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WORLD ENVIRONMENT CENTER

TRIP REPORT #2 SVILOSA CO.

SVISHTOV, BULGARIA

WASTE MINIMIZATION PROJECT

JUNE 6 - 8, 1994

WORLD ENVIRONMENT CENTER
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AUGUST 1994

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File

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I. INTRODUCTION

Pursuant to the technical assistance program for Central and Eastern European countries funded by the United States Agency for International Development, the World Environment Center (WEC) team conducted a reconnaissance visit to Svilosa Company in Svishtov, Bulgaria from October 17 - 23, 1993. As a result of that visit, the feasibility of a Waste Minimization Demonstration Project (WMDP) was established. The objective of the WMDP selected is the reduction of the concentration of carbon disulfide and carbon monoxide in the air of the spinning hall at Svilosa.

The reduction of these gases which can cause skin irritations and sore eyes will permit machine operators to be present longer at their work stations and be more observant of machine operations thus reducing the amount of waste yarn produced which presently occurs from lack of attention to machine operations.

As a result of this first visit, a Waste Minimization Team (WMT) consisting of a cross-section of persons from production, laboratory, research, maintenance and environmental areas was established. A photoionization probe (PID) equipped with a 10.2eV sensor probe which is sensitive to carbon disulfide and accessories necessary for calibration of the unit to a isobutylene gas standard were purchased and shipped to Svilosa. The WMT proceeded to establish an air sampling program in the spinning hall and correlating readings from the PID against standard laboratory analysis.

Trip #2 was made from June 6 - 8, 1994, to review progress of the project to date.

II. EXECUTIVE SUMMARY

WEC's team consisting of Raghu K. Raghavan, President, Envirometrics Systems, Inc.; Carl M. Schwing, WEC staff, made a project progress trip to the Svilosa Company - Chemical Fibre Plant in Svishtov, Bulgaria. The purpose of the visit was to evaluate the progress of the project to date.

It was found that:

- The photoionization probe had been received by Svilosa, been calibrated, and placed into use;
- The Waste Minimization Team had selected nine sampling points throughout the spinning hall to provide a profile of the various points of air flow changes;
- Sample data was being collected on a disciplined schedule and being evaluated so as to identify sources of emissions;
- The WMT had identified not only the sources of carbon disulfide leaks, but also had identified the circumstances under which releases are made;
- A short, mid, and long term plan had been prepared to reduce the amount of emissions;
- There is a need to calibrate the instrument against a carbon disulfide standard, as opposed to the normal isobutylene standard;
- There are a number of other potential waste minimization projects in the facility, the implementation of which can reduce production costs, reduce downtime, and reduce water consumption.

Based on the above information, additional supplies were purchased and sent to Svilosa so as to permit direct calibration of the photoionization probe against carbon disulfide. Further, the WMT has implemented the immediate (short term) actions necessary to respond to high carbon disulfide releases.

For further details of the project, refer to the enclosed Envirometrics Systems, Inc. report.

III. ENVIROMETRICS SYSTEMS, INC. REPORT

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Envirometrics Systems, Inc.

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Interim Report # 2
Waste Minimization Demonstration Project
at
SVILOSA Company, Svishtov, Bulgaria

INTRODUCTION

A Memorandum of Understanding (MOU) was signed in December 1993 by the World Environment Center (WEC) and the Svilosa Company (SVILOSA), Svishtov, Bulgaria to conduct a Waste Minimization Demonstration Project (WMDP) to reduce carbon disulfide and hydrogen sulfide gas concentrations in the Spinning Hall of the Rayon Yarn Mill at SVILOSA with subsequent health benefits and cost savings. This MOU was the result of a reconnaissance visit which was made by a WEC Project Team to SVILOSA during October 1993. Interim Report #1 on this project provides details of the reconnaissance visit and includes a proposal for the WMDP to be conducted at the plant.

As agreed in the MOU, WEC has purchased and shipped to SVILOSA in January 1994 an environmental monitoring equipment of U.S. manufacture to support the WMDP. WEC has also sent in March 1994 a project team to commence the first phase of the WMDP. During this visit, a Waste Minimization Team (WMT) consisting of SVILOSA's plant personnel was also formed to initially use the monitoring equipment to understand the nature of air emissions, and then investigate the alternatives for improving the air quality in the Spinning Hall. After this visit, the WMT continued with air quality monitoring and made efforts to reduce the concentration of carbon disulfide in the area.

