INDUSTRIAL HYGIENE WALK-THROUGH SURVEY REPORT
OF
UNIFLITE
BELLINGHAM, WASHINGTON

SURVEY CONDUCTED BY:
RICHARD HARTLE
TED MEINHARDT

SURVEY DATE:
FEBRUARY 2, 1978

REPORT WRITTEN BY:
RICHARD HARTLE
MARCH, 1978

INDUSTRIAL HYGIENE SECTION
INDUSTRY-WIDE STUDIES BRANCH
DIVISION OF SURVEILLANCE, HAZARD EVALUATIONS AND FIELD STUDIES
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO

PURPOSE OF SURVEY:	Preliminary visit to familiarize ourselves with the processes involved in the reinforced plastics industry and to assesss the employee records at this facility towards possible inclusion in the project entitled "Mortility and Industrial Hygiene Study of Styrene Workers."
PERSONS CONTACTED:	Ms. Shawn Goenen Health and Safety Mr. Kenny Hilliard Personnel Relations Manager Mr. Jack Davis Shipwrights Local 2071

ABSTRACT

A walk-through industrial hygiene survey was conducted at Uniflite on February 2, 1978. This facility manufactures boats by means of reinforced plastic production techniques. The different aspects of the production process were viewed and limited environmental monitoring was conducted to arrive at an appropriate sampling method for use in a possible in-depth survey at this type of facility.

INTRODUCTION

Under the Occupational Safety and Health Act of 1970, NIOSH was given the mandate and authority to conduct research and health studies toward development of health standards applicable to a broad range of occupational environments. In partial compliance with this mandate, the Industry-wide Studies Branch of the Division of Surveillance, Hazard Evaluations and Field Studies is conducting a research study entitled "Mortality and Industrial Hygiene Study of Styrene Workers". Our purpose is to locate a population of styrene workers which meet the basic study requirements (such as size, sufficient time since initial employment, past exposures, and suitable record and compare this group's cause specific mortality rates with expected rates; and to document, to the extent possible, the environmental conditions associa with this group.

It is our contention that any ill health effects associated with styrene will be more readily identified among a group of workers with a history of relativ high exposures. Among the sectors of industry associated with styrene (polystyrene manufacture, polystyrene fabrications, and reinforced plastics industry) the reinforced plastic industry represents the highest potential for exposure.

DESCRIPTION OF THE FACILITY

Uniflite is located on the west side of Bellingham, Washington. Uniflite began porduction in the mid 1950's, with the operation at that time being ver small and involving few employees. The size of the facility has grown progressively with time and currently occupies six buildings (Figure 1).

