



# TEXTILE DYE WEIGHING MONITORING STUDY

## Site Visit Reports



**TEXTILE DYE WEIGHING MONITORING STUDY**  
**SITE VISIT REPORTS**

Exposure Evaluation Division  
Economics and Technology Division  
Office of Toxic Substances  
U.S. Environmental Protection Agency  
401 M Street, S.W.  
Washington, D.C. 20460



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## **EXECUTIVE SUMMARY**

A survey was conducted jointly by the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD) to estimate airborne concentrations of dye dust in the dye weighing rooms (drug rooms) of plants that use powder dyes in the dyeing and printing of textiles. The purpose of the project was to conduct a well-designed study of representative textile dye weighing rooms, in order to improve the assessment of workplace exposure associated with the use of powder dyes in the American textile industry.

This document contains copies of the individual site visit reports which were prepared by two industrial hygienists, one supported by EPA and the other by ATMI/ETAD. No site identification information is contained in this document. The individual site reports are published here to complete the record for this study. The site reports have not undergone any formal peer review since they contain descriptive material only.

The data resulting from this study have been published in a separate EPA report, "Textile Dye Weighing Monitoring Study," EPA 560/5-90-009, April 1990.

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TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 1/0

  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site on the day of the survey were Dr. Dyson and Robert D. Willson, C.I.H., Beta Associates, Inc., subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on December 3, 1986. The industrial hygiene monitoring and recording of data were performed during the third shift (11:00 p.m. to 7:00 a.m.) of the preceding night. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 1/0 is part of a captive dyehouse operating on an integrated basis. Approximately 18 million pounds per year of synthetic and synthetic-natural blend fabrics for men's and women's outerwear are dyed in batch operations at this privately owned facility. Seventy-five dyeing machines (jet and beck) were available, all of which were in operation during the monitoring period. Fibers dyed are acrylic/modacrylic, rayon, wool, polyester, and cotton. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room is a rectangular room approximately 60 feet long and 30 feet wide, with a 15-foot ceiling. The room is accessed by one door at the north end of the room which leads to the mixing area, one door at the west side of the room which leads to the utility and cleaning area, and two outside doors at the south end of the room. Dye weighing and storage areas are located in the drug room; the mixing area is a separate area outside the north end of the drug room. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums utilizing the floor space along the walls of the drug room. Small candy jar-like containers of 60 dyes are also stored on each of two tables which are situated behind the two weighing stations. The dye drums vary in size from 200- to 250-pound barrels to smaller, 50- to



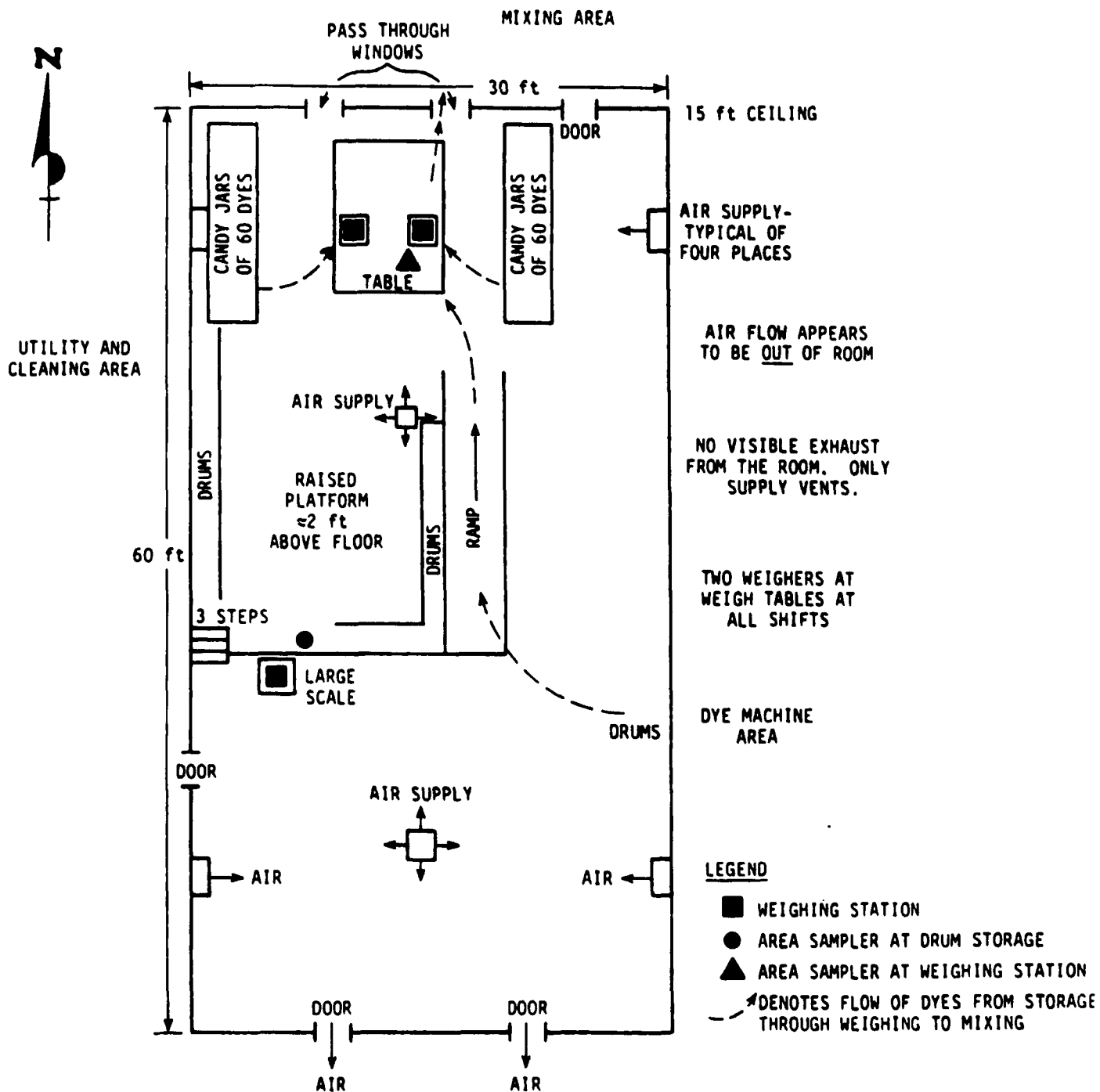


Figure 1. Sketch of drug room area.

100-pound containers. The "candy jars" each contain approximately 8-10 pounds of dye.

One weighing station housing two small scales is located at the end of the drug room near the pass-through windows used to transport the weighed dye batch to the mixing area. A larger scale is located near the drum storage area.

The general appearance of the drug room was fairly clean. The walls appeared slightly stained from dye materials. Very little spillage of dye material was observed. Reportedly, the floors are wet mopped between each shift. No floor drains are located in the drug room.

The drug room has no local exhaust ventilation installed for removing airborne dye material. There are air conditioning units and four air-supply vents. The air flow was out of the room at the south entrances.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY<sup>a</sup>

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	70	69	71
Relative humidity, %	77	73	80
Barometric pressure, in. Hg.	29.9	29.5	29.9

<sup>a</sup> Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

The company employs two full-time dye weighers on each of three shifts.

Their duties include:

- ° Relocating drums within the storage area.
- ° Weighing dyes and recording weights on batch tickets.

- Transferring dyes to the mixing area by passing the batch through a window.
- Cleaning dye storage and weighing areas.

The dye weighers employed at this facility are involved in the handling, transferring, and weighing of dyes.

The monitored dye weigher was a 44-year old male. He has been employed at the company for 18 years; 17 of those years have been spent handling dyes. He had no previous dye handling experience.

### Training

Specific dye weigher training regarding the safe handling of dyes is provided by the company in the form of respiratory protection instructions for working with powder dyes.

### Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher during dye weighing activities included a 3M 8710 respirator and rubber gloves. There was no dermal contact with dyestuffs due to the consistent wearing of rubber gloves.

### Personal Habits

The monitored dye weigher was not observed drinking or eating in the drug room during the survey. He did smoke inside the weighing area. The monitored dye weigher also performed the following two activities which created additional dye dust in the area:

- 1) Wiping the scale pan with cheesecloth following the dye weighings.
- 2) Banging the scale pan on the edge of the table to loosen the dye particles.

### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove an approximate quantity

of the dye, transferring the scoop of dye to the weigh station, pouring the required amount onto the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a stainless steel bucket. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The batch was then manually transferred to the mixing area through the pass-through window.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored employee was in the drug room for approximately 376 minutes over the 8-hour period (480 minutes). His duties required him to enter the drug room 11 times. He was monitored for exposure to particulates over a 449-minute period from 11:02 p.m. to 6:31 a.m. The data collected and observations made during the survey are summarized in Table 2. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.22	0.46	0.73
Drug room area sampler at weighing station	0.09	0.20	0.31
Drug room area sampler at drum storage, remote from weighing area	0.05	0.10	0.19

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

				Percent of monitoring period	
A.	Time in work area	Time, minutes			
	Total time monitored	449		100	
	Total time in drug room	376 <sup>a</sup>		84	
	Lunch and breaks	NA <sup>a</sup>		NA	
B.	Work capacity	Number of process units		Percent	
	Maximum work load	75		100	
	Units in operation at time of survey	75		100	
C.	Powder dyes weighed	Number of dyes		Percent	
	Total	30		100	
	Disperse	8		27	
	Basic	11		37	
	Direct	11		37	
D.	Dyes	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Total	97	100	268.455	100
	Disperse	20	21	84.085	31
	Basic	21	22	25.061	9
	Direct	56	57	159.309	59
E.	Dry chemicals weighed	Number of weighings	Percent	Weight of chemicals, pounds	Percent
	Astro Sperse PEL 50	1	100	2.751	100
F.	All chemicals weighed	Number of weighings	Percent	Weight of dry chemicals, pounds	Percent
	Total	98	100	271.206	100
	Dyes	97	99	268.455	99
	Dry chemicals	1	1	2.751	1

(continued)

TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Direct Brown 115	10	10	17.667	7
	"Direct Blue M-2"	8	8	8.447	3
	Direct Red 227	8	8	5.648	2
	Direct Red 89	7	7	6.656	2
	Direct Black 80	6	6	64.852	24
	Disperse Blue 60	6	6	21.454	8
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Direct Black 80	6	6	64.852	24
	"Disperse Black M-2"	2	2	26.207	10
	Disperse Blue 281	3	3	25.615	10
	Disperse Blue 60	6	6	21.454	8
	Direct Blue 191	4	4	20.655	8
	Direct Brown 115	10	10	17.677	7
	"Direct Orange M-2"	5	5	15.950	6

<sup>a</sup> NA - Not available.


TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY


Dye color index number	Number of weighings	Total weight of weighings, pounds
Disperse Dyes:		
Disperse Yellow 54	2	1.676
Disperse Orange 41	2	3.665
Disperse Red 73	1	4.839
Disperse Blue 73	1	0.398
"Disperse Blue U-4"	3	0.235
Disperse Blue 60	6	21.454
Disperse Blue 281	3	25.615
"Disperse Black M-2"	2	26.203
Basic Dyes:		
Basic Yellow 13	1	0.040
Basic Yellow 51	1	0.925
Basic Yellow 28	2	2.520
Basic Orange 21	1	3.571
Basic Red 46	1	1.342
"Basic Red U-2"	5	0.211
Basic Red 15	2	9.296
Basic Blue 54	1	2.684
Basic Blue 3	4	0.180
Basic Blue 141	1	0.150
Basic Green 4	2	4.142
Direct Dyes:		
Direct Yellow 106	4	3.723
"Direct Orange M-2"	5	15.950
Direct Red 89	7	6.656
"Direct Red U-1"	1	2.363
Direct Red 80	1	0.300
Direct Red 227	8	5.648
"Direct Blue M-2"	8	8.447
Direct Blue 191	4	20.655
Direct Blue 251	2	13.048
Direct Brown 115	10	17.667
Direct Black 80	6	64.852

TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 1/6

  
\_\_\_\_\_  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
\_\_\_\_\_  
Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460



## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Robert D. Willson, C.I.H., of Beta Associates, Inc. subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the morning of December 4, 1986. The industrial hygiene monitoring and recording of data were performed during the second shift (3:00 p.m. to 11:00 p.m.) on the same day. Company representatives were very helpful in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 1/6 is part of a dyehouse operating on a commission basis. Approximately 5 million pounds per year of fabrics for the manufacture of outerwear garments, life jackets, and hot-air balloons are dyed with powder dyes at this publicly owned facility. Sixteen batch dyeing machines and one continuous dyeing machine were available for use at this facility; three of the batch machines were not in operation during the monitoring period. The types of dyeing machines at this site include a thermosol continuous machine, and jig and pressure beam batch machines. Fibers of acetate, rayon, nylon, and polyester are dyed. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room is a rectangular room approximately 90 feet long and 30 feet wide, with an 18-foot ceiling. The room is accessed by two doors at one end of the room which lead to the adjacent dyehouse and a door at the opposite end which leads to the auxiliary storage area. Dye weighing and primary storage areas are located in the drug room. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums along the walls of the drug room and in a larger area at the back of the room. Most of the dyes are stored in 110-pound drums.

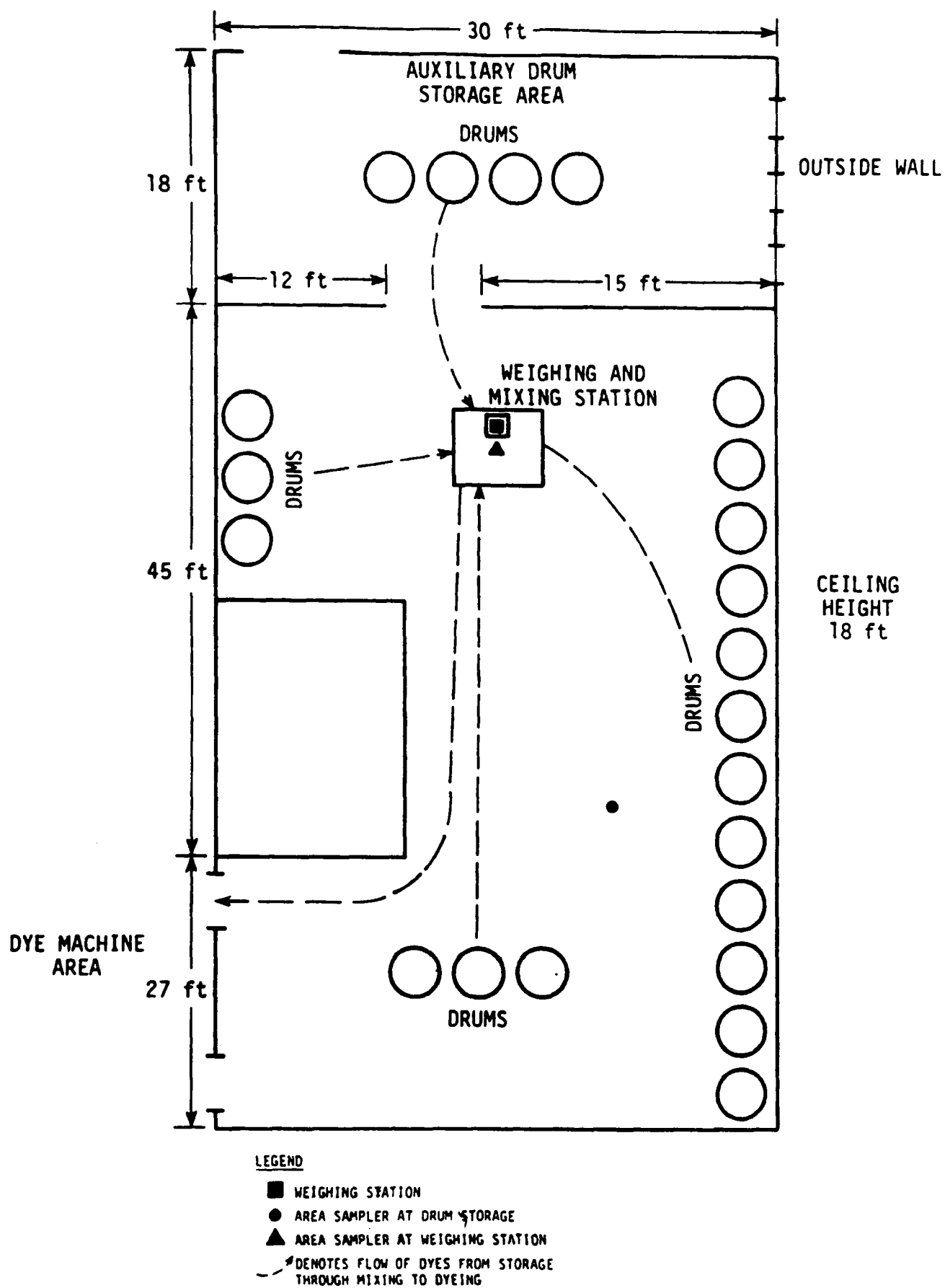


Figure 1. Sketch of drum room area.

One weighing station housing one scale is located in the center of the drug room for weighing powder dyes.

The general appearance of the weighing and storage areas was dirty. The walls, equipment, and stored drums all showed signs of accumulated dye material. Very few dyestuff spills were observed during the survey.

There was no local exhaust ventilation installed for the purpose of removing airborne dye material from the drug room. There appeared to be no visible exhaust from the room. There were steam exhaust vents on the dye machines in the dyehouse. There was no makeup air.

There are no floor drains in the drug room.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	68	68	69
Relative humidity, %	82	77	88
Barometric pressure, in. Hg.	30.16	30.07	30.20

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

The company employs one full-time weigher on each of three shifts. His duties include:

- ° Weighing dyes and dry chemicals and recording weights on batch tickets.
- ° Transferring weighed dyes from the scale pan to buckets.

- Mixing weighed dye material with water to liquefy mixture.
- Straining of dye solutions/dispersions.
- Cleaning dye storage and weighing areas.

The dye weighers employed at this facility are involved in the handling, and weighing of dyes and dry chemical; however, very few chemical additions were performed by the monitored dye weigher on the day of the survey.

The dye weigher monitored during this survey was a 50-year old male. He has been employed at the company for 17 months. He is a utility man who fills in as the dye weigher when needed. He had no previous dye handling experience.

### Training

Specific dye weigher training regarding the safe handling of dyes is provided as part of the company's Hazard Communication Program and Respiratory Protection Program and consists of review of dye material safety data sheets and instructions on respirator usage and maintenance.

### Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher included a Wilson Model AR700 half-mask respirator with a R10 dust filter and an R22 chlorine/organic vapor cartridge. As the worker did not wear gloves, there was dermal contact of the hands with the dyes while obtaining dye materials from their storage containers.

### Personal Habits

The monitored dye weigher was observed drinking and eating in the drug room during his breaks and lunch period. He did not smoke inside or outside of the weighing area. However, because he was chewing tobacco, ingestion of the dye material is possible. The monitored dye weigher washed his hands frequently to remove accumulated dye material.

## Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station, pouring the required amount into the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a bucket. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. Next, a small amount of water was added to the bucket and stirred to liquefy the mixture. On the day of the survey, only one batch was strained following mixing. Then, the bucket was transferred by other operators into the dye machine.

## SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 407 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room 10 times. He was monitored for exposure to particulates over a 464 minute period from 3:00 p.m. to 10:44 p.m. The data collected and observations made during the survey are presented in Table 2. Table 3 presents a list of dyes handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of all weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.09	0.16	0.25
Drug room area sampler at weighing station	0.07	0.12	0.15
Drug room area sampler at drum storage, remote from weighing area	<0.01	<0.01	0.04

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

				Percent of monitoring period	
A.	Time in work area	Time, minutes			
	Total time monitored	464		100	
	Total time in drug room	407		88	
	Lunch and breaks	NA		NA	
		Number of process units		Percent	
B.	Work capacity				
	Maximum work load	17		100	
	Units in operation at time of survey	14		82	
	- Continuous	1		100	
	- Batch	13		81	
		Number of dyes		Percent	
C.	Powder dyes weighed				
	Total weighed	11		100	
	Acid	10		91	
	Disperse	1		9	
		Number of weighings	Percent	Weight of dyes, grams	Percent
D.	Dyes				
	Total	54	100	56,410	100
	Acid	53	98	56,310	>99
	Disperse	1	2	100	<1
		Number of weighings	Percent	Weight of chemicals, grams	Percent
E.	Dry chemicals weighed				
	Sodium bichromate ( $\text{Na}_2\text{Cr}_2\text{O}_7$ )	2	100	324	100
		Number of weighings	Percent	Weight of all chemicals, grams	Percent
F.	All chemicals weighed				
	Total	56	100	56,734	100
	Dyes	54	96	56,410	>99
	Dry chemicals	2	4	324	<1

(continued)



TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	Percent
	Acid Blue 25	12	23	7,482	13
	Acid Yellow 135	10	19	2,258	4
	Acid Yellow 99	8	15	15,856	28
	Acid Red 266	8	15	5,155	9
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, grams	Percent
	Acid Yellow 99	8	15	15,856	28
	Acid Blue 113	5	9	8,269	15
	Acid Blue 25	12	23	7,482	13
	Acid Yellow 49	5	9	7,256	13
	Acid Green 25	2	4	5,673	10
	Acid Red 266	8	15	5,155	9

NA - Not available.

TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, grams
Acid Dyes:		
Acid Yellow 135	10	2,258
Acid Yellow 49	5	7,256
Acid Yellow 99	8	15,856
Acid Orange 149	1	4,192
"Acid Orange U-1"	1	69
Acid Red 266	8	5,155
Acid Red 52	1	100
Acid Blue 25	12	7,482
Acid Blue 113	5	8,269
Acid Green 25	2	5,673
Disperse Dyes:		
Disperse Yellow 184:1	1	100

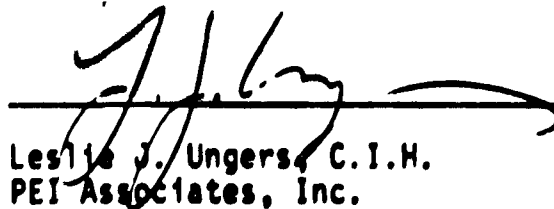
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 2/1



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
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## INTRODUCTION

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## SITE CHARACTERIZATION

### GENERAL

The drug room at site 2/1 is part of a captive dyehouse operating on an integrated basis. Approximately 3.5 million pounds per year of knitted apparel fabrics are dyed in batch operations at this publicly owned facility. There are eleven atmospheric beck dyeing machines available, all of which were operating at the time of this survey. Fibers dyed are acrylic/mod-acrylic, polyester, cotton, or combinations of these fibers. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room is a rectangular area located in the basement of the facility measuring approximately 15 feet long and 5 feet wide with a 12-foot ceiling. The room is accessed by personnel by one of two doors at either end of the room. The south entrance leads directly from the drum storage area. The drug room includes shelving and dye and dry chemical scales. Separated from the drug room by an interior wooden wall, the drum storage area measures 15 feet by 60 feet. All drums are stored on the basement floor of this area. Drums vary in size from 200-250 pound barrels to smaller, 50-100 pound containers. The mixing area is completely separate from this area of the facility. Figure 1 presents a sketch of the drug room area.

The general appearance of the weighing and storage areas was fairly clean. Although powder dye spills were not cleaned up immediately, the

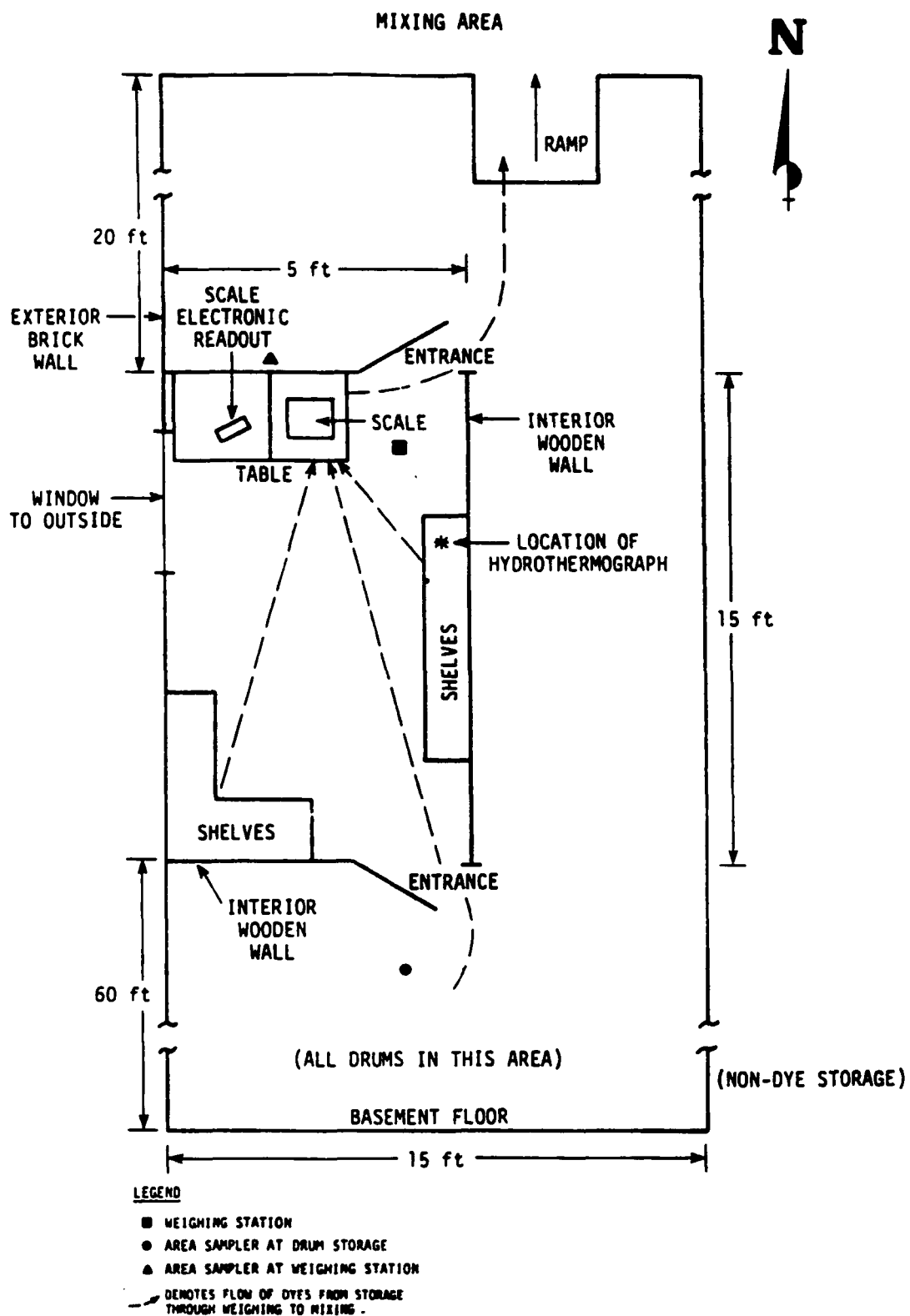


Figure 1. Sketch of drug room area.

walls, floors, and general area were maintained in fair condition. Cleanliness of equipment, however, was poor, with evidence of dye dust accumulation.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	73	68	75
Relative humidity, %	49	44	55
Barometric pressure, in. Hg	30.12	30.11	30.14

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

The drug room has no active local exhaust ventilation system installed for the purpose of removing airborne dye particles. Floor drains are present for drainage purposes in the drug room. The drum storage area is exposed along one side to the remainder of the basement area.

#### DYE WEIGHER ACTIVITIES


The company employs one full-time dye/chemical weigher on each of three shifts. His duties include:


- Weighing dyes and recording weights on dye batch tickets.
- Transferring weighed dyes from the scale pan to stainless steel buckets.
- Adding liquid agents to buckets.
- Carrying buckets of batched chemicals to the mixing area.
- Cleaning dye storage and weighing areas.

TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 2/4

  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460



## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Kenneth Troutman, C.I.H., subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on December 9, 1986. The industrial hygiene monitoring and recording of data were performed during the first shift (7:00 a.m. to 3:00 p.m.) on the next day. Company representatives were very cooperative in assisting with this survey.

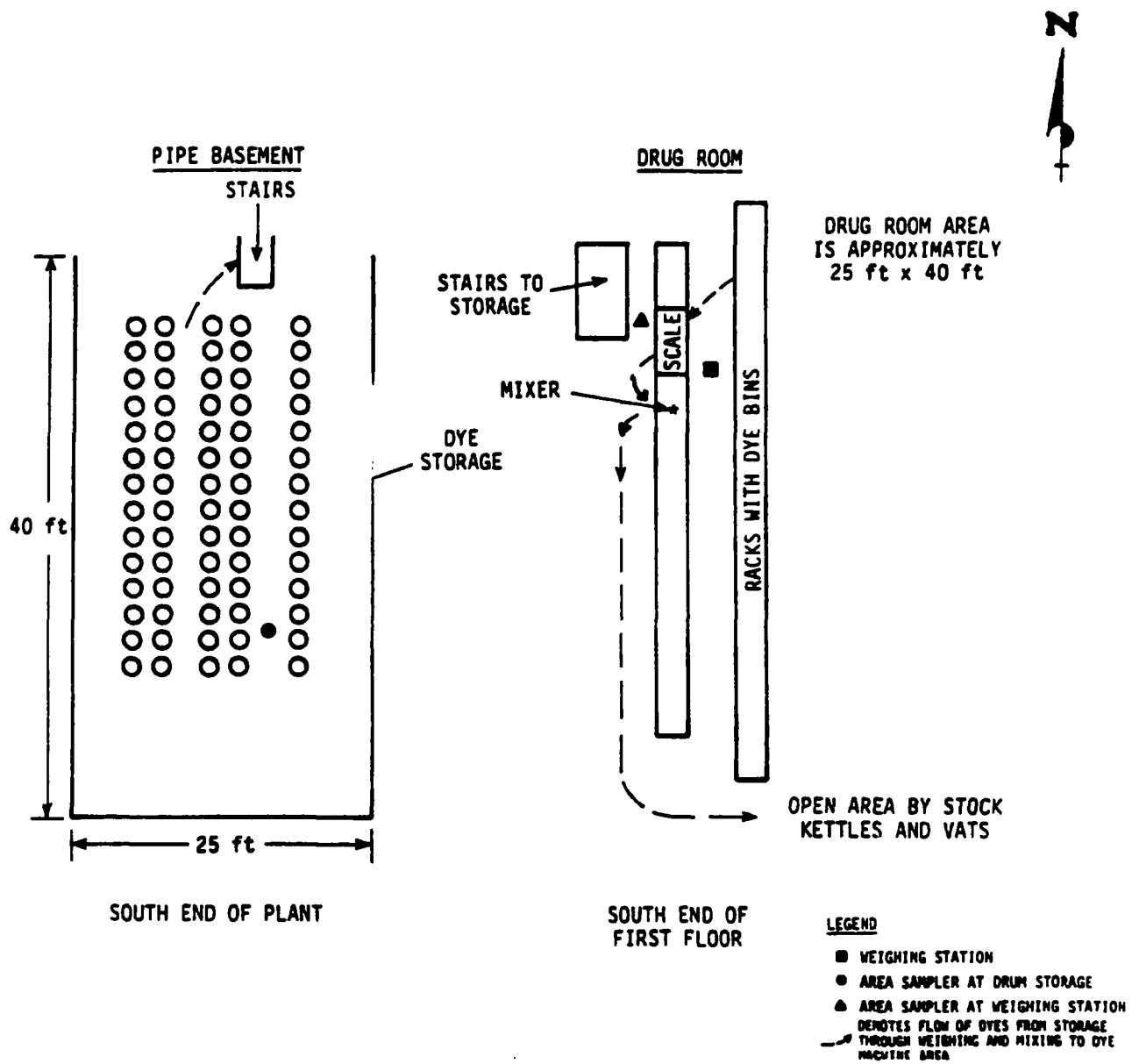


Figure 1. Sketch of drug room area.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 2/4 is part of a captive dyehouse operating on an integrated basis. Approximately 2.5 million pounds per year of wool raw stock are dyed in batch operations at this publicly owned facility. Thirty-three stock dye machines were available, 20 of which were in operation during the monitoring period. Fibers of wool and nylon are dyed for the carpet industry. Site operations include storage, dyeing, and drying.

### DRUG ROOM

The drug room, located on the first floor of the plant building, is a rectangular room approximately 40 feet long and 25 feet wide, with a 20-foot ceiling. The drug room is open to the adjacent mixing area. The drum storage area for the dyes is located in the pipe basement which is accessed from the stairwell in the drug room. Dyes are also stored in bins on racks in the drug room. The dye drums in the basement contain approximately 300 pounds of dye material while the bins in the drug room contain approximately 2 to 3 pounds of dye. Dry chemicals are not stored in the drug room area. Figure 1 presents a sketch of the drug room.

A weighing station housing one scale for weighing the powder dyes is located in the drug room near the racks which support the dye bins. A small hand mixer is located near the dye scale for mixing dye batches.

- Mixing the dyes in the bucket using a hand mixer.
- Hand carrying the buckets to the dye machines.
- Cleaning dye storage, weighing, and mixing areas.

The monitored dye weigher was a 47-year old male. He has been employed at the company for 21 years; fifteen of those years have been spent handling dyes. He had no previous dye handling experience.

#### Training

Specific dye weigher training regarding the safe handling of dyes was limited to instruction concerning use of chemical-resistant gloves and dust mask respiratory protection.

#### Personal Protective Equipment

The monitored dye weigher in the drug room did not utilize any personal protective equipment. However, the monitored dye weigher did demonstrate good technique during all weighing and mixing activities.

#### Personal Habits

The monitored dye weigher was not observed drinking or eating in the drug room. He did not smoke inside the weighing area, but he did smoke outside of that area.

#### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye and using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station and pouring the required amount into the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a bucket. This operation was repeated until all of the dye weighings specified

The general appearance of the weighing and storage areas was good. The walls, equipment, drums, and floors appeared to be free of accumulated dye material. It was reported that when spillage of the dye occurs, the floor is swept up immediately, although no spillage was observed at the time of this survey.

