IN-DEPTH SURVEY REPORT
OF
HATTERAS YACHTS
HIGHPOINT, NORTH CAROLINA

ECTB Report No. 107-13b

Survey Conducted By:

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National Institute for Occupational Safety and Health

PURPOSE OF SURVEY: Hatteras Yachts has been developing a new ventilation system for its High Point, North Carolina plant. A preliminary survey was performed on January 28, 1982. This in-depth survey will evaluate one of two systems completed in this plant.

EMPLOYEE REPRESENTATIVES CONTACTED:

Mr. John Adams, Manager, High Point operations
Mr. Walter Thomas, Facilities Engineer
Mr. Brian Kilgariff, Manager Health and Safety
Mr. Larry Thomas, Maintenance Supervisor
Mr. George Pope, Lamination Supervisor
Mr. Robert Crotts, Personnel Manager
Mr. Robert C. Arthur, Senior Design Engineer
Mr. Robert Silman, Materials and Process Engineering

EMPLOYEE REPRESENTATIVES CONTACTED: None

STANDARD INDUSTRIAL CLASSIFICATION CODE: SIC 3772 Boatbuilding and Repairing

ACKNOWLEDGEMENTS: The data was analyzed by Mr. Stanley Schulman, Statistician, DPSE, NIOSH, using the SAS Multivariate Analysis computer program.

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I. INTRODUCTION

The production of fiber reinforced plastic (FRP) boats involves the use of a polyester resin containing 40% to 60% styrene monomer. A review of the health literature for this and other FRP industries indcates that the major health problems include irritation of the mucous membranes and solvent narcosis from exposure to styrene vapor and contact dermatitis from contact with solvents, fibrous glass, and the uncured polyester resin.[1,2] Changes in psychomoter tests results were noted among subjects in styrene exposed workers at both high (82 ± 44ppm) and low (9 ± 15ppm) styrene, whereas eye and mucous membrane irritations were shown to be more frequent among individuals exposed to the higher range of concentrations.[3]

Industrial hygiene surveys carried out by NIOSH, Division of Surveilance Hazard Evaluations and Field Studies (DSHEFS) have indicated that 20.6% of the personal exposures in boatbuilding plants exceeded the eight-hour time weighted average (TWA) standard for styrene, in seven plants sampled.[4] The Division of Physical Sciences and Engineering (DPSE) is conducting an assessment of ventilation and work practices in FRP boatbuilding plants to document the best control systems. This phase of the project is to survey, in-depth, those plants having the best control systems found during the preliminary surveys.

The principal contact at Hatteras Yachts was Mr. John Adams, Manager of High Point Operations. Others contacted during the visit were: Mr. Walt Thomas, Facilities Engineer; Mr. Brian Kilgariff, Manager, Health and Safety; Mr. Larry Thomas, Maintenance Supervisor; Mr. George Pope, Lamination Superivsor; Mr. Robert Crotts, Personnel Manager; Robert Arthur, Senior Design Engineer; and Bob Silman, Materials and Process Engineer.

II. OPERATIONS AND PRODUCTION

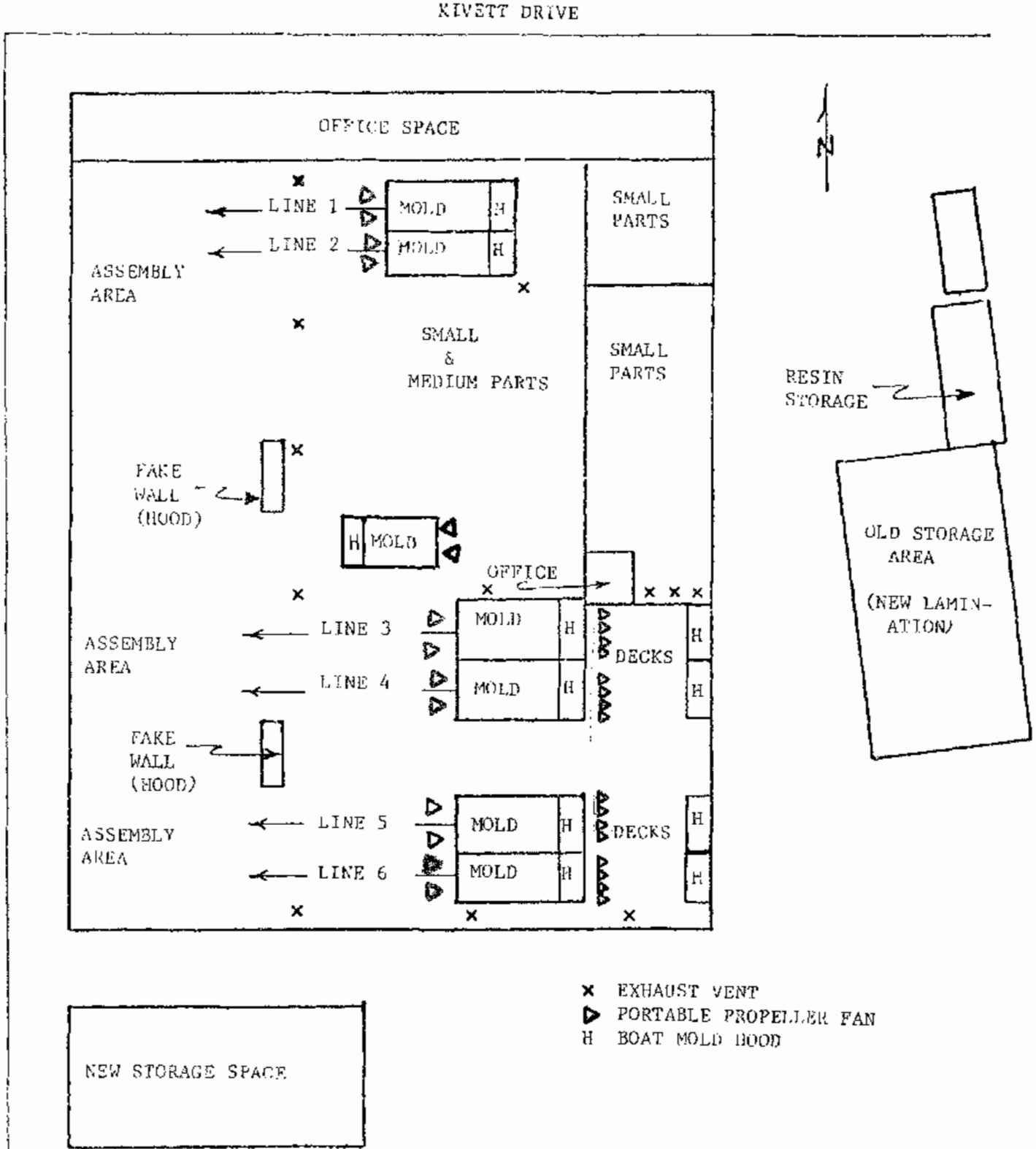
Hatteras Yachts began operation in 1959 and located in High Point, North Carolina to take advantage of the skilled craftsmen in the area. The plant has been at its present location since 1961. Hatteras Yachts is currently owned by AMF Incorporated having been purchased from North American Rockwell in 1968. The plant is currently in another of a series of expansions which has resulted in the construction of several plant modules, each with its own ventilation system. Hatteras Yachts currently manufactures boats ranging from 32 feet to 50 feet on six production lines.

There are presently three major buildings on this six acre site with 280,000 square feet under roof. The main lamination building is 270' x 200' x 20' high with an area of 54,000 square feet. The total ventilation in this building is 180,000 CFM[5]. The plant is currently undergoing expansion with the construction of a new lumber storage building and the conversion of the older storage area to new lamination production. The plant layout is shown in Figure 1.

The molds are the inverse shape of the finished component and are formed of FRP on a form called the "plug". Waxed and polished, these molds produce a product with an almost mirror like finish. The gel coat, a pigmented resin, is usually applied to the mold as a spray coat prior to the lamination. This gel coat, a pigmented styrene resin, becomes the finish coat of the product.

