement data into the actual losses, certain correction factors are required. Such conversion factors from various sources (flanges, valves, and so on) are published by Chemical Manufacturers Association. These are presented in Table 4.

The consultant and Chemko team prepared a computer spread sheet to calculate the product savings and economic benefits using above mentioned data and correction factors. The results are presented in Table 5. It is apparent from the

results that savings of approximately \$88,400 (SKcs 283,000) per year are achieved from the corrective actions taken so far.

In summary, the trip was successful. The WMC members showed keen interest and enthusiasm to learn and operate the OVA and collect the fugitive emission data from the plant.

TABLE 1.

SECTION : BENZENE HYDROGENATION
OXIDATION OF CYCLOHEXENE

DATE: AUGUST 23, 1993.

No	LINE and EQUIP. IDENTIFICATION	OV A READING PPM	CORR ACTION	OVA AFTER WER. PPM	REMARK (MATERIAL)
1	PS 102 C2 104, FLANGE E	>1000	BE POSSIBLE AFTER THE SHUT DOWN	>1000	CYCLOHEXANE
2	PS 104 C2 106 FLANGE C	>1000	TIGHTENED FLANGE	11	CYCLOHEXANE
3	PS 105 ES 201 VALVE 2025	280	TIGHTENED FLANGE	8	CYCLOHEXANE CYCLOHEXANON MIXTURE 30/60
4	EX 107 FLANGE B	205	— 11 —	33	C-NOL/CANON. 30/60

TABLE 2.

DATE: 7. SEPTEMBER 1993.

No	LINE AND EQUIP.	DVA READING PPM.	CORR. ACTION	DVA AFTER CORR. AC. PPM.	REMARKS.
1.	DP-112	410	TIGHTENED FLANGE	18	MIXT. C-NOL C-NON 30/70
2.	BORROUND. AREA D-2-110	>1000	FILLED LIQUID SEAL	170	CYCLOHEXANE
3.	DP-123A	380	EXCHANGE OF THE FLANGE GASKET	8	CYCLOHEXANON
4.	DP-104A	750	EXCHANGE OF THE FLANGE GASKET	16	CYCLOHEXANE
5.	DP-106 B	430	— —	11	CYCLOHEXANE
6.	RV UNDER VE DK-102	>1000 PPM	EXCHANGE OF VALVE GASKET	10	MIXT. C-NOL C-NOLJE 30/70

17.09.93 11:22

012 916 91573

CHEMKO STRAZSKE

TABLE 2

12000

CONT. TABLE 2.

2	CV 900	>1000	NO CORRECTIONS	?	IMPROVING WITHOUT TIME CORRECTION !!
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7.	SV 902	>1000	NO CORRECTIONS	?	IMPROVING WITHOUT THE CORRECTION
8.	DK-103	>1000	NO CORRECTIONS	8	THE SAME AS IN 7.
9.	RV 100.2	450	———	460	CAN BE REPAIRED IN THE SHUT DOWN ONLY

REMARKS:

1. THE WEEK MEASUREMENTS (WITH NEGATIVE RESULTS) ARE NOT INCLUDED.
2. IN THE CASE OF 7. AND 8 (SV 902, DK-103 RESPECTIVELY.) THE LEAKS (NOT ABLE FOR REPAIR DURING THE PLANT OPERATION - HIGH PRESSURES AND TEMPERATURES) DISAPPEARED. (PROBABLY BECAUSE OF CLOSING THE FLANGES WITH CARBON).

DILUTING EQUIPMENT
NOT USED TILL NOW

TABLE 3

Actual Prices (Valid till the end of February 1993): (1)

Paraffene:	8 375	Kg/t
NaOH 40 % sol.	6 100	
Cobaltous Nitrate	311 500	
Naphthenic Acids	44 000	
Cyclohexane	11 500	
Cyclohexanone	18 315	
Pentaerythritole	33 235	
Formic Acid	19 800	
Acetic Acid	18 850	
Acetaldehyde	15 200	
Formaldehyde	1 985	

(1) SOURCE: CHEMICO STRAZSKE

TABLE 4

STRATIFIED EMISSION FACTORS FOR EQUIPMENT LEAKS
(kg/hr/source)

Source	Service	Emission Factors (kg/hr/source) for Screening Value Ranges, ppmv		
		0-1,000	1,001-10,000	Over 10,000
Compressor seals	Gas/vapor	0.01132	0.264	1.608
Pump seals	Light liquid	0.00198	0.0335	0.437
	Heavy liquid	0.00380	0.0926	0.3885
Valves	Gas/vapor	0.00014	0.00165	0.0451
	Light liquid	0.00028	0.00963	0.0852
	Heavy liquid	0.00023	0.00023	0.00023
Flanges, connections	All	0.00002	0.00875	0.0375
Pressure relief devices	Gas/vapor	0.0114	0.279	1.691
Open-ended lines	All	0.00013	0.00876	0.01195

TABLE 5
CHEMKO STRAZSKE
WASTE MINIMIZATION PROJECT

SAMPLE PCINT	P&I IDENT.	LEAK PPM	CORR. FACTOR	KG/HR	AFTER	CORR.	ACTION	SAVINGS KG/HR	COST Kc/KG	SAVINGS Kc/HR	
					LEAK PPM	CORR. FACTOR	KG/HR				
1	PS102	1000	0.00875	8.75	1000	0.00875	8.75	0	19	0	
2	PS104	1000	0.00875	8.75	11	0.00002	0.00022	8.74978	19	1163721	
3	PS105	280	0.00014	0.0392	8	0.00014	0.00112	0.03808	12.9	3438.624	
4	EX107	205	0.00002	0.0041	33	0.00002	0.00066	0.00344	12.9	310.632	
5	DP112	410	0.00002	0.0082	18	0.00002	0.00036	0.00784	12.9	707.952	
6	DZ110	170	0.00013	0.0221	170	0.00013	0.0221	0	12	0	
7	DP123A	380	WASTE	STREAM						0	
8	DP104A	750	0.00198	1.485	16	0.00198	0.03168	1.45332	12	122078.9	
9	DP106B	430	0.00198	0.8514	11	0.00198	0.02178	0.82962	12	69688.08	
10	DK102RV	1000	WASTE	STREAM						0	
11	SV902	1000	0.00963	9.63	8	0.00028	0.00224	9.62776	12	808731.8	
12	DK103	1000	0.00875	8.75	8	0.00002	0.00016	8.74984	10.8	661487.9	
13	RV103.2	450	0.0114	5.13	450	0.0114	5.13	0	12	0	
14				0			0	0		0	
15				0			0	0		0	
16				0			0	0		0	
17				0			0	0		0	
18				0			0	0		0	
19				0			0	0		0	
20				0			0	0		0	
				43.42				13.96032	29.45968	2830165	
										SAVINGS \$/YR	88442.65

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