The drug room was not equipped with local exhaust ventilation systems for the purpose of removing airborne dye particles. The building was equipped with a general ventilation system; the drug room had two ceiling exhaust fans and one dryer exhaust.

No floor drains are located in the drug room.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	72	70	74
Relative humidity, %	79	64	95
Barometric pressure, torr	755	755	755

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

DYE WEIGHER ACTIVITIES

The company employs one full-time weigher/mixer on the first shift only. The dye weigher employed at this facility is involved in the handling, weighing, and mixing of dyes. His duties include:

- Weighing dyes and recording weights on batch tickets.
- Transferring dyes from the scale to buckets.

on the batch ticket had been completed. The dyes were then mixed near the dye scale using a hand mixer. He then transferred the bucket containing the mixed dyes to the dye machine area where the dye solution was poured into the expansion tank of the stock dyeing machine. Other workers operated the dyeing machines.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 213 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room 18 times. He was monitored for exposure to particulates over a 440-minute period from 7:12 a.m. to 2:32 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dyes handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.08	0.12	0.31
Drug room area sampler at weighing station	0.01	0.01	0.15
Drug room area sampler at drum storage, remote from weighing area	<0.01	0.01	0.10

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Percent of monitoring period	
A.	Time in work area	Time, minutes	
	Total time monitored	440	100
	Total time in drug room	213	48
	Lunch and breaks	NA	NA
B.	Work capacity	Number of process units	Percent
	Maximum work load	33	100
	Units in operation at time of survey	20	61
C.	Powder dyes weighed	Number of dyes	Percent
	Total weighed	21	100
	Acid	21	100
D.	Dyes	Number of weighings	Percent
	Total	108	100
	Acid	108	100
			Weight of dyes, ounces
			Percent
			1,576.01
			1,576.01
			100
			100
E.	Dry chemicals weighed	Number of weighings	
	Total	0	
F.	All chemicals weighed	Number of weighings	Percent
	Total	108	100
	Dyes	108	100
	Dry chemicals	0	0
			Weight of all chemicals, ounces
			Percent
			1,576.01
			1,576.01
			0.00
			100
			100
			0
G.	Dyes weighed most frequently	Number of weighings	Percent
	Acid Red 156	15	14
	Acid Yellow 19	12	11
	Acid Blue 25	12	11
			Weight of dyes, ounces
			Percent
			57.02
			132.95
			40.40
			4
			8
			3

(continued)

TABLE 2 (continued)

H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, ounces	Percent
	Acid Black 172	4	4	755.00	48
	Acid Red 57	6	6	318.87	20
	Acid Yellow 19	12	11	132.95	8

NA - Not available.



TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, ounces
Acid Dyes:		
Acid Yellow 218	1	0.88
Acid Yellow 49	2	1.02
Acid Yellow 198	4	5.13
Acid Yellow 19	12	132.95
Acid Yellow 151 (NP)*	1	0.79
Acid Orange 156	15	57.02
Acid Red 337	2	6.09
Acid Red 57	6	318.87
Acid Red 266	5	20.86
Acid Red 143	6	37.87
Acid Red 299	4	1.94
Acid Red 182	1	0.75
Acid Violet 48	4	24.82
Acid Blue 80	7	43.77
Acid Blue 324S	5	2.31
Acid Blue 25	12	40.40
Acid Blue 40	7	17.09
Acid Blue 290	4	4.54
Acid Green 25	3	87.51
Acid Green 28	3	16.41
Acid Black 172	4	755.00

\*NP designates a Neutral Premetallized Dye.

The dye/chemical weighers at this facility are involved in dye and dry chemical handling, weighing, and mixing. No dry chemicals were weighed in the drug room during this survey. Work activities require the dye/chemical weigher to spend time in the drug room, storage area, and mixing room.

The monitored dye/chemical weigher was a 24-year old male. He has been employed at the company for 6.5 years; the past 4 years have been spent handling dyes. He had no previous dye handling experience.

### Training

Information regarding the safe handling of dyes is provided by the company as part of the company's Hazard Communication program.

### Personal Protective Equipment

Personal protective equipment required by the company to be worn by dye/chemical weighers includes half-mask air-purifying cartridge respirators, rubber aprons and gloves, safety glasses, and ear plugs. The monitored dye/chemical weigher did not wear his gloves consistently, thereby resulting in frequent dermal contact with the powder dyes.

### Personal Habits

The monitored dye/chemical weigher did not eat, drink, or smoke in the weighing area.

### Work Activities

The dye/chemical weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum containing the appropriate dye, using a stainless steel hand scoop to remove an approximate quantity of the dye, transporting the scoop of dye to the weighing station, pouring the required amount onto the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a stainless steel bucket. This operation was repeated for additional dyes

until all the weighings specified on the batch ticket had been completed. The same technique would have been used for dry chemical weighings had any been required during the monitoring period. Buckets containing dye/chemical mixtures were then hand carried to the mixing area and placed on the ground next to the mixer. The mixing operation was not observed.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored employee was in the drug room for a total of 84 minutes over the 8-hour (480 minute) period. During that time, his duties required him to enter the drug room 12 times. He was monitored for particulates over a 367 minute period, from 3:10 pm to 9:17 pm. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.01	0.02	0.94
Drug room area sampler at weighing station	0.06	0.11	0.17
Drug room area sampler at drum storage, remote from weighing area	<0.01	<0.01	0.14

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

A. Time in work area		Time, minutes	Percent of monitoring period		
Total time monitored		367	100		
Total time in drug room		84	23		
Lunch break		Not available			
B. Work capacity		Number of process units	Percent		
Maximum work load		11	100		
Units in operation at time of survey		11	100		
C. Powder dyes weighed		Number of dyes	Percent		
Total weighed		15	100		
Disperse		5	33		
Basic		2	13		
Reactive		8	53		
D. Dyes		Number of weighings	Percent	Weight of dyes, kilograms	Percent
Total		20	100	63.961	100
Disperse		5	25	22.269	35
Basic		2	10	5.131	8
Reactive		13	65	36.561	57
E. Dry chemicals weighed		Number of weighings			
Total		0			

TABLE 2 (continued)

F.	Dyes weighed most frequently	Number of weighings		Weight of dyes, kilograms	
			Percent		Percent
	Reactive Blue 10	5	25	5.990	9
	Reactive Blue 7	2	10	10.352	16
G.	Largest quantity of dyes weighed	Number of weighings		Weight of dyes, kilograms	
			Percent		Percent
	"Disperse Blue M-3"	1	5	13.349	21
	Reactive Blue 137	1	5	11.570	18
	Reactive Blue 7	2	10	10.352	16
	Disperse Blue 73	1	5	6.750	11
	Reactive Blue 10	5	25	5.990	9

TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye Color Index Number	Number of weighings	Total weight of all weighings, kilograms
Disperse Dyes:		
"Disperse Red U-2"	1	1.348
Disperse Red 60	1	0.576
Disperse Blue 73	1	6.750
Disperse Blue 56	1	0.246
"Disperse Navy Blue M-3"	1	13.349
Basic Dyes:		
Basic Yellow 40	1	3.747
Basic Red 14	1	1.384
Reactive Dyes:		
Reactive Yellow 3	1	0.692
Reactive Orange 70	1	1.112
Reactive Red 43	1	2.535
Reactive Red 120	1	2.708
Reactive Red 152	1	1.602
Reactive Blue 7	2	10.352
Reactive Blue 137	1	11.570
Reactive Blue 10	5	5.990

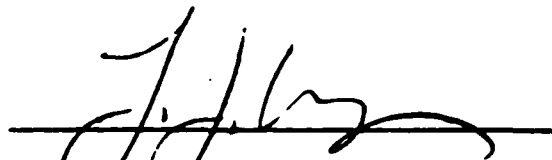
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 2/7



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Ken Troutman, C.I.H., subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the afternoon of October 21, 1986. The industrial hygiene monitoring and recording of data were performed during the first eight hours of the second of two 12-hour daily shifts (7:00 p.m. to 3:00 a.m.) on the same day. Company representatives were very cooperative in assisting with this survey.



## SITE CHARACTERIZATION

### GENERAL

The drug room at site 2/7 is part of a dyehouse operating on a commission basis. Approximately 6 million pounds of knit goods for apparel use per year are dyed in batch operations at this privately owned facility. Eleven jet dyeing machines were available, all of which were in operation at the time of the survey. Fibers dyed are acrylic/modacrylic, polyester, and cotton. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room is a rectangular room approximately 21 feet long and 18 feet wide with a ceiling 12 feet in height. The room is accessed by a door which leads to the adjacent dye machine area. An additional door leading to a separate drum storage room is located in the southeast corner of the room. Dye weighing, storage, and mixing areas are located in the drug room. Figure 1 presents a sketch of the drug room area.

#### Mixing Machine Area

One mixer is located in the west corner of the drug room near the weighing station. There are no physical barriers that separate the mixer from the rest of the drug room.

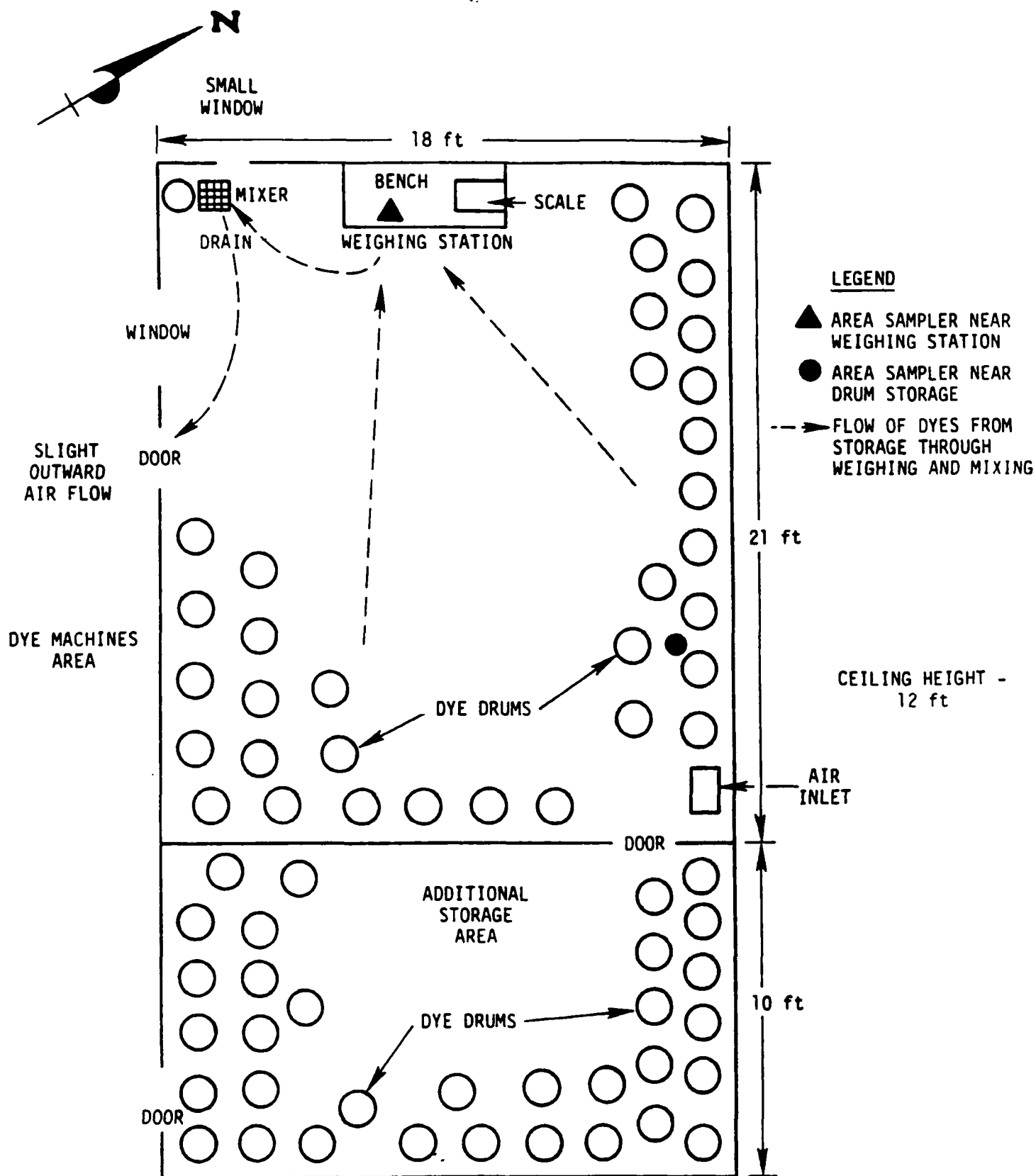


Figure 1. Sketch of the drug room area.

### Powder Dye Storage and Weighing Area

Dyes are stored in drums utilizing the floor space along the walls of the drug room. Dye drums are also stored in a separate storage room measuring 18 feet long and 10 feet wide located at the rear of the drug room. The drums vary in size from 200-250 pound barrels to smaller, 50-100 pound containers.

For weighing of powder dyes, a weighing station housing one scale is located along the wall near the mixing machine. Dry chemicals are neither stored nor weighed in the drug room.

The general appearance of the drug room was unclean. There was accumulated dye material on the walls, floors, equipment, and inventory indicating infrequent cleaning practices. No spillage of the powder dyes was observed during the survey; therefore, cleanup procedures could not be directly evaluated.

The drug room has no exhaust ventilation installed for the purpose of removing airborne dye particles. An air supply vent is located at the rear of the room near the entrance to the additional storage room. There was a slight outward flow of air at the drug room exit leading to the dye machine area.

A floor drain is located next to the mixing machine to facilitate drainage during floor cleanup activities and mixer overflow.

Environmental conditions of the drug room (i.e., temperature and humidity) were recorded hourly during the survey. Barometric pressure readings for the day were obtained from the weather station at the local airport. The environmental conditions are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	70	69	72
Relative humidity, %	68	64	75
Barometric pressure, in. Hg.	29.37	29.31	29.40

### DYE WEIGHER ACTIVITIES

The company employs one full-time dye weigher on each of two shifts.

His duties include:

- ° Relocating drums within the storage areas.
- ° Weighing dyes and recording weights on dye batch tickets.
- ° Transferring dyes from the scale to buckets, which are mixed and then hand carried to the staging area outside the drug room near the dye machines.
- ° Cleaning dye storage, weighing, and mixing areas.

The dye weighers employed at this facility are involved in handling and weighing of dyes. Work activities require the dye weigher to spend time in both the drug room and the dye machine area.

The monitored dye weigher was a 35-year old male. He has been employed at the company for 6 years; 5 of those years have been spent handling dyes. He had no previous dye handling experience.

### Training

Training on all chemicals used in the plant was provided to the dye weighers in conjunction with the company's Hazard Communication program.

### Personal Protective Equipment

Dye weighers are provided with 3M Model 8714 Acid Gas respirators and rubberized boots. The respirator was worn by the monitored dye weigher only

when he was handling dyes that he felt were irritating to his sinuses. He wore rubberized boots throughout the monitoring period. It was noted that there was slight dermal contact with the dye material; hand protection is not required by the company.

#### Personal Habits

The monitored dye weigher did not drink or eat in the drug room. He did smoke both inside and outside of the drug room. He appeared to use good technique when handling the dyes.

#### Work Activities

The dye weigher activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the drug room containing the appropriate dye and using a hand scoop to remove an approximate quantity of the dye, transporting the scoop of dye to the weighing station and pouring the required amount onto the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to an open bucket. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The bucket of weighed dye was mixed with water in the drug room. It was then hand carried to the staging area near the dye machines. The dyes were transferred to the dye machines as needed.

When a dye barrel was almost empty, the dye weigher manually transferred the remaining powder into the new barrel by inverting the old barrel over the new barrel. One or more drum transfers occurred during the survey. This was a potentially dust generating activity. The individual transfers were not recorded at the time of the survey, therefore, these transfers are not reflected in the summary tables in the total number of dye weighings.

## SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored employee was in the drug room for a total of 124 minutes over an 8-hour (480 minute) portion of his 12-hour work-shift. During that time, his duties required him to enter the drug room 16 times. He was monitored for exposure to particulates over a 475 minute period from 7:06 pm to 3:01 am. The data collected and information recorded during the survey are presented in Table 2. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.04	0.08	0.46
Drug room area sampler at weighing station	0.03	0.07	0.23
Drug room area sampler at drum storage, remote from weighing area	0.03	0.06	0.25

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

A. Time in work area		Time, minutes	Percent of monitoring period		
Total time monitored		475	100		
Total time in drug room		124	26		
Lunch break		Not available			
B. Work capacity		Number of process units	Percent		
Work load		11	100		
Units in operation at time of survey		11	100		
C. Powder dyes weighed		Number of dyes	Percent		
Total weighed*		16	100		
Disperse		4	25		
Basic		6	38		
Direct		6	38		
D. Dyes		Number of weighings	Percent	Weight of dyes, pounds	Percent
Total		27	100	56.422	100
Disperse		4	15	4.298	8
Basic		17	63	4.611	8
Direct		6	22	47.513	84

(continued)

TABLE 2 (continued)

E. Dry chemicals weighed			Number of weighings		
Total			0		
F. Dyes weighed most frequently		Number of weighings	Percent	Weight of dyes, pounds	Percent
Basic Yellow 28		5	19	2.747	5
Basic Violet 16		5	19	1.629	3
Basic Red 46		4	15	0.020	<1
G. Largest quantity of dyes weighed		Number of weighings	Percent	Weight of dyes, pounds	Percent
"Direct Black M-1"		1	4	19.127	34
"Direct Blue U-1"		1	4	15.514	27
Direct Red 224		1	4	5.10	9
Direct Yellow 106		1	4	3.932	7



TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of all weighings, pounds
Disperse Dyes:		
Disperse Yellow 54	1	0.003
Disperse Red 60	1	2.102
Disperse Blue 56	1	1.593
Disperse Green 9	1	0.60
Basic Dyes:		
Basic Yellow 28	5	2.747
Basic Red 14	1	0.11
Basic Red 46	4	0.020
Basic Violet 16	5	1.629
Basic Violet 37	1	0.098
Basic Blue 3	1	0.007
Direct Dyes:		
Direct Yellow 44	1	3.00
Direct Yellow 106	1	3.932
Direct Red 224	1	5.10
"Direct Blue U-1"	1	15.514
Direct Blue 106	1	0.84
"Direct Black M-1"	1	19.127

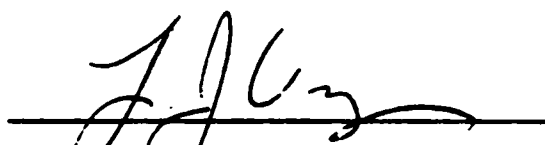
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 3/0



William L. Dyson, Ph.D., C.I.H.  
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## SITE CHARACTERIZATION

### GENERAL

The drug room at site 3/0 is part of a captive dyehouse operating on an integrated basis. Approximately 25<sup>1</sup> million pounds per year of yarn for furniture and automotive fabrics are dyed in batch operations at this privately owned facility. Twelve<sup>1</sup> CDB and Gaston County package dyeing machines were available, all of which were operating during the monitoring period. Fibers dyed are nylon and polyester. Site operations include storage, preparation, dyeing, and drying.

### DRUG ROOM

The drug room is a rectangular room approximately 51 feet long and 15 feet wide with a ceiling 12 feet in height. The room is accessed by one of three doors, one in the center of each of the north, south, and west walls. The drug room includes a weighing station with two dye scales and dye storage areas. Dry chemicals are neither stored nor weighed in the drug room. Dye machines are located in an area outside the drug room, adjacent to its west wall. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums utilizing the floor space in the vicinity of each of the four corners of the drug room. The containers vary in size

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<sup>1</sup>The incorrect information was recorded on the field survey form during the initial site visit. Corrections were made following subsequent contact with plant representatives and are indicated in this report.

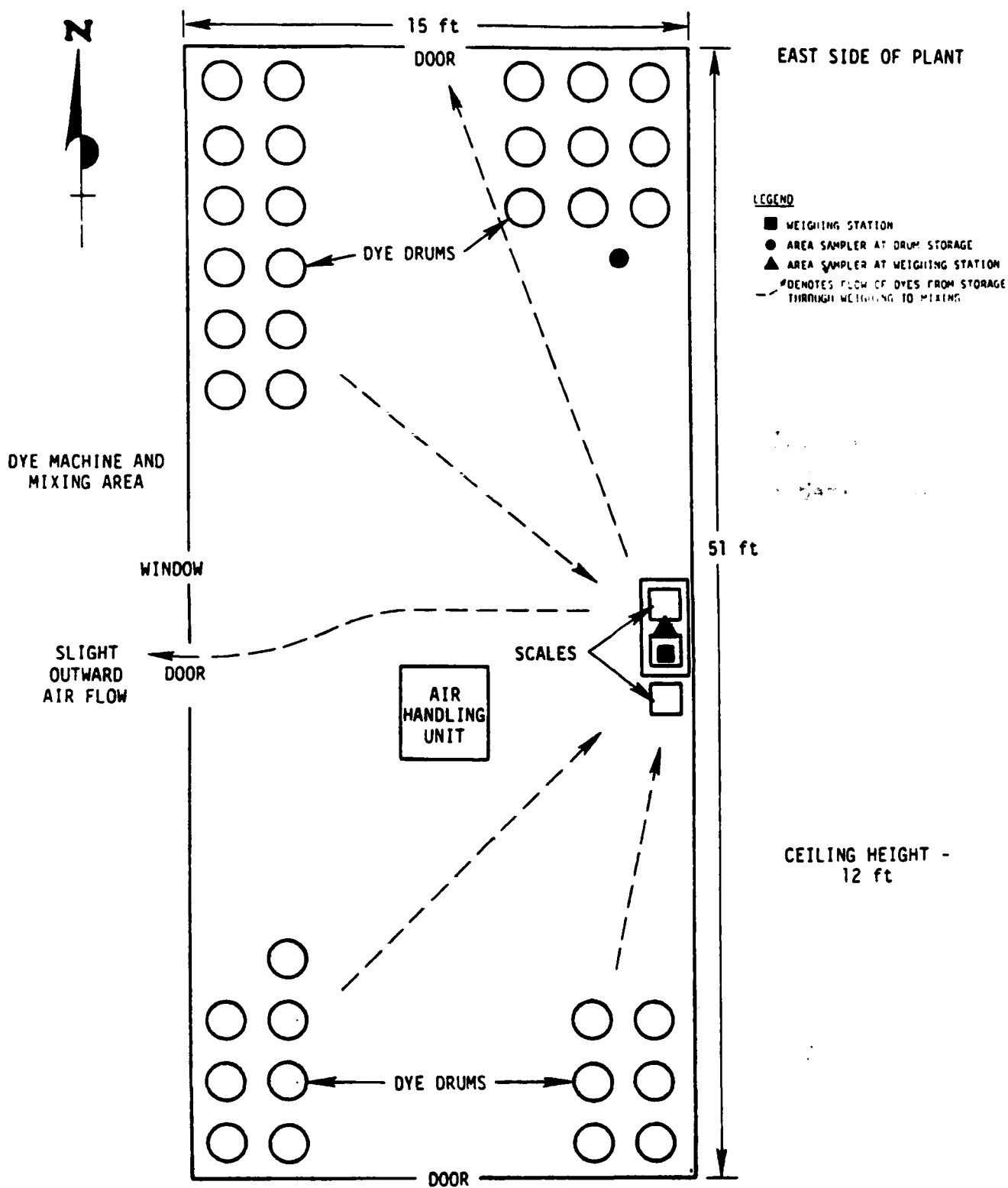


Figure 1. Sketch of drug room area.

from 200-250 pound barrels to smaller, 50-100 pound containers. One weighing station housing two scales for weighing powder dyes is located at the center of the east wall, directly opposite the west wall entrance.

The general appearance of the drug room was very clean. The walls, floor, equipment, and stored drums were all free of accumulated dye material. Scale pans and spatulas were washed at the end of each shift. Reportedly, the floors were washed down at the beginning and end of each shift. A floor drain located in the center of the room facilitates drainage during this activity. No spillage of dye material was observed during the survey.

The drug room had no local exhaust ventilation installed for the purpose of removing airborne dye particles. The air supply vent was located in the center of the room near the weighing station. A slight outward flow of air at the drug room exit to the dye machine area was observed on the day of the survey.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	72	71	72
Relative humidity, %	54	53	55
Barometric pressure, in. Hg.	29.26	29.21	29.28

\* Temperature and humidity readings were recorded hourly over the 8-hour work shift. Hourly barometric pressure readings were obtained from the local airport weather bureau for the monitoring period.

## DYE WEIGHER ACTIVITIES

The company employs two full-time dye weigher/mixers on each of three shifts. His duties include:

- ° Relocating drums within the storage area.
- ° Weighing dyes and recording weights on dye batch tickets.
- ° Transferring dyes from the scale to a separate container, which is then carried to an area outside the drug room near the dye machines.
- ° Mixing dyes with water in mixing area.
- ° Cleaning dye storage and weighing areas.

The dye weigher/mixers employed at this facility are involved in dye handling, weighing, and mixing. Dry chemicals are not handled by the dye weigher/mixer. Work activities require the dye weigher/mixer to spend time in the drug room and in the dye machine area outside the drug room.

The monitored dye weigher/mixer was a 22-year old male. He has been employed at the company for one year, during which time he has spent 8 months handling dyes. He had no previous dye handling experience.

### Training

Company training for dye weigher/mixers regarding the safe handling of dyes involves employee familiarization with the individual dye material safety data sheets (MSDS's). Dye weigher/mixers are also instructed to wear safety glasses and a respirator during dye handling activities.

### Personal Protective Equipment

Personal protective equipment provided by the company and worn by the monitored dye weigher/mixer included a 3M Model 8710 Dust and Mist respirator, gloves, and rubber boots.

### Personal Habits

The monitored dye weigher/mixer was not observed drinking, eating, or smoking in the drug room. He was observed smoking outside of the drug room.

### Work Activities

The dye weigher/mixer activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum containing the appropriate dye, using a hand scoop to remove the approximate quantity of the dye, transferring the scoop of dye to the weighing station, pouring the required amount onto the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a separate container. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The container of weighed dye material for the batch was hand carried to the mixing area outside the drug room where water was added until a good solution/dispersion was obtained. The dye weigher/mixer did not operate the dye machines.

When a barrel of dye was almost empty, the dye weigher/mixer manually transferred the remaining powder into the new barrel by inverting the old barrel over the new barrel. One or more drum transfers occurred during the survey. This was a potentially dust generating activity. The individual transfers were not recorded at the time of the survey; therefore those transfers are not reflected in the summary tables in the total number of dye weighings.

### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored employee was in the drug room for a total of 263 minutes over the 8-hour (480 minute) first work-shift. During that time, his duties



required him to enter the drug room 18 times. He was monitored for exposure to particulates over a 428 minute period from 8:06 am to 3:14 pm. The data collected and information recorded during the survey are presented in Table 2. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.10	0.31	0.41
Drug room area sampler at weighing station	0.09	0.30	0.30
Drug room area sampler at drum storage, remote from weighing area	0.01	0.05	0.09

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

A. Time in work area	Time, minutes	Percent of monitoring period
Total time monitored	428	100
Total time in drug room	263	61
Lunch break	Not available	
B. Work capacity	Number of process units	Percent
Work load	12	100
Units in operation at time of survey	12	100
C. Powder dyes weighed	Number of dyes	Percent
Total weighed	21	100
Acid	7	33
Disperse	14	67

TABLE 2 (continued)

D. Dyes	Number of weighings	Percent	Weight of dyes, grams	Percent
Total	72	100	97,926.51	100
Acid	13	18	10,813.53	11
Disperse	59	82	87,112.98	89

E. Dry chemicals weighed	Number of weighings
Total	0

F. Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	Percent
Disperse Orange 30	12	17	36,630.96	37
Disperse Blue 73	9	12	6,767.90	7
Disperse Red 159	6	8	15,039.00	15
Disperse Blue 337	6	8	7,479.10	8

G.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, grams	Percent
	Disperse Orange 30	12	17	36,630.96	37
	Disperse Red 159	6	8	15,039.00	15
	Acid Black M-1	2	3	7,520.50	8
	Disperse Blue 337	6	8	7,479.10	8

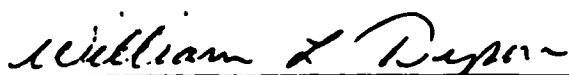
TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

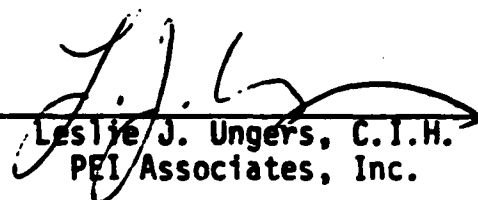
Dye color index number	Number of weighings	Weight of all weighings, grams
Acid Dyes:		
Acid Yellow 159	4	1054.20
Acid Red 360	1	364.40
"Acid Red U-3"	2	13.71
Acid Red 299	1	701.10
Acid Blue 113	1	1156.00
"Acid Blue U-1"	2	3.62
"Acid Black M-1"	2	7520.50
Disperse Dyes:		
Disperse Yellow 93	3	619.82
Disperse Yellow 198	3	1359.70
Disperse Orange 30	12	36630.96
Disperse Red 43	5	1369.70
Disperse Red 305	2	2036.00
Disperse Red 159	6	15039.00
Disperse Red 263	1	606.80
Disperse Red 91	2	425.60
Disperse Red 167:1	4	5656.60
Disperse Violet 48	2	679.60
Disperse Blue 337	6	7479.10
Disperse Blue 73	9	6767.90
Disperse Blue 60	1	3084.00
Disperse Blue 281	3	5358.20

TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 3/3

  
\_\_\_\_\_  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
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Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Ronald H. Hill, C.I.H. of Health and Hygiene, Inc. and Donald L. Unruh, C.I.H., IT Corporation, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on March 30, 1987. The industrial hygiene monitoring and recording of data were performed during the third shift (11:00 p.m. to 7:00 a.m.) on March 30-31, 1987. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 3/3 is part of a captive dye house operating on an integrated basis. Approximately 2.16 million pounds of upholstery fabric per year are printed at this privately owned facility. Two printing machines were available but only one was operating at the time of the survey. Fibers printed are acrylic/modacrylic, rayon, polyester, cotton, and nylon. Liquid Disperse Dyes are used for acrylic/modacrylic or polyester fibers; pigments are used for cotton or rayon fibers; and powder Acid Dyes are used for nylon fibers. Site operations include storage, preparation, printing (application and fixation), and finishing.

### DRUG ROOM

The drug room is a rectangular room approximately 45 feet long and 15 feet wide, with a 10-foot ceiling. The room is accessed by a door at the north end of the room which leads to the print shop area and a door at the south end of the room which leads to the dye mix area. The dye mix area is a separate room outside of the drug room. The drug room includes drum storage areas, one dye weighing station equipped with two scales, an oven, a washer, and a dryer. Figure 1 presents a sketch of the drug room and the adjacent dye mix area.

Powder dyes are stored in drums located against the east wall of the drug room. Disperse liquid dyes are stored in drums located against the



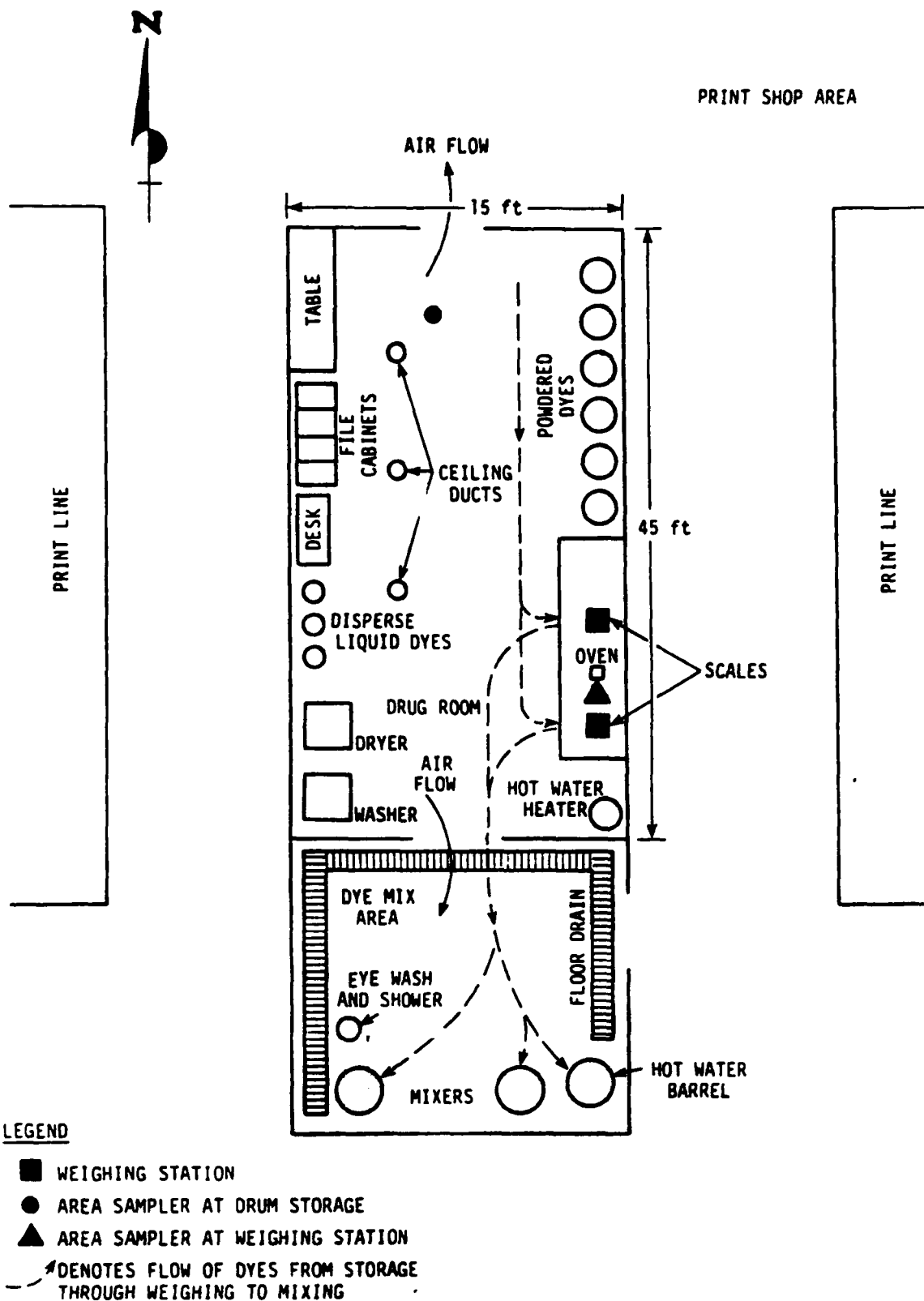


Figure 1. Sketch of drug room area.

west wall of the drug room. The drums vary in size from 200 to 250-pound barrels to 50 to 100-pound containers.