The boat hulls and superstructures are fabricated in six production lines and in an additional 32' mold set adjacent to line 3 which feeds into any of the six assembly lines. The smaller parts are fabricated in the east side of the building in rooms ventilated to carry styrene fumes away from the worker and out of the general plant area.

FIGURE 1. LAMINATION BUILDING LAYOUT
HATTERAS YACHT - HIGH POINT, NORTH CAROLINA



The boat hull molds at this plant are recessed in pits about 9 feet deep and in an upright position which has created ventilation problems. The problems arose from the difficulty of supplying ventilation air inside the hull molds from a system functioning as a dilution ventilation system. In anticipation of a lower permissible exposure limit (PEL) for styrene, Hatteras Yachts in 1981, designed a new ventilation system to permit the flushing of the hull molds with fans at the bows and the collection of the air in hoods at the sterns. This is generally referred to as a push-pull type system.

After the hull is laminated and braced with stringers, it is pulled from the mold with gantry cranes and is ready for assembly. The assembly of a boat begins with the installation of bulk heads, engines, plumbing, and electrical systems. The boat is finished with the installation of the interior and auxilliary equipment. A completed yacht emerges at the West side of the building.

In general, FRP boats may be fabricated from glass fibers (woven roving, matting or chopped glass strand) cemented with a polyester resin. Boat hulls and decks are composed entirely of woven roving and matting to meet the strength requirements. Hatch covers and other assorted small parts which do not have high stress specifications are usually composed of both roving and chopped glass strand.

Chemicals observed in the storage area are listed in Appendix A. Material Safety Data Sheets (MSDA) for some of these materials are listed in Appendix B.

III. HAZARD ANALYSIS - STYRENE AND ACETONE

Evaluation Procedures

The survey at this plant focused on the three hull laminators who work as

a team to laminate all hulls. They work on a job basis and can schedule work on any shift to complete a hull without interruptions. They also prepare materials and molds. The lamination of the 46 foot hull began at the stern and proceeded forward along the starboard side of the boat to the bow. The lamination operation then progressed aft along the port side of the hull. The work arrangement is illustrated in Figure 2. The planks are supported on racks spaced approximately as shown.

To determine the control effectiveness, the breathing zone concentrations of styrene and acetone were measured during the three-day survey by placing personal samples on the three laminators. The personal samples were collected simultaneously for consecutive 30 minute (nominal) periods to determine what specific operation might result in greater exposure to styrene and or acetone. The styrene and acetone were collected with 150 mg charcoal tubes using portable pumps operated at 100 cc/min. For analysis, the tubes were separated with front (A) and back (B) sections and desorbed in 1 ml of carbon disulfide. Analyses were performed in accordance with NIOSH Method P&CM 127 by gas chromotography using a flame ionization detector at the Utah Biomedical Testing Laboratories (UBTL).

To determine the role of background levels of styrene in the total exposure of workers, area samples were collected at points adjacent to work sites. Except for duration (240 minutes) and sampling rate (10 cc/min), sampling and analyses were identical to the personal samples.

IV. CONTROLS

Prior to installation of the local exhaust system, the controls in this plant had been limited to general ventilation. This has been altered to provide local ventilation of the push-pull type on each hull mold as shown in Figure 2. The system evaluated in this study is on production lines 3 and 4. The push air is supplied by two 20" diameter Bayley Propellair fans having drum housings and straightening vanes.

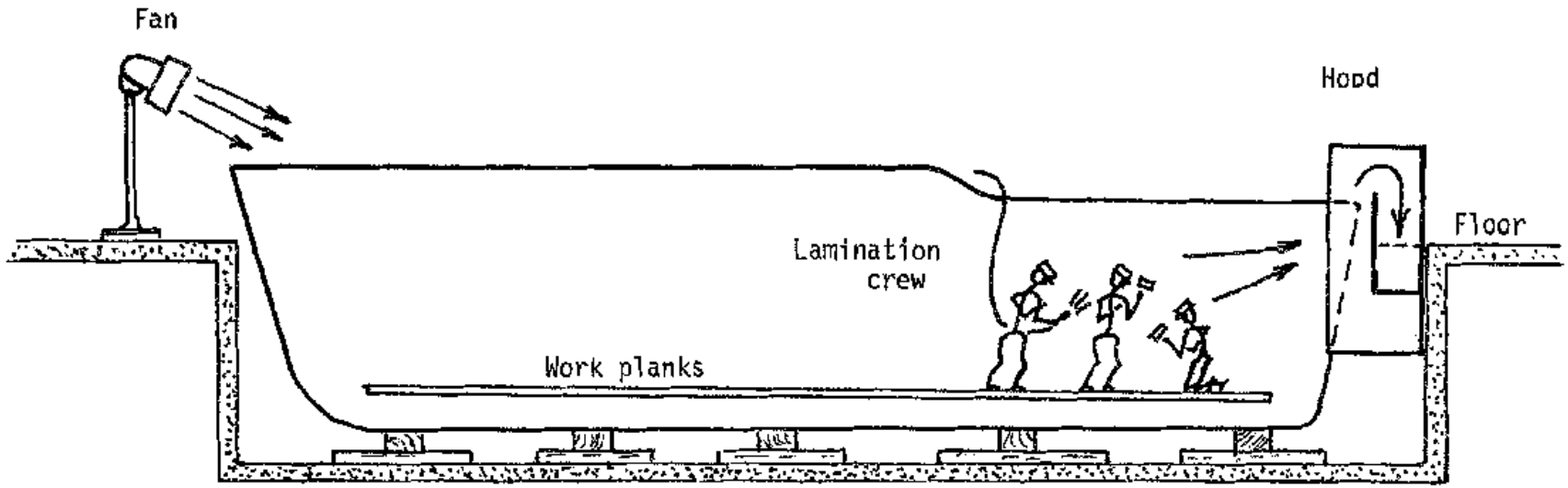


Figure 2. Work arrangement for 46 foot hull mold

The air velocities of these fans were measured with the Kurz velometer and converted to volume flow. The results are shown in Table 1. The fan exit velocity is reduced to about 350 FPM at the bow of the boat.

The system exhaust is generated with a propeller fan mounted on the roof and connected by duct work to the hood located at the stern of the mold. (See Figure 3). The system static pressure was 1.12 inches of water near the fan; this decreases the fan capacity from the rated 15,000 CFM to 6450 CFM. The actual flow was calculated from a velocity traverse made in the largest subfloor duct. The velocity measurements were made with a pitot tube and a TSI hot wire anemometer. The data is located in Appendix C. The exhaust air velocities at the four 24" x 15.5" filters located in the hood behind each mold gave a total air flow of 6590 CFM. The data and calculations are also in Appendix C.

Table 1. Velocity and Flow of Bayley Propellair Fans

	Area of Fan Hood Measured				
	Velocity, FPM		Flow, CFM		Total CFM
Fan Location	Annular	Center	Annular	Center	
Port Side Bow	2100	420	4200	75	4275
Starboard Bow	2090	380	4180	70	4250

The air velocities in the boat hull were measured with the Kurz velometer. Because the hull is rigged with planking for the laminators, the plank racks made good reference points for the flow measurements. The plank racks location in the hull and their dimensions are shown in Figure 4 and Figure 5 and the velocity data obtained for each corresponding hull section are shown in Figure 6. Assuming that the higher