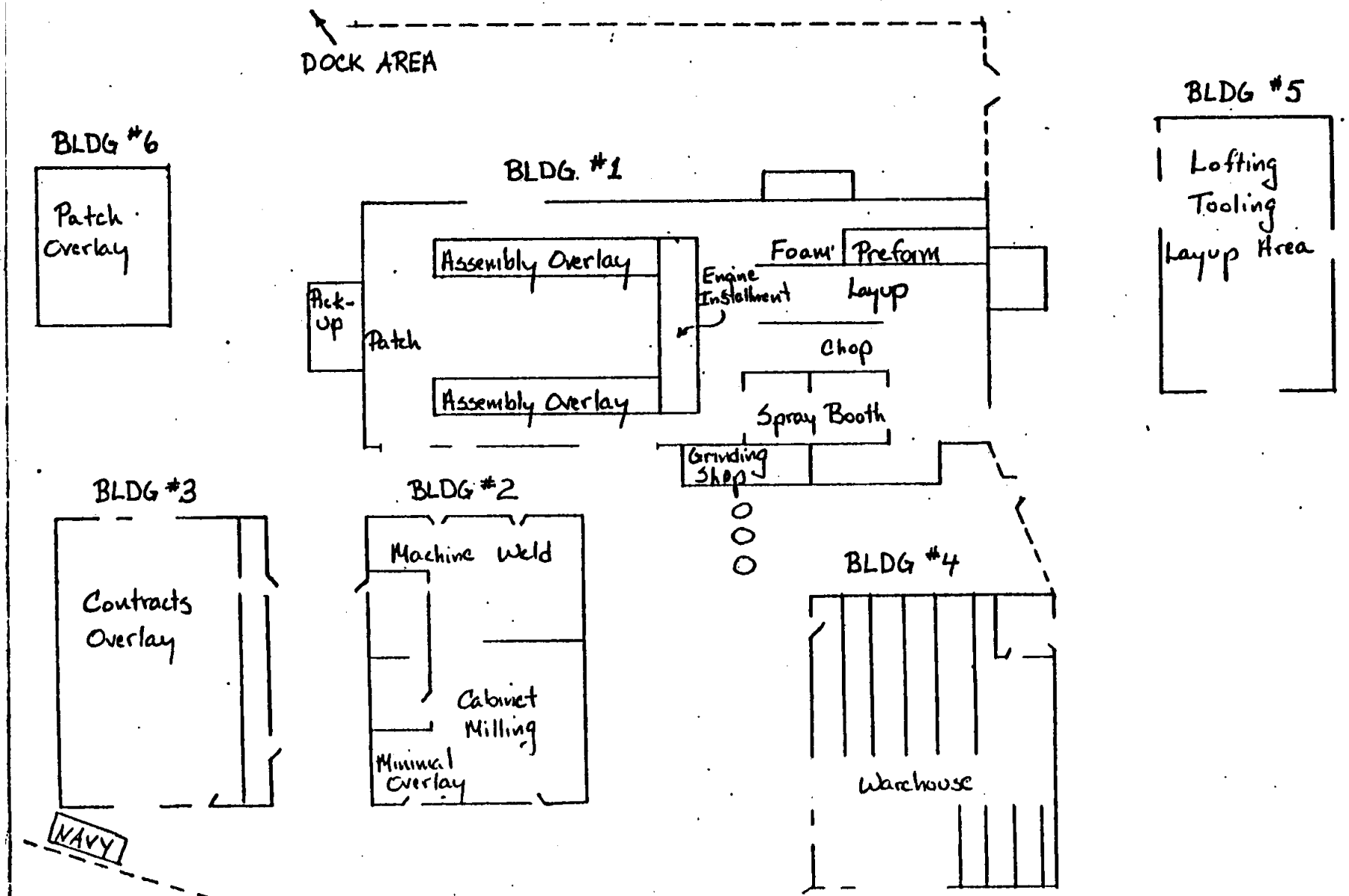
DESCRIPTION OF PROCESS

The production process is typical of this industry and begins with the construction of prototypes; each representing a specific part of the finished product such as the hull or deck. The prototype is made of wood, fiberglass, and resin, and is constructed mostly by hand. These prototypes serve as forms onto which fiberglass and polyester resins are laid up and reinforced to produce molds. The interior surface of the mold takes the shape of the exterior surface of the finished product.

The actual production process begins by waxing the mold onto which the finished product will be formed. Next, a "gel-coating" operation is performe This operation involves the application of a pigmented resin to the mold, whi will ultimately appear as the outside, "painted" surface of the finished product. This operation was conducted in an enclosed area and the operator was equipped with supplied-air type respiratory protection.

The next sequential operation involves the hand lay-up of roven woving (precut fiberglass) to the gel-coated mold. A resin consisting of ~40% styrene and ~60% "polyesters" is applied via spray-gun and hand rolled into the fiber glass layers. Methyl ethyl ketone peroxide is added at the spray gun nozzle to initiate polymerization of the styrene and resin. This operation is repeated until the desired structural thickness is attained.

FIGURE 1


DOCK AREA
BLDG #6
Patch
Overlay
BLDG #1
Assembly Overlay
Pick-up
Patch
Assembly Overlay
Engine Installment
Foam
Preform
Layup
Chop
Spray Booth
Grinding Shop
BLDG #5
Lofting
Tooling
Layup Area
BLDG #3
Contracts
Overlay
BLDG #2
Machine Weld
Cabinet
Milling
Minimal
Overlay
BLDG #4
Warehouse
NAVY

The reinforced fiberglass coated mold is allowed to "cure" for a minimum of 24 hours. The product is then removed from the mold. Sanding, grinding and cutting ensues to remove rough edges and make openings such as windows and doors. The completed hull or deck structures are then mated and a number of operations involving trim and detailing are conducted. Completed boats are inspected and damaged areas are "patched" prior to shipment.

DESCRIPTION OF JOBS

The two main job categories at this facility, as identified in the personnel records, are plasticians and shipwrights. The plasticians were primarily concerned with jobs relating to plastic work while shipwrights were involved with non-plastic jobs such as tooling or carpentry. Of the current 378 hourly plant employees, 86 are classifies as plasticians and 292 are of the shipwright category. Following is a description of the jobs subdivided under these main headings.

Plasticians

1. Lamination - Application of fibrous glass cloth to molds and covering with polyester resin.
    a. Squeegy - involves hand manipulation of squeegys rollers, and brushes to work the resin into the fibrous glass cloth (roven wooving).
    b. Resin application - usually from hand-held spray-gun; coats cloth with resin prior to squeegy operation.

