



**WORLD ENVIRONMENT CENTER**

**STAFF TRIP REPORT**

**TO**

**CZECH REPUBLIC**

**OCTOBER 11, 1993**

**WORLD ENVIRONMENT CENTER  
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## I. INTRODUCTION

The World Environment Center (WEC) has a cooperative agreement with the United States Agency for International Development (USAID) to provide U.S. private sector expertise to transfer technology and skills to Eastern European industry and government representatives so that they can more effectively reduce industrial and urban pollution, improve solid, hazardous, and toxic waste management, improve industrial health and safety practices, improve energy conservation and management, and increase community awareness in environmental and energy related areas.

Dr. B. Bhushan Lodh, WEC staff, and Ms. Ludmila Hofmanova, Coordinator for the Czech Republic, visited Spolana Chemicals located at Neratovice on October 11, 1993 to determine whether this enterprise is a suitable candidate for a possible Waste Minimization Demonstration Project (WMDP). Neratovice is about 25 miles north of Prague.

The enterprise manufactures vinyl chloride monomer (VCM), polyvinyl chloride (PVC), viscose rayon, chlorine, caprolactam and other products.

## II. MEETINGS

An initial meeting was held to discuss the WMDP. The following were the participants and their business cards are presented in Section IV.

1. Ing. Frantisek Barkman, Technical Director
2. Mr. Ivan Zika, Division of Environment Protection
3. Mr. Stanislav Burda, VCM/PVC Plant Technical Manager
4. Mr. Jan Jankovec, Sr. Chemical Engineer, Process Engineering Division
5. Mr. Martin Dobes, Dipl. Engineer
6. Ing. Jan Persin, Technological Department, Caprolactam, Group Leader
7. Ms. Ludmila Hofmanova, Coordinator for the Czech Republic
8. Dr. B. Bhushan Lodhi, WEC Staff

WEC staff described the WMDP procedures to the attendees. One of the points he emphasized was the full cooperation of the top management for the program and Mr. Barkman assured of that.

Mr. Jankovec, Spolana Chemicals, pointed out the VCM plant's air pollution problems and mentioned that they are planning to install an incineration system to control the pollution. He would like to see the WMDP program to be carried out at the VCM/PVC plant and to include the incineration system in the program. WEC staff mentioned that the decision will be made after a visit to the plant.

Mr. Persin, Spolana Chemicals, mentioned that the caprolactam plant also has air pollution problems. The Czech Air Pollution Authority requires him to measure the concentration of the pollutants escaping from the plant building. WEC staff agreed to visit the plant at the request of Mr. Persin.

### III. PLANT VISIT

#### VCM Plant

The plant was installed in 1974 and uses Stauffer technology to produce VCM. Ethylene is converted to ethylene dichloride (EDC) by direct chlorination and oxychlorination as shown in Figure 1. The raw material, ethylene, is supplied by Litvinov. The plant capacity is 120 MT/year. The crude ethylene dichloride (EDC) is purified in distillation columns. The emissions from light ends and heavy ends are incinerated in a liquid waste incinerator. There was practically no smell of volatile organic compound (VOC) from the storage of ethylene to the direct chlorination and oxychlorination reactors areas. A little smell of EDC was felt at EDC pyrolysis unit. All the vent gases from VCM plant equipment goes to a caustic scrubber. The unscrubbed VCM escapes to the atmosphere through the stack.

The plant has a serious process emission problem, than the fugitive emission.

#### PVC Plant

The plant uses Hills (German) technology to manufacture PVC (120 MT/year). There are 14 water phase suspension polymerization reactors. The pumps and agitators have double mechanical seals to control the fugitive VCM emission. The plant is in a closed building. The VCM concentration in the plant air is monitored by a Foxboro Organic Vapor Analyzer. Part of the circulation air is bled into the atmosphere uncontrolled. If the VCM concentration in the air rises, the maintenance people bring the concentration under control by correcting the leaks from the equipment and joints.

#### Caprolactam Plant

This plant is 25 years old. Cyclohexanone, which is supplied by Chemko Strazske, is used as raw material. Reaction with ammonia-derived hydroxylamine forms cyclohexanone oxime which undergoes molecular re-arrangement to the seven membered ring caprolactam. Oleum and ammonia are also used in the process. Ammonium sulfate is a by-product which is crystallized and used as fertilizer. A block diagram of the process is shown in Figure 2.