For weighing of the powder dyes, two scales are located on a counter next to the access door to the dye mix area.

The general appearance of the drug room was poor. The walls, equipment, and stored drums contained significant accumulations of dyestuff, indicating infrequent cleaning. It was reported that the floors and weighing tables were washed down weekly. No immediate clean-up procedures in the case of spills has been established.

The drug room was not equipped with a local exhaust ventilation system for the purpose of removing airborne dye particles. The room was equipped with an air conditioning system in which air was supplied from a ceiling vent. The general building air was supplied through air supply ducts which exhausted through roof vents. The ventilation in the drug room created a slight positive pressure compared to the other plant areas, evidenced by the flow of air out of the room at each of the access doorways.

A floor drain which surrounds the perimeter of the dye mix area is located just outside the door at the south end of the drug room to facilitate drainage when the floor is hosed down weekly.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	68	66	73
Relative humidity, %	76	70	81
Barometric pressure, in. Hg.	28.64	28.61	28.68

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

The company employs four full-time dye weighers on the first shift and one dye weigher on each of the second and third shifts. Their duties include:

- ° Relocating drums of dye material within the drug room by use of a drum dolly.
- ° Weighing dyes and recording weights on batch tickets.
- ° Transferring dyes from the scale to buckets.
- ° Emptying buckets of weighed dyestuff mixed with water into mixing barrels.
- ° Adding liquid chemicals to the mixing barrels.
- ° Mixing the dyes and chemical materials in the mixing barrels with portable mixers.
- ° Cleaning dye storage, mixing, and weighing areas.

The dye weighers employed at this facility are involved in the handling, transferring, and weighing of dry and liquid dyes and chemicals.

The monitored dye weigher was a 24-year old male. He has been employed at the company for one year; all of that time has been spent handling dyes. He had no previous dye handling experience.

#### Training

Specific dye weigher training regarding the safe handling of dyes was provided by the company as instructions as to when to wear a dust mask and

chemical goggles, and training on how to read Material Safety Data Sheets (MSDS's). A file of dye and chemical MSDS's is kept in the dye storage and weighing room.

#### Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher in the drug room included a Gerson Model No. 1710 disposable dust respirator and steel-toed shoes. The monitored dye weigher used the dust mask during all weighing activities; however, the effectiveness of the respirator may be limited for the following reasons: 1) only one strap was used on the mask, 2) the same disposable respirator is often worn for several consecutive days, and 3) the monitored dye weigher had a long, full beard, which could prevent a proper air tight seal.

#### Personal Habits

The monitored dye weigher was observed smoking in the weigh room after the dyes were weighed and in the print shop area outside of the weigh room. He did not eat or drink in the drug room area. The monitored dye weigher washed his hands after all of the powder dyes were weighed.

#### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station and spooning out the required amount into the scale dish with a wooden tongue depressor, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a bucket. The bucket was then filled two-thirds full with hot water and emptied into barrels. This

operation was repeated until all of the dye weighings specified on the batch ticket had been completed. Other liquid chemicals were then added, and the solution was mixed in the barrels by use of portable mixers. On the day of the survey, most of the dye weighing activities took place during the first two hours of the shift. Finally, the barrels were manually transported to the printing machines by drum dolly. Fourteen color combinations were weighed by the dye weigher.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 125 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room eighteen times. He was monitored for exposure to particulates over a 447-minute period from 11:20 p.m. to 6:47 a.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.01	0.02	0.13
Drug room area sampler at weighing station	<0.01	0.01	0.05
Drug room area sampler at drum storage, remote from weighing area	<0.01	<0.01	0.05

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

				Percent of monitoring period	
A.	Time in work area	Time, minutes			
	Total time monitored	447		100	
	Total time in drug room	125		28	
	Lunch and breaks	NA		NA	
		Number of process units		Percent	
B.	Work capacity				
	Maximum work load	2		100	
	Units in operation at time of survey	1		50	
		Number of dyes		Percent	
C.	Powder dyes weighed				
	Total	8		100	
	Acid	3		38	
	Neutral Premetallized	5		62	
		Number of weighings	Percent	Weight of dyes, grams	Percent
D.	Dyes				
	Total	42	100	4,488.52	100
	Acid	14	33	2,019.83	45
	Neutral Premetallized	28	67	2,468.69	55
		Number of weighings	Percent	Weight of chemicals, pounds	Percent
E.	Dry chemicals weighed				
	Urea	3	100	40.5	100
		Number of weighings	Percent	Weight of dry chemicals, grams	Percent
F.	All chemicals weighed				
	Total	45	100	22,859.52	100
	Dyes	42	93	4,488.52	20
	Dry chemicals	3	7	18,371.0	80

(continued)

TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	Percent
	Acid Black 107	11	26	932.25	21
	Acid Brown 298	9	21	1306.05	29
	Acid Orange 3	7	17	1911.23	43
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, grams	Percent
	Acid Orange 3	7	17	1911.23	43
	Acid Brown 298	9	21	1306.05	29
	Acid Black 107	11	26	932.25	21

NA - Not available.

TABLE 3. POWDER DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, grams
Acid Dyes:		
Acid Yellow 49	2	28.50
Acid Orange 3	7	1911.23
Acid Blue 25	5	80.10
Neutral Premetallized Dyes:		
Acid Yellow 151	1	26.25
Acid Orange 60	1	3.37
Acid Red 399	6	200.77
Acid Brown 298	9	1306.05
Acid Black 107	11	932.25



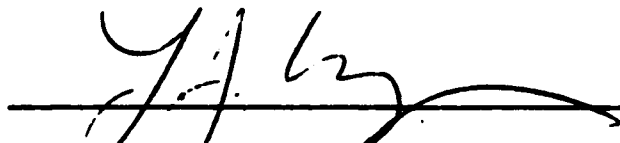
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 3/8



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Robert D. Willson, C.I.H. of Beta Associates, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the afternoon of June 17, 1986. The industrial hygiene monitoring and recording of data was performed during the first shift (7:00 a.m. to 3:00 p.m.) on June 18, 1986. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 3/8 is part of a captive dyehouse operating on an integrated and commission basis. Approximately 24 million pounds of yarn per year are dyed in batch operations at this privately owned facility. Thirty-five dyeing machines were available and 31 were in operation during the entire monitoring period. Equipment included package and skein dyeing machines, and machines for producing variegated yarns from stock dyed yarns. Yarns dyed at this site are composed of wool, polyester, rayon, cotton, acrylic/modacrylic, and occasionally nylon; or various combinations of these fibers. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room is a square room approximately 36 feet long and 46 feet wide with a ceiling 12 feet in height. The room is located in the northwest corner of the first floor of the facility. It includes areas for drum storage and a weighing station equipped with two dye scales. There is a pass through door on the north side of the room for receiving batch tickets, and a pass through window on the south side of the room for transporting weighed dyes to the adjacent mixing room, which is separate from the drug room. The mixing area is located to the south of the drug room; dye machines

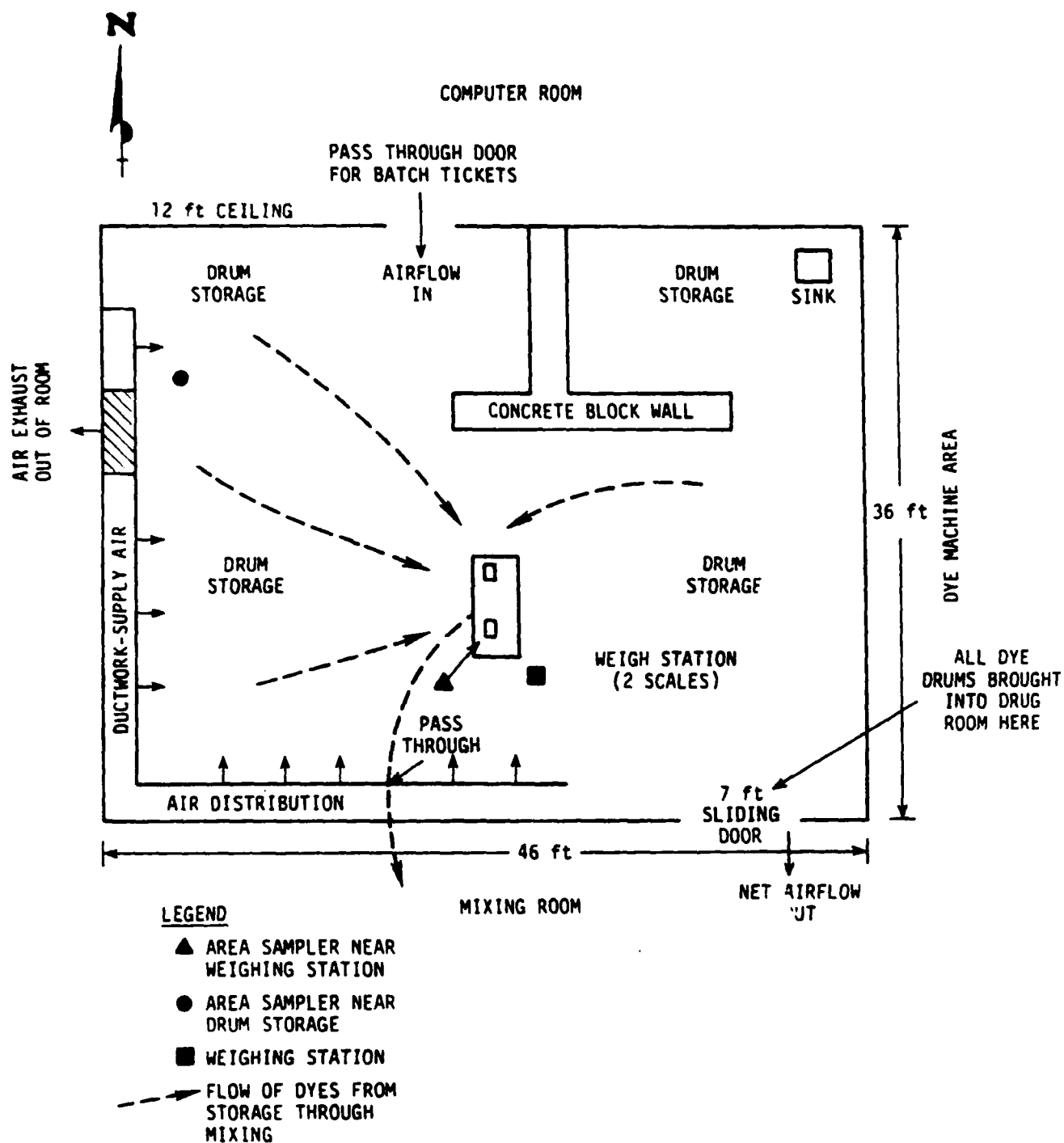


Figure 1. Sketch of Drug Room.

are located to the east of the drug room. Figure 1 presents a sketch of the drug room area.

Dyes are stored in drums utilizing the floor space throughout the drug room. The containers vary in size from 200-250 pound barrels to smaller 50-100 pound containers. One weighing station, which measures 2½ feet by 6 feet, is located in the center of the drug room where two scales are located. The weighing station is equipped with a computer terminal for video display of batch tickets. Dry chemicals are both stored and weighed in an area outside of the drug room. Occasionally, the dye weigher must perform a dry, "non-dye" weighing. During this survey, a fluorescent whitening agent (FWA) was weighed by the dye weigher. Within the scope of this study, this material is not considered a dye but it is stored in the drug room.

The general appearance of the drug room was clean. There was no accumulation of dye on the floor, walls, or equipment. All drums were covered when in storage. Very few spills of powder dyes occurred during this survey, which maintained the overall cleanliness of the area. Reportedly, the floor was hosed down with water after each shift.

The drug room environmental conditions (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

The ventilation system within the drug room created a negative pressure thereby generating air movement into the drug room from the computer room. Similarly, the drug room was under positive pressure as compared to the adjacent mixing room so that air flowed out of the drug room and into the mixing room. No specific engineering controls had been installed for the purpose of removing airborne dye particles.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	77	76	78
Relative humidity, %	54	50	60
Barometric pressure, torr	749	748	750

\*Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

The company employs one full-time dye weigher on each of three shifts.

His duties include:

- ° Transporting new drums of dye into the storage areas and removing empty drums.
- ° Relocating drums within the storage area.
- ° Weighing dyes and recording weights on dye batch tickets.
- ° Transferring weighed dyes from the scale to buckets, and then hand-passing the buckets through the pass through window to the mixing room.
- ° Obtaining quality control samples from new drums and carrying those samples to the laboratory.
- ° Cleaning dye storage and weighing areas.

The dye weighers employed at this facility are only involved in the handling, transfer, and weighing of dyes. These individuals are not involved in mixing or handling of dry chemicals during normal process operations.

The monitored dye weigher was a 43-year old male. He has been employed at the company for 9 years; eight of those years have been spent handling dyes. He had no previous dye-handling experience.

#### Training

Employee training is provided by the company. This training covers the label information contained on the dyes and is performed in connection with the company's Hazard Communication Program.

#### Personal Protective Equipment

Dye weighers are provided with rubber boots and gloves, Tyvek aprons and dust mask respirators (MSA Model 2200). It was noted that the monitored dye weigher removed his rubber gloves frequently; evidence of skin exposure to the dye material was seen in the discoloration of the dye weigher's hands by the dyes. The dye weigher did not wear his respirator properly; both elastic straps were not positioned for proper fit and optimum protection.

#### Personal Habits

Eating and drinking were not permitted in the drug room. The dye weigher was observed smoking both inside and outside of the drug room, although company policy prohibits smoking in the drug room. The dye weigher did not wash his hands prior to smoking.

#### Work Activities

The dye weigher activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum containing the appropriate dye, using a hand scoop to remove an excess quantity of the dye, transferring the scoop of dye to the weighing station, pouring the required amount onto the scale dish, returning the unused portion of the dye to the drum and,

transferring the weighed portion of the dye to a bucket. Larger quantities of dye were sometimes transported in paper bags. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The bucket was transferred by hand to the mixing room through the pass through window.

When a barrel of dye was almost empty, the drum was no longer used. The dye weigher did not transfer the dregs of one drum into a new barrel.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored employee was in the drug room for a total of 342 minutes over the 8-hour (480 minute) first work shift. He was monitored for exposure to particulates over a 469 minute period from 7:03 a.m. to 2:51 p.m. During that time, his duties required him to enter the drug room twelve times.

Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.08	0.16	0.29
Drug room area sampler at weighing station	0.03	0.07	0.16
Drug room area sampler at drum storage, remote from weighing area	0.03	0.07	0.21



TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Percent of moni- toring period		
A. Time in work area	Time, minutes			
Total time monitored	469	100		
Total time in drug room	342	73		
Lunch break	Not available			
B. Work capacity	Number of process units	Percent		
Maximum work load	35	100		
Units in operation at time of survey	31	88		
C. Powder dyes weighed	Number of dyes	Percent		
Total weighed	46	100		
Acid	8	17		
Basic	18	39		
Chrome	1	2		
Disperse	11	24		
Acid Metallized	5	11		
Neutral Premetallized	3	6		
D. Dyes	Number of weighings	Percent	Weight of dyes, grams	Percent
Total	149	100	74,576.84	100
Acid	15	10	872.40	1
Basic	112	75	23,166.25	31
Chrome	2	1	18,956.00	25
Disperse	11	7	18,680.30	25
Acid Metallized	6	4	6,397.89	8
Neutral Premetallized	3	2	6,504.00	9
E. Dry "non-dyes" weighed	Number of weighings	Percent	Weight of dry chemicals, grams	Percent
Fluorescent Whitening Agent (FWA) #61	1	100	44.8	100

TABLE 2 (continued)

F.	All solids weighed	Number of weighings	Percent	Weight of solids, grams	
					Percent
	Total	150	100	74,621.64	100
	Dyes	149	99	74,576.84	99.9
	Dry "non-dyes"	1	1	44.8	<1
G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	
					Percent
	Basic Red 51	16	11	2,834.89	3.8
	Basic Blue 41	16	11	2,664.94	3.6
	Basic Blue 124	13	9	285.59	0.4
	Basic Red 46	10	7	384.82	0.5
	Basic Yellow 11	9	6	1,930.56	2.6
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, grams	
					Percent
	Mordant Black 11	2	1.3	18,956.00	25
	Disperse Yellow 23	1	0.7	13,276.00	18
	Basic Red 29	5	3.3	4,194.70	6
	Acid Yellow 129	1	0.7	3,025.00	4
	Acid Blue 158	2	1.3	2,902.00	4
	Basic Red 51	16	11	2,834.89	4

TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total Weight weighed, grams
<b>Acid Dyes:</b>		
Acid Yellow 127	1	1.70
Acid Yellow 17	3	437.00
Acid Orange 10	1	66.60
Acid Red 1	2	80.60
Acid Violet 7	2	7.90
Acid Blue 90	1	7.20
Acid Blue 45	4	270.10
Acid Blue 7	1	1.30
<b>Neutral Premetallized Dyes:</b>		
Acid Yellow 129	1	3,025.00
Acid Brown 227	1	1,768.00
Acid Black 58	1	1,711.00
<b>Chrome Dyes:</b>		
Mordant Black 11	2	18,956.00
<b>Acid Metallized Dyes:</b>		
Acid Yellow 99	1	496.49
Acid Orange 74	1	432.20
Acid Red 186	1	481.20
Acid Red 194	1	2,086.00
Acid Blue 158	2	2,902.00
<b>Disperse Dyes:</b>		
Disperse Yellow 218	1	716.30
Disperse Yellow 3	1	77.30
Disperse Yellow 23	1	13,276.00
Disperse Red 65	1	1,552.00
Disperse Red 60	1	1.60
Disperse Red 82	1	144.70
Disperse Red 4	1	21.40
Disperse Blue 3	1	11.90
Disperse Blue 56	1	2,400.00
Disperse Blue 60	1	401.40
Disperse Blue 139	1	77.00

(continued)

TABLE 3 (continued)

Dye color index number	Number of weighings	Total Weight weighed, grams
Basic Dyes:		
Basic Yellow 24	2	1,072.44
Basic Yellow 11	9	1,930.56
Basic Yellow 87	8	432.49
Basic Yellow 29	2	1,635.30
Basic Yellow 28	8	1,140.90
Basic Yellow 91	1	333.40
Basic Yellow 25	3	2,661.50
Basic Red 14	3	108.79
Basic Red 29	5	4,194.70
Basic Red 46	10	384.82
Basic Red 51	16	2,834.89
Basic Red 15	6	1,828.40
"Basic Blue U-1"	2	69.86
Basic Blue 54	4	701.27
Basic Blue 124	13	285.59
Basic Blue 41	16	2,664.94
Basic Blue 3	3	882.30
Basic Green 4	1	4.10

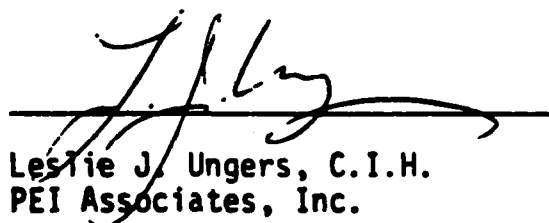
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 4/1



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, D.C. 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Ken Troutman, C.I.H., subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the afternoon of October 22, 1986. The industrial hygiene monitoring and recording of data were performed during the first shift (7:00 a.m. to 3:00 p.m.) of the next day (October 23, 1986). Company representatives were very helpful in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 4/1 is part of a captive dyehouse operating on an integrated basis. Approximately 6 million pounds per year of raw stock are dyed in batch operations at this publicly owned facility. Seven Morton atmospheric dyeing machines were available at this location; all seven of which were in operation during this survey. Fibers dyed are acrylic/mod-acrylic, wool, and nylon. Site operations include storage, dyeing, and drying.

### DRUG ROOM

The drug room is rectangular in shape and is approximately 30 feet long and 18 feet wide with a ceiling 10 feet in height. The room, at the north end of the plant, is accessed by a door on the east side which leads to the adjacent mixing area. The drug room includes dye storage areas, a dye scale, and a workbench area. Dry chemicals are not stored or weighed in the drug room. The dye machines are located in an area just outside the drug room. Figure 1 presents a sketch of the drug room area.

Dye storage is accomplished utilizing the floor space along the south and west walls of the drug room. Dye containers vary in size from 200-250 pound barrels to smaller, 50-100 pound containers. One weighing station housing a dye scale is located in the northwest corner of the drug room, opposite the room entrance.

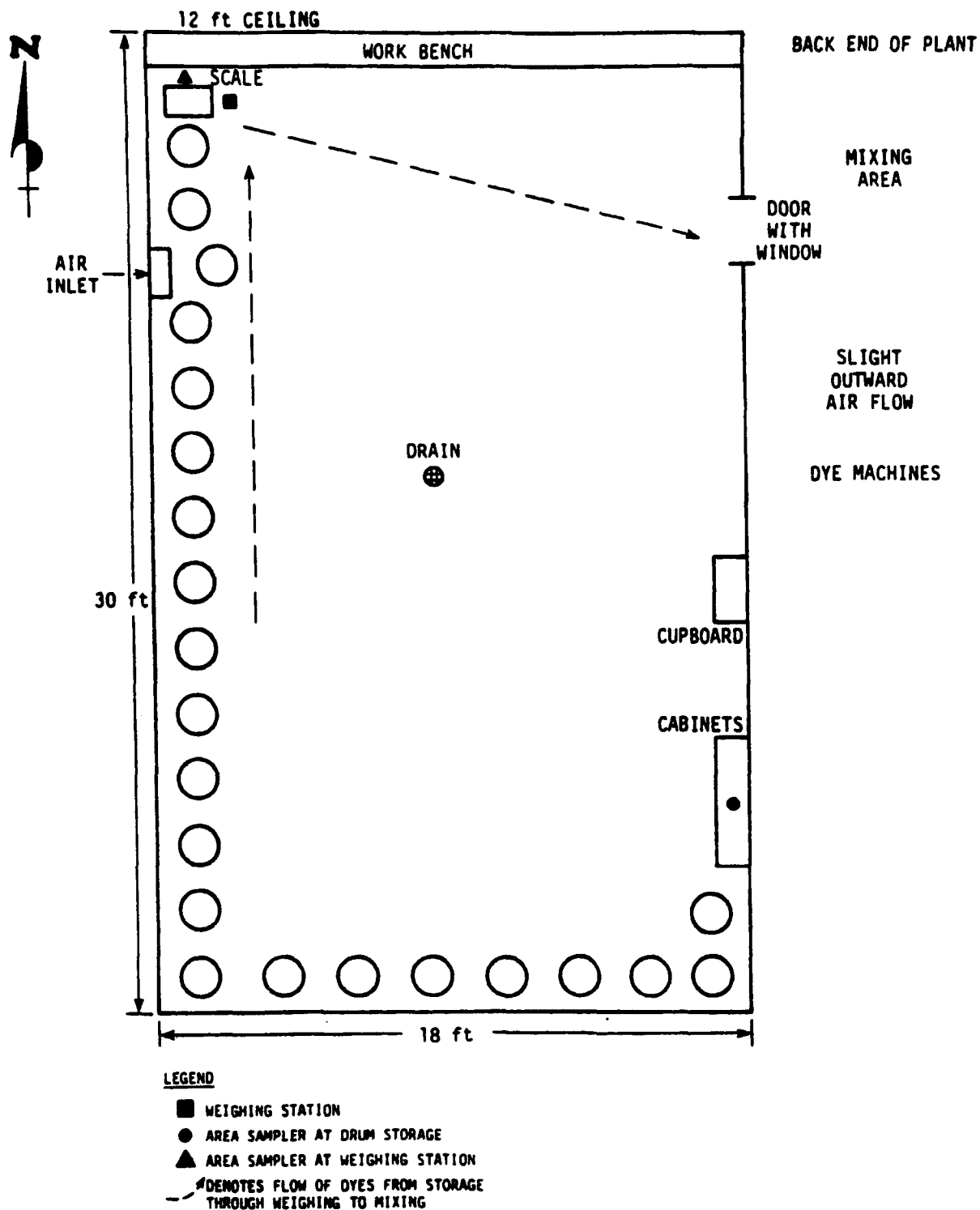


Figure 1. Sketch of drug room area.



The general appearance of the drug room was clean. There was no accumulation of dye material on the floor, walls, equipment, or stored drums. No spillage of dye material was observed during the survey.

The drug room has no exhaust ventilation installed for the purpose of removing airborne dye particles. An air vent for the drug room is located on the west wall near the weighing station, which created a slight outward flow of air at the drug room entrance. One floor drain is located in the center of the drug room to facilitate drainage during clean-up operations.

Environmental conditions of the drug room (i.e., temperature and humidity) were recorded hourly during the survey. Hourly barometric pressures were obtained from the local weather bureau subsequent to the survey. The recorded environmental conditions are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	78	74	79
Relative humidity, %	56	51	58
Barometric pressure, in. Hg.	29.30	29.26	29.32

#### DYE WEIGHER ACTIVITIES

The company employs one full-time dye weigher on each of two shifts.

His duties include:

- ° Relocating dye drums within the storage area.
- ° Weighing dyes and recording the weights on dye batch tickets.

- Transferring weighed dyes from the scale pan to a separate container, and hand carrying that container to the mixing area outside of the drug room.
- Mixing dyes with water near the dye machines outside of the drug room.
- Transporting mixed dyes from mixing area to the dye machine area.
- Cleaning dye storage and weighing areas.

The dye weighers employed at this facility are only involved in the handling, transfer, weighing, and mixing of dyes. These individuals do not handle dry chemicals during normal process operations.

The monitored dye weigher was a 61-year old male. He has been employed at the company for 34 years; 25 of those years have been spent handling dyes. He had no previous dye handling experience.

#### Training

Employee training specific to the safe handling of dyes is included as part of the company's Hazard Communication program. Material safety data sheets (MSDS's) are used as information sources for the training sessions.

#### Personal Protective Equipment

Two models of respirators are available for the dye weighers' use, 3M Model 8710 Dust and Mist respirators and the 3M Model 8500 Nontoxic Particle Mask respirators. The monitored dye weigher wore a model 8710 respirator. Gloves were also worn by the dye weigher during all dye weighing activities as part of his personal protective equipment.

#### Personal Habits

The monitored dye weigher did not eat, drink, or smoke in the drug room. It was noted that the dye weigher's personal hygiene practices were good.

## Work Activities

The dye weigher activities in filling each batch ticket order were as follow: dyes were obtained by walking to a drum containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weighing station and pouring the required amount onto the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a separate container. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The container of weighed dyes was then carried to the mixing area near the dye machines outside of the drug room, and the weighed dyes were mixed with water.

## SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored employee was in the drug room for a total of 94 minutes over the 8-hour (480 minute) first work-shift. During that time, his duties required him to enter the drug room 14 times. He was monitored for exposure to particulates over a 445 minute period from 7:09 am to 2:34 pm. The data collected and observations made during the survey are presented in Table 2. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of all weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.06	0.13	0.73
Drug room area sampler at weighing station	0.18	0.37	0.59
Drug room area sampler at drum storage, remote from weighing area	0.04	0.09	0.19

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

A. Time in work area		Time, minutes	Percent of monitoring period		
Total time monitored		445	100		
Total time in drug room		94	21		
Lunch break		Not available			
B. Work capacity		Number of process units	Percent		
Maximum work load		7	100		
Units in operation at time of survey		7	100		
C. Powder dyes weighed		Number of dyes	Percent		
Total weighed		17	100		
Acid		9	53		
Neutral Premetallized		8	47		
D. Dyes		Number of weighings	Percent	Weight of dyes, pounds	Percent
Total		38	100	68.0048	100
Acid		28	74	12.2256	18
Neutral Premetallized		10	26	55.7792	82

(continued)

TABLE 2 (continued)

E. Dry chemicals weighed		Number of weighings	
Total		0	

F. All chemicals weighed	Number of weighings	Percent	Weight of all chemicals, pounds	Percent
Total	38	100	68.0048	100
Dyes	38	100	68.0048	100
Dry chemicals	0	0	0	0

G. Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, pounds	Percent
Acid Red 361	7	18	1.5695	2
Acid Blue 258	6	16	1.3375	2
Acid Yellow 49	4	11	1.1035	2
Acid Yellow 216	3	8	1.911	3

H. Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, pounds	Percent
Acid Violet 121	1	3	26.72	39
Acid Black 58	1	3	13.70	20
Acid Red 359	1	3	7.612	11
Acid Yellow 79	1	3	5.94	9

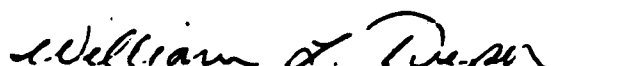
TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY


Dye color index number	Number of weighings	Total weight of all weighings, pounds
Acid Dyes:		
Acid Yellow 79	1	5.9400
Acid Yellow 216	3	1.9110
Acid Yellow 49	4	1.1035
Acid Red 260	2	0.0402
Acid Red 361	7	1.5695
Acid Violet 48	2	0.0250
Acid Blue 277	1	0.2425
Acid Blue 80	2	0.0564
Acid Blue 258	6	1.3375
Neutral Premetallized Dyes:		
Acid Yellow 121	1	1.5720
Acid Red 259	2	0.1022
Acid Red 359	1	7.6120
Acid Violet 121	1	26.7200
Acid Blue 284	1	2.1910
Acid Brown 227	1	3.8060
Acid Brown 45	2	0.0760
Acid Black 58	1	13.7000

TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 4/3

  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460



## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Ronald H. Hill, C.I.H. of Health and Hygiene, and Donald L. Unruh, C.I.H., IT Corporation, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the morning of March 31, 1987. The industrial hygiene monitoring and recording of data were performed during the second shift (2:00 p.m. to 10:00 p.m.) of the same day. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 4/3 is part of a dyehouse operating on both an integrated and commission basis. Approximately 14 million pounds of yarn per year are dyed in batch operations at this publicly owned facility. Fifteen package dyeing machines were available, all of which were in operation during the monitoring period. Fibers dyed are cotton (90% production volume), acrylic/modacrylic, rayon, wool, nylon, and polyester. Site operations include storage, preparation, dyeing, and drying.

### DRUG ROOM

The drug room is a rectangular room approximately 60 feet long and 40 feet wide, with a 16-foot ceiling. It is sectioned into separate drum storage, weighing, and mixing areas. The drum storage area is accessed by a door at the west end of the room which leads to the weighing area, a door at the south end of the room which leads to the mixing areas, and a door at the east end of the room which leads downstairs. The weighing area is accessed by a door from the west side of the drum storage area. The weighing area includes two dye weighing stations, each equipped with one scale. A weighing station housing one scale is also located in the mixing area. Figure 1 presents a sketch of the drug room areas.

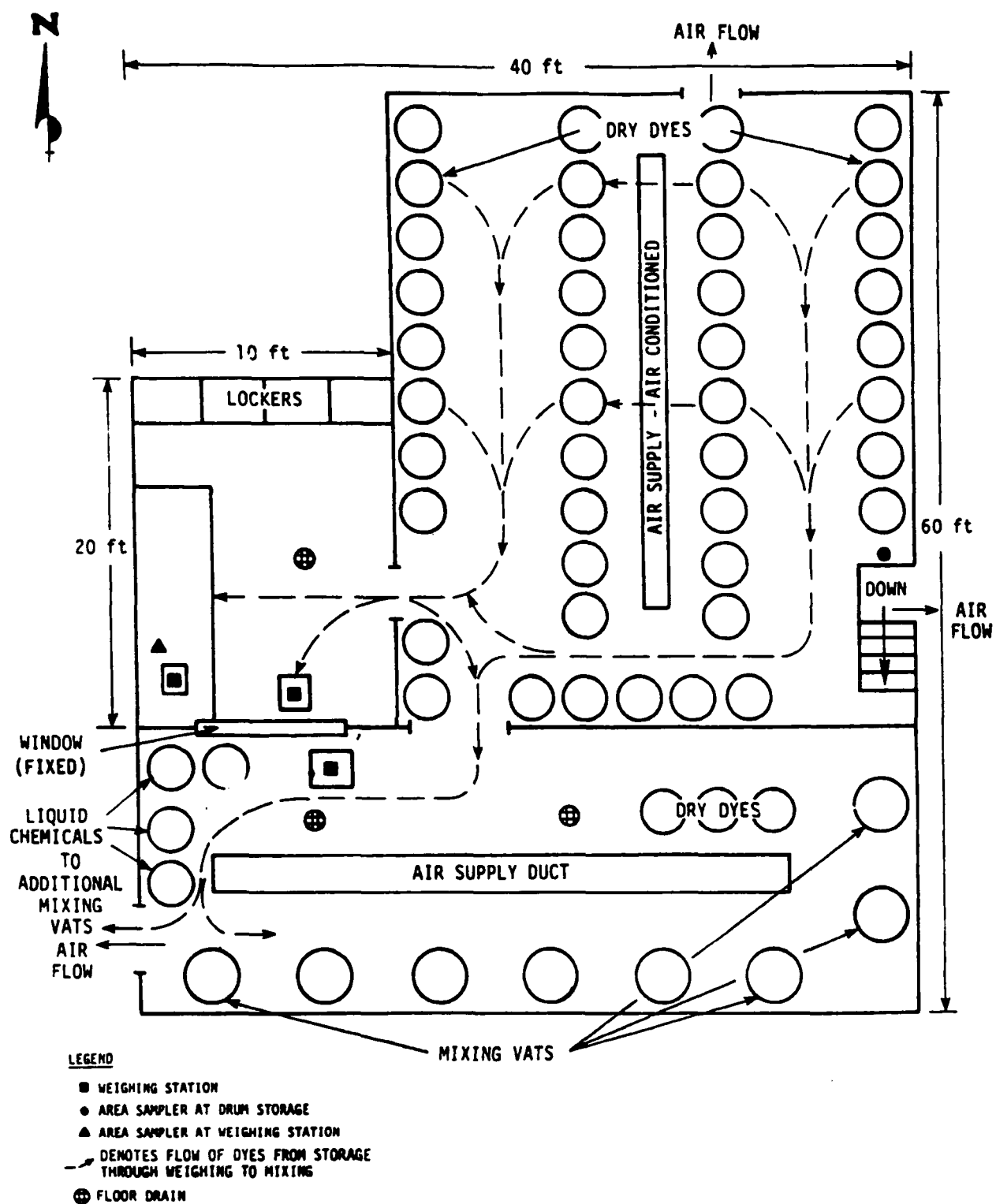


Figure 1. Sketch of drug room area.