WEC has continued to provide technical support in the project and sent another project team to visit SVILOSA during June 1994 to review and discuss the progress which has been made. During this visit, a schedule was developed to improve the use of monitoring equipment and implement the second and third phase of the WMDP. SVILOSA has also developed a long-range plan for improving air quality in the Spinning Hall. The following report describes purchase and use of monitoring equipment, air quality data compiled by SVILOSA, and the progress which has been made in the project upto the end of June 1994.

ESI

SELECTION OF MONITORING EQUIPMENT

WEC purchased a photoionization detector (PID) manufactured in the United States by HNU Systems, Inc. (HNU Model IS-PI-101-10.2). This equipment is a portable analyzer fitted with a 10.2eV probe to detect and measure the concentrations of specific gases in the air and certified as being "Intrinsically Safe" for use in specific operating conditions. PIDs are sensitive to the presence of a wide range of organic vapors and other toxic gases and has been successfully used in hazardous waste site investigations. HNU's PID is the oldest product of its type which is manufactured in the United States. At least one manufacturer of rayon in the United States has reportedly used this instrument for several years to monitor the presence of carbon disulfide in rayon mills. The sensor in a PID is a sealed ultraviolet (UV) light source which emits photons with an energy level high enough to ionize many gases in trace amounts, including the pollutants expected to be found in a rayon yarn mill - carbon disulfide and hydrogen sulfide. As carbon disulfide is known to be present in larger concentrations than hydrogen sulfide in the Spinning Hall, the equipment purchased for the WMDP in SVILOSA was fitted with a UV lamp which was more sensitive to detecting carbon disulfide. By directly calibrating a PID against the specific mixture of gases found in the Spinning Hall, it is also possible to get a direct reading of the environmental quality of the working area by using this instrument.

In addition to the facts that PIDs are portable and can provide a direct reading of the concentrations of the gases to be found in the Spinning Hall, this particular model of PID was selected due to its simplicity of operation and lower price in comparison with other products available in the United States. The instrument was shipped, with manufacturer's calibration of the gas analyzer for benzene as the reference standard, to SVILOSA in January 1994 with a spare battery and gas cylinders to be used in recalibration of the instrument. The calibration gas provided with the instrument was isobutylene as benzene is known to be hazardous and a representative mixture of the trace gases to be measured in the Spinning Hall was not readily available. At the plant of the manufacturer, the instrument was first calibrated in the benzene standard and a reading was then taken with isobutylene provided in the gas cylinder. After using the instrument in the field, its calibration could be checked and reestablished by adjusting the instrument controls (if necessary) to obtain the original reading while measuring the concentration of the recalibration gas. An instruction manual was also shipped with the instrument and this document was translated from English to the Bulgarian language by SVILOSA in preparation for using the instrument.

WASTE MINIMIZATION TEAM

The visit of WEC's project team to SVILOSA during March 1994 started with a meeting with the plant's top management to review the goals of the WMDP and to discuss waste minimization techniques which can be applied to the project. The participants in this meeting included the following personnel representing SVILOSA : Dip Eng. Michail Koltchev, Deputy General Director; Dipl. Eng. Velitchko Kounev, Manager of Rayon Mill; and Dipl. Eng. Rumen Vitkov, Manager of Research and Development. WEC was represented during the meeting by Dr. Bohdan T. Aftanas, project manager, and Raghu K. Raghavan, consultant. During the meeting, WEC's representatives described the requirements of a successful waste minimization program, including the role of top management in setting goals of the program and the role of waste minimization teams (WMTs) in conducting specific waste minimization projects. SVILOSA announced during the meeting that the plant has given the highest priority to the WMDP during 1994.