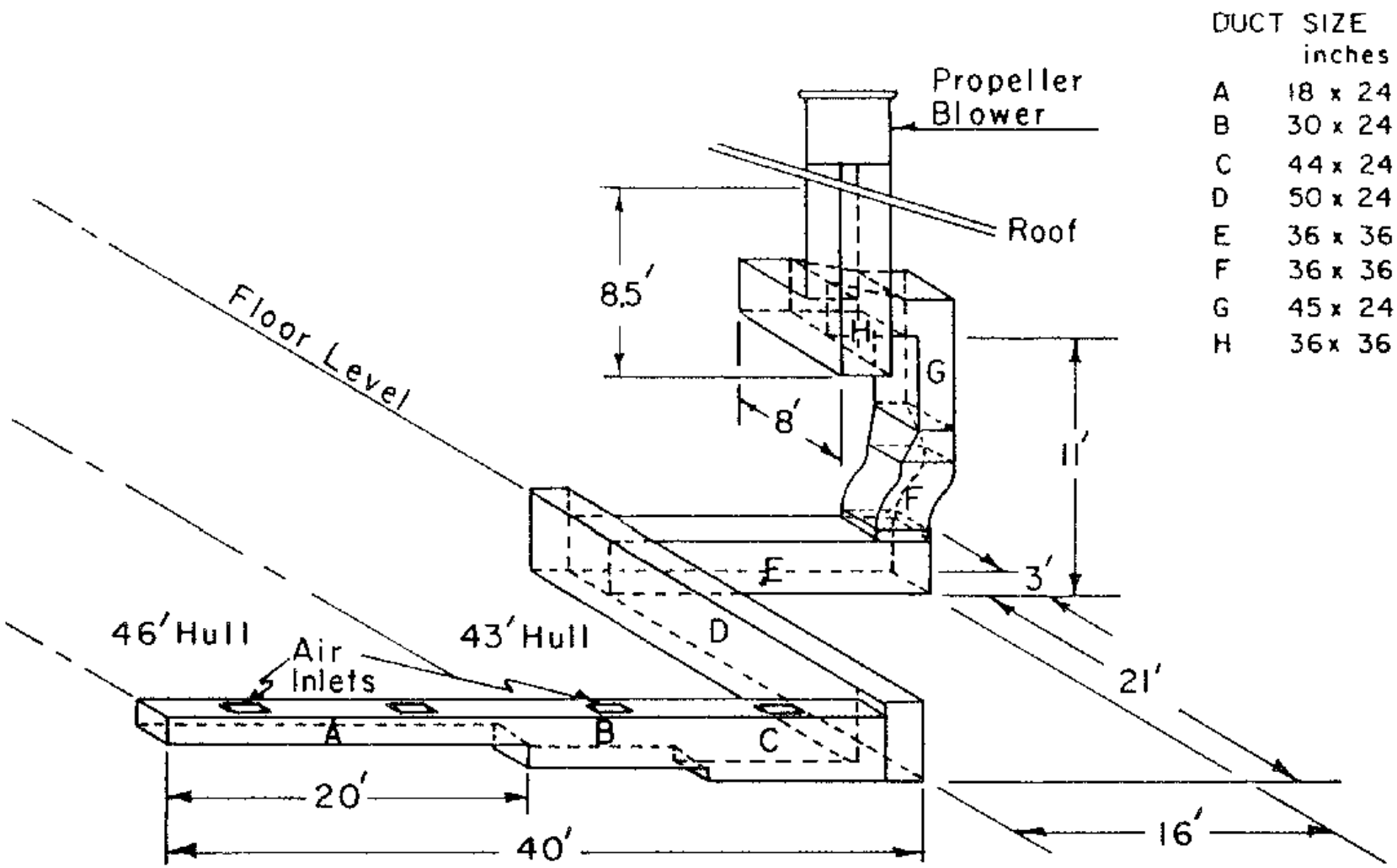


FIGURE 3. HATTERAS YACHT - HULL MOLD VENTILATION SYSTEM

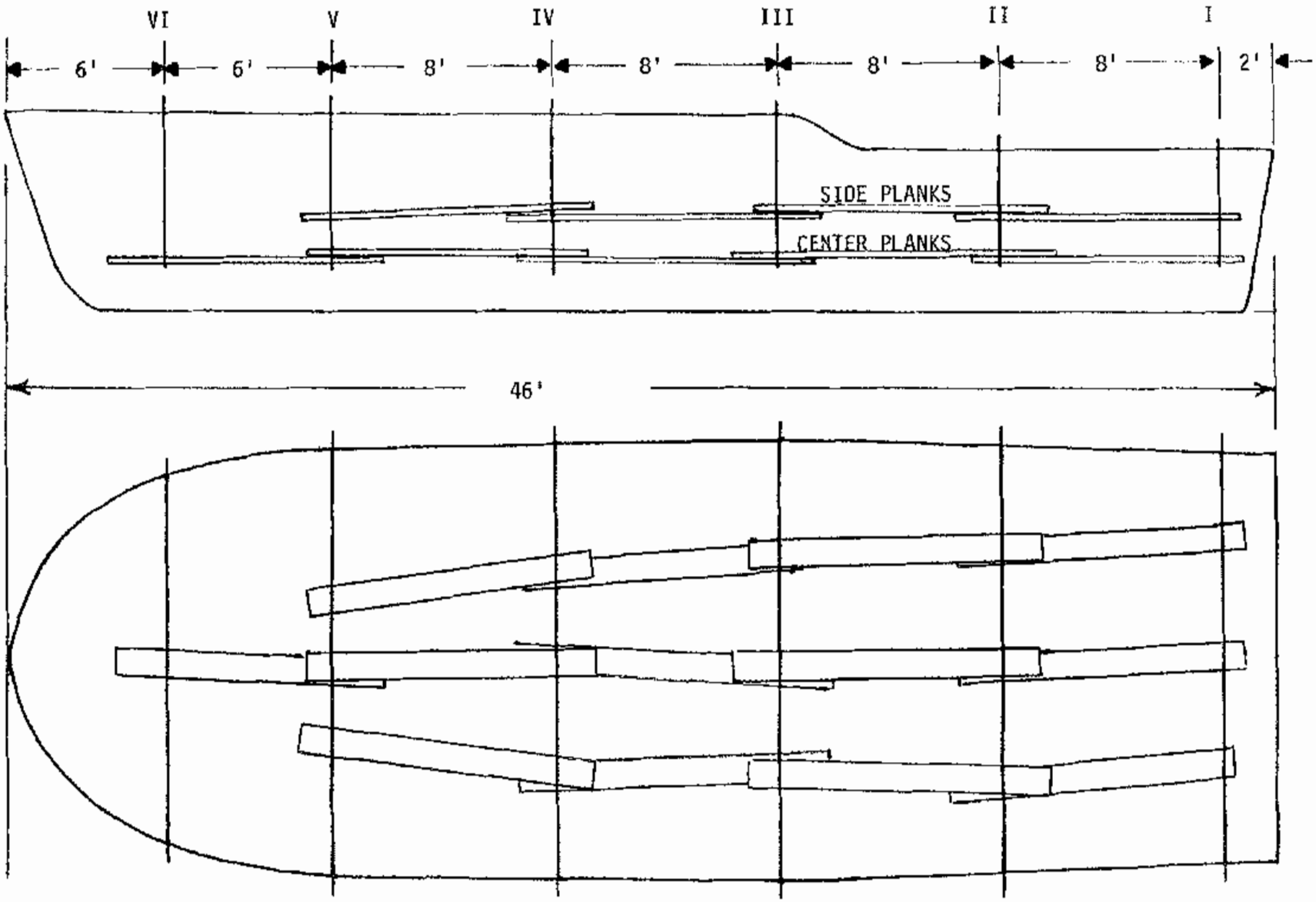


FIGURE 4. HULL RIGGED WITH WORK PLANKS AND RACKS

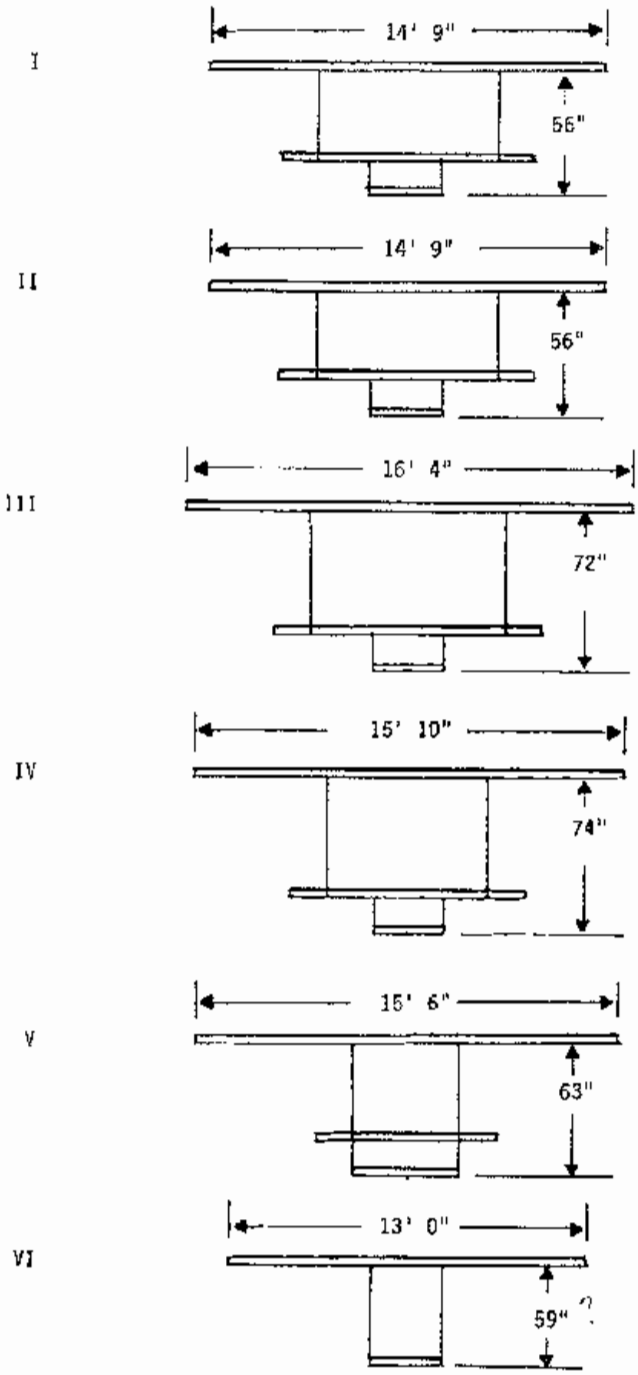


FIGURE 5. DIMENSIONS OF PLANK RACKS

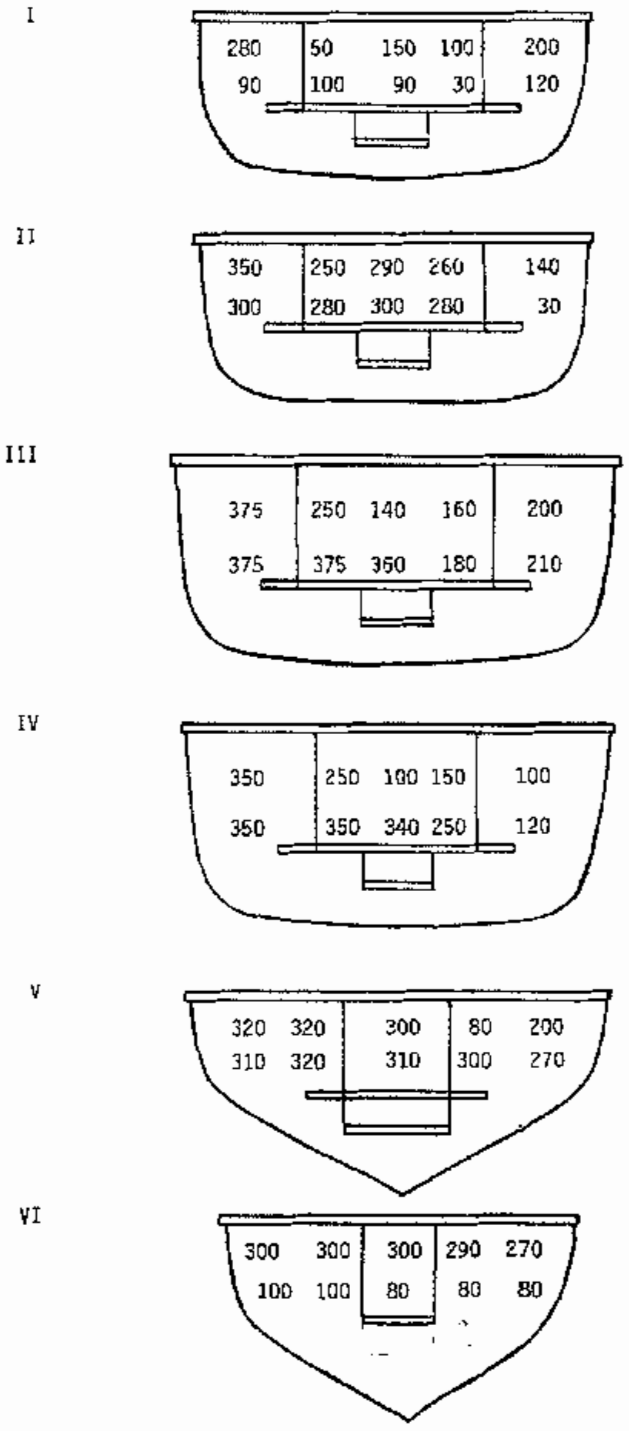


FIGURE 6. AIR VELOCITIES IN HULL SECTIONS, FPM

velocities indicate the main current of air, it appears that the air propelled by the fans moves to the bottom of the hull at mid ship and then up and into the suction hood at the stern. The lower velocities at the hood (Section I) are a result of the lower than expected exhaust and results in spill-over into the room air. Spill-over was observed by using a smoke tube along the gunwhale. This indicated that air was spilling out of the boat hull. A measurement taken with the HNu analyser indicated that the concentration of styrene just down stream of the spray-on point in the hull was 100 to 200 ppm. The reading was taken at the boat gunwhale; the air sampled was that flowing close to the freshly laminated surface.

V. RESULTS OF SAMPLING

The three laminators were sampled for nominal 30 minute periods to determine their exposure to styrene and acetone. The workers performed the lamination operation in a pattern of laminating the right or starboard side of the boat hull from the stern to the bow then the port or left side from the bow to the stern. The hull ventilation fans blow air from the bow to the stern. This creates the situation where the styrene from the spray gun is blown toward the roll out laminators. The data from the samples were analyzed to determine the mean exposure of each worker and to determine the difference in exposure for laminators on the starboard side as opposed to the port side. The worker mean exposures, calculated as arithmetic means, are shown in Table 2.