Dyes are stored in drums in both the storage area, and the mixing area near the mixing vats. The drums vary in size from 200- to 250-pound barrels to smaller 50- to 100-pound containers. Small quantities of liquid chemicals are also stored in the drug room near the mixing vats.

The general appearance of the drug room was fair. The walls, equipment, and stored drums were fairly clean of accumulated dye material. Spills of dye and chemical material were cleaned by washing down the floor. The floors are routinely washed down after each shift. Floor drains are located in the mixing and weighing areas of the drug room to facilitate drainage during these operations.

The drug room was equipped with no local exhaust ventilation system for the purpose of removing airborne dye particles. The building was equipped with a general central forced air conditioning system. The weighing area was also air conditioned. The drum storage and mixing areas were under a slight positive pressure compared to the other plant areas, indicated by the flow of air out of these areas at the door ways.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	74	72	77
Relative humidity, %	48	33	59
Barometric pressure, in. Hg.	29.30	29.18	29.45

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

## DYE WEIGHER ACTIVITIES

The company employs two full-time dye weigher/mixers on each of three shifts. Their duties include:

- ° Relocating dye drums with a drum dolly within the storage area.
- ° Weighing dyes and chemicals and recording weights on batch tickets.
- ° Transferring dyes and chemicals from the scale to buckets and hand carrying the buckets into the mixing areas.
- ° Adding dyes and chemicals to the mixing vats and blending them with water.
- ° Cleaning dye storage, mixing, and weighing areas.

The dye weighers employed at this facility are involved in the handling, transferring, and weighing of powder dyes and dry and liquid chemicals. On the day of the survey, the majority of the monitored dye weigher/mixer's time was spent in the mixing vat area.

The monitored dye weigher/mixer was a 24-year old male. He has been employed at the company for eight years; five of those years have been spent handling dyes. He had no previous dye handling experience.

### Training

Specific dye weigher/mixer training by the company regarding the safe handling of dyes was provided in the form of chemical hazard training and review of the material safety data sheets (MSDS) maintained in the operations room.

### Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher/mixer included steel-toed shoes, safety glasses, and rubber gloves. No respirator was worn. The monitored dye weigher/mixer used his safety glasses and gloves only when handling liquid chemicals and caustics, not during dye weighing activities.

## Personal Habits

The monitored dye weigher/mixer was observed smoking in the weighing area between dye weighings, and in the mixing area after transferring the weighed material into the mixing vats. The weigher/mixer washed his hands after each dye weighing.

## Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station and pouring the required amount into a stainless steel bucket, and returning the unused portion of the dye to the drum. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The batch was then hand carried to the mixing area and emptied into the mixing vats where it was mixed with hot water. The dye/chemical mixtures were pumped directly from the mixing vats into the kiers.

## SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 96 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room nine times. He was monitored for exposure to particulates over a 457-minute period from 2:10 p.m. to 9:47 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.03	0.06	0.43
Drug room area sampler at weighing station	0.02	0.04	0.09
Drug room area sampler at drum storage, remote from weighing area	0.01	0.01	0.05

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Percent of monitoring period	
A.	Time in work area	Time, minutes	
	Total time monitored	457	100
	Total time in drug room	96	21
	Lunch and breaks	NA	NA
		Percent	
B.	Work capacity	Number of process units	
	Maximum work load	15	100
	Units in operation at time of survey	15	100
		Percent	
C.	Powder dyes weighed	Number of dyes	
	Total	18	100
	Disperse	6	33
	Reactive	12	67
		Percent	
D.	Dyes	Number of weighings	Percent
	Total	29	100
	Disperse	7	24
	Reactive	22	76
		Percent	
E.	Dry chemicals weighed	Number of weighings	Percent
	Total	22	100
	Alkaline Reducing Agent	3	14
	Anhydrous Sodium Hydroxide (NaOH)	8	36
	Sodium Hydrosulfite (Na <sub>2</sub> S <sub>2</sub> O <sub>4</sub> )	1	5
	Trisodium phosphate (Na <sub>3</sub> PO <sub>4</sub> )	10	45
		Percent	
F.	All chemicals weighed	Number of weighings	Percent
	Total	51	100
	Dyes	29	57
	Dry chemicals	22	43

(continued)



TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Reactive Red 180	3	10	12.815	10
	Reactive Orange 16	3	10	8.437	6
	Reactive Yellow 15	3	10	1.915	1
	"Reactive Blue U-4"	3	10	0.075	0.1
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Reactive Red 94	2	7	37.46	28
	Reactive Red 198	2	7	19.95	15
	Reactive Black 5	1	3	19.35	15
	Reactive Red 180	3	10	12.815	10

NA - Not available.

TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, pounds
Disperse Dyes:		
Disperse Yellow 114	1	0.252
Disperse Yellow 42	1	0.300
Disperse Red 135	1	1.820
Disperse Red 151	1	11.11
Disperse Red 88	2	6.020
Disperse Blue 73	1	0.024
Reactive Dyes:		
Reactive Yellow 160	1	0.222
Reactive Yellow 15	3	1.915
Reactive Orange 82	1	0.150
Reactive Orange 16	3	8.437
Reactive Red 94	2	37.46
Reactive Red 198	2	19.95
Reactive Red 180	3	12.815
Reactive Violet 5	1	0.100
"Reactive Blue U-4"	3	0.075
Reactive Blue 27	1	0.341
Reactive Blue 21	1	12.00
Reactive Black 5	1	19.35

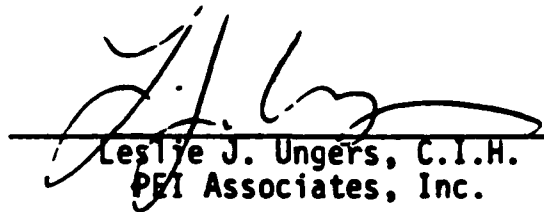
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 4/6



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Melvin R. Witcher, Jr., C.I.H. of Health and Hygiene and Donald L. Unruh, C.I.H., IT Corporation, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on May 18, 1987. The industrial hygiene monitoring and recording of data were performed during the first part of the first 12-hour shift (8:00 a.m. to 8:00 p.m.) on May 19, 1987. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

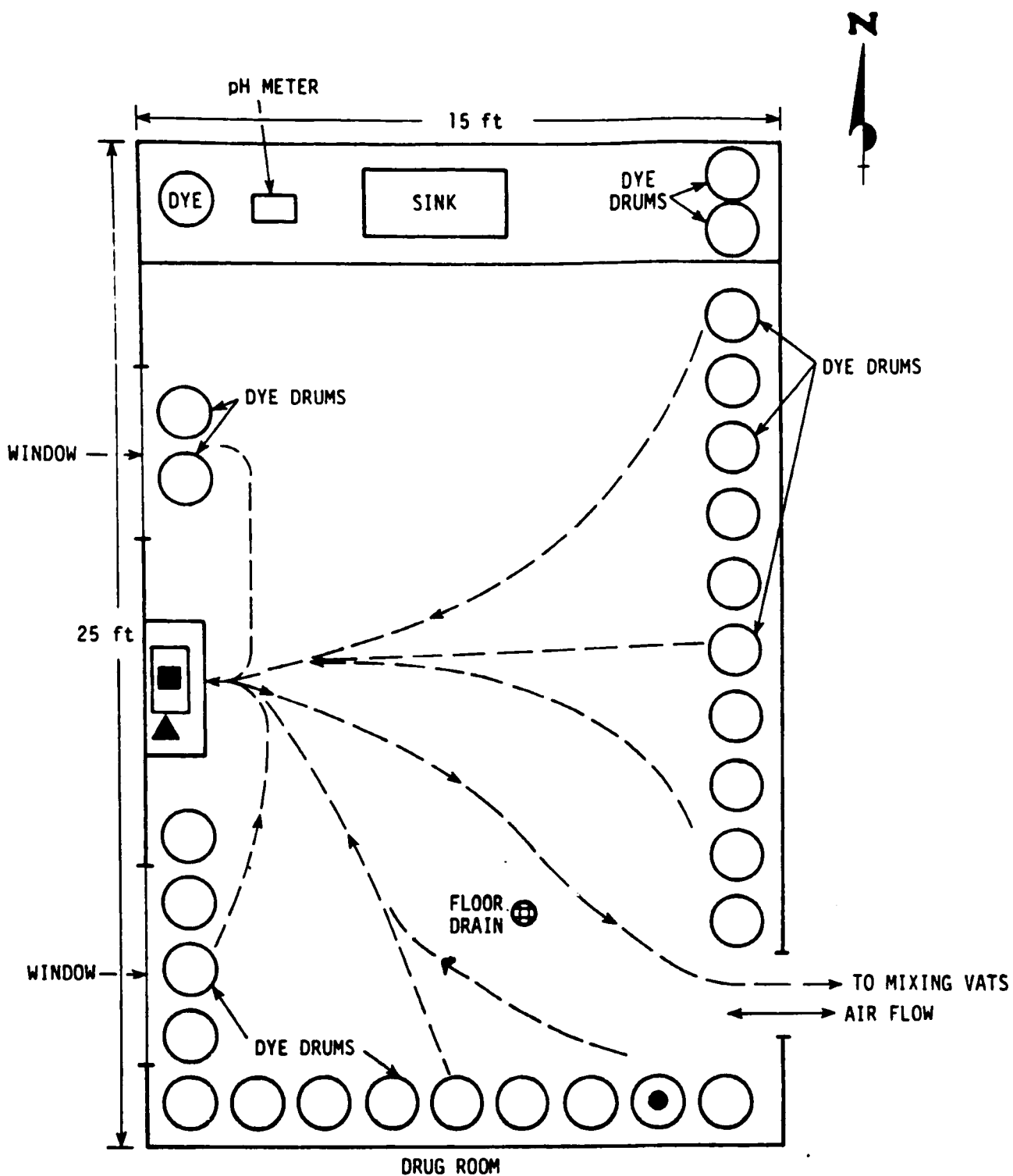
The drug room at site 4/6 is part of a captive dyehouse operating on an integrated basis. Approximately 2 million pounds of carpet yarns per year are dyed in continuous operations at this privately owned facility. Two continuous dyeing machines were available, one of which was in operation at the time of the survey. Nylon is the only fiber dyed. Site operations include storage, preparation, dyeing, and drying. The dyed yarns are processed into carpets at another location.

### DRUG ROOM

The drug room, located on the first floor of the plant building, is a rectangular room approximately 25 feet long and 15 feet wide, with a 10-foot ceiling. The room is accessed by a door at the southeast end of the room which leads to the mixing area. The mixing area is a separate area outside of the drug room. The drug room includes drum storage areas and a dye weighing station equipped with one scale. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums utilizing the floor spaces against the walls of the drug room. The drums vary in size from 200- to 250-pound barrels to 50- to 100-pound containers.

For weighing of the powder dyes, a small scale is located on a table situated against the west wall of the drug room.



# **LEGEND**

- WEIGHING STATION
  - AREA SAMPLER AT DRUM STORAGE
  - ▲ AREA SAMPLER AT WEIGHING STATION
  - DENOTES FLOW OF DYES FROM STORAGE THROUGH WEIGHING TO MIXING
- SOUTHWEST CORNER  
OF YARN DYEING AREA

Figure 1. Sketch of drug room area.

The general appearance of the drug room was poor. The walls, equipment, inventory, and floors contained heavy accumulations of dye material. Spills were reportedly left on the floor until washing occurred, but the accumulation of dust indicated that floor washing took place infrequently. A drain was located in the drug room floor to facilitate drainage during cleaning; however, this activity did not occur during the survey.

The drug room was not equipped with a local exhaust ventilation system for the purpose of removing airborne dye particles. General building ventilation was provided through open windows. No net airflow at the drug room entrance was observed.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	78	74	83
Relative humidity, %	86	76	97
Barometric pressure, in. Hg.	29.29	29.28	29.29

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

The company employs one full-time dye weigher/mixer on each of two 12-hour shifts. His duties include:

- ° Relocating dye drums from the receiving area to the drug room.

- Weighing dyes and recording weights on batch tickets.
- Transferring weighed dyes from the scale to 5-gallon plastic pails.
- Adding the dry dye to the mixing vats.
- Mixing chemicals in separate mixing vats into which the dye solution from the initial mixing vat is pumped for additional mixing.
- Cleaning dye storage, weighing, and mixing areas.

The dye weighers employed at this facility are involved in the handling, transferring, weighing, and mixing of dyes and dry chemicals.

The monitored dye weigher was a 42-year old male. He has been employed at the company for 1.5 years; approximately 9 months of that time has been spent handling dyes. He had no previous dye handling experience.

#### Training

No dye weigher training programs were provided by the company regarding the safe handling of dyes.

#### Personal Protective Equipment

No personal protective equipment was required by the company or utilized by the monitored dye weigher in the drug room. Significant dermal contact with the dyestuffs was observed because he wore a sleeveless shirt and often handled powder dyes with his bare hands.

#### Personal Habits

The monitored dye weigher was observed smoking in the drug room and mixing area. He did not routinely wash his hands before smoking or after skin contact with the dyes.

#### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove an approximate quantity



of the dye, transferring the scoop of dye to the weigh station and pouring the required amount into a 5-gallon plastic pail, and returning the unused portion of the dye to the drum. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The batch was then hand carried to the mixing area and dumped into the mixing vat. The plastic pail was then rinsed with a small amount of water, and this rinse water was added to the mixing vat. A guar gum slurry was added to a separate mixing vat, into which the mixed dye solutions were pumped. The final dye solutions were pumped to the dyeing machines via pipelines.

When a dye drum was almost empty, the monitored dye weigher transferred the dregs from the old drum into the new drum by inverting the old drum over the new drum. About 3 or 4 such drum transfers were observed during the survey.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 46 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room sixteen times. He was monitored for exposure to particulates over a 447-minute period from 8:28 a.m. to 3:55 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dyes handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.06	0.09	0.48
Drug room area sampler at weighing station	0.10	0.15	0.47
Drug room area sampler at drum storage, remote from weighing area	0.01	0.02	0.11

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

				Percent of monitoring period	
A.	Time in work area	Time, minutes			
	Total time monitored	447		100	
	Total time in drug room	46		10	
	Lunch and breaks	NA		NA	
B.	Work capacity	Number of process units		Percent	
	Maximum work load	2		100	
	Units in operation at time of survey	1		50	
C.	Powder dyes weighed	Number of dyes		Percent	
	Total	6		100	
	Acid	4		67	
	Neutral Premetallized	1		17	
	Acid Metallized	1		17	
D.	Dyes	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Total	15	100	119.59	100
	Acid	11	73	59.85	50
	Neutral Premetallized	1	7	45.43	38
	Acid Metallized	3	20	14.31	12
E.	Dry chemicals weighed	Number of weighings	Percent	Weight of chemicals, pounds	Percent
	Celcagum D49D-1	8	100	65.39	100
F.	All chemicals weighed	Number of weighings	Percent	Weight of dry chemicals, pounds	Percent
	Total	23	100	184.98	100
	Dyes	15	65	119.59	65
	Dry chemicals	8	35	65.39	35

(continued)

TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Acid Orange 156	5	33	44.55	37
	Acid Black 52	3	20	14.31	12
	Acid Red 266	3	20	4.81	4
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Acid Brown 298	1	7	45.43	38
	Acid Orange 156	5	33	44.55	37
	Acid Black 52	3	20	14.31	12

NA - Not available.

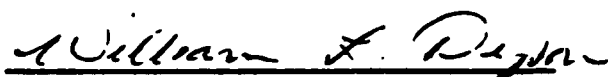
TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, pounds
Acid Dyes:		
Acid Orange 156	5	44.55
Acid Red 266	3	4.81
Acid Red 361	1	5.33
Acid Red 299	2	5.16
Neutral Premetallized Dyes:		
Acid Brown 298	1	45.43
Acid Metallized Dyes:		
Acid Black 52	3	14.31

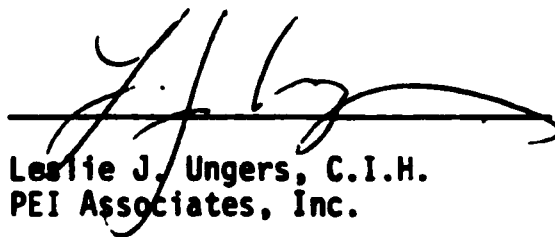
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 4/9



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. Environmental Protection Agency  
Office of Toxic Substances  
401 M Street S.W.  
Washington, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Leslie J. Ungers, C.I.H., Senior Industrial Hygienist for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the afternoon of May 16, 1986. The monitoring and recording of data was performed during the second shift (4:00 p.m. to 12 midnight) on the same day. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 4/9 is part of a captive dye house operating in a vertical integrated production facility. The company is publicly owned and dyes approximately 12 million pounds of yarn per year. The yarn is dyed in batch operations performed in 15 high pressure package dye machines, all of which were in operation on the day of the survey. Fibers dyed may be wool, polyester, rayon, cotton, silk, or flax; or various combinations of these fibers. A majority of the dyeing is performed on a blend yarn composed of polyester and wool. Site operations include storage, preparation, dyeing, and drying.

### DRUG ROOM

The drug room is a rectangular room approximately 150 feet in length, 30 feet in width, with a ceiling 12 feet in height. The room is located on the second floor of the dye house and is accessed by a personnel door at one end, and a freight elevator at the opposite end. The drug room includes a combined dye and dry chemical storage area, dye scales, dry chemical scales, and mixing machines. Figure 1 presents a sketch of the drug room area.

#### Mixing Machine Area

Along the south wall of the drug room, separated by a 4-inch concrete dike, are 17 homogenizers which are used for mixing. The homogenizers and their holding tanks supply the dyeing operations located on the floor below. Dry chemicals and dyes are manually added to the tanks as the final step



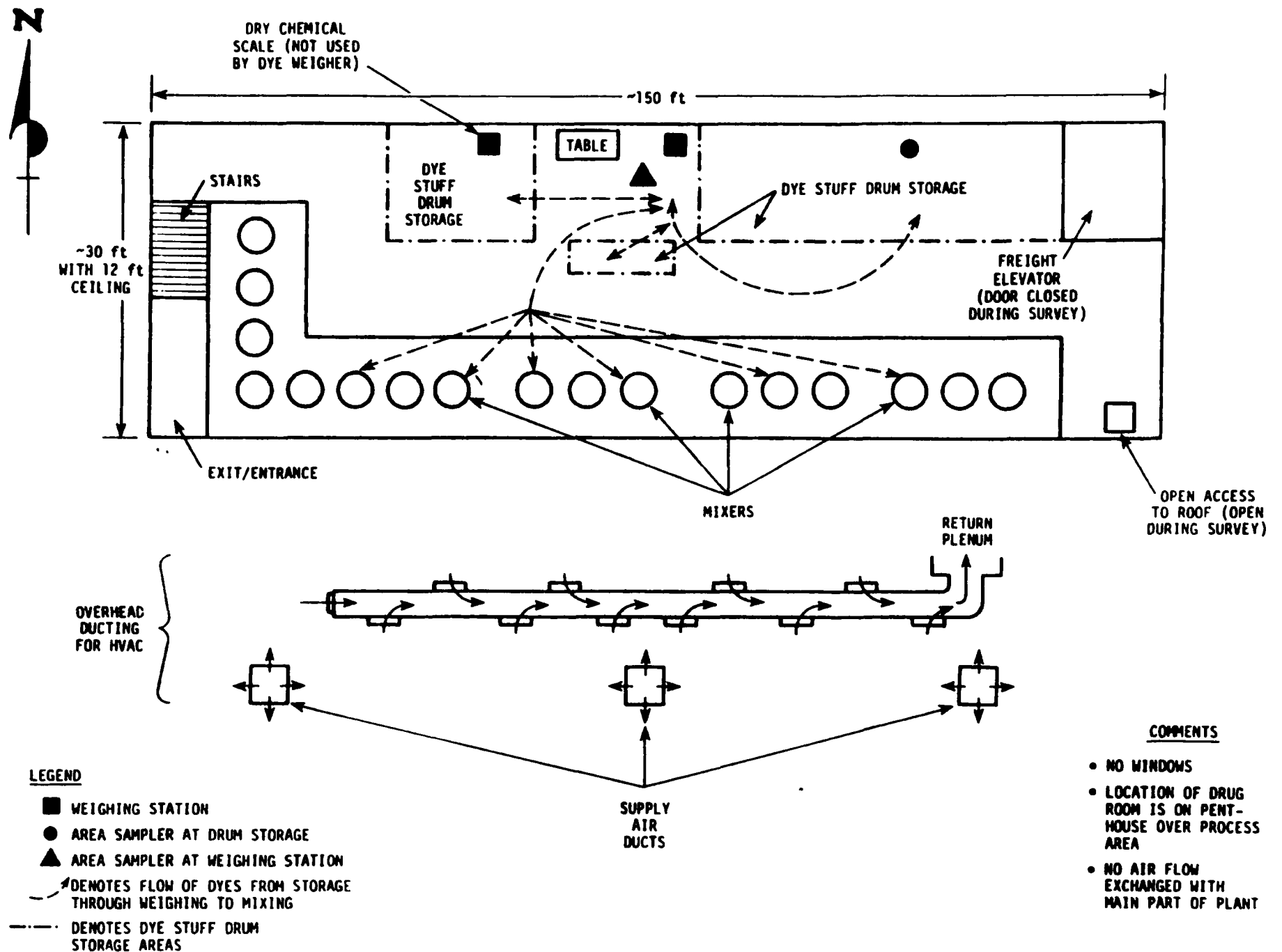


Figure 1. Sketch of Drug Room Area.

in the dye formulation. Wet chemicals and water are supplied to the individual homogenizers through pipelines. The floor of the mixing area is covered with a rubberized material to facilitate water spray washing of the floor and machinery. Drains are located below the homogenizers and in the general work area.

#### Powder Dye Storage and Weighing Area

Dyes storage is accomplished using floor space throughout the drug room. Containers of dyes are located along most of the length of the room opposite the homogenizers. The containers vary in size from 200-250 pound barrels to smaller 50-100 pound containers. The floor of the storage area is rubberized to facilitate cleaning between shifts. Two weighing areas are located in the drug room. The dry chemicals are weighed on a scale located at the west end of the room; approximately 30 feet from the scale used to weigh the powder dyes. The dry chemical scale and associated weighing operations are not conducted by the employee responsible for weighing the dyes. The dyes are weighed on a scale located in the center of the drug room. The company has installed a computer terminal for video display of the batch ticket; however, at the time of the survey the system had not gone on line.

The general appearance of the drug room is very clean. There is no accumulation of dye on the floor or walls. The cleanliness is believed to be a direct result of the frequent water washing conducted by employees; reportedly, employees clean the floor and homogenizers after every shift. During the survey, the relative humidity of the room ranged from 78 to 96 percent. These high values are a result of the open homogenizers, moisture from the dyeing machines, and frequent water cleaning operations, activities

which maintain the water vapor level and high humidity in the drug room air. Pipes and fixtures located near the ceiling and on the upper portion of the wall are relatively free of dye particulate. These structures are stained with dye that has settled as particulate, acquired water from the surrounding air, and dissolved to form a liquid stain.

The drug room environmental conditions recorded during the survey are presented in Table 1.

The drug room has no exhaust ventilation installed for the purpose of removing airborne dye particles. The room is equipped with a heating and air-conditioning system separate from the rest of the facility. Makeup air for this system is taken from the outside. Three overhead air supply vents are located at equal distances down the length of the room. The overhead exhaust air ducts and plenum are also located near the ceiling approximately 5 feet from the air supply vents.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY<sup>\*</sup>

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	79	78	80
Relative humidity, %	87	78	96
Barometric pressure, torr	755	754	756

<sup>\*</sup> Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

The company employs one full-time dye weigher on each of three shifts. His duties include:

- Transporting barrels of dye from the freight elevator to storage areas in the drug room.
- Relocating barrels within the storage area.
- Weighing dyes and recording weights on dye batch tickets.
- Transferring weighed dyes from scale pan to buckets, and carrying buckets to homogenizers.
- Pouring weighed dyestuff into mixing tanks.
- Operating the homogenizers.
- Cleaning dye storage, weighing, and mixing areas.

The dye weighers employed at this facility are only involved in the handling, transfer, weighing, and mixing of dyes. These individuals do not handle dry chemicals during normal process operations.

The dye weigher monitored was a 27-year old male. He has been employed at the company for 10 years, five of these years were spent handling dyes. During the previous 5 years he did not handle dyes.

### Training

The company provides employees with training as a part of the firm's Hazard Communication program. The Material Safety Data Sheets (MSDS's) are the primary source of information for the training sessions.

### Personal Protective Equipment

Company policy requires dye weighers to wear Airstream<sup>R</sup> powered air-purifying respirators, aprons, chemical splash shields, and natural latex rubber gloves. It should be recognized that a powered air-purifying respirator provides filtered air to the employee's helmet. This helmet directs the air down across the employee's face and breathing zone. The air then exits the respirator at a point near the employee's chin and neck area. These respirators are known to create turbulence outside the facepiece over

an area of the employee's body used to position the air sampling filters. Such air turbulence can have an impact on the air monitoring results. The monitored dye weigher wore his respirator only during dye weighing activities and routinely wore the other required forms of personal protective equipment while in the drug room.

#### Personal Habits

The company does not permit employees to eat, drink, or smoke on the job. The monitored dye weigher frequently washed his hands after transferring dye material or following the removal of his gloves.

#### Work Activities

The following steps were taken each time the dye weigher being monitored filled an order on a batch ticket. Dyes were obtained by walking to a barrel containing the appropriate dye, using a hand scoop to remove an approximate quantity, transporting the scoop of dye to the scale, pouring out the required amount onto the balance pan, returning the unused portion to the barrel, and transferring the weighed portion to a stainless steel bucket. This operation was repeated until all the dye weighings specified on the batch ticket had been completed and transferred to the same bucket. The bucket was then transferred to the dry chemical area for additions of non-dye substances, or directly to a homogenizer.

When a barrel of dye was almost empty, the dye weigher manually transferred the dregs into the next barrel by inverting the barrel, or if available, by lifting the plastic liner out of the used barrel. Operations of this nature resulted in some minor loss of dye; significant spillage was immediately cleaned up. The number of transfers of this type were not recorded.

## SPECIFIC MEASUREMENTS AND OBSERVATIONS

The employee monitored was in the drug room for a total of 359 minutes over an 8-hour period (480 minutes). During that time, his duties required him to enter the drug room four times. He was monitored for exposure to particulates over a 426 minute period from 4:15 p.m. to 11:21 p.m. The employee arrived 15 minutes after the shifted started and left the drug room 39 minutes before the shift was finished.

Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dyes handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.56	1.20	1.37
Drug room area sampler at weighing station	0.14	0.30	0.47
Drug room area sampler at drum storage, remote from weighing area	0.03	0.05	0.12

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

					Percent of monitoring period	
A.	Time in work area	Time, minutes				
	Total time monitored	426		100		
	Total time in drug room	359		84		
	Lunch break	50		12		
		No. of process units		Percent		
B.	Work Capacity					
	Maximum work load	15		100		
	Units in operation at time of survey	15		100		
		No. of dyes		Percent		
C.	Powder dyes weighed					
	Total weighed	31		100		
	Acid	7		23		
	Neutral Premetallized	6		19		
	Chrome	3		10		
	Disperse	8		26		
	Reactive	7		23		
		No. of dyes	No. of weighings	Percent	Weight of dyes, kilograms	Percent
D.	Dyes					
	Total	31	62	100	197.837	100
	Acid	7	9	14.5	20.669	10.4
	Neutral Premetallized	6	17	27.4	39.898	20.2
	Chrome	3	5	8.1	51.255	25.9
	Disperse	8	22	35.5	85.214	43.1
	Reactive	7	9	14.5	0.801	0.4

(continued)

TABLE 2 (continued)

E.	Dry chemicals weighed	No. of weighings	Percent	Weight of dyes, kilograms	Percent
	Total	3	100	8.902	100
	Bichromate of soda	1	33	7.082	80
	Celco D-49-D (modified guar gum)	2	66	1.820	20
F.	All solids weighed	No. of weighings	Percent	Weight of solids, kilograms	Percent
	Total	65	100	206.739	100
	Dyes	62	95	197.837	96
	Dry chemicals	3	5	8.902	4
G.	Dyes weighed most frequently	No. of weighings	Percent	Mass of dyes, kilograms	Percent
	Acid Yellow 235	5	8	18.5	9
	"Disperse Black M-1"	4	6	41.645	21
	Disperse Blue 77	4	6	17.975	9
	Disperse Orange 37	4	6	4.126	2
	Mordant Black 11	3	5	34.085	17
	Acid Black 60	3	5	4.020	2
	Acid Brown 330	3	5	2.183	1
H.	Largest quantity of dyes weighed	No. of weighings	Percent	Weight of dyes, kilograms	Percent
	"Disperse Black M-1"	4	6	41.645	21
	Mordant Black 11	3	5	34.085	17
	Acid Yellow 235	5	8	18.5	9
	Disperse Blue 77	4	6	17.975	9
	Mordant Black 9	1	2	15.400	8



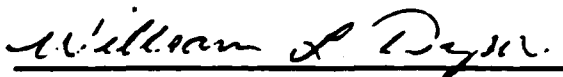
TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, kg
Acid Dyes:		
Acid Yellow 241	2	1.334
Acid Orange 142	1	0.247
Acid Violet 90	1	0.760
Acid Blue 80	2	4.480
Acid Blue 185	0	-
Acid Green 108	1	8.009
Acid Green 104	1	3.718
Acid Black 187	1	2.121
Neutral Premetallized Dyes:		
Acid Yellow 235	5	18.500
Acid Yellow 129	2	2.815
Acid Red 182	2	1.200
Acid Brown 330	3	2.183
Acid Black 60	3	4.020
Acid Black 107	2	11.180
Chrome Dyes:		
Mordant Orange 3	1	1.770
Mordant Black 11	3	34.085
Mordant Black 9	1	15.400
Disperse Dyes:		
Disperse Orange 37	4	4.126
Disperse Red 60	4	2.583
Disperse Red 73	2	1.680
Disperse Blue 56	3	10.340
Disperse Blue 77	4	17.975
Disperse Blue 79	1	6.865
"Disperse Black M-1"	4	41.645
Reactive Dyes:		
"Reactive Yellow U-1"	1	0.043
Reactive Yellow 37:1	1	0.004
Reactive Red 168	2	0.247
"Reactive Red U-2"	1	0.030
"Reactive Red U-3"	1	0.036
Reactive Blue 27	1	0.239
"Reactive Blue U-1"	2	0.202

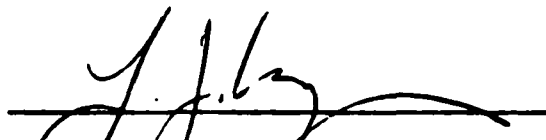
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 5/2



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. Environmental Protection Agency  
Office of Toxic Substances  
401 M Street S.W.  
Washington, D.C. 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Leslie J. Ungers, C.I.H., Senior Industrial Hygienist for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the morning of October 8, 1986. The industrial hygiene monitoring and recording of data were performed during the first shift (10:00 a.m. to 6:00 p.m.) on the same day. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

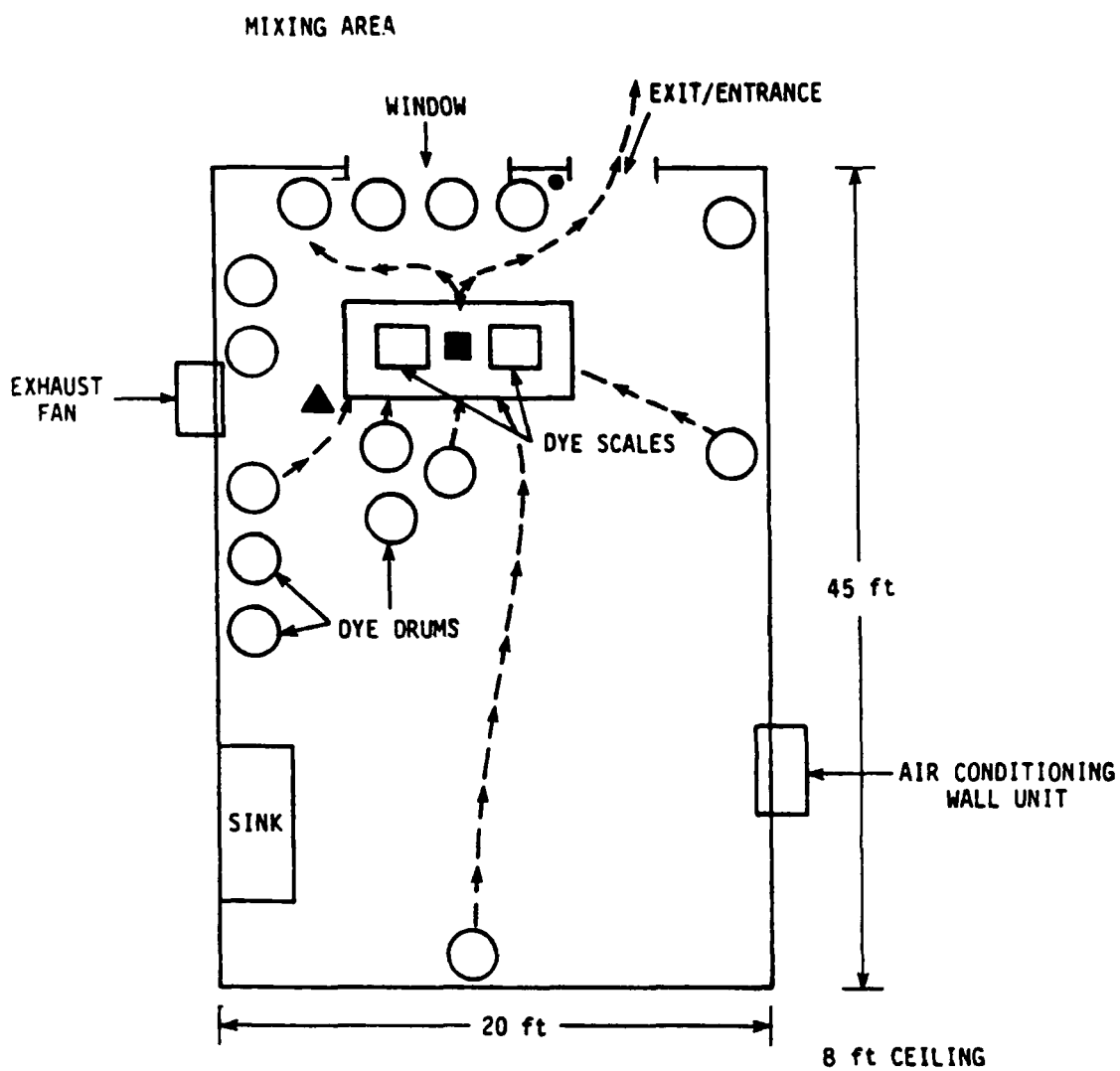
### GENERAL

The drug room at site 5/2 is part of a captive dyehouse operating on an integrated basis. Approximately 4.75 million pounds of carpet per year are produced at this publicly owned facility. Nylon carpet yarns and roll goods are dyed in batch operations on skein and beck dyeing machines, respectively. Eight machines were available and seven were in operation throughout the survey period. The only fiber dyed is nylon. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room is a rectangular room approximately 45 feet long and 20 feet wide, with a ceiling 8 feet in height. The room is located on the second floor (penthouse) and is accessed by a door at one end of the room which leads to the adjacent mixing area. Dye weighing and storage areas are located in the drug room; the mixing area is a separate area outside of the drug room. A window in the wall adjacent the mixing area was closed at all times during the survey. The window has a large glass pane and is used only to observe activities outside the drug room, not as an opening for transferring dyes to the mixing room. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums utilizing the floor space along the walls of the drug room. At the time of the survey, several drums were also located



#### LEGEND

- WEIGHING STATION
- AREA SAMPLER AT DRUM STORAGE
- ▲ AREA SAMPLER AT WEIGHING STATION
- DENOTES FLOW OF DYES FROM STORAGE THROUGH WEIGHING TO MIXING

Figure 1. Sketch of drum room area.

in the area of the room behind the weighing station. The drums vary in size from 200-250 pound barrels to smaller, 50-100 pound containers. One weighing station housing two scales is located at the end of the drug room near the door. Dry chemicals are neither stored nor weighed in the drug room.