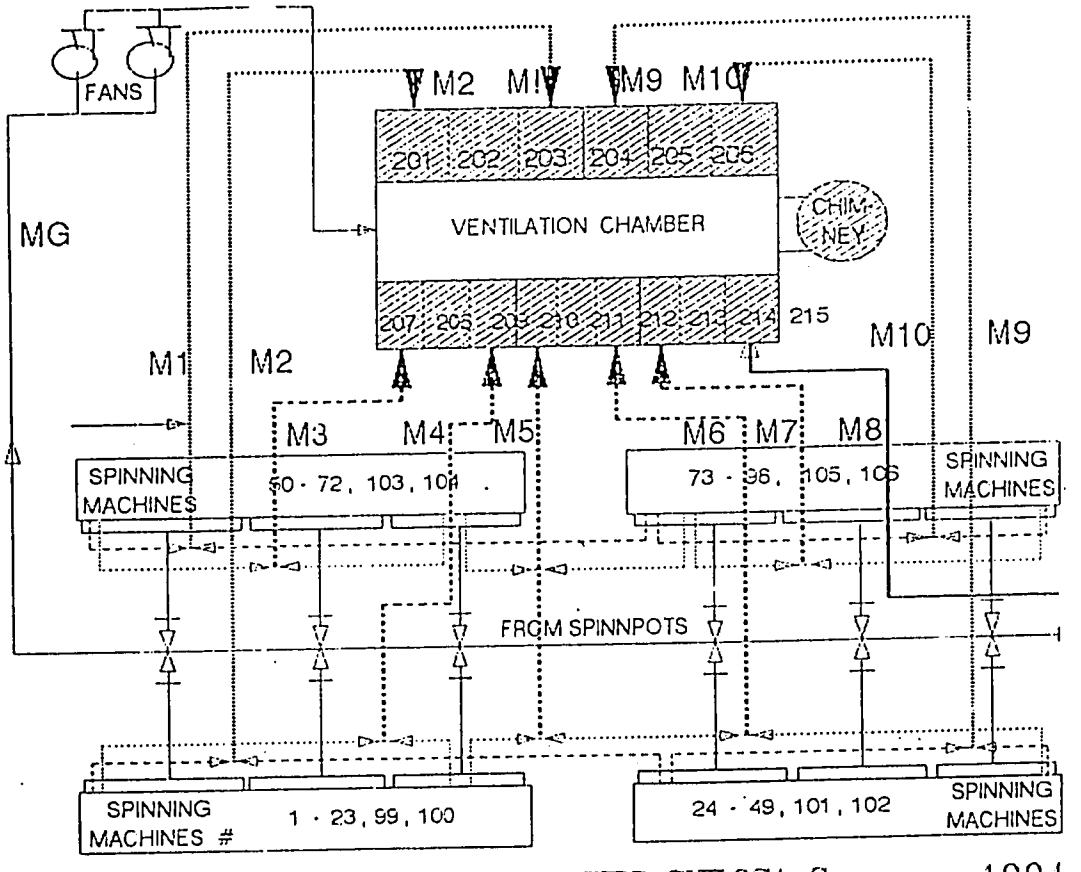
A meeting was then held with the WMT formed by the top management for implementing the project, which included the following personnel :

- Production Manager, Spinning Hall
- Specialist, Ventilation and Air Conditioning
- Specialist, Monitoring and Measuring
- Head of Department, Quality Control
- Head of Department, Environmental Protection
- Assistant Manager, Rayon Yarn Mill
- Manager, Rayon Yarn Mill
- Manager, Research and Development

During this meeting, it was also announced that Mr. Ivan Stoev, an experienced technician, will be trained in using the HNU-PID, which had been purchased to support the WMDP. In addition, baseline data on air quality in the Spinning Hall will be maintained by Mrs. Livbka Ignatova who was already trained in the laboratory techniques for sampling and analyzing air in the Spinning Hall. Mr. Rumen Vitkov, Manager of Research and Development, will be responsible for designing and implementing the WMDP. During the same meeting, a formal presentation was made by WEC's consultant of the operating principles, precautions during use and parts of the HNU-PID. WEC also handed over to SVILOSA auxiliary equipment which had been purchased for measuring ambient temperature, relative humidity and air flow rates while monitoring air quality.