Worker B does most of the spraying of resin and would be expected to have the highest styrene exposure level. All workers have essentially the same exposure levels. Note that the highest exposure level, 97 ppm, is for worker C attained while laminating in the bow with the push fans turned off. The push fans are turned off to prevent the high air velocity, at that point, from blowing the resin spray onto the workers.

Table 2. Average Styrene Exposure of Workers, ppm Styrene

Worker	A	B	C
Day 1	34	30	33
Day 2	26	25	31
Day 3	24	33	16
Total	28	29	27
Range	1-80	1-62	1-97

It was also expected that workers A and C would have higher exposures to styrene when following the sprayer, B, on the starboard side than on the port side. This was tested by entering the data into a multivariate analysis program and using the log transformed data for differences of starboard side and port side exposure. The result indicates, at the 96.5% level of confidence, that the exposure on the port side is significantly higher than the exposure on the starboard side.

The only other conclusion that explains this difference is that the major source of styrene is from the curing resin. The freshly sprayed resin is downwind of the workers on the starboard side and upwind on the port side (see Figure 2). Data taken during lamination operations was separated into starboard and port side arrays. The average exposure level on the starboard side lamination was 27 ppm styrene; for the port side lamination the average exposure level was 43 ppm styrene. The starboard exposure level is 37% lower than the port side exposure level and represents a possible benefit by simply changing the direction of laminating the hull. Management was apparently aware of this possibility but met with worker resistance because it interupted the continuity of laminating "around" the hull.

Eighteen area samples were obtained. The area samplers were located atop the exhaust hood, inside the exhaust hood and near the push fans. The results are shown in Table 3. The area samples were taken with charcoal tubes and sampling pumps calibrated at about 5 cc/stroke and about 10 strokes/minute which permitted a sampling period of up to 4 hours.