The general appearance of the drug room was very clean. There was no accumulation of dye on the floor or walls. There was a slight accumulation of dye material on the equipment and stored drums. Although no spillage of powder dyes was observed during the survey, the lack of accumulated dye on the floor indicates adequate spill cleanup procedures.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

A small 10-inch exhaust fan was located in the wall near the weighing station for the purpose of removing airborne dye particles. An air conditioning unit was located at the other end of the room on the wall opposite the exhaust fan. A slight negative pressure was created within the drug room, probably due to the operation of the drug room air conditioning unit.

No floor drains were located in the drug room for drainage purposes.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY<sup>\*</sup>

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	73	62	78
Relative humidity, %	61	57	72
Barometric pressure, in. Hg.	30.12	30.08	30.19

<sup>\*</sup> Readings of each parameter were recorded hourly over the 8-hour work shift.

## DYE WEIGHER/MIXER ACTIVITIES

The company employs one full-time dye weigher/mixer on each of two shifts. The facility does not operate a third shift. His duties include:

- Relocating drums within the storage area.
- Weighing dyes and recording weights on dye batch tickets.
- Transferring dyes from the scale to a heavy, single sheet paper towel (typical of the type found in restroom dispensers), which is then hand carried to the mixer outside the dye room.
- Cleaning dye storage, weighing, and mixing areas.

The dye weighers/mixers employed at this facility are involved in dye and dry chemical handling, weighing, and mixing. Dry chemicals are stored and handled in the mixing area. Work activities require the dye weigher/mixer to spend time in both the drug room and the mixing room.

The monitored dye weigher/mixer was a 28-year old male. He has been employed at the company for approximately 1.5 years; all of that time has been spent handling dyes. He had no previous dye handling experience.

### Training

Specific training regarding the safe handling of dyes is not provided by the company to employees who are engaged in dye handling operations at this facility.

### Personal Protective Equipment

Personal protective equipment required by the company to be worn by dye weighers/mixers includes dust mask respirators and gloves. It was observed that the dye weigher/mixer had slight dermal contact with the dye material during dye transfer to the mixers. Contact was minor and limited to the hands. The respirator was worn frequently by the monitored dye weigher/mixer during actual dye weighings and was removed most of the time when he was outside the drug room.

### Personal Habits

The monitored dye weigher/mixer was not observed drinking or eating in the drug room. He did not smoke inside or outside of the drug room. As part of his personal hygiene practice, he washed his hands when his shift ended.

### Work Activities

The dye weigher/mixer activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transporting the scoop of dye to the weighing station, pouring the required amount onto the scale dish, returning the unused portion of the dye to the drum, and pouring the weighed portion of the dye from the scale dish directly onto a paper towel. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The paper towel containing the weighed dye material for the batch was hand carried to the mixer outside the drug room and the dye material was poured into the mixing vat. Any dry chemicals required were then added to the mixing vat.

### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The employee monitored was in the drug room for a total of 137 minutes over an 8-hour (480 minute) period. He was monitored for exposure to particulates over a 454 minute period from 10:03 a.m. to 5:37 p.m. During that time, his duties required him to enter the drug room 19 times. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.



## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.06	0.07	0.36
Drug room area sampler at weighing station	0.19	0.25	0.30
Drug room area sampler at drum storage, remote from weighing area	0.07	0.09	0.15

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

A. Time in work area		Time, minutes	Percent of monitoring period		
Total time monitored		454	100		
Total time in drug room		137	30		
Lunch break		Not available			
B. Work capacity		Number of process units	Percent		
Maximum work load		8	100		
Units in operation at time of survey		7	88		
C. Powder dyes weighed		Number of dyes	Percent		
Total weighed		3	100		
Acid		3	100		
D. Dyes		Number of weighings	Percent	Weight of dyes, pounds	Percent
Total		84	100	11.550	100
Acid		84	100	11.550	100
E. Dry chemicals weighed		Number of weighings	Percent		
Total		0			


TABLE 2 (continued)

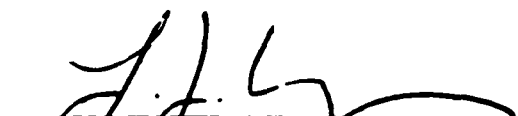
F. Dyes weighed (in order of frequency and quantity)	Number of weighings		Weight of dyes, pounds	
		Percent		Percent
"Acid Red M-2"	35	42	5.452	47
Acid Blue 324	29	34	3.106	27
Acid Yellow 219	20	24	2.992	26

TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, pounds
Acid Dyes:		
Acid Yellow 219	20	2.992
"Acid Red M-2"	35	5.452
Acid Blue 324	29	3.106

TEXTILE DRUG ROOM MONITORING STUDY  
SITE VISIT REPORT  
Site Number 5/4

  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:  
U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, D.C. 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Ronald H. Hill, C.I.H. of Health and Hygiene and Leslie J. Ungers, C.I.H., Senior Industrial Hygienist for PEI Associates, Inc., representing EPA. The presurvey meeting was held with company officials on the morning of November 5, 1986. The industrial hygiene monitoring and recording of the data were performed during half of the first shift (3:00 p.m. to 7:00 p.m.) and half of the second shift (7:00 p.m. to 11:00 p.m.) on the same day. Company representatives were very helpful in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 5/4 is part of a captive dyehouse operating on an integrated basis which uses powder dyes. Approximately 13 million pounds of domestic sheeting and pillowcase fabrics per year are produced at this publicly-owned facility. Eleven beck dyeing machines were available; all eleven were performing batch dyeing operations during the entire monitoring period. Fibers dyed are primarily blends of polyester and cotton, but rayon and wool are in some products. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room is a rectangular room approximately 40 feet long and 20 feet wide, with a 9 foot ceiling. It is located on the second floor and is accessed by two doors. One door leads into the mixing area and the other leads into the plant. Dye weighing and storage areas are located in the drug room; the mixing area is a separate area adjacent to the drug room. Figure 1 presents a sketch of the drug room area.

Dyes are stored in drums located on the floor of the drug room. The drums vary in size from 200- to 250-pound barrels to smaller 50- to 100-pound containers.

For weighing the powder dyes, one small scale is located on a table in the corner of the drug room. Dry chemicals are stored in the mixing room

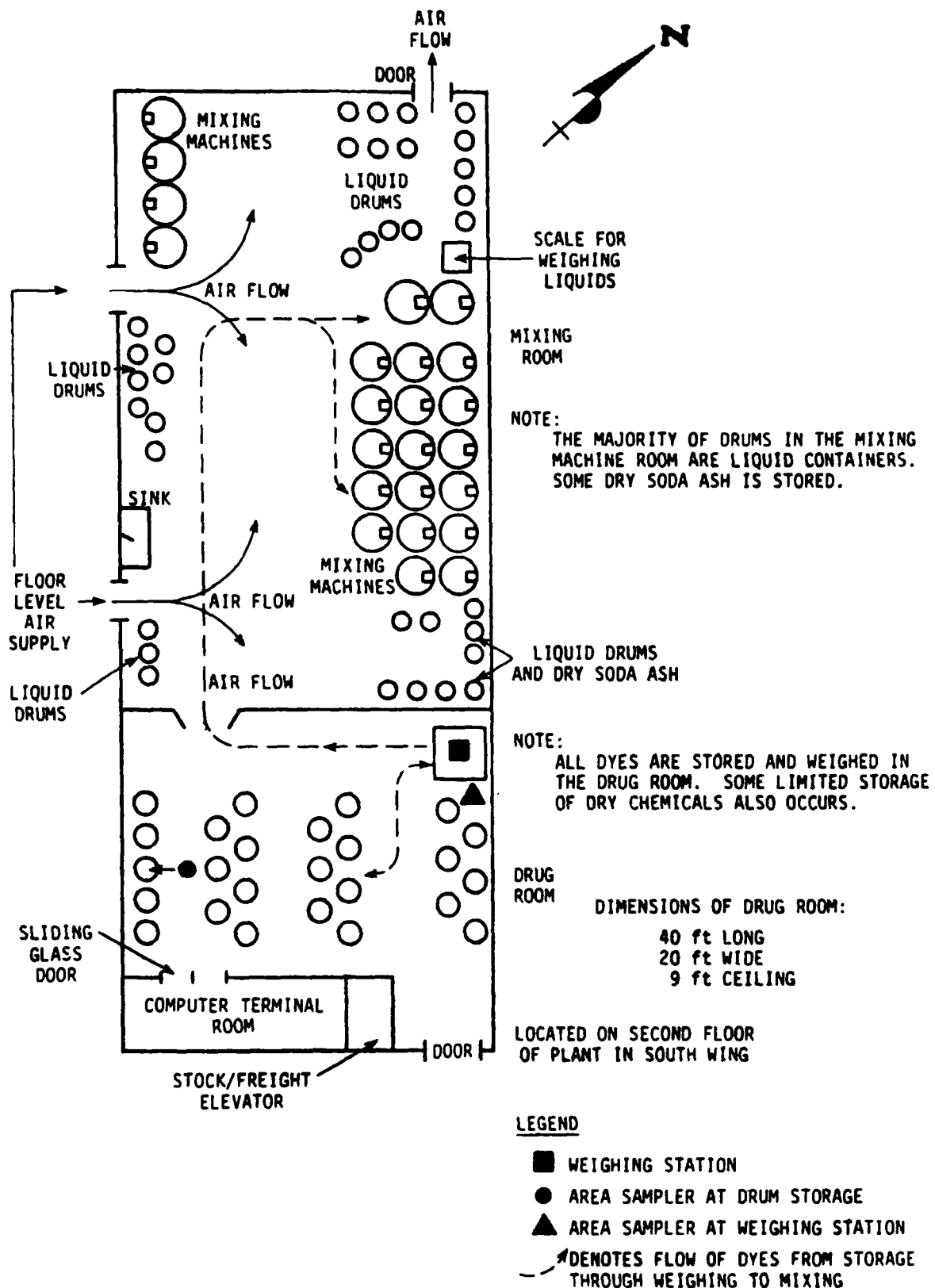


Figure 1. Sketch of drug room area.



with the majority of the drums containing liquids. Dry soda ash is also stored in the mixing room.

The general appearance of the weighing and storage areas was very clean. There was a small accumulation of dye on the walls, equipment, and drum lids. The floors did not have an accumulation of dye. Reportedly, the floors were hosed down frequently.

The drug room is not equipped with a local exhaust ventilation system for removing airborne dye particles. The drug room is equipped with a general heating and air conditioning unit. Air is supplied at the floor level in the mixing area and exhausted by ceiling vents.

Floor drains and grates are located in the drug room to facilitate drainage when the floor is hosed down during cleaning operations.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	67	67	68
Relative humidity	79	77	82
Barometric pressure, in.Hg.	29.97	29.95	29.98

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

## DYE WEIGHER ACTIVITIES

The company employs two full-time weighers on each of two 12-hour shifts. Their duties include:

- ° Relocating drums within the drug room by use of a dolly.
- ° Weighing dyes and dry chemicals and recording weights on batch tickets.
- ° Transferring dyes and dry chemicals to stainless steel buckets and then hand carrying the buckets to the mixing machines.
- ° Adding the dyes and dry chemicals to the mixing machines.
- ° Cleaning dye storage, weighing, and mixing areas.

The dye weighers employed at this facility are involved in the handling, transferring, weighing, and mixing of dyes and dry chemicals.

Two dye weighers were monitored during this survey. The monitoring team believed that this facility operated on three 8-hour shifts. They planned to monitor the second shift commencing at 3:00 pm. Upon arrival at the site, it was learned that the facility operated two 12-hour shifts. In order to obtain a representative 8-hour shift sample, half of the eight hour monitoring was conducted on each shift. The first weigher was monitored during the latter part of his 12-hour shift (3:00 p.m. to 7:00 p.m.), and the second weigher was monitored during the beginning of his 12-hour shift (7:00 p.m. to 11:00 p.m.). Both weighers wore the same sampling devices.

The first shift dye weigher was a 27-year old male. He has been employed at the company for 5 years; three of those years have been spent in handling dyes. He had two years previous dye handling experience. The second shift dye weigher was a 43-year old male. He has been employed at the company for 7 years; five of those years have been spent handling dyes. He had no previous dye handling experience.

## Training

Specific training for dye weighers regarding the safe handling of dyes is provided by the company in the form of films, text on dye materials, on-the-job standard operating procedures, and a training program.

## Personal Protective Equipment

Personal protection equipment utilized by the monitored dye weighers in the drug room included 3M 8500 nontoxic dust masks and gloves. It was observed that the dye weighers' hands and forearms had very slight dermal contact with the dyestuffs in use.

## Personal Habits

The monitored dye weighers were not observed drinking or eating in the drug room. They did not smoke inside the weighing area but did smoke outside the area. Each monitored dye weigher frequently washed his hands with soap and water. They changed from work clothes into street clothes and washed their faces and hands before leaving the plant.

## Work Activities

The dye weigher activities in filling each batch ticket order were as follows: Dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove the approximate quantity of the dye, transferring the scoop of dye to the weigh station, pouring the required amount onto the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a stainless steel bucket. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The bucket containing the dyes was then transferred to the mixing area where the dye and other chemicals were added to the mixing tank. The tank was equipped with an

agitator to thoroughly mix the dyes. The dye weigher operated the mixing equipment.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored employees were in the drug room for a total of 287 minutes over an 8-hour (480 minutes) period. During that time, their duties required them to enter the drug room seven times. They were monitored for exposure to particulates over a 400-minute period from 3:07 p.m. to 6:38 p.m., and from 7:10 p.m. to 10:19 p.m. The data collected and observations made during the survey are presented in Table 2. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of all weighings of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in workers' breathing zones	0.01	0.03	0.02*
Drug room area sampler at weighing station	0.01	0.02	0.043
Drug room area sampler at drum storage, remote from weighing area	<0.01	<0.01	0.04

\*The total weight on the filter is less than the weight of commercial dye as determined by the analytical method. Weights at such low levels are approaching the maximum capabilities of most analytical balances and therefore are subject to much uncertainty.

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING THE SURVEY

A. Time in work area		Time, minutes	Percent of monitoring period		
Total time monitoring		400	100		
Total time in drug room		287	72		
Lunch and breaks		Not available			
B. Work capacity		Number of process units	Percent		
Maximum work load		11	100		
Units in operation at time of survey		11	100		
C. Powder dyes weighed		Number of dyes	Percent		
Total weighed		16	100		
Disperse		6	38		
Direct		10	62		
D. Dyes		Number of weighings	Percent	Weight of dyes, grams	Percent
Total		46	100	10,707.74	100
Disperse		23	50	5,799.82	54
Direct		23	50	4,907.92	46
E. Dry chemicals weighed		Number of weighings			
Total		0			
F. All chemicals weighed		Number of weighings	Percent	Weight of all chemicals grams	Percent
Total		46	100	10,707.74	100
Dyes		46	100	10,707.74	100
Dry chemicals		0	0	0.00	0

(continued)

TABLE 2 (continued)

F.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	Percent
	Disperse Yellow 218	7	15	812.12	8
	Disperse Red 60	6	13	1,296.03	12
	Direct Yellow 142	6	13	660.26	6
	Disperse Blue 56	5	11	2,658.44	25
	Direct Red 243	5	11	368.74	3

H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, grams	Percent
	Disperse Blue 56	5	11	2,658.44	25
	Direct Red 9	1	2	2,271.81	21
	Disperse Red 60	6	13	1,296.03	12
	Direct Blue 80	4	9	949.06	9
	Disperse Yellow 218	7	15	812.12	8

TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index no.	Number of weighings	Total weight of weighings, grams
Disperse dyes:		
Disperse Yellow 218	7	812.12
Disperse Orange 29	3	81.23
Disperse Red 60	6	1,296.03
Disperse Red 338	1	793.33
Disperse Violet 26	1	158.67
Disperse Blue 56	5	2,658.44
Direct dyes:		
Direct Yellow 142	6	660.26
Direct Yellow 58	1	77.97
Direct Orange 34	1	147.28
Direct Red 243	5	368.74
Direct Red 9	1	2,271.81
Direct Blue 80	4	949.06
Direct Blue 191	1	363.87
Direct Brown 115	2	18.97
Direct Brown 116	1	12.00
Direct Black 62	1	38.00

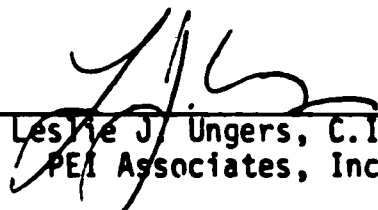
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 5/9



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460



## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Donald L. Unruh, C.I.H., IT Corporation, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on March 9, 1987. The industrial hygiene monitoring and recording of data were performed during the second shift (3:00 p.m. to 11:00 p.m.) on that day. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 5/9 is part of a captive dye house operating on both an integrated and commission basis. Approximately 5.5 million pounds of woven piece goods per year are dyed with powder dyes at this publicly owned facility. Seven jets and seven becks were available for batch dyeing as well as four continuous dyeing machines. Two continuous machines were in operation at the start of the shift; three were in operation at the end. Six jets were in operation throughout the entire monitoring period. No becks were operating at the beginning of the shift, but one was in operation at the end. Fibers dyed in the manufacture of woven fabrics are acrylic/modacrylic, rayon, nylon, polyester, cotton, occasionally acetate, and wool samples. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room, located in the southwest corner of the second floor of the plant building, is a rectangular room approximately 80 feet long and 60 feet wide, with an 8-foot ceiling. The room is accessed by a door in the middle of the room which leads to the dye weighing area. The weighing area, measuring 25 feet by 20 feet, is a room located inside the drug room. Inside the weighing area are stored dye drums, and two dye weighing stations. In the drug room outside of the weighing area, there are areas of dye drum storage along the outside walls of the weighing room, as well as in many

areas throughout the room. The mixing areas are located along the north and south walls of the drug room. Figure 1 presents a sketch of the drug room and mixing areas.

The dye drums vary in size from 200- to 250-pound barrels to 8 to 10-pound containers.

In the weighing room, a gram scale for weighing small volumes of powder dyes is located on a table on which small containers of dyes are stored. A pound scale for weighing large quantities of dyes and dry chemicals is located next to this table.

The general appearance of the drug room was moderately clean. The walls, floors, and stored dye drums were fairly free of dyestuff. There was a small accumulation of dye material on the equipment. Spills were washed up immediately.

The drug room was not equipped with a local exhaust ventilation system for the purpose of removing airborne dye particles. Two overhead air supply vents were located in the mixing vat area. All ventilation ducts in the weighing area were blocked except for one supply slot as indicated in Figure 1. The air flow was into the weighing room from the hallway, indicating a slightly negative pressure inside as compared to the rest of the building.

Floor drains are located in the drug room and mixing room to facilitate drainage when the floor is hosed down, an operation which reportedly takes place at the end of every shift.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

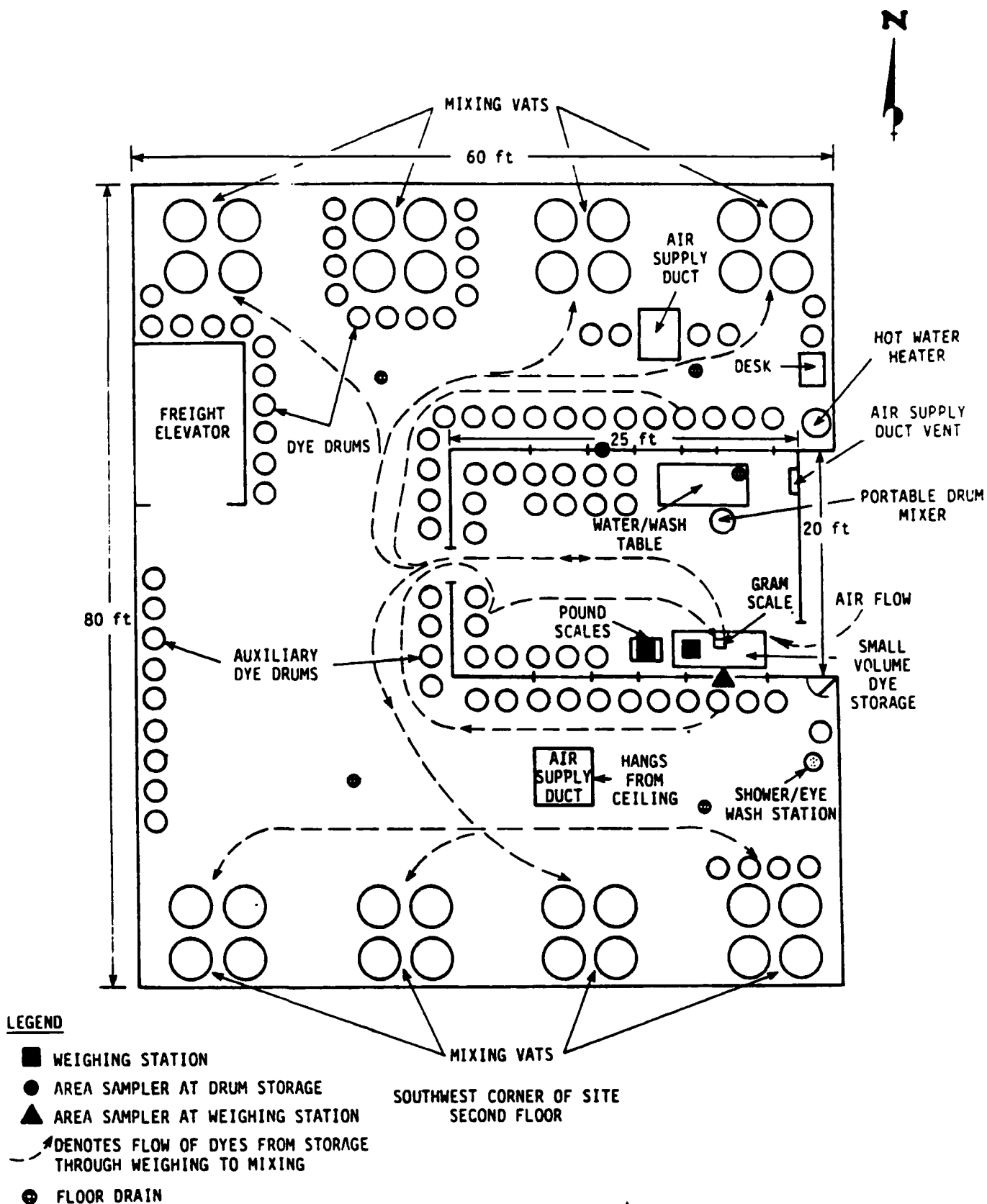


Figure 1. Sketch of drug room and mixing areas.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	80	78	81
Relative humidity, %	70	63	88**
Barometric pressure, torr	749	719	760

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

\*\* Recorded while all floors were being washed.

### DYE WEIGHER ACTIVITIES

The company employs one full-time weigher on each of three shifts. His duties include:

- Weighing dyes and dry chemicals and recording weights on batch tickets.
- Transferring weighed dyes and dry chemicals from the scale to buckets and hand carrying the buckets to the mixing areas.
- Relocating dye drums within the drug room using a drum dolly.
- Cleaning dye storage, weighing and mixing areas.

The dye weighers employed at this facility are involved in the handling, transferring, and weighing of dyes and dry chemicals.

The monitored dye weigher was a 49-year old male. He has been employed at the company for 19 years; ten of those years have been spent handling dyes. He had no previous dye handling experience.

### Training

Specific employee training regarding the safe handling of dyes involved rudimentary verbal training regarding the harmful constituents of certain classes of dyes. It was reported that no hazard communication training of any kind has been conducted in the past three years.

## Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher in the drug room included a Willson half-mask disposable dust respirator during dye weighings and steel-toed shoes. A Willson full-face cartridge respirator was worn while performing caustic soda weighings. A safety eye wash station is located near the mixing vats along the south wall of the room; however, it was not functional at the time of the survey.

## Personal Habits

The monitored dye weigher did not smoke or eat inside the weighing area. He washed his hands after each batch weighing.

## Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station, pouring the required amount into the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a bucket. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The batch was then hand carried to the mixing area and added to the mixing vats. When a bucket was used, it was washed out after transferring the batch to the mixing vat. These rinsings were also added to the mixing vat. Small quantities of dye were carried in the weighing pan. At times, liquid chemicals were also added to the mixing vats.

## SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 403 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room seven times. He was monitored for exposure to particulates over a 452-minute period from 3:07 p.m. to 10:39 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.02	0.07	0.33
Drug room area sampler at weighing station	0.02	0.07	0.12
Drug room area sampler at drum storage, remote from weighing area	<0.01	0.01	0.05

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Percent of monitoring period			
A.	Time in work area	Time, minutes			
	Total time monitored	452	100		
	Total time in drug room	403	89		
	Lunch and breaks	NA	NA		
B.	Work capacity	Number of process units	Percent		
	Maximum work load	18	100		
	Units in operation at time of survey	9 (avg.)	50		
C.	Powder dyes weighed	Number of dyes	Percent		
	Total	18	100		
	Acid	3	17		
	Disperse	7	39		
	Basic	4	22		
	Direct	4	22		
D.	Dyes	Number of weighings	Percent	Weight of dyes, grams	Percent
	Total	44	100	51,081.4	100
	Acid	6	14	8,258.7	16
	Disperse	24	55	40,932.8	80
	Basic	5	11	1,564.0	3
	Direct	9	20	325.9	1
E.	Dry chemicals weighed	Number of weighings	Percent	Weight of chemicals, grams	Percent
	Glauber's Salt (Na <sub>2</sub> SO <sub>4</sub> ·10 H <sub>2</sub> O)	10	100	92,532.4	100
F.	All chemicals weighed	Number of weighings	Percent	Weight of dry chemicals, grams	Percent
	Total	54	100	143,613.8	100
	Dyes	44	81	51,081.4	36
	Dry chemicals	10	19	92,532.4	64

(continued)



TABLE 2 (continued)

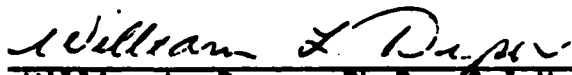
G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	Percent
	Disperse Orange 30	6	14	26,573.2	52
	Disperse Blue 56	6	14	8,661.0	17
	Disperse Red 177	4	9	5,125.6	10
	Direct Yellow 106	4	9	157.5	<1
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, grams	Percent
	Disperse Orange 30	6	14	26,573.2	52
	Disperse Blue 56	6	14	8,661.0	17
	Acid Blue 25	2	5	6,341.1	12
	Disperse Red 177	4	9	5,125.6	10


NA - Not available.

TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, grams
Acid Dyes:		
Acid Yellow 219	2	304.0
"Acid Red U-5"	2	1,613.6
Acid Blue 25	2	6,341.1
Disperse Dyes:		
Disperse Yellow 42	3	500.7
Disperse Orange 30	6	26,573.2
Disperse Red 177	4	5,125.6
Disperse Red 60	3	49.3
Disperse Blue 56	6	8,661.0
Disperse Blue 27	1	13.5
Disperse Blue 60	1	9.5
Basic Dyes:		
Basic Yellow 21	1	68.0
Basic Orange 30	1	60.0
Basic Blue 21	1	15.0
Basic Blue 41	2	1,421.0
Direct Dyes:		
Direct Yellow 106	4	157.5
"Direct Orange M-3"	1	30.3
Direct Red 243	1	1.9
Direct Blue 80	3	136.2

TEXTILE DRUG ROOM MONITORING STUDY  
SITE VISIT REPORT  
Site Number 6/2

  
\_\_\_\_\_  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
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Leslie J. Ungers, C.I.H.  
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## INTRODUCTION

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## SITE CHARACTERIZATION

### GENERAL

The drug room at site 6/2 is part of a captive dyehouse operating on an integrated basis. Approximately 23 million pounds per year of knitted piece goods for automotive or apparel use are dyed in batch operations (99 percent with powder dyes) at this publicly-owned facility. All available dyeing machines were in operation during the entire survey period. These machines consisted of fourteen jet and nineteen beam dyeing machines. Of the latter, nine were open to the atmosphere and ten were pressurized. Fibers dyed are nylon, polyester, acetate, and triacetate. Site operations include greige storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room, located on a second floor mezzanine above the dyehouse, is a rectangular room approximately 70 feet long and 25 feet wide, with a 10-foot ceiling. The room is accessed by a door at the north end which leads to the mixing area and descending stairs, and double doors at the south end which lead to a storage area for chemicals and unopened drums of dyes and an elevator. A wide aisle running the length of the room provides access to the drums of dyes. This aisle is also used by plant workers to gain access to the elevator and to transport materials or equipment from the elevator to the mixing area. Mixing occurs in a separate area outside the drug room. Mixed

dye solutions/dispersions are gravity-fed via pipeline into dyeing equipment. The drug room includes drum storage, one dye weighing station equipped with two scales (a computer-adjusted gram scale and a pound scale) and storage bins for pre-weighed dye mixes. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums throughout the drug room and outside the south wall of the drug room. The drums vary in size from 200- to 250-pound barrels to 50- to 100-pound containers. Pre-weighed dye mixes are stored in five temporary storage bins located against the west wall of the drug room. The two scales for weighing powder dyes are located against the north wall between the storage bins and the door to the mixing area.

The general appearance of the drug room was fair. The walls were moderately stained from dyestuff contact. The floor was swept at the end of the monitored shift and when a spill occurred. It was reported by the company that the floor is swept at the conclusion of each shift and washed weekly.

The drug room was not equipped with a local exhaust ventilation system for the purpose of removing airborne dye particles. The room was equipped with a general heating and air conditioning system. Air is moved through overhead supply and return ducts in the ceiling, which creates a slight positive pressure compared to the other plant areas. This is indicated by the flow of air from the drug room at each doorway.