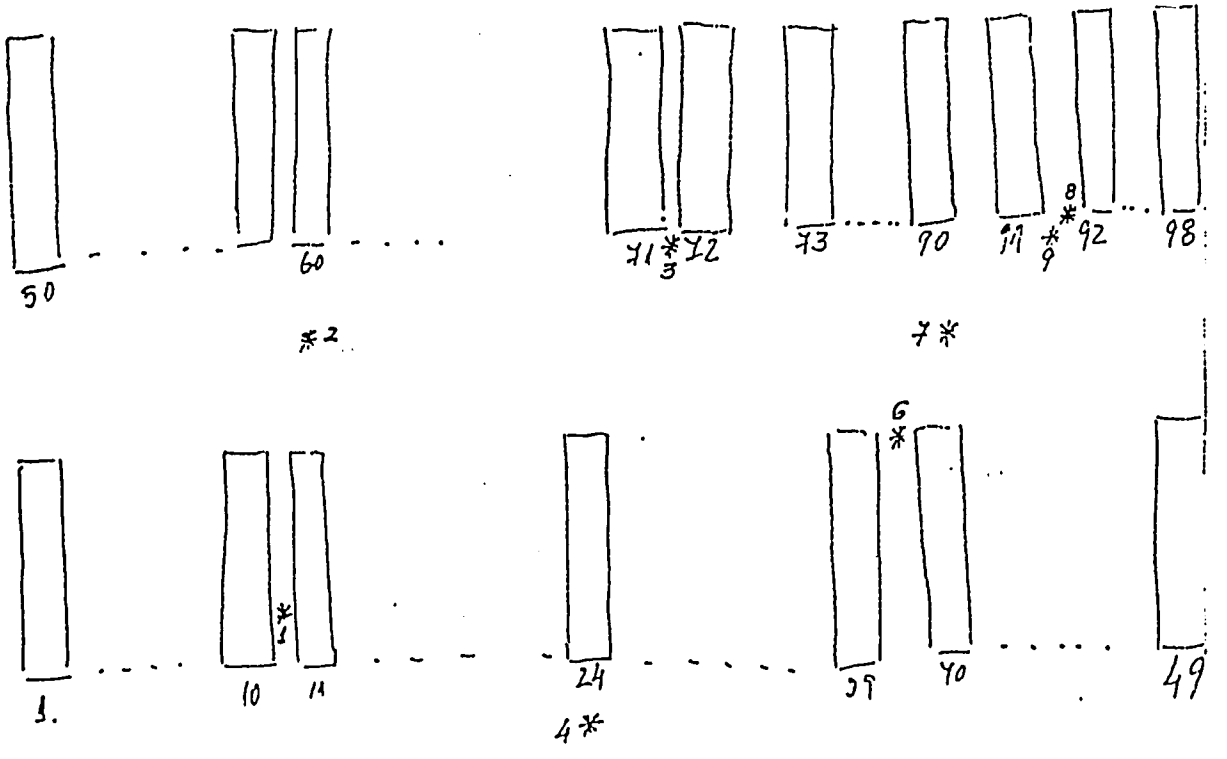
ATTACHMENT 1

SCHEMATIC LAYOUT OF SPINNING HALL AND AIR QUALITY MONITORING LOCATIONS SELECTED AT SVILOSA COMPANY



WASTE MINIMIZATION PROJECT-WEC-SVILOSA Company, 1994

AIR QUALITY MONITORING LOCATIONS (* 1 THROUGH *9)



ENVIRONMENTAL MONITORING DATA

During the visit of WEC's project team in March 1994, several readings were taken in the Spinning Hall by using the HNU-PID, the auxiliary equipment provided by WEC, and the laboratory techniques which were employed at SVILOSA for measuring the concentrations of carbon disulfide and hydrogen sulfide. These readings were then analyzed and discussed by the WMT to understand the nature of air emissions in the Spinning Hall and to identify the alternatives for reducing the concentration of noxious gases in the area of interest. Additional investigations were conducted during May and June 1994 after recalibrating the HNU-PID by using the isobutylene gas provided with the instrument. The laboratory techniques were used continuously during this period to maintain a profile of air quality in the Spinning Hall. Based upon a discussion of these data by the WMT during the visit of WEC's project team in June 1994, a program was then developed to complete the WMDP during the term of the project (through September 1994) as well as in the long term. The following section describes the environmental monitoring data which have been compiled by SVILOSA from the commencement of the WMDP.