2. Gel-coat - Application of pigmented resin to mold through hand-held spray gun.

3. Chopper gun operator - Operates hand-held chopper-gun which deposits resin and stranded fiberglass to mold.

Shipwrights

1. Assembly
    a. grinding edges of hulls & decks prior to matching
    b. matching hulls & decks
    c. cutting window & door openings
    d. installation of windows, wiring interiors, etc.
    e. engine installation

2. Finishing
    a. application of trim
    b. polishing
    c. inspection & repair

3. Woodwork - Construction of wood parts such as seat reinforcement, deck, trim, etc.

4. Upholstery - Assemble of seats, canvas tops, etc.

5. Weld - Welding of the various metal features of the boats.

6. Foam - Foam production process to increase the buoyancy properties of the boats.

DESCRIPTION OF MEDICAL, SAFETY AND INDUSTRIAL HYGIENE

here is no formal medical program at Uniflite; all persons requiring edical attention are directed to their private physician or in case of mergency situations, to the local hospital. Individuals with First Aid nowledge are available in most areas of the facility. The Safety and ealth program is conducted by Ms. Shawn Goenen. Industrial Hygiene monitor-ng is conducted by the Washington Industrial Safety and Health Administratic WISHA) or the University of Washington. Results of recent air monitoring n production areas of the facility for styrene and acetone will be vailable upon completion of an interim study report, now being drafted y the University of Washington.

ENVIRONMENTAL

imited sampling was conducted during the walk-through survey, primarily to stablish an adequate sampling method for the in-depth survey for this type f industry. Results of 3 personal samples of individuals involved with and lay-up indicated concentrations as high as 161 ppm styrene and 183 ppm cetone. Area sampling revealed general area concentrations as high as 10 ppm styrene and 83 ppm acetone. Table I summarizes this environmental ata. It may be important to note that these are 1-2 hour samples and annot be interpreted as representing 8 hour TWA exposures. These samples ere obtained to aid in the development of in-depth survey protocol and ot to characterize environmental exposures. Results indicate a 2 hour ampling period at 50-100 cc/min to be best suited for this type of environ-ent. The NISHA headquarters was visited and environmental data from their urveys was obtained. Appendix A contains copies of reports obtained ertaining to Uniflite.

CONCLUSIONS AND RECOMMENDATIONS

line other reinforced plastic manufacturing facilities were visited in the tate of Washington, and it appears that Uniflite is a typical facility of his industry; the only difference being that it is somewhat larger.

f this facility has the basic personnel information needed for a mortality tudy, then it's inclusion in our current study of styrene workers is ecommended.

TABLE I
RESULTS OF ENVIRONMENTAL SAMPLING
UNIFLITE 2-2-78

SAMPLE I.D.	OPERATION	STYRENE CONC. (ppm)	ACETONE CONC. (ppm)
#15 - Personal	Lay-up	113.1	182.6
#14 - Personal	Lay-up	161.3	140.8
#24 - Personal	Lay-up	29.9	80.1
#13 - Area	Lay-up	101.4	74.8
#3 - Area	Lay-up	110.3	82.8
#22 - Area	Lay-up	19.1	80.0
#6 - Area	Lay-up	89.6	67.0
#5 - Area	Chopping	8.7	19.0
#18 - Area	Chopping	16.3	35.7

APPENDIX I

October 28, 1975

Uniflite, Inc.
9th and Harris
Bellingham, WA 98225

Attention: Mr. Odd Valum

Gentlemen:

On September 25, 1975, a visit was made to your plant by Phil Peters and Joe Darcy for the purpose of evaluating exposure to styrene monomer and associated solvents used in the fiberglass boat-building industry. This visit was requested by management to determine the effectiveness of oscillating fans used attempting to reduce the concentration of vapors in the workplace. These fans were installed subsequent to a citation issued on August 8, 1974, in which were indicated excessive exposure to solvent vapors.

As indicated in Table I, samples taken on September 25, 1975 showed a substantial decrease in vapor concentration. Since these concentrations were significantly less than those measured previously, some doubt was expressed as to the validity of these samples. Therefore, at the request of this office, another visit was made to the plant on October 8, 1975 to resample those operations sampled on September 25, 1975. These samples confirmed the results of those taken earlier and thus it appears that the overhead oscillating fans are providing effective ventilation.

There is, however, still an area of concern: the stringer installation operation. You might consider a similar fan strictly intended for this operation.

Since you are exhausting substantial amounts of air from the building, you might want to consider a make-up air system especially during the cold winter months when all doors and windows are closed.

The data in Table II indicates excessive exposure to acetone, methyl ethyl ketone and toluene during clean and patch operations. Our survey was supposed to evaluate the effectiveness of a centrifugal blower installed

in the forward hatch of the boats. However, your people were apparently unaware of the existence of this blower and they had us set up our sampling gear in the wrong area. Thus, solvent vapor concentrations showed no difference from previous sampling. At the conclusion of the survey, the mistake was discovered but too late to sample in that boat in which the centrifugal blower was located. However, air flow determinations were made which indicated that air in the forward hatch (volume of about 200 cubic feet) would be changed at a rate of about 1.5 times a minute. Further, the blower provides about 700 cubic feet per minute through hoses to other areas of the boat.