The higher styrene concentration in the hood is an indication of the effectiveness of the system in collecting the fumes, however airflow measurements and smoke tube traces in and around the hull mold showed that air was spilling out of the hull. The 42 ppm styrene concentration near the fans in the AM sample on the third day can be explained as the result of turning the fans off when lamination is being carried out in the bow

Table 3. Area Styrene Samples, ppm Styrene

Day	Above hood		In Hood		Near Push Fan	
	AM.	PM	AM	PM	AM	PM
1	10	10	47	57	6	4
2	12	3	60	37	12	4
3	4	5	15	18	42*	5
Average, CFM	9	6	41	37	9	4
Total, CFM	7		38		13	

*This sample is excluded from the average. Fan turned off during work in bow area caused reading of 42 ppm in A.M. sample.

area. This suggests that it would be better to slow the fan speed to maintain some ventilation rather than shut the fans down.

VI. CONCLUSION AND RECOMMENDATIONS

The personal sampling data obtained for the three workers indicates good control in terms of the average exposure. The mean exposure for all the workers is 27 ppm styrene. The peak values of 80, 62 and 97 ppm styrene for workers of A, B and C respectively indicates that there are some problems even though these values are below the current PEL of 100 ppm TWA.

A push-pull ventilation system requires that considerably more air be "pulled" into the hood or intake than is propelled by the push fans because of the additional entrained air. A "balance" of these two air flows is desired to minimize power consumption. The push ventilation fans generate good air velocities but spillover of "push air" into the general work area occurs. This air spillover was detected by the use of smoke tubes while observeing air movements within the hull mold. The deficiency of the system is caused by a high static pressure resulting from the winding path the air must take through the duct work and the use of a propeller fan which does not perform well at a static pressure greater than about 1 inch w.g. The effect of this spill-over air is moderated by the large dilution volume of the building. However, during periods of high production, this spill over may result in excessive contamination of the general work area. The solution to this problem is to either straighten the duct work, use a more suitable fan, or preferably both. The higher personal exposure values for styrene, obtained on the port side of the boat indicate that the major source of styrene is from the curing resin. When the curing resin is up-wind from the workers the styrene vapors must blow past them. The data obtained in this study indicates that exposures could be reduced 37% by working toward the fans. It is also recommended that the push fans in the bow be slowed rather than shut off when the bow area is being laminated. This will provide some ventilation without interfering with the resin spray.

REFERENCES

1. International Labour Office, 1972, Encyclopedia of Occupational Health and Safety, Vol II, McGraw-Hill Book Company, New York, New York.

2. Bourne, L. B. & Milner, F. J. M. 1963, Polyester Resin Hazards, British Journal of Industrial Medicine, 20: 100-109.

3. Brooks, S., Associate Professor of Environmental Health and Medicine, Kettering Laboratory, University of Cincinnati, "Investigation of Workers Exposed to Styrene in the Reinforced Plastic Industry." 1979, 330 pp. This report was performed for the Society of Plastics Industries.

4. Crandall, M. S., "Extent of Exposure to styrene in the Reinforced Plastic Boat Making Industsry." DHHS (NIOSH) 82-110 March, 1982

5. Thomas, W., Facilities Manager, Hatteras Yachts, private communication, 2/25/82.

Appendix A

List of Chemicals Used in Hatteras Yachts Plant

Resin Solution UN-1866, 80-601CG
Alpha Resins Co.
Collierville, Tennessee

Gelkote, Back up
183921 Paint
Glidden Company
Cleveland, Ohio

Gelkote, Bottoms
188373 Paint
Glidden Company
Cleveland, Ohio

Polyester Adhesive (Resin)
CX-1316
Owens Corning Fiberglas
Toledo, Ohio

N,N - Diethylaniline
DuPont Company
Wilmington Delaware

GelKote, White
088 Paint
Glidden Company
Cleveland, Ohio

Polyester Resin
DION 6604T-S-5006 234718
Koppers Corporation
Pittsburg, Pennsylvania

Isofoam
R-0318-B
WITCO Chemical
Isocyanate Products Division

Methyl Ethyl Ketone Peroxide
Cadox M-50
Noury Chemical Corporation
Burt, New York

Acetone
Tennessee Eastman Company
Kingsport, Tennessee

Polylite, Polyester resin
90-874
Reichold Chemicals, Inc.
White plains, New York

Benzoyl Peroxide/Dibutyl Phthalate
Organic Peroxide Mixture
Noury Chemical Corporation
Burt, New York

Appendix B.

Material Safety Data Sheets

AMF

HATTERAS YACHTS
2100 Kivett Drive, P O Box 2690, High Point, North Carolina 27261 • 919/889-6621
AMF INCORPORATED

October 6, 1982

William F. Todd
Research Chemical Engineer
NIOSH
4676 Columbia Parkway
Cincinnati, Ohio 45226

Dear Bill:

Enclosed you will find the Material Safety Data Sheet on the Owens Corning adhesive used in our fiberglass department. I am sorry it took longer than expected to get a new sheet.

If I can be of further assistance please call.

Sincerely,

Bob

Bob Arthur
Senior Material and Process Engineer

BA:sw

Enclosure

20

OWENS/CORNING FIBERGLAS

material safety data sheet

section 1 name & product

manufacturer's name
(a) OWENS-CORNING FIBERGLAS CORPORATION

emergency phone no (24 hours)
(b) ----------

street address
(c) Fiberglas Tower

for latest data, consult manufacturer

date this form written
(d) September 24, 1982

city, state, zip code
(e) Toledo, Ohio 43659

signature of certifying company official
(f) Susan R. Fangeler

chemical name, trade name, and synonyms
(g) E671 Polyester Resin (CX1316)

formula of primary component(s)
(h) Polyester Resin

section 2 ingredients

	%	TLV (units
Polyester Resin	70-85	
Styrene	15-30	

(not specification values)

section 3 physical data

2 boiling point (°F)	145°C (293°F)	6 specific gravity	
3 vapor pressure (mmHg at 20°c)	5 mm	7 % volatile by volume	
4 vapor density (air = 1)	3.6	8 color and odor	
5 solubility in water		9 physical state	Liquid

section 4 fire and explosion hazard data

10 flash point (and method used): 31°C (87°F) Tag closed cup

11 flammable limits (STP): LFL 1.1 UFL 6.1

12 extinguishing media: ☐ water fog ☑ foam ☐ alcohol foam ☒ CO_2 ☒ dry chemical ☐ other [NFPA Class I

13 special fire fighting protective equipment

None - fight like a fuel oil fire.

14 unusual fire and explosion hazards

Styrene is flammable. Prohibit smoking and open flames. Prevent static and other electrical sparking.

section 5 reactivity data

15 stability	normal conditions		16 conditions to avoid
	fire conditions		Styrene will polymerize readily at elevated temperatures. If this occurs in a closed container, there is a possibility of violent ruptur
17 incompatibility (materials to avoid)	☐ water ☐ acid ☐ base ☐ corrosive ☐ oxidizing material		
	☐ other		Peroxides

18 hazardous decomposition products

Carbon monoxide, carbon dioxide, low molecular weight hydrocarbons, organic acids.

19 hazardous polymerization	may occur	X	20 conditions to avoid: Sunlight, open flames, contamination and prolonged storage above 38°C (100°F).
	will not occur		

material safety data sheet (continued) (Polyester resin)

section 6 health hazard data

2 oral ingestion
Toxic

ntact
th liquid styrene and its vapor can be extremely irritating to the eyes.

3 skin contact
Liquid contact with the skin may cause moderate irritation (dermatitis).

4 skin absorption

5 inhalation (TLV or suggested control figure) Irritating to the mucous membranes of the nose and throat. Anesthetic in high concentrations. TLV for styrene: 100 ppm.

6 effects of overexposure Eye, nose and throat irritation. In extreme cases, may cause dizziness, drowsiness, or loss of consciousness.