First, baseline data on air quality in the spinning hall were obtained in March 1994 at nine (9) locations as shown in the schematic drawing given in Attachment 1 of this report. Laboratory techniques for measuring the concentration of noxious gases showed that the content of carbon disulfide varied from 35 to 60 milligrams per cubic meter (mg/cu.m); the concentration of hydrogen sulfide varied from 1 to 5 mg/cu.m. The readings taken by the HNU-PID at these locations showed that both the average and range of concentration of noxious gases were lower by a factor of approximately 1/3rd in comparison with laboratory data. It was therefore decided to recalibrate the HNU-PID based on sample gases of carbon disulfide to be prepared at SVILOSA, as well as to improve the laboratory techniques for measuring gas concentrations. For this purpose, WEC purchased special bags for preparing the gas samples and a sampler pump to be used in laboratory techniques. Subsequent recalibration of the HNU-PID could however be done only by using isobutylene gas and the field data obtained by this instrument were found to be consistently lower than laboratory data. During the visit of WEC's project team during June 1994, it was decided to purchase special syringes developed originally for use in chromatography for injecting accurately measured samples of carbon disulfide and air into special bags order to prepare sample gases of known concentration which can be used in future recalibration of the HNU-PID.

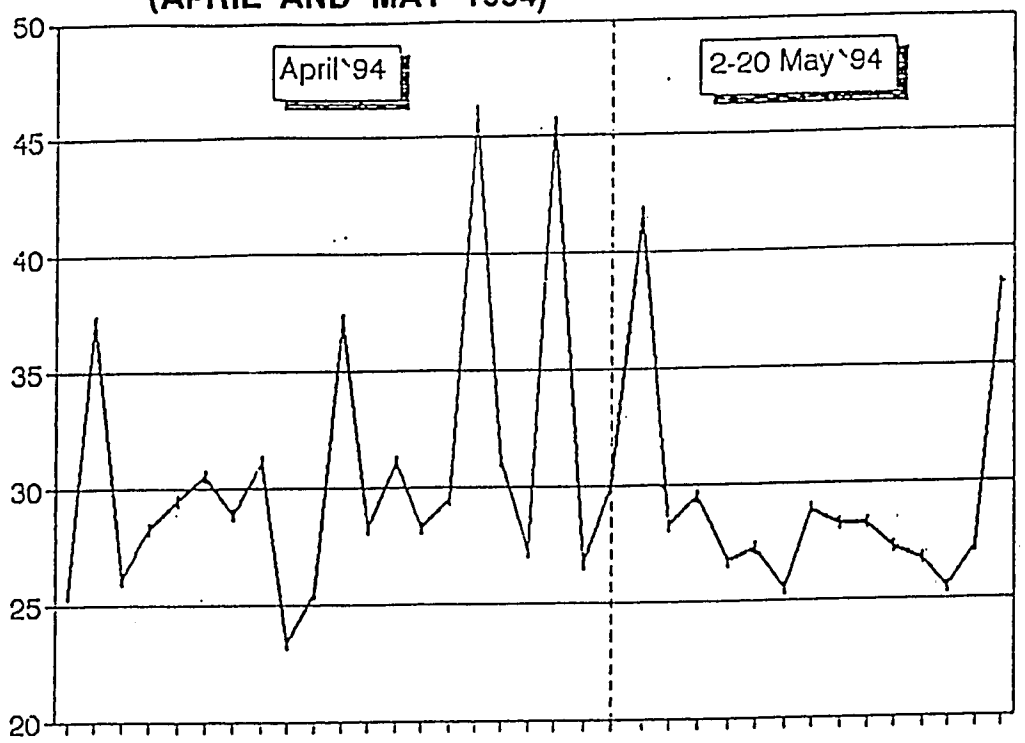
Despite the persisting need to confirm the accuracy of field data obtained by the HNU-PID, the WMT immediately recognized the value of this portable environmental monitoring instrument in investigating the sources of air emissions in the Spinning Hall after commencing the WMDP in March 1994. It was found that the instrument was sensitive to changes in gas concentrations in the area and could be used to measure gas concentration at locations in the Spinning Hall which could not be easily investigated in the past by using laboratory techniques. The instrument was also found to be simple in operation and easy to recalibrate. Measurements have been made of gas concentrations at the following new locations in the Spinning Hall :