One floor drain is located in the north end of the drug room which facilitates water removal during weekly floor cleaning.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

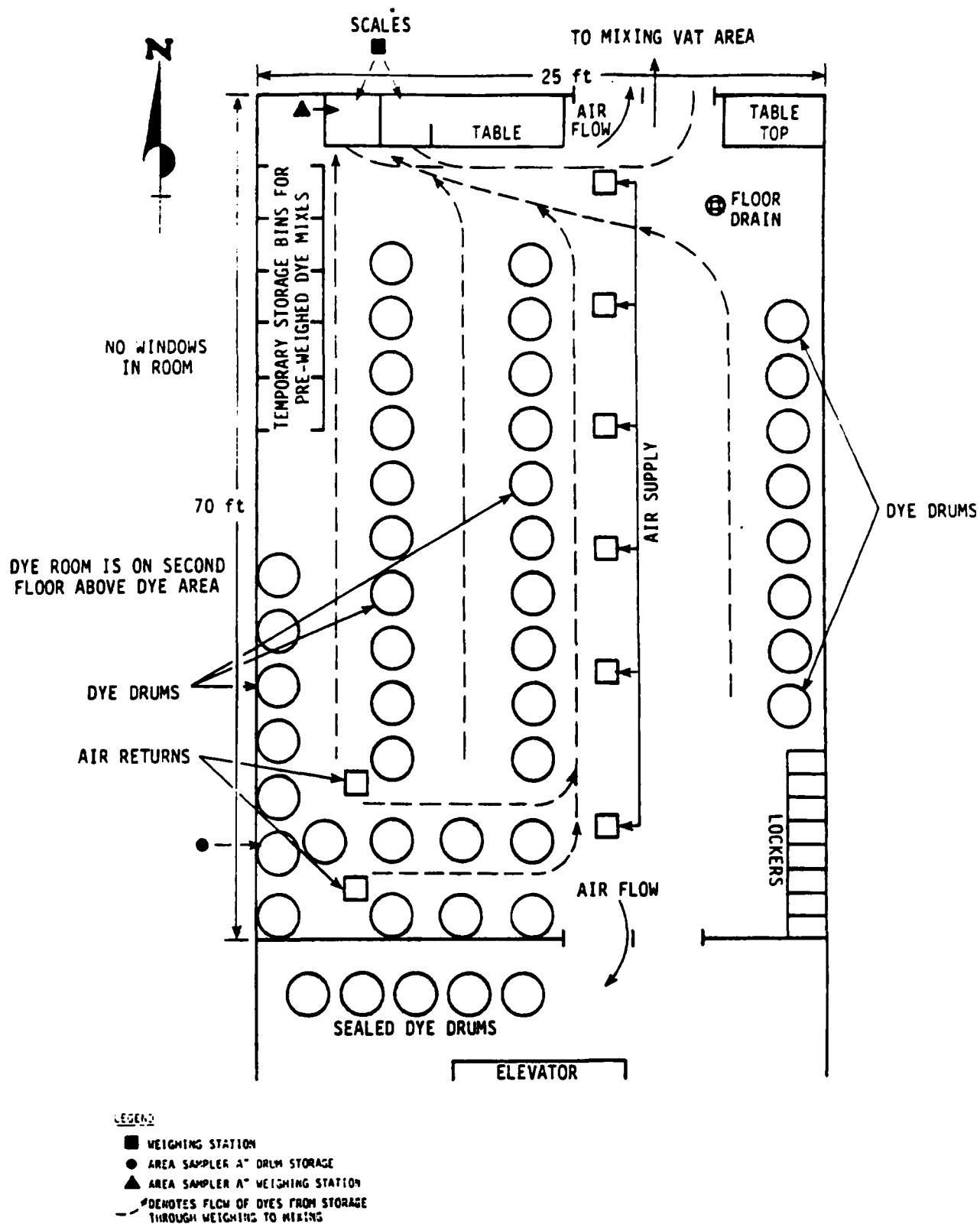


Figure 1. Sketch of drug room area.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	72	65	74
Relative humidity, %	71	66	78
Barometric pressure, in. Hg.	30.10	30.07	30.17

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

The company employs one full-time dye weigher on each of three shifts. There are twelve employees who rotate duties in this area at this facility. Their duties include:

- Weighing dyes and recording weights on batch tickets.
- Transferring weighed dyes from the scale to plastic bags, buckets, or stainless steel bowls.
- Cleaning dye storage and weighing areas.

The dye weighers employed at this facility are involved in the handling, transferring, and weighing of dyes. Employees other than dye weighers transfer the weighed dyes to the mixing vats. All incoming dyes are quality control checked in the receiving lab prior to being released to the drug room.

The monitored dye weigher was a right-handed 43-year old male. He has been employed at the company for 17 years; twelve of those years have been spent handling dyes. He had no previous dye handling experience.

#### Training

Specific dye weigher training regarding the safe handling of dyes was provided in the form of monthly safety meetings and training on the hazards



of dyes and how to read Material Safety Data Sheets (MSDS). A file of appropriate dye MSDS's is kept in the Manager's office.

#### Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher in the drug room included a disposable dust mask respirator, rubber apron, safety glasses, rubber gloves, and steel-toed shoes. The monitored dye weigher used the above-mentioned equipment at all times during the survey; however, because he rolled up his long sleeve shirt to his elbows, the possibility existed of dermal contact with dyes. It was also observed that the respirator fit was such that it did not provide a seal necessary to achieve optimum protection; usually only one of two straps was secured.

#### Personal Habits

The monitored dye weigher and other workers in the drug room were observed drinking in the drug room. The monitored dye weigher did not smoke inside or outside the weighing area. As part of his personal hygiene practice, the weigher washed his hands only before taking breaks. He consistently wore his rubber gloves during all dye weighing activities.

#### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station and pouring the required amount into a plastic bucket, plastic bag, or stainless steel bowl, and returning the unused portion of the dye to the drum. At times, drums of dyes requiring relatively large weighings were pushed to a location near the scales prior to scooping. This operation was repeated until all of

the dye weighings specified on the batch ticket had been completed. To ensure dye containment, the upper portion of the plastic bags were folded and stapled shut; buckets were covered with plastic sheeting. The containers remained in the scale area until time for mixing; a time period ranging from minutes to greater than an hour. Other workers then transported the weighed dye mixture to the mixing area where they were transferred into the mixing vats.

On one occasion, when a drum of dye (Disperse Red 135) was almost empty, the dye weigher manually transferred the dregs into the next drum by inverting the old drum over the new drum. On three other occasions, the dregs remained in the almost depleted drum, which was used as a trash receptacle and then (presumably) discarded. It was also noted that an unused mixing vat of dye dispersion for a full-size fresh dyelot was not piped to a dyeing machine, but was instead diverted to the discard drainage system and released because the beam of fabric scheduled to be dyed had blown in the scouring operation, necessitating postponement of dyeing the scheduled dyelot.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 456 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room four times. He was monitored for exposure to particulates over a 459-minute period from 7:06 a.m. to 2:45 p.m. At the beginning of the shift, the dye weigher was very active with a full schedule of weighings to be performed. He worked steadily without a break for the first 3-1/2 hours of the shift.

Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the

survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.06	0.18	0.27
Drug room area sampler at weighing station	0.03	0.08	0.15
Drug room area sampler at drum storage, remote from weighing area	<0.01	0.01	0.04

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Percent of monitoring period	
A.	Time in work area	Time, minutes	
	Total time monitored	459	100
	Total time in drug room	456	99
	Lunch and breaks	NA	NA
		Number of process units	Percent
B.	Work capacity		
	Maximum work load	33	100
	Units in operation at time of survey	33	100
C.	Powder dyes weighed	Number of dyes	Percent
	Total	30	100
	Acid	6	20
	Neutral Premetallized	2	7
	Disperse	22	73
		Number of weighings	Percent
D.	Dyes		
	Total	88	100
	Acid	6	7
	Neutral Premetallized	2	2
	Disperse	80	91
		Weight of dyes, pounds	Percent
	Total	625.922	100
	Acid	<1.043	<1
	Neutral Premetallized	0.039	<1
	Disperse	624.84	99
E.	Dry chemicals weighed	Number of weighings	
	Total	0	
		Number of weighings	Percent
F.	All chemicals weighed		
	Total	88	100
	Dyes	88	100
	Dry chemicals	0	0
		Weight of dry chemicals, pounds	Percent
	Total	625.922	100
	Dyes	625.922	100
	Dry chemicals	0.000	0

(continued)

TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Disperse Yellow 42	10	11	25.48	4
	Disperse Blue 27	8	9	41.294	7
	Disperse Orange 30	7	8	56.064	9
	Disperse Blue 60	7	8	11.49	2
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, pounds	Percent
	"Disperse Black M-3"	6	7	118.231	19
	Disperse Orange 41	3	3	87.22	14
	Disperse Red 167	5	6	71.32	11
	Disperse Orange 30	7	8	56.064	9

NA - Not available.

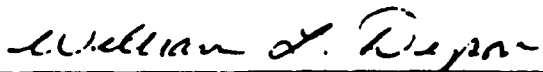
TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, pounds
Acid Dyes:		
Acid Yellow 49	1	0.001
Acid Yellow 159	1	0.038
Acid Orange 116	1	0.001
Acid Red 396	1	0.002
"Acid Blue U-1"	1	<0.001
Acid Blue 205	1	1.00
Neutral Premetallized Dyes:		
Acid Yellow 116	1	0.005
Acid Blue 177	1	0.034
Disperse Dyes:		
Disperse Yellow 64	1	0.120
Disperse Yellow 42	10	25.48
Disperse Yellow 3	1	0.007
Disperse Yellow 86	1	10.23
Disperse Orange 41	3	87.22
Disperse Orange 30	7	56.064
Disperse Red 135	1	23.73
Disperse Red 333	2	30.69
Disperse Red 55	4	2.638
Disperse Red 263	3	25.58
Disperse Red 167	5	71.32
Disperse Red 73	4	0.676
Disperse Red 91	3	15.47
Disperse Violet 57	5	28.18
Disperse Blue 56	2	21.66
"Disperse Blue U-4"	2	12.20
Disperse Blue 77	1	17.69
Disperse Blue 87	3	18.44
Disperse Blue 27	8	41.294
Disperse Blue 60	7	11.49
Disperse Blue 79	1	6.43
"Disperse Black M-3"	6	118.231

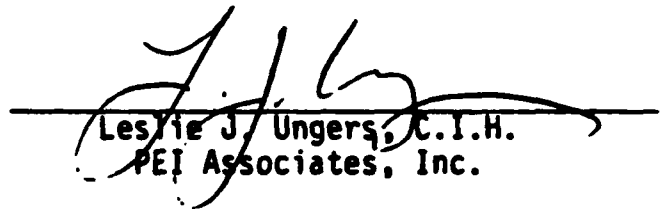
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 6/5



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Melvin R. Witcher, Jr., C.I.H. of Health and Hygiene, and Donald L. Unruh, C.I.H. of IT Corporation, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on May 20, 1987. The industrial hygiene monitoring and recording of data were performed during the first shift (7:00 a.m. to 3:00 p.m.) on the next day. Company representatives were very cooperative in assisting with this survey.



## SITE CHARACTERIZATION

### GENERAL

The drug room at site 6/5 is part of a captive dyehouse operating on an integrated basis. Approximately 350,000 pounds of whole garments (socks) per year are dyed in batch operations at this privately-owned facility. Two Smith Drum and three Milnor rotary dyeing machines were available, all of which were in operation at the time of the survey. Fibers consist of acrylic, wool, nylon, cotton, and polypropylene. Site operations include storage, preparation, dyeing, drying, and steam pressing of the garments.

### DRUG ROOM

The drug room, located in the center of the plant building, is a rectangular room approximately 28 feet long and 18 feet wide. It is an open-top structure inside a larger metal building. The drug room had no structural roof. The four 8-foot walls of the room served as a support for several large cylindrical water tanks, which were positioned lengthwise across the width of the drug room. The tanks did not completely enclose the top of the drug room. The room is accessed by a door along the east wall of the room which leads to the general plant area. The drug room includes a drum storage area and one dye weighing station equipped with one scale. Figure 1 presents a sketch of the drug room.

A weighing station housing one scale for weighing the powdered dyes, is located in the drug room near the racks which contain the dye bins.

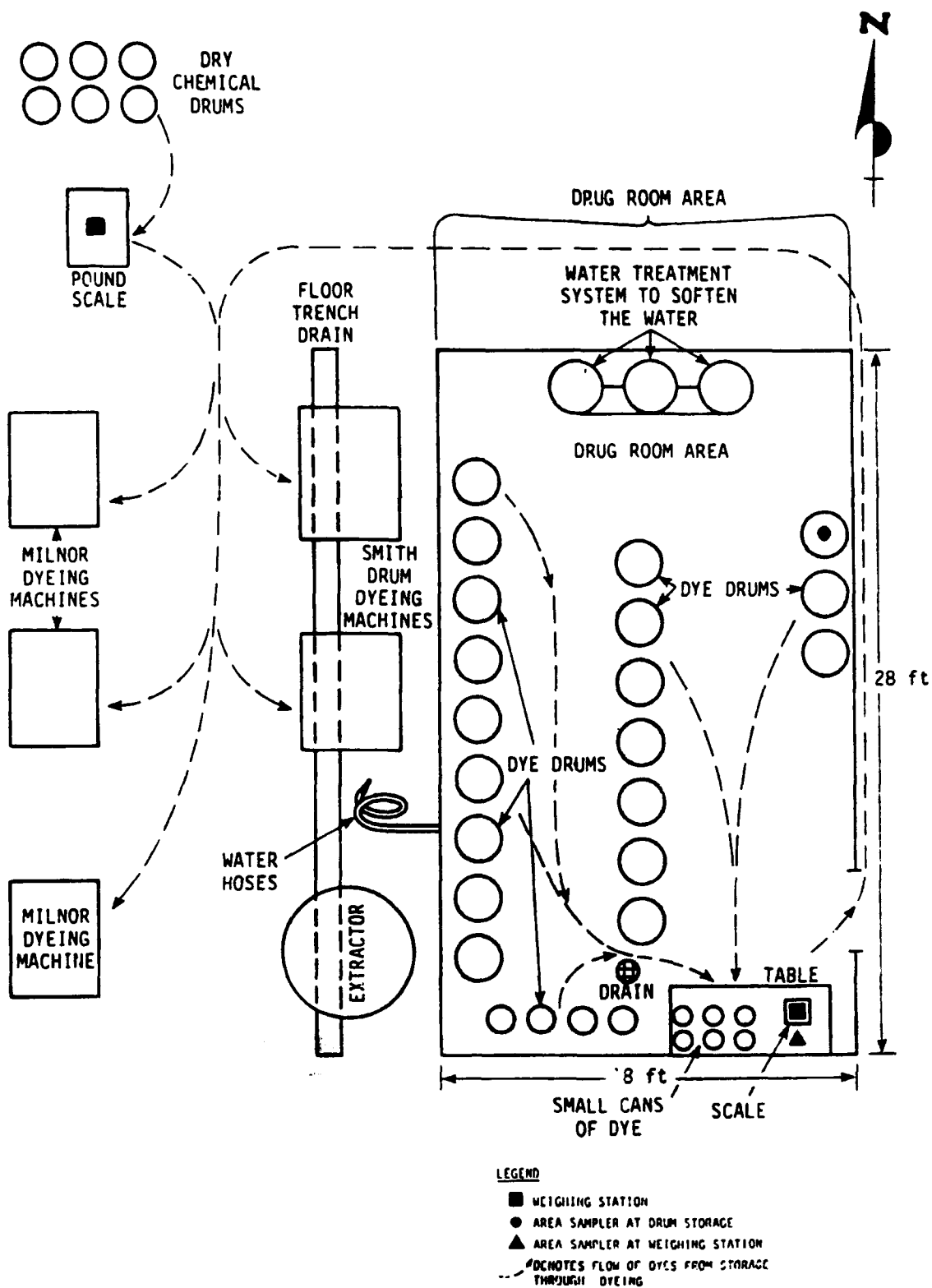


Figure 1. Sketch of drug room area.

Dyes are stored in drums utilizing the floor space against the walls of the drug room. Drums of dyes are also stored on the floor near the weighing station and in the center of the room. Small sample size cans of dye of approximately 10 pounds are located on the weigh station table next to the scale. Drum sizes vary from 200 to 250 pounds to 100 to 150 pounds. Dry chemicals are stored outside the drug room near the dye machine area.

One scale for weighing powder dyes is located on a table next to the drug room entrance. A second scale for weighing dry chemicals is located in the dye machine area.

The general appearance of the weighing and storage areas was fair. There was some evidence of dye stains on the floor and walls. There was also a small accumulation of dye material on the equipment and inventory. Spills of the dye material were not cleaned up during the survey period.

The drug room was not equipped with local exhaust ventilation systems for the purpose of removing airborne dye particles. The general building air was supplied from overhead roof vent fans. Because the drug room is an open-top structure, any air flow is the result of normal ambient air flow throughout the general plant area.

One floor drain was located in the drug room near the weighing station to facilitate drainage during floor cleaning; however, this activity was not observed during the survey. The accumulation of dust and the presence of dye stains on the floor indicated that floor washing occurs infrequently.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	85	79	89
Relative humidity, %	67	58	81
Barometric pressure, in. Hg.	28.52	28.50	28.54

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

On each of two shifts the company employs one full-time person who weighs dyes in addition to performing many other duties. His duties include:

- ° Weighing dyes and dry chemicals and recording weights on batch tickets.
- ° Transferring powder dyes from the scale to 2-gallon stainless steel pails and hand carrying the pails to the dye machines.
- ° Adding the dry dyes and dry chemicals directly to the addition spout on the dyeing machines.
- ° Loading materials to be dyed into the dyeing machine and operating the dyeing machine.
- ° Transferring dyed goods to the extractor and operating that machine.
- ° Transferring goods from the extractor to a cart, which was then pushed to the drying machines in another on-site location by a different worker.
- ° Cleaning dye storage and weighing areas.

The operator/dye weighers at this facility are involved in dye handling, transferring, weighing, adding of dry dyes and dry chemicals to dyeing machines, loading and unloading dyeing machines, loading and unloading extractors.

The monitored dye weigher was a 31-year old male. He has been employed at the company for 11 years; all of those years have been spent handling dyes. He had no previous dye handling experience.

### Training

The monitored dye weigher had experience in reading material safety data sheets (MSDS's); however, no formal training regarding the safe handling of dyes was provided by the company.

### Personal Protective Equipment

Personal protective equipment utilized by the dye weighers in the drug room included an MSA half-mask respirator with high-efficiency particulate filters, an apron, safety glasses, and gloves. The monitored dye weigher used all of the required personal protective equipment while performing dye-handling activities. Because the monitored dye weigher wore a short-sleeved shirt, dermal contact with dyestuffs may have occurred, although this was not observed.

### Personal Habits

The monitored dye weigher was not observed drinking or eating in the drug room. He did not smoke inside the weighing area, but he did smoke outside of that area. As part of this personal hygiene practices, the monitored dye weigher washed his hands after each dye weighing.

### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye and using a hand scoop or a large spoon to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station and pouring the required amount into the scale dish, returning

the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a stainless steel pail. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. Dry chemicals were weighed and added to the batch as specified in the formulation. The batch was then hand carried to the washing machine-like rotary dyeing machines and poured into the addition spout on the dyeing machine. The pail was rinsed and the rinse water was poured into the dyeing machine. The dye/chemical mixture was gravity fed directly into the garment dyeing machine. This method of operation--the direct addition of dry dye into dyeing machines--is significantly different from operations at other monitored sites where dry dye powders are dissolved or dispersed in hot water with the aid of a mixer prior to addition to the dyeing machine. Garments were loaded into the dyeing machine by the dye weigher and the dyeing machine was operated. After the garments were dyed, the dye weigher transferred the dyed goods to the extractor. After operating the extractor, the dye weigher transferred the garments to a cart, which was pushed by another worker to the dryers at a different location within the plant.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 36 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room nine times. He was monitored for exposure to particulates over a 463-minute period from 7:10 a.m. to 2:53 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dyes handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.08	0.10	0.53
Drug room area sampler at weighing station	0.03	0.04	0.14
Drug room area sampler at drum storage, remote from weighing area	0.01	0.01	0.14

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Percent of monitoring period	
A.	Time in work area	Time, minutes	
	Total time monitored	463	100
	Total time in drug room	36	8
	Lunch and breaks	NA	NA
		Number of process units	Percent
B.	Work capacity		
	Maximum work load	5	100
	Units in operation at time of survey	5	100
		Number of dyes	Percent
C.	Powder dyes weighed		
	Total weighed	12	100
	Acid	7	58
	Neutral Premetallized	1	8
	Basic	1	8
	Reactive	3	25
		Number of weighings	Percent
		Weight of dyes, grams	Percent
D.	Dyes		
	Total	15	100
	Acid	10	67
	Neutral Premetallized	1	7
	Basic	1	7
	Reactive	3	20
		Number of weighings	Percent
		Weight of chemicals, pounds	Percent
E.	Dry chemicals weighed		
	Total	20	100
	Ammonium sulfate	2	10
	CDB-63	1	5
	DYL Chem developer	4	20
	DYL Salt conc.	4	20
	Soda ash grade 100 (Na <sub>2</sub> CO <sub>3</sub> )	1	5
	Sodium bisulfite	1	5
	Sodium sulfate	6	30
	Potassium pyrophosphate	1	5

(continued)



TABLE 2 (continued)

F.	All chemicals weighed	Number of weighings	Percent	Weight of all chemicals, grams	
					Percent
	Total	35	100	107,100.60	100
	Dyes	15	43	6,403.62	6
	Dry chemicals	20	57	100,696.98	94
G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	
					Percent
	Acid Red 260	3	20	363.63	6
	Acid Yellow 79	2	13	47.62	1
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, grams	
					Percent
	Acid Red 158	1	7	1,840.45	29
	"Reactive Blue U-5"	1	7	1,271.64	20
	Reactive Yellow 27	1	7	999.48	16

NA - Not available.

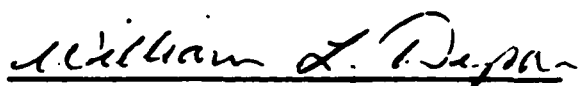
TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, grams
Acid Dyes:		
Acid Yellow 79	2	47.62
Acid Red 111	1	368.32
Acid Red 158	1	1,840.45
Acid Red 260	3	363.63
Acid Blue 264	1	182.34
Acid Blue 102	1	368.32
Acid Blue 113	1	100.69
Neutral Premetallized Dyes:		
Acid Blue 335	1	34.02
Basic Dyes:		
Basic Blue 41	1	303.91
Reactive Dyes:		
Reactive Yellow 27	1	999.48
Reactive Red 40	1	523.20
"Reactive Blue U-5"	1	1,271.64

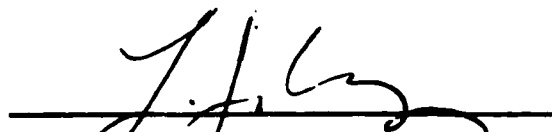
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 6/6



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET S.W.  
WASHINGTON, D.C. 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Ronald H. Hill, C.I.H. of Health and Hygiene and Leslie J. Ungers, C.I.H., Senior Industrial Hygienist for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the afternoon of November 4, 1986. The industrial hygiene monitoring and recording of data were performed during the second shift (3:30 p.m. to 11:00 p.m.) on the same day. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 6/6 is part of a dyehouse operating on a commission basis. Approximately 1.2 million pounds per year of piece goods for apparel use are dyed in semi-continuous/continuous operations at this privately owned facility. Three dyeing machines were available, two of which were in operation at the time of monitoring. These machines consist of a pad for continuous application of dyes or vat pigments and the appropriate auxiliary equipment for fixation via either thermosol or other continuous or semi-continuous processes. Fibers dyed are rayon, wool, nylon, polyester, cotton, and flax. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

There are two drug rooms in the plant. The major drug room is located on the second floor and is approximately 120 feet long and 30 feet wide with a ceiling 12 feet in height. The minor drug room is located on the first floor and is 30 feet long and 25 feet wide with a 12-foot ceiling. There are two stairways leading from the first floor drug room into the major drug room near the mixing equipment on the second floor. No mixing takes place on the first floor. Figures 1 and 2 present a sketch of the major drug room and the minor drug room, respectively.

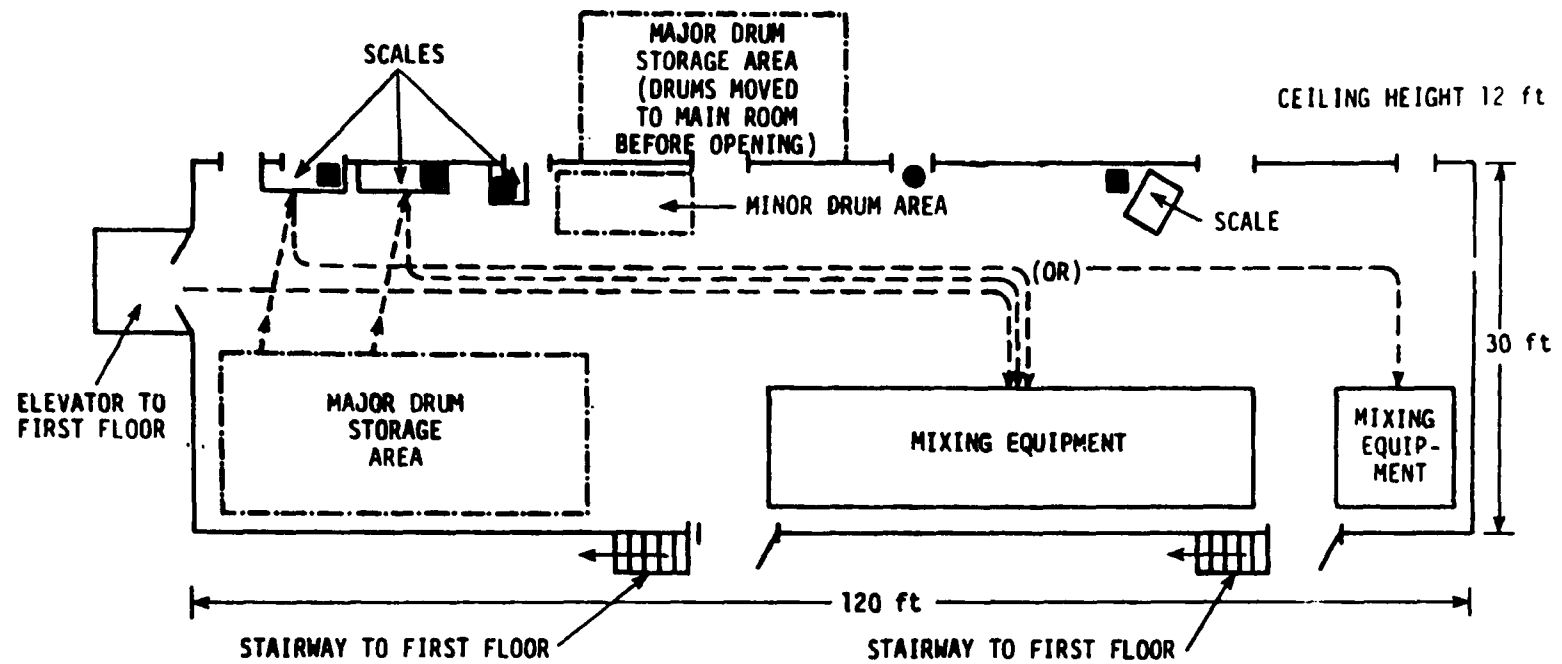


Figure 1. Sketch of major drug room area, second floor.

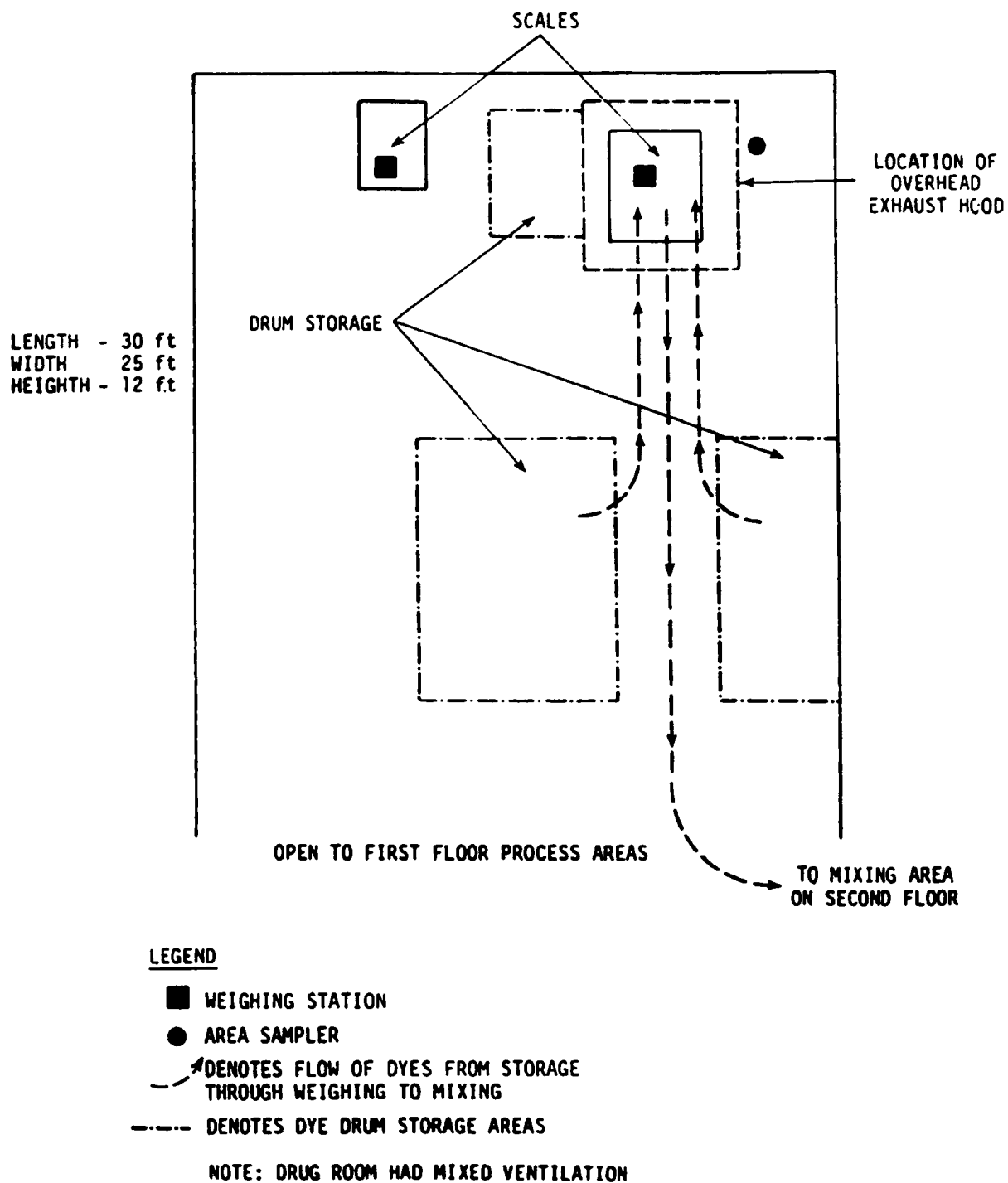


Figure 2. Sketch of minor drug room area, first floor.

Dyes are stored in drums in both the first and second floor drug rooms. The major drum storage area for the dyes is located on the second floor. In both the major and minor drug rooms, small, temporary drum storage areas exist. The drums vary in size from 200-250 pound barrels to smaller 50-100 pound drums. Dry chemicals (in drums and bags) are stored in these same storage areas.

Four scales are located in the major drug room for weighing of dyes. In the minor drug room, there are two scales available for weighing of dyes.

The general appearance of the major drug room was fair. There was little accumulation of dye on the walls. The equipment and drum lids showed some accumulation of dye material. The floors had a significant accumulation of dye indicating that spills are not routinely cleaned up.

The general appearance of the minor drug room was poor. There were stains and an accumulation of dye on the walls. The equipment showed significant accumulation of dye material, while the drum lids showed some accumulation of dye. The floors had a significant accumulation of dyestuff which indicates that spills are not routinely cleaned up.

The major drug room had no specific engineering controls installed for the purpose of removing airborne dye particles. The general ventilation in the major drug room consisted of 3 overhead fans. These fans were not in use at the time of the survey; no net air flow was measured at the drug room entrances.

In the minor drug room, one of the weighing stations had been equipped with an overhead exhaust hood for the purpose of removing airborne dye particles. The general ventilation in the minor drug room was passive.



There were floor grates located in the major drug room to facilitate drainage around the mixing machines.

Environmental conditions at the plant (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	72	68	78
Relative humidity, %	77	55	90
Barometric pressure, in. Hg	30.08	30.07	30.10

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

The company employs two full-time weighers on each of three shifts. Two dye weighers are typically on duty during each shift; however, at the time of the survey, only one experienced dye weigher was working. The second individual was a trainee who did not actively participate in most of the dye handling operations. General duties of the dye weighers include:

- ° Relocating drums of dyes using a dolly.
- ° Weighing dyes and dry chemicals and recording weights on batch tickets.
- ° Transferring dyes and dry chemicals from the scale to a steel bucket.
- ° Dispensing liquid dyes.

- ° Manual addition of dry and liquid dyes and dry chemicals to the mixing tanks.
- ° Cleaning dye storage, weighing and mixing areas.

Most of the dyes used on this day were liquids, primarily Vat Dye pastes. During the monitoring period, only two powder dyes were used, a single Naphthol (azoic coupling compound) which was applied and then coupled with a single Naphthol Salt (diazotized azoic base). Technically, these two substances are intermediates which are applied separately. They react on the fiber to form the dye "in situ."

The dye weigher monitored during this survey was a 33-year old male. He has been employed at the company for 3 years; all of those years have been spent in handling dyes. He had three years of previous dye handling experience.

### Training

Company employee training regarding the safe handling of dyes is provided through information posted in the work area and booklets.

### Personal Protective Equipment

Personal protective equipment provided by the company and utilized by the dye weigher in the drug rooms included a dust mask respirator and rubber gloves. It was observed that the monitored dye weigher exhibited work practices with respect to handling an empty powder dye container which created an increased potential for exposure to airborne dye material, such as banging the container to empty the dye in the bottom. Although gloves were worn during all weighing operations, the dye weigher's forearms, shirt sleeves, and pants were contaminated with small amounts of dye powder.

### Personal Habits

The monitored dye weigher was observed drinking in the drug room. He was observed smoking inside the drug room between weighing activities as well as outside the drug room areas. These actions were contrary to the company's stated policies.

### Work Activities

The monitored dye weigher activities in filling each batch ticket order were as follows: the dye was obtained by walking to a drum in the storage area containing the appropriate dye and using a hand scoop to remove an approximate quantity of the dye (a shovel was used to transfer dye material in the first floor drug room), transferring the scoop or shovel of dye to the weigh station and pouring the dye onto the scale dish, returning the unused portion of the dye to the drum, and then transferring the weighed portion of the dye to a steel bucket. Only two powder dyes were used during the survey, which were separately weighed and applied to each dyelot. Dry chemical addition to the batch was made prior to transferring the material to the mixing area. Following dry chemical addition (if required), the batch was hand carried to the mixing area. Dyes weighed in the first floor drug room were transferred to the second floor drug room mixing area using the elevator. The dye and dry chemical mixture was manually added into the mixing tank and the stirrer or mixer was activated.

### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The employee monitored was in the major drug room 205 minutes and in the minor drug room 12 minutes over the 8-hour period (480 minutes). He was monitored for exposure to particulates over a 446 minute period from 3:30

p.m. to 10:56 p.m. During that time, his duties required him to enter the major drug room 14 times and the minor drug room 4 times. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

## ANALYTICAL RESULTS

EPA reported that the analytical method was unable to detect Naphthol Dyes, the only dye class encountered during the monitoring period. Therefore, no analytical results are available for this site. The total weight of all solids filtered from the air in this facility follow (in milligrams dye per cubic meter air):

	<u>Total weight</u>
Average of 4 monitoring devices in worker's breathing zone	0.77
Drug room area sampler at a weighing station, first floor drug room*	0.07
Drug room area sampler at a weighing station, second floor drug room*	0.36

\* Because there were two drug rooms in operation at this site, one area monitor was placed in the vicinity of the weighing station in each drug room.

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

A. Time in work area	Time, minutes	Percent of monitoring period
Total time monitored	446	100
Total time in major drug room	205	46
Total time in minor drug room	12	3
Lunch break	Not available	

TABLE 2 CONTI.

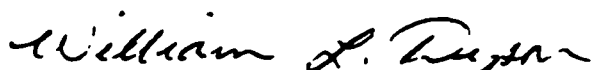
B. Work capacity		Number of process units		Percent	
Work load		3		100	
Units in operation at time of survey		2		67	
C. Powder dyes weighed		Number of dyes		Percent	
Total weighed		2		100	
Naphthol		1		50	
Naphthol Salt		1		50	
D. Powder Dyes	Number of weighings	Percent, %	Weight of dyes, pounds	Percent	
Total	8	100	87.27	100	
Azoic Coupling Component 17	6	75	32.37	37	
Azoic Diazo Component 13	2	25	54.90	63	
E. Dry chemicals weighed	Number of weighings	Percent, %	Weight of dry chemicals, pounds	Percent	
Total	6	100	405.00	100	
Anhydrous Na <sub>2</sub> CO <sub>3</sub>	3	50	45.00	11	
Reducing agent	3	50	360.00	89	
F. All solid chemicals weighed	Number of weighings	Percent, %	Weight of all chemicals, pounds	Percent	
Total	14	100	492.27	100	
Dyes	8	57	87.27	18	
Dry chemicals	6	43	405.00	82	

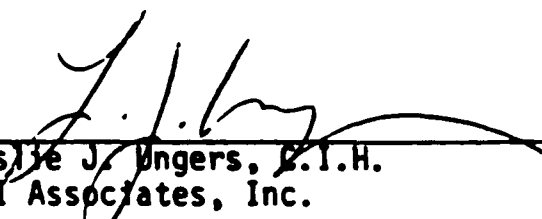
TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, pounds
Naphthol Dyes:		
Azoic Coupling Component 17	6	32.37
Azoic Diazo Component 13	2	54.90

TEXTILE DRUG ROOM MONITORING STUDY  
SITE VISIT REPORT

Site Number 7/7

  
\_\_\_\_\_  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
\_\_\_\_\_  
Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. Environmental Protection Agency  
Office of Toxic Substances  
401 M Street S.W.  
Washington, D.C. 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Robert D. Willson, C.I.H. of Beta Associates, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the afternoon of September 9, 1986. The industrial hygiene monitoring and recording of data were performed during the third shift (11:00 p.m. to 7:00 a.m.) on the same day. Company representatives were very cooperative in assisting with this survey.



## SITE CHARACTERIZATION

### GENERAL

The drug room at site 7/7 is part of a captive dyehouse operating on an integrated basis. Approximately 1.5 million pounds per year of apparel (both pieces and whole garment) are dyed in batch operations at this privately owned facility. Paddle dyeing machines were used for dyeing piece goods and whole garments; package dye machines were used for dyeing the yarn before it is knitted. Ten dye machines were available, all of which were operating during the monitoring period. Fibers dyed are acrylic/modacrylic, cotton, and polyester fibers. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

The drug room is a rectangular room approximately 50 feet long and 14 feet wide, with a ceiling 8-feet in height. The room is located on the first floor of the building and is accessed by two doors at opposite ends of the room, one leading to the adjacent mixing room and the other to the laboratory area. Dye weighing and storage areas are located in the drug room; the mixing room is in an area outside of the drug room. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums utilizing the floor space along the walls of the drug room. At the time of the survey, a single row of approximately 15 drums was stored along the north wall of the room and a single row of

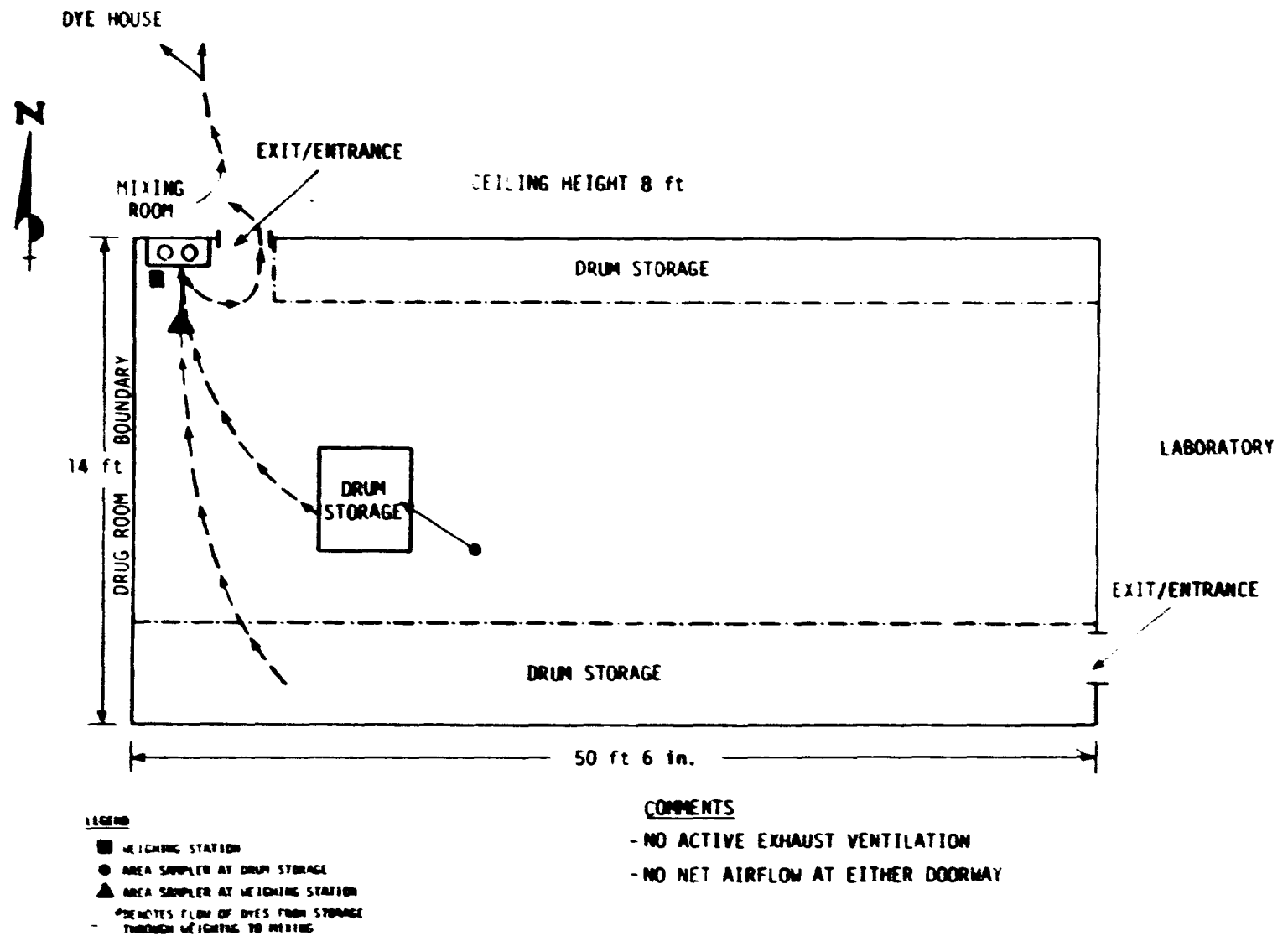


Figure 1. Sketch of drug room area.

approximately 25 drums was stored along the south wall of the room. Five drums were stored near the middle of the room. The drums vary in size from 200-250 pound barrels to smaller, 50-100 pound containers. One weighing station with two scales is located at the far north corner of the room near the exit which leads to the dye house. Dye weighing operations are conducted at this weighing station; dry chemicals are stored and weighed in an area outside the drug room.

The general appearance of the drug room was clean. There was no accumulation of dye on the floor, walls, or equipment. All drums of dyes were covered when in storage. No spillage of the powder dyes was observed during the survey.

The drug room has no mechanical exhaust ventilation. Both doors to the room were kept open to facilitate air movement within the room. No net airflow was measured at either entrance on the day of the survey.

Environmental conditions of the drug room (i.e., temperature and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	80	80	80
Barometric pressure, in. Hg.	29.47	29.46	29.50

\* Temperature readings were recorded hourly over the 8-hour work shift. Hourly barometric pressure readings were obtained for the monitoring period from the local airport's weather bureau.

## DYE WEIGHER ACTIVITIES

The company employs two full-time dye weighers on both the first and second shifts, and one full-time dye weigher on the third shift. The term "dye weigher" does not provide an adequate description of the activities of these workers. The weighing of dyes comprises only a small portion of their work day. Duties of the machine operator/dye weigher/mixer include:

- Relocating drums within the storage area.
- Weighing dyes and recording weights on dye batch tickets.
- Transferring weighed dyes from the scale to buckets, which are then hand carried to the mixing room outside the drug room.
- Adding hot water to the buckets and mixing the contents in the bucket with an mixer.
- Transferring the mixed batch to the dye machines and adding it to the machine.
- Operating dye application machines.
- Cleaning dye storage and weighing areas.

Among other duties, the machine operator/dye weighers employed at this facility handle, transfer, weigh, and mix dyes. These individuals do not handle dry chemicals during normal process operations.

The monitored dye weigher was a 34-year old male. He has been employed at the company for approximately one year; all of that time has been spent handling dyes. He had one year of previous dye handling experience.

### Training

Company training for dye weighers regarding the safe handling of dyes consists of use of respiratory protection, and personal protective equipment (aprons and gloves).

### Personal Protective Equipment

Company policy requires dye weighers to wear half-mask air-purifying respirators with organic vapor cartridges and particulate filters, aprons, and rubber gloves. The respirator worn by the monitored dye weigher during all weighing activities was a Willson<sup>R</sup> Model AR700. No incidences of dermal contact were noted during the survey.

### Personal Habits

The company did not permit employees to drink, eat, or smoke in the drug room. The monitored dye weigher was observed smoking outside of that area on his breaks.

### Work Activities

Activities of the monitored dye weigher in filling each batch ticket order were as follows: dyes were obtained by walking to a drum containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weighing station, pouring the required amount onto the scale dish, and returning the unused portion of the dye to the drum. The weighed portion of the dye was transferred to a stainless steel bucket. This operation was repeated until weighings of all the dyes specified on the batch ticket had been completed. The stainless steel bucket containing the weighed dye material for the batch was then hand carried to the mixing room and mixed with water in the bucket. The mixed dye solution was then transferred to the dyehouse and poured into the dyeing machine. No drum transfers were observed during this survey.

### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The employee monitored was in the drug room for a total of 16 minutes over an 8-hour period (480 minutes). He was monitored for exposure to

particulates over a 369 minute period from 10:52 p.m. to 5:01 a.m. During that time, his duties required him to enter the drug room three times. Only three batch weighings were performed during the survey. Due to water contamination potential, while the monitored dye weigher was working in the dyehouse, the filter cassettes upon which the samples were being collected were assembled in a closed face configuration (from approximately 11:45 pm until shipment to the laboratory). Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

#### ANALYTICAL RESULTS

EPA reported that analysis of solids filtered from air in the breathing zone of monitored workers was attempted. Solvent used in the analytical method reacted with a high proportion of Basic Dyes (the only dye class encountered at this site) which were weighed during the monitoring period. Therefore, analytical results for this site are unacceptable and will not be included in the final data analysis. Total weight of solids filtered from the air follow (in milligrams dye per cubic meter air):

	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.27
Drug room area samples at weighing station	0.08
Drug room area samples at drum storage, remote from weighing area	0.06

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Time, minutes	Percent of monitoring period		
A. Time in work area					
Total time monitored		369	100		
Total time in drug room		16	4		
Lunch break		Not available			
		Number of process units	Percent		
B. Work capacity					
Maximum work load		10	100		
Units in operation at time of survey		10	100		
		Number of dyes	Percent		
C. Powder dyes weighed					
Total weighed		7	100		
Basic		7	100		
D. Dyes		Number of weighings	Percent	Weight of dyes, grams	Percent
Total		7	100	6,033.97	100
Basic		7	100	6,033.97	100
E. Dry chemicals weighed		Number of weighings	Percent		
Total		0	100		
F. Dyes weighed most frequently					
Each dye weighed was weighed once.					
G. Largest quantity of dyes weighed		Number of weighings	Percent	Weight of dyes, grams	Percent
"Basic Black M-1"		1	14	2,329	39
Basic Yellow 28		1	14	1,476	24
Basic Red 49		1	14	866	14
Basic Green 4		1	14	834	14

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

				Percent of monitoring period	
A. Time in work area		Time, minutes			
Total time monitored		369		100	
Total time in drug room		16		4	
Lunch break		Not available			
B. Work capacity		Number of process units		Percent	
Maximum work load		10		100	
Units in operation at time of survey		10		100	
C. Powder dyes weighed		Number of dyes		Percent	
Total weighed		7		100	
Basic		7		100	
D. Dyes		Number of weighings	Percent	Weight of dyes, grams	Percent
Total		7	100	6,033.97	100
Basic		7	100	6,033.97	100
E. Dry chemicals weighed		Number of weighings	Percent		
Total		0	100		
F. Dyes weighed most frequently					
Each dye weighed was weighed once.					
G. Largest quantity of dyes weighed		Number of weighings	Percent	Weight of dyes, grams	Percent
"Basic Black M-1"		1	14	2,329	39
Basic Yellow 28		1	14	1,476	24
Basic Red 49		1	14	866	14
Basic Green 4		1	14	834	14



TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighing, grams
Basic Yellow 28	1	1476.0
Basic Red 46	1	78.0
Basic Red 49	1	866.0
Basic Violet 16	1	443.0
Basic Blue 3	1	7.97
Basic Green 4	1	834.0
"Basic Black M-1"	1	2329.0

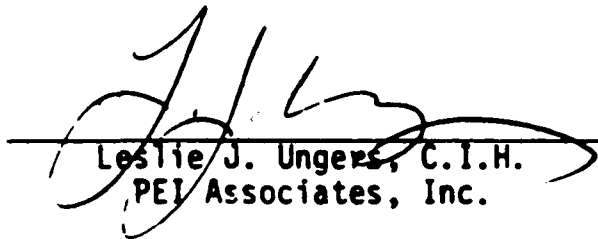
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 7/9



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Donald L. Unruh, C.I.H., IT Corporation, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on May 4, 1987. The industrial hygiene monitoring and recording of data were performed during the first shift (8:00 a.m. to 4:00 p.m.) on May 5, 1987. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 7/9 is part of a dyehouse operating on a commission basis. Approximately 0.9 million pounds of garments per year are dyed in batch operations at this privately owned facility. Seven paddle dyeing machines were available, all of which were in operation during the monitoring period. This operation consists of dyeing partially fabricated garments of cotton and/or nylon fibers. Site operations include storage, preparation, dyeing, and packaging for shipment back to the garment manufacturer.

### DRUG ROOM

The general building is co-leased with a furniture manufacturing company. The drug room, located in the southeast central portion of the work area, is a rectangular room approximately 35 feet long and 15 feet wide, with a 12-foot ceiling. The room is accessed by a door at the west end of the room which leads to the dye vats. No mixing takes place in the drug room. The drug room includes drum storage areas in the western half of the room and one dye weighing station equipped with two scales in the eastern half of the room. Figure 1 presents a sketch of the drug room.

Dyes are stored in small drums in open storage bins located against the north wall of the drum storage room and in larger drums on the floor in the center and at the south end of the room. Small bottles of liquid chemicals and dye samples are located in an open cabinet next to the weigh station.

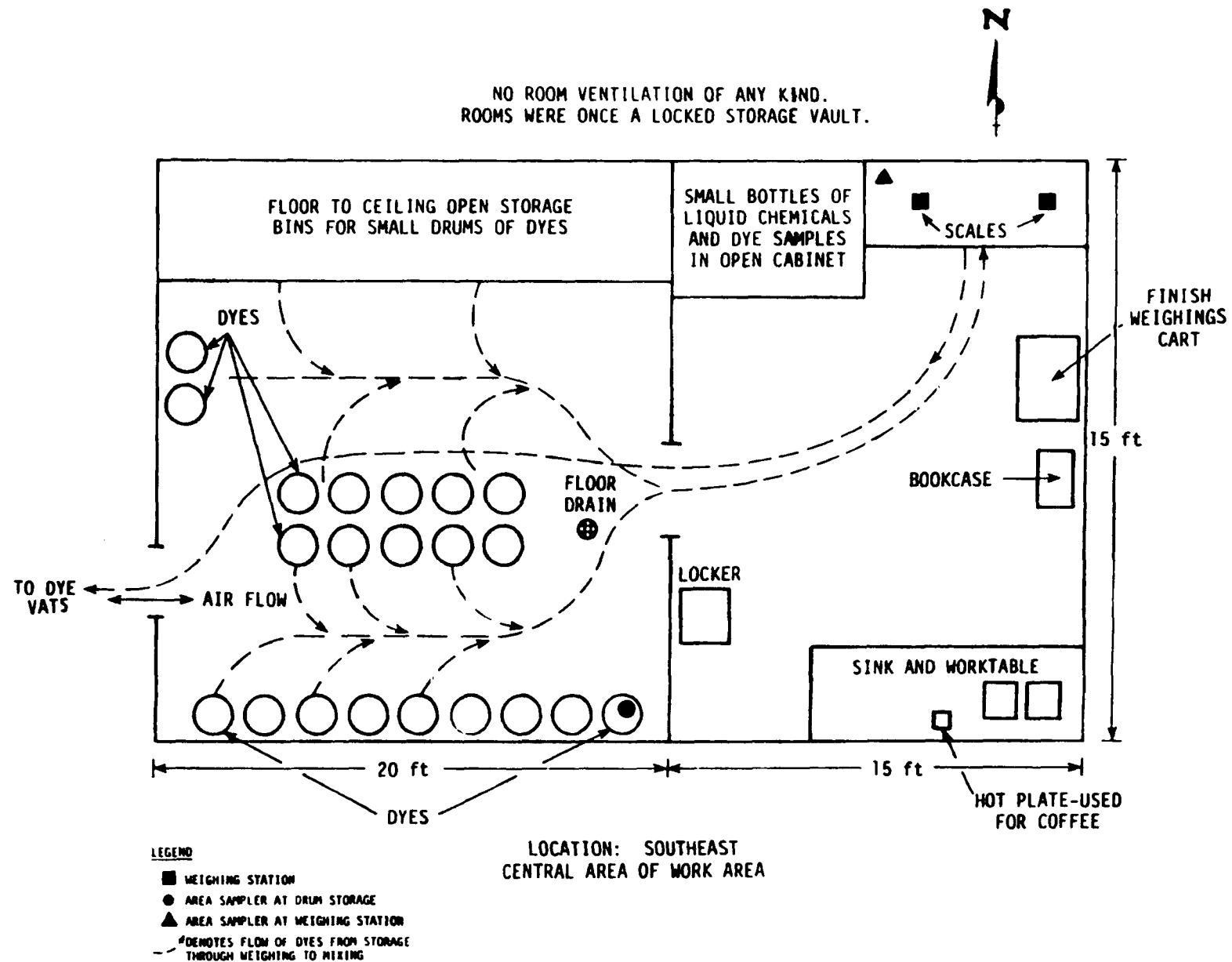


Figure 1. Sketch of drug room area.

The drums vary in size from 200 to 250-pound barrels to smaller, 50 to 100-pound containers.

For weighing of the powder dyes, two scales are located on a table which is situated in the northeast corner of the weighing room.

The general appearance of the drug room was very clean. The walls, equipment, floors, and inventory were clean of accumulated dye material. No spills were observed on the day of the survey.

The drug room was not equipped with a local exhaust ventilation system for the purpose of removing airborne dye particles. Because the drug room area occupies what was once a locked storage vault, no room ventilation exists. The general building was equipped with wall and roof fans and gas heaters for winter heating. Air flows both in and out of the drug room at its entrance.

A floor drain is located in the drug room drum storage area. Reportedly, the floor is hosed down during cleaning activities.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY<sup>\*</sup>

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	73	67	75
Relative humidity, %	72	63	81
Barometric pressure, in. Hg.	29.60	29.51	29.66

<sup>\*</sup> Readings of each parameter were recorded hourly over the 8-hour work shift.

## DYE WEIGHER ACTIVITIES

The company employs one full-time dye weigher on the first shift only.

Her duties include:

- ° Weighing dyes and recording weights on batch tickets.
- ° Transferring dyes from the scale to a sealed plastic container.
- ° Cleaning dye storage and weighing areas.

The dye weigher employed at this facility is involved in the handling and weighing of dyes only. There is no transferring of weighed dyes to the dyeing machines by the dye weigher; the workers from the dyehouse retrieve their own dye batches from the drug room. Dyes are mixed in the paddle tanks prior to addition of the garments to be dyed.

The monitored dye weigher was a 42-year old female. She has been employed at the company for approximately one year, all of which time has been spent handling dyes. She had no previous dye handling experience.

### Training

The monitored dye weigher received no specific training regarding the safe handling of dyes. She reads the labels on the dye drums for information concerning the dyes.

### Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher in the drug room included a smock top with long sleeves and rubber gloves. The monitored dye weigher wore her gloves during all weighing activities. No other personal protective equipment was available at the site.

### Personal Habits

The monitored dye weigher did not smoke, eat or drink inside the weighing area. As part of her personal hygiene, she washed her gloves after each

weighing. In prior employment, this worker was a technician in a microbiology laboratory, and some of the previously learned safe work practices have been carried over to this job.

#### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye and using a hand scoop or a plastic tub to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station and pouring the required amount into the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a plastic container. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The plastic container was then sealed closed. A dyehouse worker collects the container of dye and manually transports it to the use area.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 320 minutes over the 8-hour period (480 minutes). During that time, her duties required her to enter the drug room six times. She was monitored for exposure to particulates over a 435-minute period from 8:15 a.m. to 3:30 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.



## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.01	0.01	0.19
Drug room area sampler at weighing station	<0.01	0.01	0.11
Drug room area sampler at drum storage, remote from weighing area	<0.01	<0.01	0.10

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

			Percent of monitoring period		
A.	Time in work area	Time, minutes			
	Total time monitored	435		100	
	Total time in drug room	320		74	
	Lunch and breaks	NA		NA	
B.	Work capacity	Number of process units		Percent	
	Maximum work load	7		100	
	Units in operation at time of survey	7		100	
C.	Powder dyes weighed	Number of dyes		Percent	
	Total	9		100	
	Direct	9		100	
D.	Dyes	Number of weighings	Percent	Weight of dyes, grams	Percent
	Total	33	100	15,510.00	100
	Direct	33	100	15,510.00	100
E.	Dry chemicals weighed	Number of weighings			
	Total	0			
F.	All chemicals weighed	Number of weighings	Percent	Weight of dry chemicals, grams	Percent
	Total	33	100	15,510.00	100
	Dyes	33	100	15,510.00	100
	Dry chemicals	0	0	0.000	0

(continued)

TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	Percent
	Direct Red 75	9	27	2278.13	15
	Direct Yellow 106	8	24	673.95	4
	Direct Red 72	6	18	8150.94	53
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, grams	Percent
	Direct Red 72	6	18	8150.94	53
	Direct Blue 160	2	6	3895.40	25
	Direct Red 75	9	27	2278.13	15

NA - Not available.


TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY


Dye color index number	Number of weighings	Total weight of weighings, grams
Direct Dyes:		
Direct Yellow 106	8	673.95
Direct Red 72	6	8150.94
Direct Red 75	9	2278.13
Direct Red 9	1	2.33
Direct Violet 9	1	1.74
Direct Blue 25	1	18.60
Direct Blue 218	4	462.70
Direct Blue 189	1	26.21
Direct Blue 160	2	3895.40

TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 8/0

  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Donald L. Unruh, C.I.H., IT Corporation, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on March 10, 1987. The industrial hygiene monitoring and recording of data were performed during the first shift (7:00 a.m. to 7:00 p.m.) on the following day. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

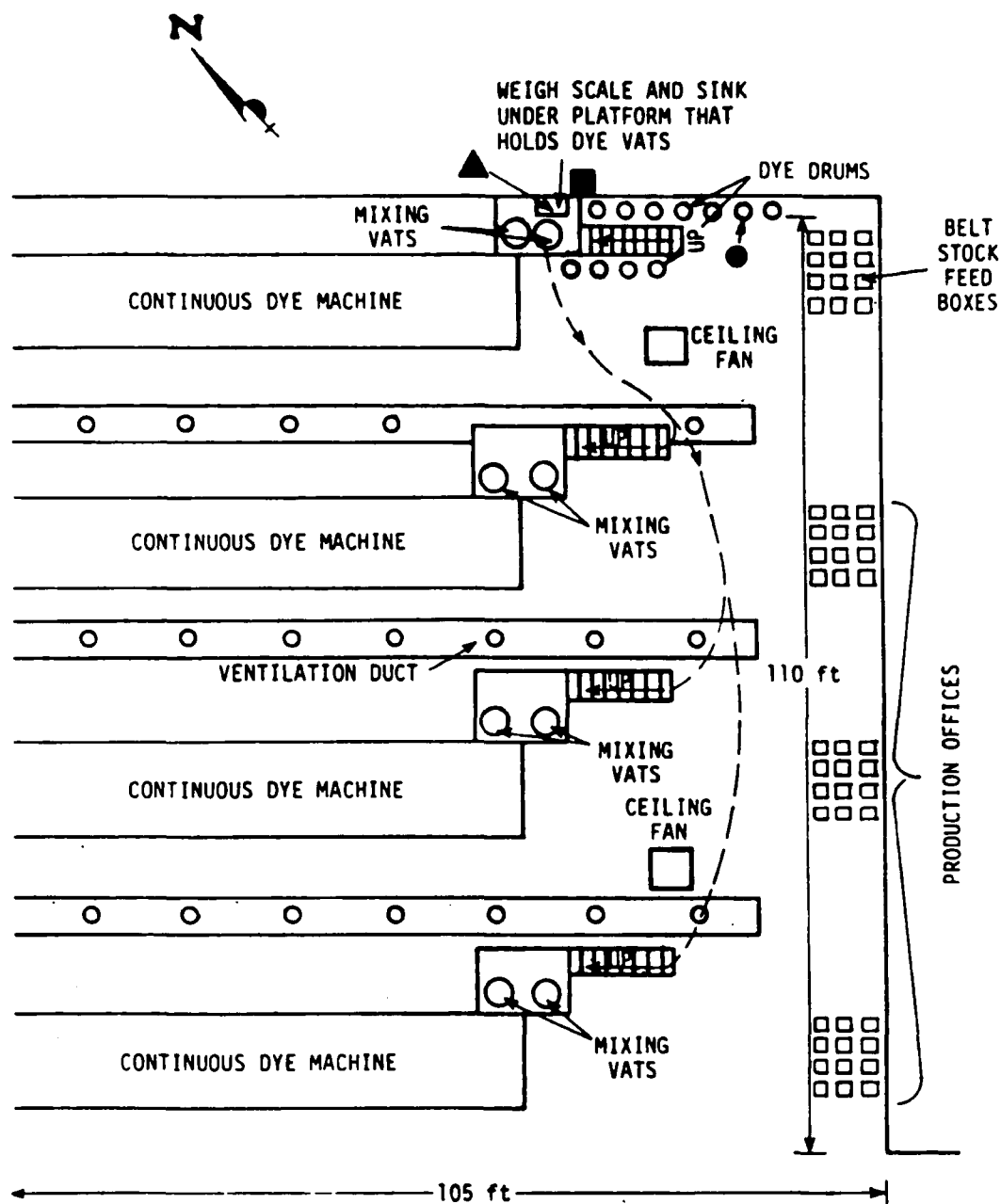
### GENERAL

The drug room at site 8/0 is part of a captive dye house operating on an integrated basis. Approximately six million pounds of belting per year are dyed at this privately owned facility. Four continuous dyeing machines were available, but only one was in operation at the time of the survey. Fibers dyed are nylon, polyester, and cotton. Site operations include storage, preparation, dyeing, and finishing.

### DRUG ROOM

There was no drug room isolated from the balance of the plant. Dyes were weighed in the production area which is a rectangular room approximately 110 feet long and 105 feet wide. In this study, the entire production area was considered to be the drug room. A weighing station housing one scale is located at the northeast corner. Dye drums are stored next to the weighing station and the adjacent stairwell. The majority of the room is occupied by four dye machines and their associated elevated mixing vats. Feed boxes of greige seat belt materials are stored along the southeast wall. Figure 1 presents a sketch of the dye weighing/production area.

Dyes are stored in drums next to the weigh station. The drums vary in size from 200- to 250-pound barrels to smaller 50- to 100-pound containers.



DRUG AREA IS IN THE PLANT AND THERE ARE NO BOUNDARIES TO BLOCK ANY AIR FLOWS.

#### LEGEND

- WEIGHING STATION
- AREA SAMPLER AT DRUM STORAGE
- ▲ AREA SAMPLER AT WEIGHING STATION
- DENOTES FLOW OF DYES FROM STORAGE THROUGH WEIGHING TO MIXING

NOTE: DRUG AREA IS IN THE PLANT AREA  
-THE AREA IS OPEN, THEREFORE  
GENERAL AREA AIR FLOW IS NOT  
RESTRICTED.

Figure 1. Sketch of dye weighing/production area.



The general appearance of the area was good. The walls and equipment were clean of dyestuff; the inventory was moderately clean. It was reported that the floors are cleaned weekly.

The production room was equipped with no local exhaust ventilation systems for the purpose of removing airborne dye particles. Air is supplied to the room by overhead ventilation ducts situated between the dyeing machines and circulated by two ceiling fans.

Floor drains are located in the area to facilitate drainage for the continuous wash baths. The floors are cleaned weekly. Spills of dye material were left on the floor for the cleaning man to sweep and mop up.

Environmental conditions of the production area (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	64	63	67
Relative humidity, %	62	52	70
Barometric pressure, torr	735	733	736

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

On each of two 12-hour shifts, four continuous dye machine front end operators (one per range) are responsible for dye weighing operations for his own unit. Their primary duty, however, is operating the dyeing machines. Their specific duties relating to dye handling include:

- ° Weighing dyes and chemicals and recording weights on batch tickets. Typically, weighings to supply the initial charge and color corrections occur about four times per shift.\*
- ° Transferring dyes from the scale to a bucket and carrying the bucket to the mixing vats.
- ° Dumping the dye material into the open mixing vat.
- ° Cleaning dye storage, mixing, dyeing, and weighing areas.

The dye weighers employed at this facility are involved in the handling, transferring, and weighing of powder and liquid dyes and chemicals.

The monitored dye weigher was a 30-year old male. He has been employed at the company for 14 years; ten of those years have been spent handling dyes. He had no previous dye handling experience.

### Training

No formal dye weigher training regarding the safe handling of dyes was provided by the company. Dye weighers are given a respirator and instructed to wear it when weighing powder dyes. A file of Material Safety Data Sheets (MSDS's) was maintained in the production office.

### Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher during all weighing activities included a 3M half-mask respirator with high efficiency filters and steel-toed shoes. The monitored dye weigher utilized his respirator but also has a full beard which may prevent it from maintaining an adequate seal.

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\* Dye batches reportedly are weighed about 4 times per shift. On this day, the first dyelot on the range in operation required weighing of the initial charge and 3 or 4 color corrections. At the conclusion of the monitoring period, the second dyelot on the range had required weighing of the initial charge and one color correction.

## Personal Habits

The monitored dye weigher/machine operator was observed eating and smoking in the work area. The machine operators are given no official breaks or meal periods; therefore, the operator next to him must cover for a worker when he goes to the restroom or the canteen\*. The monitored dye weigher washed his hands after each batch weighing.

## Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station, pouring the required amount into the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a bucket. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The batch was then hand carried and emptied into the open mixing vat.

## SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the production area for a total of 437 minutes over the 8-hour period (480 minutes) of study which covered the first two-thirds of his 12-hour shift. During that time, his duties required him to be at the weighing station or at his continuous dyeing machine eight times. He was monitored for exposure to particulates over a 474-minute

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\* The work area is essentially a dye application area, although dyes are weighed within the confines of this room. As the operation is continuous, the application equipment is monitored by a worker whenever it is in operation.

period from 7:07 a.m. to 3:01 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.01	0.04	0.21
Drug room area sampler at weighing station	0.01	0.03	0.13
Drug room area sampler at drum storage, remote from weighing area	0.01	0.04	0.16

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Percent of monitoring period	
A.	Time in work area	Time, minutes	
	Total time monitored	474	100
	Total time in production room	437	92
	Lunch and breaks	NA	NA
		Number of process units	Percent
B.	Work capacity		
	Maximum work load	4	100
	Units in operation at time of survey	1	25
C.	Powder dyes weighed	Number of dyes	Percent
	Total	3	100
	Disperse	3	100
		Number of weighings	Percent
D.	Dyes		
	Total	11	100
	Disperse	11	100
		Weight of dyes, pounds	Percent
	Total	4.66	100
	Disperse	4.66	100
E.	Dry chemicals weighed	Number of weighings	
	Total	0	
		Number of weighings	Percent
F.	All dry materials weighed		
	Total	11	100
	Dyes	11	100
	Dry chemicals	0	0
		Weight of all chemicals, pounds	Percent
	Total	4.66	100
	Dyes	4.66	100
	Dry chemicals	0.00	0
		Number of weighings	Percent
G.	Dye weighed most frequently		
	Disperse Red 72	6	55
			38

(continued)

TABLE 2 (continued)

H.	Largest quantity of dye weighed	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Disperse Blue 27	3	27	2.48	53

NA - Not available.