7 first aid procedures FOR INHALATION: Remove victim to fresh air. Keep warm. Give oxygen or artificia respiration as required. FOR EYE CONTACT: Flush eye with flowing water (eye fountain) for 15 minutes. Obtain medical aid. FOR SKIN CONTACT: Wash with soap and a large volume of flowing water. Remove contaminated clothing and launder before rewearing. FOR INGESTION: Hospitalize immediately.

section 7 spill or leak procedures

8 steps to be taken in case material is released or spilled Remove all sources of ignition (flames, hot surfaces, and electrical, static or frictional sparks). Ventilate area. Absorb with inert materials such as vermiculite or sand and place in a closed container for disposal as solid waste. Wash area well with trisodium phosphate and water. Resin that may habe been mixed with

9 disposal method peroxide initiators prior to spillage should be mixed with an inert filler and removed to an open area. Allow time to gel and cure. Use either approved sanitary landfill or incineration. Do not incinerate closed containers.

1 special protection information

ion	local exhaust	special
	X	
	mechanical (general)	other
	X	

1 respiratory protection (specify type)

Up to 100 ppm - none; above 100 ppm - approved organic vapor respirator

2 protective clothing

Gloves - neoprene or non-soluble plastic

3 eye protection ☐ not normally necessary ☐ safety glasses without side shields ☒ safety glasses with side shields ☒ chemical workers goggles ☐ gas tight goggles or equivalent ☐ other

other protective equipment

Use explosion proof motors

Safety showers and eyewash stations should be available.

ction 9 special precautions or other comments

precautions to be taken in handling and storing

Store and handle as NFPA class 1-C flammable liquid. Store below 27°C (80°F) in a closed container and in a dry area to avoid spoilage.

other precautions

In bulk storage, check vent and flame arrestors for plugging by the formation of ymer. Ground all connections, containers, etc., when using.

MATERIAL SAFETY DATA SHEET

FOR COATINGS, RESINS AND RELATED MATERIALS

GP

UNPROMOTED

DATE OF PREP P-S-9/77 (Approved by U.S. Department of Labor "Essentially Similar" to Form OSHA-20)

Section I

POLYESTER RESIN

MANUFACTURER'S NAME REICHHOLD CHEMICALS, INC.

STREET ADDRESS 525 North Broadway CITY, STATE, AND ZIP CODE White Plains, New York 10603

EMERGENCY TELEPHONE NO (914) 682-5700

PRODUCT CLASS Unsaturated polyester in monomer

TRADE NAME POLYLITE® Polyester Resin MANUFACTURER'S CODE IDENTIFICATION 90-874

Section II — HAZARDOUS INGREDIENTS

INGREDIENT	PERCENT	TLV PPM	TLV mg/M³	LEL PPM	VAPOR PRESSURE (mm Hg)
Unsaturated Polyester	> 50	---			N.A.
Styrene Monomer	< 50	100		11000	< 5

STYRENE HAZARDS: SEE MCA CHEMICAL SAFETY DATA SHEET SD-37

Section III — PHYSICAL DATA

APPEARANCE Clear, amber liquid

VAPOR DENSITY ☒ HEAVIER ☐ LIGHTER THAN AIR

BOILING RANGE > 145°C

EVAPORATION RATE ☐ FASTER ☒ SLOWER THAN ETHER

PERCENT VOLATILE BY VOLUME (%) < 50

SPECIFIC GRAVITY (H_2O=1) 1.08 - 1.13

Section IV — FIRE AND EXPLOSION HAZARD DATA

DOT CATEGORY Flammable Liquid FLASH POINT 89°F (Setaflash)

EXTINGUISHING MEDIA

Foam, carbon dioxide or dry chemical.
Class B extinguisher per National Fire Protection Association.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Styrene will polymerize readily at elevated temperatures of fire conditions.
If this occurs in a closed container, there is a possibility of violent rupture.

SPECIAL FIRE FIGHTING PROCEDURES

None - fight like a fuel oil fire.

Section V – HEALTH HAZARD DATA

THRESHHOLD LIMIT VALUE Styrene 100 ppm (See Section II). (GP Unpromoted Polyester resin)

EFFECTS OF OVEREXPOSURE

Styrene @ 400 ppm or in strong concentration is irritating to all parts of the respiratory tract and eyes. May be fatal @ 10,000 ppm. Somewhat anaesthetic. (N.B.) Styrene vapor generation of polyester resins will rarely exceed 200 ppm.

EMERGENCY AND FIRST AID PROCEDURES

Remove victim from exposure to well-ventilated area - make comfortably warm but not hot - use oxygen or artificial respiration as required. In case of eye contact, flush promptly with copious amounts of water for 15 minutes and seek medical attention.

Section VI – REACTIVITY DATA

STABILITY ☐ UNSTABLE ☒ STABLE

CONDITIONS TO AVOID

Heat, direct sunlight and ignition sources.

INCOMPATABILITY (Materials to avoid)

Strong acids, peroxides and other oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide and dioxide, low molecular weight hydrocarbons and organic acids.

HAZARDOUS POLYMERIZATION ☒ MAY OCCUR ☐ WILL NOT OCCUR

CONDITIONS TO AVOID

Sunlight, open flames, contamination and prolonged storage above 100°F.

Section VII – SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Remove saturated clothing promptly and wash affected areas with soap and water. Remove all sources of ignition (flames, heat and sparking). Ventilate area. Use protective measures outlined in Section VIII.

WASTE DISPOSAL METHOD Absorb with inert materials such as vermiculite or sand and place in closed container for disposal as solid waste. Wash area well with trisodium phosphate and water. Disposal must conform to local, state and federal regulations.

Section VIII – SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION Up to 100 ppm: None

100 ppm and above: U.S. Bureau of Mines approved air line mask or self-contained breathing apparatus.

VENTILATION

Provide general dilution or local exhaust ventilation to comply with Sections II and IV. (Styrene vapor is heavier than air). Use explosion-proof motors.

PROTECTIVE GLOVES Neoprene or non-soluble plastic.

EYE PROTECTION Use safety wear designed to protect against splash or liquids.

OTHER PROTECTIVE EQUIPMENT Safety showers and eye wash stations should be available.

Section IX – SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

OTHER PRECAUTIONS Avoid improper addition of promoter and/or catalyst. Consult product bulletin. A promoter (metal organic such as cobalt or aniline type) and catalyst (organic peroxide type) used with this product should always be mixed separately with the product and should never be mixed directly together.

MATERIAL SAFETY DATA SHEET

NPVLA 6-70

(Approved by U.S. Department of Labor "Essentially Similar" to Form LSB-OOS-4)

Section I

MANUFACTURER'S NAME: Tennessee Eastman Company

ACETONE

STREET ADDRESS:

CITY, STATE, AND ZIP CODE: Kingsport, Tennessee 37662

EMERGENCY TELEPHONE NO.: 615-247-0411

CHEMICAL NAME AND SYNONYMS	TRADE NAME
Acetone	Acetone
CHEMICAL FAMILY	**FORMULA**
Ketone	CH_3COCH_3

Section II — HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS

PIGMENTS	%	TLV (Units)	SOLVENTS	%	TLV (Units)
CATALYST			ADDITIVES		
			OTHERS		

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

Section III — PHYSICAL DATA

BOILING POINT (°F)	134°F (56.6°C)	SPECIFIC GRAVITY ($H_2O=1$)	0.79
VAPOR PRESSURE (mm Hg.) @ 20°C	180 @ 20°C 400 @ 39.5°C	PERCENT VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (n Butyl Acetate =1)	
SOLUBILITY IN WATER	Complete	Molecular Weight	58.08
APPEARANCE AND ODOR	Clear liquid	Autoignition Temp.	1002°F (538°C)

Section IV — FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED)	FLAMMABLE LIMITS	Lel	Uel
TOC -2°F (-19°C)		2.6	12.8

EXTINGUISHING MEDIA: Water spray, dry chemical, carbon dioxide

SPECIAL FIRE FIGHTING PROCEDURES: None

UNUSUAL FIRE AND EXPLOSION HAZARDS: None

Section V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: 1000 parts per million

EFFECTS OF OVEREXPOSURE: Eyes - moderately irritating

Skin - repeated/prolonged skin contact results in defatting of skin

Is this material a sensitizer? No

EMERGENCY AND FIRST AID PROCEDURES: For narcotic effects, remove to fresh air.