- Spinning nests inside the machines being operated for spinning different specifications of rayon.
- Manifolds of the pipes which are used for normally exhausting noxious gases from the spinning machines.
- Inside the machines during operation under normal ventilation of gases.
- Inside the machines during operation under additional ventilation of gases.
- Suction air ducts below the tables used for receiving spun rayon cakes.
- Over the tables used for receiving spun rayon cakes from the machines.
- In the area near the hydraulic seals provided below the spinning nests.
- Main air ducts used for forced ventilation of spinning machines.
- Additional locations in the Spinning Hall to characterize air quality.
- Below the spinning machines with changed damper settings in air ducts.

After reviewing these field data, the WMT has already recommended several changes in operation which are expected to improve upon the air quality in the Spinning Hall. Some of these changes in operating procedures have been experimented during the last few months. However, the operating changes have not yet been fully implemented and the air quality data continues to rely upon the laboratory techniques at the selected locations. As shown by the baseline data on air quality given in Attachment 2 of this report, a significant trend of reduction in the average of gas concentrations has not yet been observed . It is believed that by improving the recalibration of HNU-PID to confirm the accuracy of air quality data obtained by the instrument, a better system and larger baseline can be developed to monitor the release of noxious gases from the spinning machines to the working area. It is also pertinent to note that air quality in the Spinning Hall depends substantially upon the types of rayon yarn being produced at a given time.

ATTACHMENT 2

AIR QUALITY MONITORING DATA AT SELECTED LOCATIONS (APRIL AND MAY 1994)



Date	#1	#2	#3	#4	#5	#6	#7	#8	#9	Average
01-Apr	30	25	20	25	25	35	20	25	25	25.6
04-Apr	45	45	35	25	30	45	45	40	25	37.2
05-Apr	30	25	30	20	20	25	30	30	25	26
06-Apr	45	25	20	25	25	45	25	25	20	28
07-Apr	40	25	25	25	25	30	30	35	30	29.4
08-Apr	35	25	25	30	25	35	35	30	35	30.6
11-Apr	30	30	25	25	25	40	30	30	25	28.9
12-Apr	20	20	75	25	30	25	25	30	30	31.1
13-Apr	25	20	25	20	20	35	20	20	25	23.3
14-Apr	25	25	30	25	20	30	25	25	25	25.6
15-Apr	50	40	25	40	35	40	35	40	30	37.2
18-Apr	30	25	20	25	20	35	30	35	35	28.3
19-Apr	25	20	20	25	30	30	30	40	60	31.1
20-Apr	20	25	20	20	30	35	35	35	35	28.3
21-Apr	40	30	25	25	35	25	30	25	30	29.4
22-Apr	45	40	35	40	35	55	45	45	75	46.1
25-Apr	30	25	35	25	25	25	25	50	40	31.1
26-Apr	20	20	15	20	20	35	30	45	40	27.2
27-Apr	70	50	45	45	35	45	40	45	35	45.6
28-Apr	25	25	30	20	25	35	20	30	30	26.7
29-Apr	25	30	25	25	25	35	30	35	40	30.0
03-May	45	35	45	45	35	45	35	40	50	41.7
04-May	30	25	25	20	25	45	25	30	30	28.3
05-May	25	30	25	25	25	25	35	45	30	29.4
06-May	25	30	25	25	25	40	25	20	25	26.7
09-May	40	30	30	20	25	30	25	25	20	27.2
10-May	30	30	25	20	20	35	20	25	25	25.6
11-May	30	25	30	25	30	30	30	30	30	28
12-May	20	25	25	30	30	40	30	30	25	28
13-May	30	20	25	30	35	40	30	20	25	28.3
16-May	30	25	25	25	30	35	25	25	25	27.2
17-May	30	30	25	30	25	25	30	20	25	26.7
18-May	40	25	25	20	25	35	25	20	15	25.6
19-May	35	20	25	25	30	25	30	30	25	27.2
20-May	15	25	35	35	45	55	35	55	45	38.3