This product is manufactured in a closed building with 4 levels. Most of the fugitive emissions occur in the second level where the reactors are located. The area smells of volatile organic carbon (VOC) and ammonia. Near the oximation area, the ammonia and trichloro ethylene (TCE) fugitive emission was so high that tears came to the eyes of the WEC staff due to irritation. There was also the

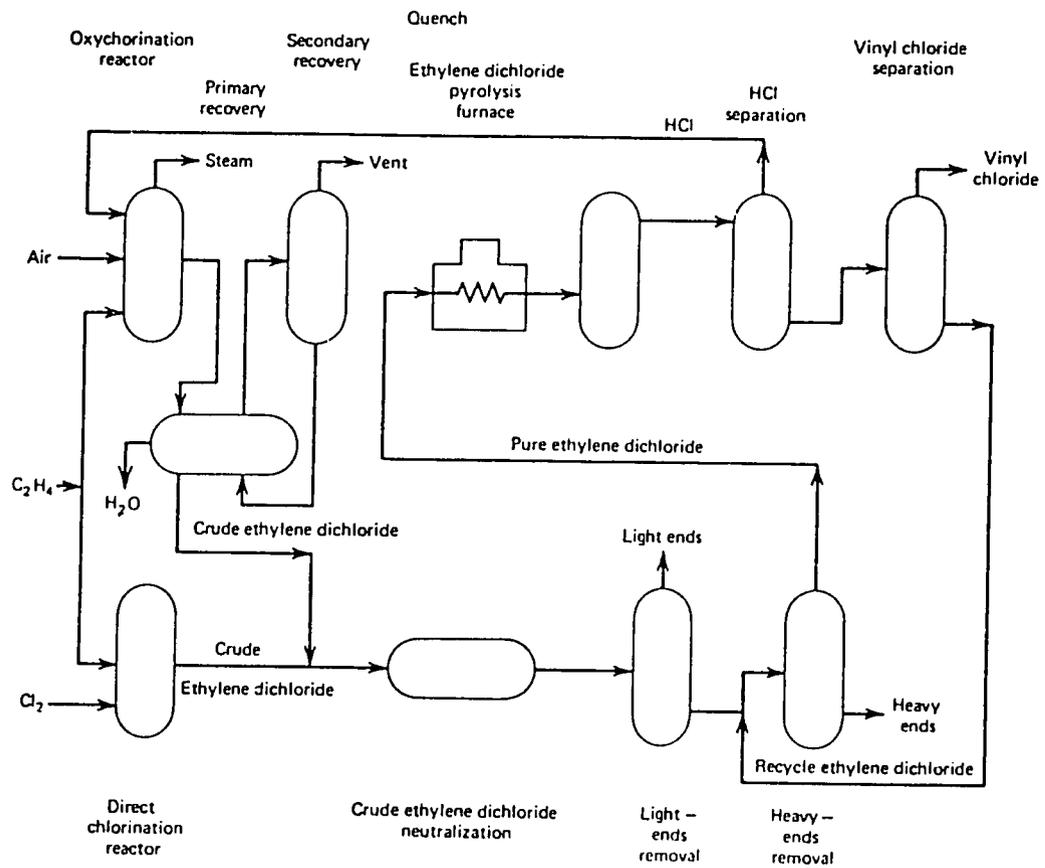


Figure 1 Typical balanced vinyl chloride process with air-based oxychlorination.