While no sampling was done we feel that this blower will certainly provide adequate ventilation for all clean and patch operations providing it is used properly.

If we may be of further service, please do not hesitate to call.

Very truly yours,

Felix J. Darcy
Industrial Hygiene Consultant

FJD:mm
Enclosure

cc. Roy Mills
Joe Darcy
Gene Trucano
Everett Files

Uniflite, Inc.
Bellingham
9/25/75

TABLE I

OPERATION	DATE	SAMPLE#	CONCENTRATION PPM (1) STYRENE	ACETONE	MIXTURE (2)
Chopper Gun	9/25/75	P4	20	35	0.235
	"	D2	10	<5	0.105
Area Sample	"	D3	15	20	0.170
taken near	"	D5	20	10	0.210
chopper gun	"	D6	20	30	0.230
operation	"	D8	20	20	0.220
	"	D9	10	<5	0.105
	"	P8	40	40	0.440
	"	P9	10	<5	0.105
	"	P10	10	<5	0.105
	10/8/75	J19	75	70	0.820
Hull and	9/25/75	P6	25	40	0.290
Deck	"	D1	15	<5	0.155
Laminating	"	D4	20	20	0.220
	"	D7	30	25	0.325
	"	D10	15	<5	0.155
	10/8/75	J1	15	15	0.165
	"	J2	50	50	0.550
	"	J5	50	60	0.560
	"	J6	65	65	0.715
	"	J7	25	20	0.270
	"	J9	70	60	0.760
	"	J12	55	35	0.585
	"	J13	35	50	0.400
	"	J15	45	30	0.480
	"	J20	20	25	0.225
	"	J21	215	130	2.280*
Stringer	10/8/75	J17	110	45	1.145*
Instal-	"	J18	105	90	1.140*
lation	"	C10	85	170	1.020*
Gel	9/25/75	P1	25	120	0.370
Coating	10/8/75	J3	<5	50	0.100
	"	J4	40	45	0.445
	"	J8	60	75	0.675
	"	J11	25	45	0.295
	"	J14	50	40	0.540
	"	J16	40	55	0.455
TLV (3)			100	1000	

(1) ppm - Parts of vapor per million parts of air.
(2) Mixture - When this value exceeds unity (1) then the TLV (3) is exceeded.
(3) TLV - Threshold Limit Values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect.

*Indicates excessive concentration

Uniflite, Inc.
Bellingham
9/25/75

TABLE II

OPERATION	DATE	SAMPLE#	CONCENTRATION PPM (1) ACETONE	MEK	TOLUENE	MIXTURE (2)	
Patch and Clean	9/25/75	P2	125	75	65	.825	27
	"	P3	210	60	135	1.95 *	74
	"	P5	80	275	160	2.255*	15
	10/8/75	C1	60	40	35	0.435	90
	"	C2	35	40	10	0.055	5
	"	C3	105	55	40	0.58	10
	"	C4	295	145	120	1.62 *	5
	"	C5	115	80	85	0.94	5
	"	C6	220	115	90	1.245*	10
	"	C7	270	130	115	1.495*	5
	"	C8	65	25	30	0.34	5
	"	C9	220	220	195	2.295*	10
TLV (3)			1000	200	200		

(1) ppm - parts of vapor per million parts of air.
(2) Mixture - When this value exceeds unity (1) then the TLV (3) is exceeded.
(3) TLV - Threshold Limit Values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect.
*Indicates excessive concentration

Bellingham
S & H No. 79127

TABLE I

Solvent Vapor Exposure

ample No.	Date	Employee/Job Description	Actual Exposure Minutes	Sample Volume (L)	Concentration - ppm	
					Styrene	Toluene
1	3/29/77	Darold DeBeeld, Layup Lead	21	21	77	--
2	3/29/77	Lelha VanRy, Patch and Cleanup	16	16	---	16
					TWA = 74	4
		Permissible Exposure Limit			100	200

Data Sheet

TDI Concentrations
Uniflite Boat Works
Bellingham, Washington

Sample No.	Location	TDI Concentration mg/m^3 *	Remarks
1	Mixing and Pouring Foam	0.075	All samples collected in workmen's breathing zone
2	Mixing Station	0.114	
3	Pouring Molds	0.122	
4	Pouring Molds	0.095	
5	Mixing Station	0.135	

Note * Threshold Limit Value for TDI is C 0.14 mg/m^3.