IMPLEMENTING WMDP

Based upon the investigations conducted after commencing the WMDP in March 1994, SVILOSA has developed and started implementing a waste minimization program to reduce the concentration of noxious gases in the Spinning Hall. A copy of this program is given in Attachment 3 of this report. According to this program, SVILOSA has identified ten (10) tasks for immediate attention; three (3) additional tasks have been identified for implementation in the short term; and five (5) more tasks have been identified for implementation in the long term. Most of the tasks for immediate attention are related to changing operating practices, such as switching on the forced ventilation before removing the spun rayon cakes. This practice will reduce the release of carbon disulfide and hydrogen sulfide from the machines when its covers are opened to remove the rayon cakes. It will also increase the protection of workers removing the cakes from additional exposure to the noxious gases. Another immediate change in operations will require that not more than four (4) windows in a spinning machine be opened at the same time for removal of rayon cakes. In addition to the proposed change in operating practices, additional maintenance of the suction ducts in the Spinning Hall has been recommended to prevent leakages of gases from damaged units. The activities to be completed in the short term include the replacement of hydraulic seals in five (5) machines in the Spinning Hall with a new model which is expected to reduce leakages of carbon disulfide from the area below the spinning nests during operation. The production manager of the Spinning Hall has been made responsible for selecting the machines and schedule for replacement of the hydraulic seals. Another activity for the short term involves the better monitoring and controls of the dampers which are installed to change air flow rates through the ducts ventilating the spinning nests. These short-term activities were selected based upon a finding made by the HNU-PID during the WMDP that there is direct correlation between gas concentrations and leakages from the hydraulic seals and air velocities in the suction ducts provided below spinning nests. The long -term task in the proposed waste minimization program of SVILOSA are more related to major repairs of the comprehensive ventilating systems which are provided in the Spinning Hall. The waste minimization program of SVILOSA was discussed in detail during the last visit of WEC's project team in June 1994. During this visit, Mr. Carl Schwing, WEC's project manager, recommended to WMT that during the remaining project period, at least two parallel teams be formed to identify high concentrations of noxious gases and take immediate corrective action to reduce these concentrations. The results of implementing the waste minimization program are expected to be available by the end of September 1994.

ATTACHMENT 3

PROGRAM FOR DEMONSTRATING WASTE MINIMIZATION IN THE SPINNING HALL, SVILOSA COMPANY, BULGARIA

GOAL OF THE PROJECT : Improve the air quality in the spinning hall by reducing the concentrations of carbon disulfide and hydrogen sulfide.

TASK	Schedule Period	Person in Charge
Immediate Tasks		
1. Switch on the forced ventilation before removing the rayon cake.	Permanent	Operators
2. Opening the dampers of the receiving table ventilation.	Permanent	Operators
3. Opening of no more than 4 machine windows at the same time.	Permanent	Operators
4. Timely removal of waste rayon cakes from the spinning hall.	Permanent	Operators
5. Clean the alkaline groove for viscose after serving the machine.	Permanent	Operators
6. Observe the requirements for covering and transporting the rayon cakes.	Permanent	Transporters
7. Clean the floor drainage and collecting duct.	Permanent	Shift Foreman
8. Repair the front and back enclosures.	As necessary	Hall Mechanic
9. Secure leak-proofness of the collecting	As necessary	Hall Mechanic
10. Monitor and control of the continuous ventilation.	Permanent	Chief ,"HV"Dept.
Short-Term Tasks		
1. Monitor and control ventilation from the spinning nests by using air dampers.	During WMDP	Chief,"HV" Dept. & Spinning Hall
2. Repair or replace flanges in the Spinning Hall air ductings.	During WMDP	Chief,"HV"Dept.
3. Replace the lower hydraulic seals on five spinning machines with new model.	During WMDP	Chief, Spinning Hall
Long-Term Tasks		
1. Full replacement of front enclosures with repaired parts.	As necessary	Hall Mechanic
2. Replace spinning nests with new or repaired parts.	As necessary	Hall Mechanic
3. Repair all forced ventilation dampers.	As necessary	Hall Mechanic
4. Repair air ductings in the utility tunnel	Before Jan.'95	Manager of the Rayon Mill
5. Repair system for blowing air into the Spinning Hall	Before Jan.'95	Chief,"HV"Dept.

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