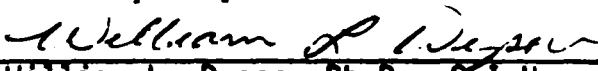
TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

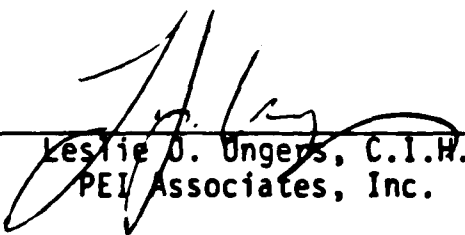
Dye color index number	Number of weighings	Total weight of weighings, pounds
Disperse Dyes:		
Disperse Red 72	6	1.78
Disperse Blue 27	3	2.48
Disperse Blue 60	2	0.40

TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 8/6

  
\_\_\_\_\_  
William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.

  
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Leslie D. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460



## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dye stuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Leslie J. Ungers, C.I.H., Senior Industrial Hygienist for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the morning of October 7, 1986. The industrial hygiene monitoring and recording of data were performed during the first shift (7:00 a.m. to 3:00 p.m.) on October 9, 1986. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 8/6 is part of a dyehouse operating on both an integrated and commission basis. Approximately 3 million pounds of novelty yarns per year are dyed with powder dyes in batch operations at this privately owned facility. Nine dyeing machines were available, seven of which were in operation at the time of the survey. The machines were developed and constructed by the company. Fibers dyed are acrylic/modacrylic, acetate, rayon, wool, nylon, polyester, cotton, polypropylene, and silk. Site operations include storage, preparation, dyeing, and drying.

### DRUG ROOM

The drug room, located on the first floor of the plant building, is a rectangular room approximately 40 feet long and 25 feet wide, with a 12-foot ceiling. The room is accessed by a door at one end of the room which leads to the mixing area. The mixing area is a separate area outside of the drug room. The drug room includes drum storage areas and two dye weighing stations, each equipped with one scale. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums on drum shelves located against the walls of the drug room. Drums of dyes used frequently are stored on the floor near the weighing stations. The drums vary in size from 200- to 250- pound barrels to 50- to 100-pound containers.

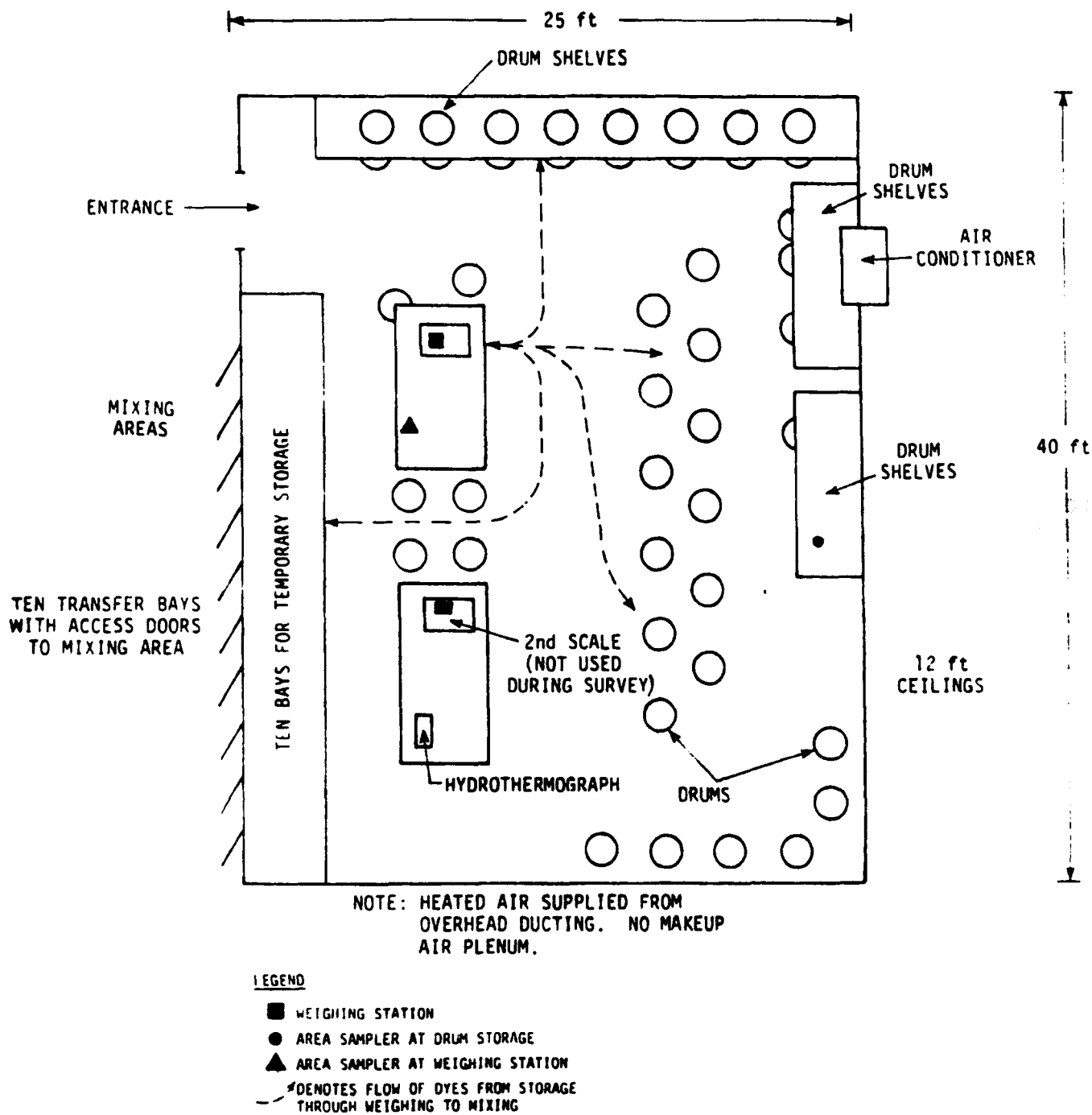


Figure 1. Sketch of the drug room area.

For weighing of the powder dyes, two small scales are located on two tables, which are situated next to 10 temporary storage bays with access doors to the mixing area. One of the scales was not used during the survey. Small quantities of dry chemicals are stored in the drug room, however, no dry chemicals were weighed during the survey.

The general appearance of the drug room was fair. There were small stains and some accumulation of dust on the walls. There was also a small accumulation of dye powder on the equipment, drum tops, and floors.

The drug room was not equipped with a local exhaust ventilation system for the purpose of removing airborne dye particles. The room was equipped with general heating and air conditioning separate from the rest of the building. Air is supplied from overhead ducts and there is no makeup air plenum, thereby causing a slight positive pressure compared to the other plant areas.

Floor drains are located in the drug room to facilitate drainage when the floor is hosed down during cleaning activities; however, this activity was not observed during the survey. The accumulation of dye powder on the floor indicates that floor washing activities are infrequent.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	69	68	76
Relative humidity, %	72	70	73
Barometric pressure, in. Hg.	30.15	30.11	30.17

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

#### DYE WEIGHER ACTIVITIES

The company employs one full-time weigher on each of two shifts. Duties include:

- Weighing dyes and recording weights on batch tickets.
- Transferring dyes from the scale to a paper bag and passing the bag through the bay doors into the mixing areas. A person in the mixing room receives the dyes and transfers the material into the mixing vessel.
- Cleaning dye storage, and weighing areas.

The dye weighers employed at this facility are involved in the handling, transferring, and weighing of dyes and dry chemicals, although no handling of dry chemicals was observed on the day of the survey. All dye weigher activities outside of the drug room were associated with non-dye related tasks, e.g., coffee breaks and discussions with the supervisor.

The monitored dye weigher was a 25-year old female. She has been employed at the company for 6.5 years; four of those years have been spent handling dyes. She had no previous dye handling experience.

#### Training

Specific employee training regarding the safe handling of dyes was provided in the literature included in the company hazard communications program.

### Personal Protective Equipment

Personal protective equipment utilized by the dye weighers in the drug room included a 3M particulate dust mask, apron, safety glasses, and latex gloves. The monitored dye weigher used the dust mask and gloves at all times during the survey; however, it was observed that dermal contact occurred on the monitored dye weigher's arms as a result of her need to reach into the drums to scoop out dye.

### Personal Habits

The weigher was observed drinking in the drug room. She did not smoke inside the weighing area. The weigher washed her hands before taking breaks and before leaving for lunch.

### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye and using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station and pouring the required amount into the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a paper bag. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The batch was then hand carried to the mixing area by passing the paper bag containing the batch of dye through one of 10 bay access doors.

### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 413 minutes over the 8-hour period (480 minutes). During that time, her duties

required her to enter the drug room four times. She was monitored for exposure to particulates over a 434-minute period from 7:28 a.m. to 2:42 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

#### ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.19	0.51	0.55
Drug room area sampler at weighing station	0.03	0.09	0.11
Drug room area sampler at drum storage, remote from weighing area	0.06	0.16	0.23

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Percent of monitoring period	
A.	Time in work area	Time, minutes	
	Total time monitored	434	100
	Total time in drug room	413	95
	Lunch and breaks	NA	NA
		Number of process units	Percent
B.	Work capacity		
	Maximum work load	9	100
	Units in operation at time of survey	7	78
		Number of dyes	Percent
C.	Powder dyes weighed		
	Total	25	100
	Acid	1	4
	Neutral Premetallized	2	8
	Acid Metallized	1	4
	Disperse	5	20
	Basic	4	16
	Reactive	12	48
		Number of weighings	Percent
D.	Dyes		
	Total	259	100
	Acid	6	2
	Neutral Premetallized	8	3
	Acid Metallized	4	2
	Disperse	33	13
	Basic	58	22
	Reactive	150	58
		Weight of dyes, grams	Percent
	Total	73,496	100
	Acid	702	1
	Neutral Premetallized	1,110	2
	Acid Metallized	617	<1
	Disperse	4,225	6
	Basic	15,841	22
	Reactive	51,001	69
		Number of weighings	
E.	Dry chemicals weighed		
	Total	0	
		Number of weighings	Percent
F.	All chemicals weighed		
	Total	259	100
	Dyes	259	100
	Dry chemicals	0	0
		Weight of dry chemicals, grams	Percent
	Total	73,496	100
	Dyes	73,496	100
	Dry chemicals	0.000	0

(continued)



TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	Percent
	"Reactive Red U-4"	41	16	15,664	21
	Reactive Yellow 125	39	15	13,267	18
	"Reactive Blue U-3"	32	12	4,130	6
	Basic Red 29	20	8	7,626	10
	Basic Yellow 11	20	8	6,114	8
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, grams	Percent
	"Reactive Red U-4"	41	16	15,664	21
	Reactive Yellow 125	39	15	13,267	18
	Reactive Blue 116	2	1	13,161	18
	Basic Red 29	20	8	7,626	10
	Basic Yellow 11	20	8	6,114	8

NA - Not available.

TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, grams
Acid Dyes:		
Acid Red 357	6	702
Neutral Premetallized Dyes:		
Acid Yellow 121	2	51
Acid Brown 384	6	1,059
Acid Metallized Dyes:		
Acid Blue 158	4	617
Disperse Dyes:		
Disperse Orange 30	10	1,923
Disperse Red 211	9	914
Disperse Red 82	2	123
Disperse Blue 60	1	180
Disperse Blue 79	11	1,085
Basic Dyes:		
Basic Yellow 11	20	6,114
Basic Red 29	20	7,626
Basic Blue 69 <sup>a</sup>	16	2,071
Basic Blue 45	2	30
Reactive Dyes:		
Reactive Yellow 25 <sup>a</sup>	2	230
Reactive Yellow 27	7	448
Reactive Yellow 125	39	13,267
"Reactive Red U-4"	41	15,664
Reactive Red 40	10	673
Reactive Violet 33	2	852
Reactive Blue 29	5	810
Reactive Blue 114 <sup>a</sup>	1	960
Reactive Blue 116	2	13,161
Reactive Blue 21	3	480
"Reactive Blue U-3"	32	4,130
"Reactive Black U-1"	6	326

<sup>a</sup> Characterized by dye weigher as relatively dusty.

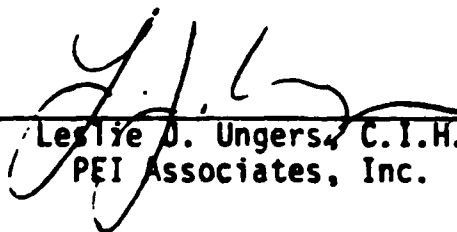
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 8/8



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie D. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Dr. Dyson and Donald L. Unruh, C.I.H., subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials on the afternoon of March 12, 1987. The industrial hygiene monitoring and recording of data were performed during the second shift (4:00 p.m. to 12:00 a.m.) of the same day. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 8/8 is part of a captive dye house operating on an integrated basis. Approximately 2.25 million pounds of warp yarn per year are dyed in batch operations at this privately owned facility. Four beam dyeing machines were available, all of which were in operation at the time of the survey. Fibers dyed are rayon, polyester, and cotton. Site operations include storage, preparation, dyeing, drying, and weaving of the dyed yarn.

### DRUG ROOM

The drug room, located in the south end of the plant building, is a rectangular room approximately 20 feet long and 14 feet wide, with a 18-foot ceiling. The room is directly connected to the mixing and drum storage areas. The drug room includes drum storage areas and two dye weighing stations, the first with one scale and the second with two scales. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums in a drum storage room that measures approximately 55 feet by 25 feet and connects to the drug room. Drums of dyes used frequently are stored on the floor near the weighing stations. The drums vary in size from 200- to 250-pound barrels to smaller, 50- to 100-pound containers.



For weighing of the powder dyes, two small scales are located on a table, and one scale is located on the floor.

The general appearance of the drug room was poor. There was some accumulation of dye material on the walls. There were also stains and an accumulation of dye material on the equipment, drum tops, and floors. The floor was swept only along the main passageways, leaving an accumulation of dyestuff between the dye drums and equipment.

The largest of the weigh station scales was equipped with a hood-like structure, but it was not connected to any active local exhaust ventilation. A similar hood was in place on one of the dye drums which appeared to be dustiest and was used frequently. This location is likewise not provided with local exhaust ventilation. Air is supplied to the room from open windows and window exhaust fans.

The floor is composed of wood, in which there are no floor drains.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY\*

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	76	71	80
Relative humidity, %	53	48	57
Barometric pressure, torr	729	728	729

\* Readings of each parameter were recorded hourly over the 8-hour work shift.

## DYE WEIGHER ACTIVITIES

The company employs one dye weigher on each of three shifts who performs other tasks in addition to weighing dyes. Dye batches are mixed in the drug room two or three times a shift; the dye weigher spends the remainder of the shift in other areas of the plant. His duties include:

- Weighing dyes and recording weights on batch tickets.
- Transferring dyes in the weigh pan from the scale to the mix tank.
- Pouring dye into the water filled mix tank.
- Mixing dye solutions.
- Transferring dye solutions to kiers by pump.
- Loading undyed beams into kiers.
- Unloading dyed beams from kiers.
- Cleaning dye storage and weighing and mixing areas.

The dye weighers employed at this facility are involved in the handling, transferring and weighing of dyes, and handling and transferring of greige and dyed yarn beams.

The monitored dye weigher was a 25-year old male. He has been employed at the company for eight years; 7.5 of those years have been spent handling dyes. He had no previous dye handling experience.

### Training

Company provided dye weigher training regarding the safe handling of dyes was provided by posting procedures for safe handling of dyes on the walls. No formalized instruction was provided by the company.

### Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher included a 3M-8710 disposable, half-mask dust respirator. The monitored dye weigher used the dust mask during all dye weighing activities. It was



noted that dermal contact occurred, since the dye weigher did not wear gloves and did not avoid skin contact with the dye material.

### Personal Habits

The monitored dye weigher did not eat, drink, or smoke in the weigh area. The weigher washed his hands after loading each batch into the mixing vat.

### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye and using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station and pouring the required amount into the scale dish, and returning the unused portion of the dye to the drum. The weighed dye was then hand carried in the scale dish to the mixing vat containing water and dumped in. This operation was repeated until all dye weighings specified on the batch ticket had been completed. Chemicals used in dyeing were weighed and added as needed. Once the dye was mixed, the solution was pumped into the kier.

### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 146 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room eight times. He was monitored for exposure to particulates over a 458-minute period from 3:58 p.m. to 11:36 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dye materials handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for Disperse Dye content. Vat Dyes could not be determined by the analytical procedure that was used. Total dye content was estimated by extrapolation on a weight basis. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.02	0.10	0.53
Drug room area sampler at weighing station	0.03	0.11	0.16
Drug room area sampler at drum storage, remote from weighing area	0.01	0.03	0.16

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

		Percent of monitoring period	
A.	Time in work area	Time, minutes	
	Total time monitored	458	100
	Total time in drug room	146	32
	Lunch and breaks	NA	NA
		Number of process units	Percent
B.	Work capacity		
	Maximum work load	4	100
	Units in operation at time of survey	4	100
C.	Powder dyes weighed	Number of dyes	Percent
	Total	11	100
	Vat	6	55
	Disperse	5	45
		Number of weighings	Percent
D.	Dyes		Weight of dyes, pounds
	Total	17	100
	Vat	8	47
	Disperse	9	53
		Weight of chemicals, pounds	Percent
E.	Dry chemicals		
	Total	9	100
	Citric Acid	4	44
	Soda Ash ( $\text{Na}_2\text{CO}_3$ )	1	11
	Sodium Hydrosulfite	4	44
		Number of weighings	Percent
F.	All chemicals weighed		Weight of dry chemicals, pounds
	Total	26	100
	Dyes	17	65
	Dry chemicals	9	35

(continued)

TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Disperse Red 86	3	18	0.969	4
	Disperse Yellow 108	3	18	0.377	2
	Vat Violet 13	2	12	2.922	13
	Vat Blue 6	2	12	1.896	9
H.	Largest quantity of dyes weighed	Number of weighings	Percent	Weight of dyes, pounds	Percent
	Vat Orange 2	1	6	5.180	23
	"Vat Brown M-1"	1	6	4.320	19
	Vat Violet 1	1	6	3.440	15

NA - Not available.

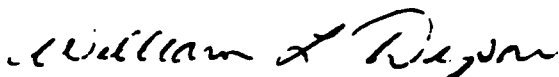
TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, pounds
Disperse Dyes:		
Disperse Yellow 67	1	0.240
Disperse Yellow 108	3	0.377
Disperse Red 86	3	0.969
Disperse Blue 73	1	0.305
Disperse Blue 109	1	0.837
Vat Dyes:		
Vat Yellow 2	1	1.729
Vat Orange 2	1	5.180
Vat Violet 1	1	3.440
Vat Violet 13	2	2.922
Vat Blue 6	2	1.896
"Vat Brown M-1"	1	4.320

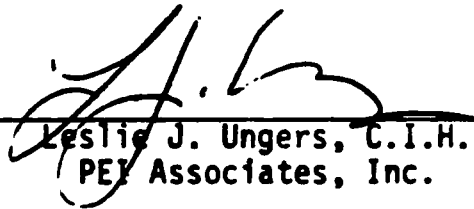
TEXTILE DRUG ROOM MONITORING STUDY

SITE VISIT REPORT

Site Number 9/1



William L. Dyson, Ph.D., C.I.H.  
Health and Hygiene, Inc.



Leslie J. Ungers, C.I.H.  
PEI Associates, Inc.

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY  
OFFICE OF TOXIC SUBSTANCES  
401 M STREET, S.W.  
WASHINGTON, DC 20460

## INTRODUCTION

This survey was conducted as part of an exposure study being performed as a cooperative effort between the U.S. Environmental Protection Agency (EPA), the American Textile Manufacturers Institute, Inc. (ATMI), and the Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD). The study's objective was to determine the extent of textile workers' exposure to dye dust when weighing and mixing powder dyes. The sites to be visited were selected to obtain a random sampling of eligible sites. Contact with the site representative to schedule the site visit was made by William L. Dyson, Ph.D., C.I.H. of Health and Hygiene, Inc., representing ATMI and ETAD. In attendance at the site were Melvin R. Witcher, Jr., C.I.H. of Health and Hygiene, and Donald L. Unruh, C.I.H., IT Corporation, subcontractor for PEI Associates, Inc., representing EPA. The pre-survey meeting was held with company officials May 27, 1987. The industrial hygiene monitoring and recording of data were performed during the first shift (6:00 a.m. to 2:00 p.m.) on May 28, 1987. Company representatives were very cooperative in assisting with this survey.

## SITE CHARACTERIZATION

### GENERAL

The drug room at site 9/1 is part of a captive dyehouse operating on an integrated basis. Approximately 300,000 pounds per year of whole garments (socks) are dyed in batch operations at this privately owned facility. Eleven rotary dyeing machines were available, seven of which were in operation at the initiation of the monitoring period. By the end of the shift, this number had increased to nine. Fibers dyed are acrylic/modacrylic, wool, nylon, polyester, and cotton. Site operations include storage, dyeing, and finishing.

### DRUG ROOM

The drug room is a rectangular room approximately 60 feet long and 35 feet wide, with a 8-foot ceiling. The room is accessed by a door at the west end of the room which leads to the mixing area and an emergency exit at the east end of the room. The mixing area is a separate area outside of the drug room. The drug room includes drum storage areas and a dye weighing station equipped with two scales. Figure 1 presents a sketch of the drug room.

Dyes are stored in drums utilizing the floor space along the center portion of the drug room. Pallets of soda ash and ammonium sulfate are located against the east wall next to the emergency exit. Drums of liquid chemicals are also stored in the drug room, against the south wall. The drums vary in size from 200- to 250-pound barrels to smaller 50- to 100-pound containers.



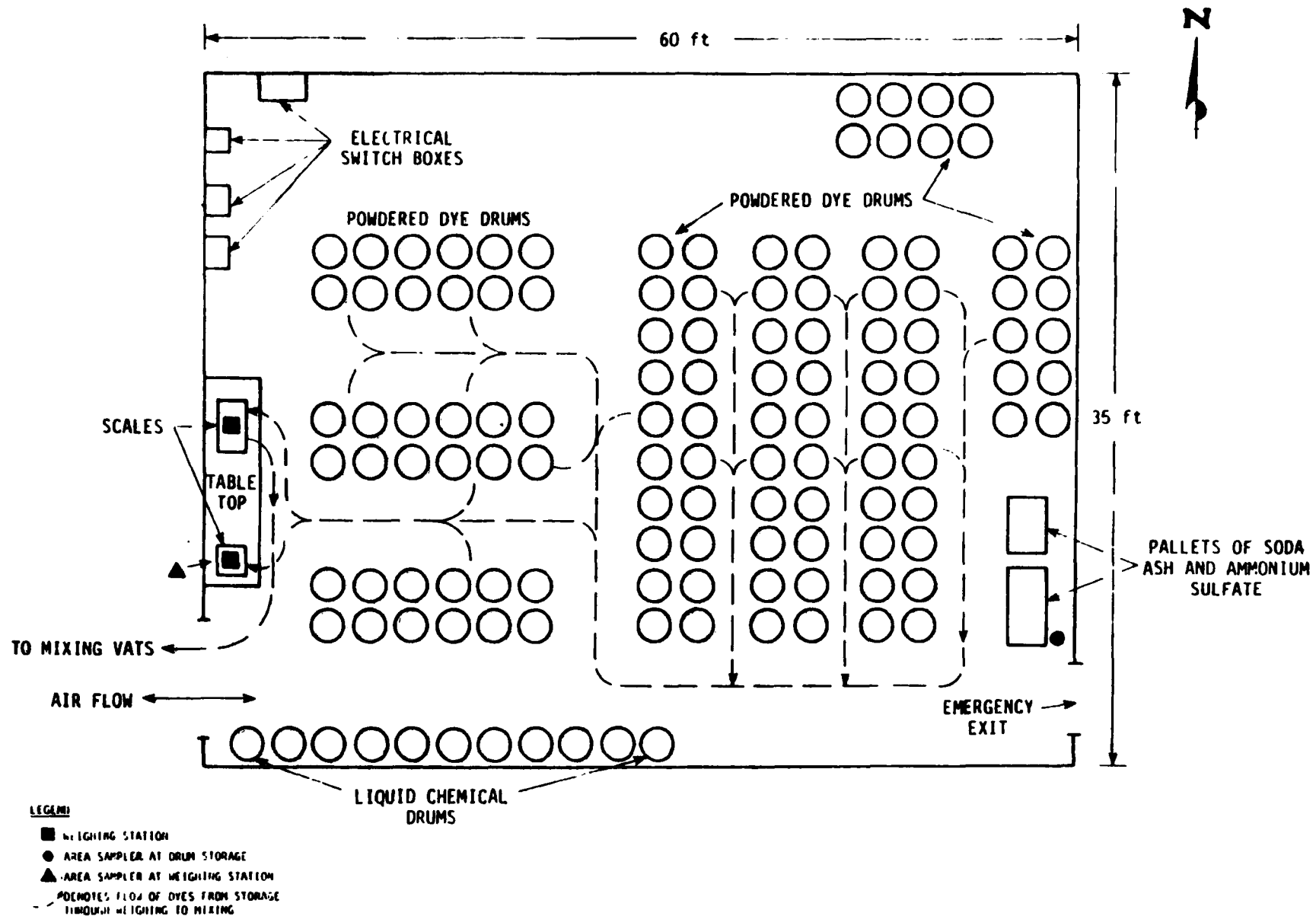


Figure 1. Sketch of drug room area.

Two scales are located on a table near the exit to the mixing area. The gram scale at this weighing station is used most frequently for weighing of powder dyes.

The general appearance of the drug room was fair. There were many stains caused by dyes and a small accumulation of dye powder on the floor. There was also an accumulation of dye powder on the stored drums. The walls and equipment were moderately clean of accumulated dyestuff. Approximately one month prior to the survey, the location of drug room had been moved, at which time a concentrated clean-up effort was made. Routinely, spills of dry dye or chemical material are not cleaned up immediately. Reportedly, they are left on the floor to be swept up during weekly floor cleaning.

The drug room was not equipped with a local exhaust ventilation system for the purpose of removing airborne dye particles. The general building ventilation consisted of steam space heaters and roof fans. There was no net airflow observed at the entrance to the drug room.

No floor drains were located within the drug room. The floor is swept weekly as part of routine clean-up procedures.

Environmental conditions of the drug room (i.e., temperature, humidity, and barometric pressure) were recorded hourly during the survey and are summarized in Table 1.

TABLE 1. ENVIRONMENTAL CONDITIONS RECORDED DURING THE SURVEY<sup>\*</sup>

Parameter	Mean, 8-hour value	Range	
		Minimum	Maximum
Temperature, °F	79	73	84
Relative humidity, %	74	68	83
Barometric pressure, in. Hg.	29.90	29.95	29.93

<sup>\*</sup> Readings of each parameter were recorded hourly over the 8-hour work shift.

## DYE WEIGHER ACTIVITIES

The company employs one full-time worker who combines dye weighing and color matching activities during the first shift only. His duties include:

- Transferring dye drums within the drug room using a drum dolly.
- Weighing dyes and recording weights on batch tickets.
- Transferring dyes from the scale to a stainless steel pail.
- Preparing batch orders.
- Cleaning dye storage and weighing areas.
- Performing color matching.

The dye weigher employed at this facility is involved in the handling and weighing of dyes and liquid chemicals. He is not involved in dye batch mixing operations.

The monitored dye weigher was a 77-year old male. He has been employed at the company for 17 years; all of those years have been spent handling dyes. He had 38 years of previous dye handling experience.

### Training

Specific dye weigher training regarding the safe handling of dyes was provided by the company in the form of training on how to read Material Safety Data sheets (MSDS).

### Personal Protective Equipment

Personal protective equipment utilized by the monitored dye weigher in the drug room included leather work gloves. The monitored dye weigher used the gloves during all dye weighing activities. No other forms of personal protection were provided or used.

### Personal Habits

The monitored dye weigher was not observed drinking or smoking in the drug room; however, he did smoke in the office area. As part of his personal

hygiene practice, the dye weigher washed his hands after each batch weighing. The monitored dye weigher used no special precautions in handling the dye material.

#### Work Activities

The dye weigher's activities in filling each batch ticket order were as follows: dyes were obtained by walking to a drum in the storage area containing the appropriate dye, using a hand scoop to remove an approximate quantity of the dye, transferring the scoop of dye to the weigh station and pouring the required amount into the scale dish, returning the unused portion of the dye to the drum, and transferring the weighed portion of the dye to a stainless steel pail. This operation was repeated until all of the dye weighings specified on the batch ticket had been completed. The batch was then hand carried to the mixing area. Mixing and transfer operations were the responsibility of other workers. When a dye barrel was almost empty, the dye weigher transferred the dregs from the depleted barrel into the new barrel by inverting the former over the latter.

#### SPECIFIC MEASUREMENTS AND OBSERVATIONS

The monitored dye weigher was in the drug room for a total of 127 minutes over the 8-hour period (480 minutes). During that time, his duties required him to enter the drug room 12 times. He was monitored for exposure to particulates over a 465-minute period from 6:10 a.m. to 1:55 p.m. Table 2 presents a summary of the data and information recorded during the survey. Table 3 presents a list of the dyestuffs handled during the survey, including the dye color index number, the number of weighings of each dye, and the total weight of the weighings of each dye.

## ANALYTICAL RESULTS

Solids filtered from the air in this facility were analyzed by EPA for total dye content. Total weight of all solids and analytical results from the four filtering devices, corrected for recovery, follow (in milligrams dye per cubic meter air):

	<u>Active Colorants</u>	<u>Commercial Dyes</u>	<u>Total Weight</u>
Average of 2 monitoring devices in worker's breathing zone	0.09	0.22	0.45
Drug room area sampler at weighing station	0.07	0.16	0.28
Drug room area sampler at drum storage, remote from weighing area	<0.01	0.01	0.18

TABLE 2. SUMMARY OF DATA AND INFORMATION RECORDED DURING SURVEY

				Percent of monitoring period	
A.	Time in work area	Time, minutes			
	Total time monitored	465		100	
	Total time in drug room	127		27	
	Lunch and breaks	NA		NA	
B.	Work capacity	Number of process units		Percent	
	Maximum work load	11		100	
	Units in operation at time of survey (avg.)	8		73	
C.	Powder dyes weighed	Number of dyes		Percent	
	Total	41		100	
	Acid	17		41	
	Disperse	5		12	
	Basic	4		10	
	Reactive	6		15	
	Direct	9		22	
D.	Dyes	Number of weighings	Percent	Weight of dyes, grams	Percent
	Total	103	100	24,082.00	100
	Acid	61	59	7,443.10	31
	Disperse	5	5	8,068.60	33
	Basic	4	4	675.00	3
	Reactive	7	7	2,908.00	12
	Direct	26	25	4,987.30	21
E.	Dry chemicals weighed	Number of weighings	Percent	Weight of dry chemicals, grams	Percent
	Revatol S powder (sodium m-nitrobenzene sulfonate)	1	100	34.00	100
F.	All chemicals weighed	Number of weighings	Percent	Weight of dry chemicals, grams	Percent
	Total	104	100	24,116.00	100
	Dyes	103	99	24,082.00	99+
	Dry chemicals	1	1	34.00	<1

(continued)

TABLE 2 (continued)

G.	Dyes weighed most frequently	Number of weighings	Percent	Weight of dyes, grams	Percent
	"Acid Red U-6"	12	12	257.7	1
	Acid Yellow 159	10	10	104.6	<1
	Acid Blue 281	6	6	173.6	1
	Direct Yellow 106	6	6	9.0	<1

H.	Largest quantity of dye weighed	Number of weighings	Percent	Weight of dyes, grams	Percent
	"Acid Black M-3"	4	4	4,460.0	19
	Disperse Blue 109	1	1	4,390.0	18
	"Disperse Black M-4"	1	1	2,789.0	12
	Direct Black 80	3	3	2,745.0	11

NA - Not available.

TABLE 3. DYE MATERIALS HANDLED DURING THE SURVEY

Dye color index number	Number of weighings	Total weight of weighings, grams
Acid Dyes:		
Acid Yellow 40	2	1.1
"Acid Yellow U-1"	2	70.0
Acid Yellow 65	1	175.0
Acid Yellow 159	10	104.6
Acid Orange 116	4	86.4
Acid Orange 51	1	320.0
"Acid Red U-6"	12	257.7
Acid Blue 281	6	173.6
Acid Blue 40	2	15.8
Acid Blue 239	3	92.1
Acid Blue 345	1	419.0
Acid Blue 113	2	446.0
Acid Green 25	2	3.7
"Acid Brown M-1"	3	45.1
"Acid Brown U-2"	4	292.0
"Acid Black M-3"	4	4460.0
"Acid Black M-2"	2	481.0
Disperse Dyes:		
Disperse Red 60	1	256.0
Disperse Blue ~ 109	1	4390.0
Disperse Blue 3	1	4.6
Disperse Blue 56	1	629.0
"Disperse Black M-4"	1	2789.0
Basic Dyes:		
Basic Orange 21	1	85.0
Basic Violet 14	1	74.0
Basic Blue 54	1	392.0
Basic Green 4	1	124.0

(continued)



Dye color index number	Number of weighings	Total weight of weighings, grams
Reactive Dyes:		
Reactive Yellow ~ 58	2	642.0
Reactive Yellow 64	1	117.0
Reactive Red 43	1	414.0
Reactive Red 120	1	562.0
Reactive Blue 52	1	166.0
Reactive Blue 18	1	1007.0
Direct Dyes:		
Direct Yellow ~ 106	6	9.0
Direct Orange 72	3	12.7
Direct Orange 80	1	1345.0
Direct Red 80	4	14.5
Direct Red 149	1	117.0
Direct Blue 78	4	51.1
Direct Brown 113	3	49.0
Direct Black 2	1	644.0
Direct Black 80	3	2745.0