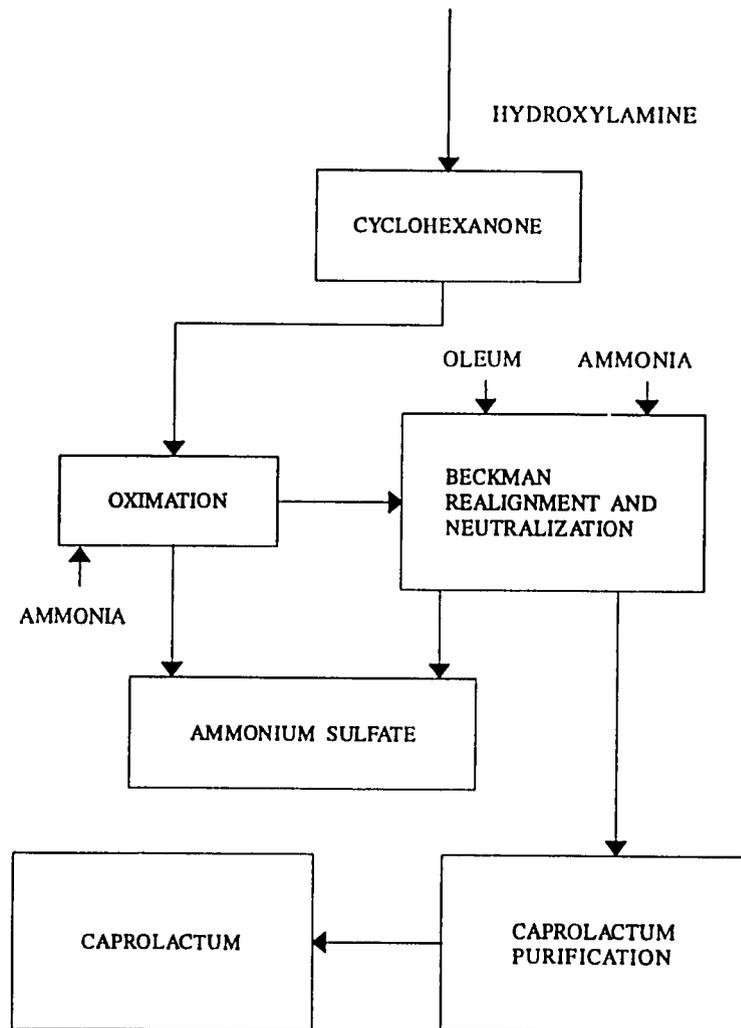


FIGURE 2: CAPROLACTUM PROCESS

smell of VOC at the ground level where pumping station for caprolactam is located. Most of the fugitive emissions escape to the atmosphere through the top floor of the building. The Czech Republic Air Pollution Authority has requested the analysis of the fugitive emissions.

The capacity of the plant is 40,000 tons per year. Cyclohexanol, cyclohexanone, ammonia and trichloro ethylene are expensive chemicals. This plant could be a WMDP by controlling the losses of the above mentioned chemicals as fugitive emission.

### Closing Meeting

After the plant visit, a closing meeting was held. Those present were Mr. Ivan Zika, Mr. Jan Persin from Spolana Chemicals, Ms. Ludmila Hofmanova, Coordinator, Czech Republic, and Dr. B. Bhushan Lodh, WEC staff. Mr. Frantisek Barkman, Spolana Chemicals, could not attend the meeting as he had to go to Prague.

WEC staff mentioned his observations. He did not find sufficient fugitive emission sources in the VCM and PVC plants to justify a WMDP program. These plants have a process emission problem. The caprolactam plant has a serious fugitive emission problem and could be considered for a WMDP program.

Mr. Zika insisted on VCM/PVC plant be selected as WMDP which WEC staff respectfully rejected. Mr. Zika then stated that the VCM plant is under compliance order from the Czech Air Pollution Authority and are required to be in compliance with the applicable air pollution laws by the end of 1996. If WEC will conduct the WMDP program at the VCM plant, they will apply for extension of the compliance order to 3 to 4 more years. WEC staff still did not agree and pointed out that since Spolana has a Foxboro OVA analyzer, they should conduct on their own the waste minimization program at these plants. He responded that they do not have sufficient manpower. In the end, Mr. Zika agreed with the WEC recommendation of the caprolactam plant to be the WMDP and expressed that the waste minimization program should also be carried out simultaneously at the VCM plant. WEC staff agreed to consider the proposal and mentioned that the caprolactam plant will be his recommendation for a WMDP. Final decision will be made by Thomas J. McGrath.

#### **IV. RECOMMENDATIONS**

1. VCM and PVC plants have mainly process emission problems. They do not have sufficient fugitive emissions to be a suitable candidate for a WMDP to demonstrate effective cost savings.
2. Caprolactam plant has a serious VOC and ammonia fugitive emission problem. Cyclohexanone, cyclohexanol, TCE and ammonia are expensive chemicals. An effective cost savings can be demonstrated by conducting a WMDP program at this plant. It is recommended this plant be considered for a waste minimization demonstration project.

WEC may consider training additional Spolana Chemicals personnel simultaneously with the caprolactam program who will then conduct the waste minimization at the VCM/PVC plant with their own Foxboro OVA analyzer.

**V. BUSINESS CARDS OF CONTACTS**



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