Skin contact - flush with water

Eye contact - irrigate with water

Section VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	XX	

INCOMPATABILITY *(Materials to avoid)*

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	XX	

Section VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Flush with large amounts of water; keep away from sparks and flames

WASTE DISPOSAL METHOD

Section VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*: None special

VENTILATION	LOCAL EXHAUST: XX		SPECIAL
	MECHANICAL *(General)*		OTHER

PROTECTIVE GLOVES: Rubber

EYE PROTECTION: Face shield/safety glasses

OTHER PROTECTIVE EQUIPMENT

Section IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Keep container tightly closed, keep away from sparks/fla

OTHER PRECAUTIONS: None

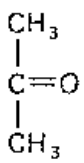
Acetone

Eastman Chemicals

SOLVENTS

Publication No. M-134A*

ACETONE



Typical Properties

Molecular Weight	58.08
Evaporation Rate (n-butyl acetate = 1)	7.7
Weight/Vol, 20°C,	
lb/gal (U. S.)	6.59
kg/liter	0.79
lb/gal (Imperial)	7.91
Solubility, 20°C, wt%	
In water	Complete
Water in	Complete
Dilution Ratio, toluene	4.6
VM & P naphtha	0.55
Refractive Index, 20°C	1.3589
Vapor Pressure, 20°C, mm Hg	180
Freezing Point, °F (°C)	−138 (−95)
Flash Point, Tag Closed Cup, °F (°C)	−4 (−20)
Tag Open Cup, °F (°C)	−2 (−19)
Fire Point, °F (°C)	−2 (−19)
Flammable Limits in Air, % by volume	
Lower	2.6
Upper	12.8
Autoignition Temperature (ASTM D-2155), °F (°C)	1000 (538)
NFPA Classification 30:	Flammable Liquid, Class IB
ICC Labels Required	Red
Bureau of Explosives Classification	Flammable Liquid

Replaces Eastman Publication No. M-134

Acetone is the simplest and the most important ketone commercially available. It is an economical, active solvent widely used in film casting, fiber formation, lacquers, inks, cleaners, and thinners. It is also a valuable raw material for chemical syntheses.

A fast-evaporating solvent, acetone has the ability to produce low-viscosity solutions of many polymers. One of the most active solvents for cellulose esters, it is used extensively in converting these polymers into films and coatings. Many formulations for cements, lacquers, artificial leathers, inks, and similar products contain acetone to dissolve cellulose nitrate. The solvent systems in formulations of paint and varnish removers, cosmetics and perfumes, airplane dopes, and liniments often include acetone.

Acetone is a valuable chemical intermediate, in fact, its largest use is in the production of acetic anhydride (through conversion to ketene which is then reacted with glacial acetic acid). Substantial quantities of acetone are also used as a raw material in the synthesis of solvents such as methyl isobutyl ketone, methyl isobutyl carbinol, and mesityl oxide. It is also an intermediate in the manufacture of bisphenol A, antioxidants, drugs, and resins such as the methacrylates and epoxies.

Combining economy and high solvency, acetone is sometimes used to replace all or portions of other active solvents in lacquer thinner formulations. Several properties of acetone important to lacquers are compared in the following table with similar properties of several other Eastman active solvents.

Eastman Solvent	Evap Rate	Blush Res., % R H @ 80°F (27°C)	Solution Viscosity, 25°C, cp		
			RS ½ Sec Cellulose Nitrate 10 Wt %	*Exon*[a] 470 Resin 20 Wt %	*Elvacite*[b] 2010 Resin 20 Wt %
Acetone	7.7	20	15	14	22
Methyl Ethyl Ketone	4.6	45	20	16	30
Ethyl Acetate, 85%	4.2	38	26	24	42
Isopropyl Acetate	3.0	69	38	29	59

[a] *product of Firestone Chemical Corp.*
[b] *product of E. I. du Pont de Nemours Co., Inc.*

Acetone is employed as a denaturant in several specially denatured alcohol formulas. Because of the high solubility of acetylene in acetone, the absorbent packaging used in acetylene storage cylinders often is saturated with acetone to avoid excessive pressures and thus provide safer handling and storage.

Acetone functions as a processing solvent in the manufacture of cellulose acetate fibers, photographic films, and skived acetate and pyroxylin plastics. Miscible in all proportions with water and organic solvents such as ethers, alcohols, and esters, acetone finds use as an extraction solvent in various recovery and purification processes for products such as vegetable oils, lubricating oils, and pharmaceuticals.

Eastman Sales Specifications*

Color (Pt-Co Scale), ppm, max	5
Specific Gravity, 20°/20°C	0.791 - 0.793
Acidity, as acetic acid, wt %, max	0.002
Boiling Range, 760 mm, °C	1.0° range including 56.1°
Acetone, wt %, min	99.5
Permanganate Time, hr, min	2
Nonvolatile Matter, g/100 ml, max	0.002
Iron	None
Halides	None
Water, wt %, max	0.5
Odor	Characteristic, nonresidual
Appearance	Shall be free from insoluble matter or haze

**Specifications are subject to change without notice. For current specifications, request Eastman Sales Specificanon No. 3512.*

Complies with ASTM Standard D-329-66

TOXICITY AND HANDLING PRECAUTIONS

Toxicity. Screening studies of the toxicity of acetone have been conducted by the Laboratory of Industrial Medicine, Eastman Kodak Company. The acute oral LD_{50} for mice was 4000-8000 mg/kg Exposure to vapor concentrations of 16,000 ppm caused the death of one of six rats in four hours.

Extensive human experience confirms the low toxicity of acetone. Inhalation of 2500-3000 ppm of the vapor causes minor irritation of the eyes and nose.[1] Skin absorption of acetone is very low. Because of its solvent action, defatting of the skin will occur from prolonged or repeated skin contact.

Handling Precautions. Acetone is extremely flammable and very volatile. Keep containers closed and away from heat, sparks and open flame. The threshold limit value for acetone is 1000 ppm.[2] Use with adequate ventilation. Prolonged or repeated skin contact should be avoided.

[1] *Patty, F. A., Industrial Hygiene and Toxicology, Vol. II, second edition, Interscience, New York. 1963.*
[2] *American Conference Governmental Industrial Hygienists, Threshold Limit Values of Airborne Contaminants, 1970.*

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET DEA

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917) Code: 065-4050

SECTION I

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO.
Allied Chemical Corp., Specialty Chem. Div.	(201) 455-2000
ADDRESS (Number, Street, City, State, and ZIP Code) P.O. Box 1087R, Morristown, NJ 07960	
CHEMICAL NAME AND SYNONYMS N,N-Diethylaniline	TRADE NAME AND SYNONYMS Same "DEA"
CHEMICAL FAMILY Aromatic Amine	FORMULA $(C_2H_5)_2NC_6H_5$

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS		N/A	BASE METAL		N/A
CATALYST		N/A	ALLOYS		N/A
VEHICLE		N/A	METALLIC COATINGS		N/A
SOLVENTS		N/A	FILLER METAL PLUS COATING OR CORE FLUX		N/A
ADDITIVES		N/A	OTHERS		N/A
OTHERS		N/A			

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
= .0609 LB/FL.OZ		
N,N-Diethylaniline	100	

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	215.5°C	SPECIFIC GRAVITY (H_2O=1)	N/A
VAPOR PRESSURE (mm Hg)	10 mm at 92.4°C	PERCENT, VOLATILE BY VOLUME (%)	N/A
VAPOR DENSITY (AIR=1)	6.7	EVAPORATION RATE (_____ =1)	N/A
SOLUBILITY IN WATER	Insoluble		
APPEARANCE AND ODOR	Yellow oil with amine odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
185°F	Unknown		

EXTINGUISHING MEDIA: Water (spray or fog), Carbon Dioxide or Dry Chemicals

SPECIAL FIRE FIGHTING PROCEDURES: No unusual procedures

UNUSUAL FIRE AND EXPLOSION HAZARDS: None

N,N-Diethylaniline (DEA)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Oral LD_{50} (rat) 0.98 cc/kg Skin LD_{50} (rat) 0.5-1.0 cc/kg

EFFECTS OF OVEREXPOSURE
Toxic by ingestion, skin absorption and inhalation of vapor and an eye irritant as defined by FHSA.

EMERGENCY AND FIRST AID PROCEDURES In case of contact, immediately remove all contaminated clothing, including shoes, and flush skin or eyes with plenty of water for at least 15 minutes; get medical attention. Wash clothing before reuse. If ingested, call a physician and, if conscious induce vomiting by giving a Tbsp of salt in a glass of warm water and repeat until vomit fluid is clear. Apply artifical respiration if not breathing. Keep patient warm and quiet.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID: Excessive temperature or heat.
	STABLE	X	

INCOMPATABILITY (Materials to avoid)
Oxidizing materials

HAZARDOUS DECOMPOSITION PRODUCTS
Information not available.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	Excessive temperature or heat.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash to sewer with plenty of water if governmental regulations will permit.

WASTE DISPOSAL METHOD
As above.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

VENTILATION	LOCAL EXHAUST: Vent to remove fumes	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES: Recommended use	EYE PROTECTION: Goggles

OTHER PROTECTIVE EQUIPMENT: Normal work clothes - Shirt and pants

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Store away from excessive heat and open flames. Use only with adequate ventilation. Keep container closed.

OTHER PRECAUTIONS
See precautionary label on drums.

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1357

MATERIAL SAFETY DATA SHEET (MEKP)

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO.
Noury Chemical Corporation	(716) 778-8554

ADDRESS (Number, Street, City, State, and ZIP Code)
2153 Lockport-Olcott Road, Burt, New York 14028

CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS
See Addenda Sheet	Cadox M-50

CHEMICAL FAMILY	FORMULA
Organic Peroxides	

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS N/A			BASE METAL N/A		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
Methyl Ethyl Ketone Peroxide	40-50	Unk.
Hydrogen Peroxide	0-5	1 ppm

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	N/A	SPECIFIC GRAVITY (H_2O=1)	1.17
VAPOR PRESSURE (mm Hg)	Unk.	PERCENT, VOLATILE BY VOLUME (%)	N/A
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (_____=1)	N/A
SOLUBILITY IN WATER	negligible		
APPEARANCE AND ODOR	Clear, Colorless liquid, slight odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
Closed Cup (seta) 180°C			

EXTINGUISHING MEDIA
See Addenda Sheet

SPECIAL FIRE FIGHTING PROCEDURES
See Addenda Sheet

UNUSUAL FIRE AND EXPLOSION HAZARDS
See Addenda Sheet

MEKP

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	Unknown
EFFECTS OF OVEREXPOSURE	Unknown
EMERGENCY AND FIRST AID PROCEDURES	See Addenda Sheet

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE	X	CONDITIONS TO AVOID
	STABLE		

INCOMPATABILITY *(Materials to avoid)*: See Addenda Sheet

HAZARDOUS DECOMPOSITION PRODUCTS: Unknown

HAZARDOUS POLYMERIZATION	MAY OCCUR	N/A	CONDITIONS TO AVOID
	WILL NOT OCCUR	N/A	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Spilled material must be absorbed onto vermiculite, perlite or absorbent earth and disposed of immediately. See Waste Disposal Methods.

WASTE DISPOSAL METHOD: See Addenda Sheet

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*: See Addenda Sheet

VENTILATION	LOCAL EXHAUST: Yes	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES: Yes	EYE PROTECTION: Yes

OTHER PROTECTIVE EQUIPMENT

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: See Addenda Sheet

OTHER PRECAUTIONS

(MEKP)

ADDENDA SHEET TO MATERIAL SAFETY DATA SHEET

CADOX M-50

SECTION I

Chemical Name - 9.0% Active Oxygen Methyl Ethyl Ketone Peroxide In Dimethyl Phthalate

SECTION III PHYSICAL DATA

Decomposition Temperature - Cadox M-50 may decompose violently with fire if maintained at a temperature of 145°F for extended periods of time.

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Extinguishing Media - Large fires are best fought using large amounts of water, preferably applied as a water fog or spray. Precautions must be taken to avoid distributing the burning material over a larger area when using a water jet. Dry chemical, foam or carbon dioxide extinguishers can be used on small fires.

Special Fire Fighting Procedures - If fire occurs near the peroxide, spray water on the peroxide containers to prevent overheating.

Continued exposure to heat can result in the formation of flammable vapors.

Unusual Fire and Explosion Hazards - In addition to heat, Cadox M-50 can also be ignited by contamination with acids and strong oxidizing or reducing agents including accelerators for polymerization reactions. See Section VI - "Materials to Avoid". Confined vapors can ignite with explosive force.

MEKP

SECTION V HEALTH HAZARD DATA

Emergency and First Aid Procedures - Contact with skin, eyes and clothing must be avoided. Prolonged inhalation of Cadox M-50 must be avoided. Contaminated clothing must be laundered before reuse.

In case of contact with skin, wash with soap and water; for eyes, immediately wash with plenty of water (every second is important) and consult a physician. In case of ingestion, immediately consult a physician and your local poison control center, identifying the material as methyl ethyl ketone peroxide solution in dimethyl phthalate containing a small amount of hydrogen peroxide.

SECTION VI REACTIVITY DATA

Stability - Although Cadox M-50 is stable at ambient temperatures, storage at temperatures above 145°F can result in violent decomposition. Storage in the original containers at 65 - 85°F is recommended. Stability is severely affected by contamination with other materials. Cadox M-50 is an oxidizing material which must be handled with care.

Conditions to Avoid - Cadox M-50 must be kept away from all sources of heat and ignition such as radiators, steam pipes, direct rays of the sun, open flames and sparks.

Incompatability - Materials to Avoid - Special care must be taken to avoid contamination with combustible materials, acids, strong oxidizing or reducing agents and accelerators for polymerization reactions, etc. Do not add accelerators such as cobalt naphthenate or dimethylaniline directly to this material as a vigorous decomposition may result.

SECTION VII SPILL OR LEAK PROCEDURES

Waste Disposal Method - Use a non-combustible material like vermiculite, perlite or absorbent earth to soak up spilled material. Using a non-sparking shovel, collect the saturated vermiculite and deposit in small shallow piles on newspaper located in an open, safe place. Ignite the newspaper with a lighted torch having a 6 foot handle and back away. No more than one pound of peroxide should be burned at one time.

SECTION VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection - A combination chemical cartridge and mechanical filter respirator should be used wherever spray application is taking place.

(MEKP)

SECTION IX SPECIAL PRECAUTIONS

Operating Precautions - Metering and Pumping - Pumping systems employed must be designed to prevent heat build-up and conditions of friction and pressure build-up. Friction caused by moving parts must be avoided.

Static Electricity - When working with this peroxide, precautions to reduce static electricity must be observed. All equipment must be grounded and high humidity conditions should be maintained where possible.

Suitable Handling Materials for Cadox M-50 - Only inert, non-contaminating materials must be used with peroxides. Polyethylene is a suitable material and is commonly used for piping or dispersing equipment. Stainless steel (Types 316 or 304), teflon or nylon are suitable for contact with peroxides.

Materials such as brass, stainless steel (type 400) iron and rubber should not be used.

CAUTION! Never mix accelerators such as cobalt octoate directly with Cadox M-50. This mixture can decompose violently. First, disperse thoroughly the required amount of accelerator into the resin. Then add and disperse the peroxide.

Diluents - For spray gun application or any other process requiring a more dilute form of Cadox M-50, diallyl phthalate, dimethyl phthalate, diacetone alcohol, methyl ethyl ketone, or ethyl acetate may be added to Cadox M-50. Do not use acetone as a diluent for methyl ethyl ketone peroxides.

Storage Areas - This peroxide must be stored away from the manufacturing area and separated from other combustibles or materials which could induce decomposition.

Drain thoroughly and flush empty containers with water before discarding.

Storage Temperature - Cadox M-50 should be stored in a cool place in the original containers. Storage temperature of 65 - 85°F is recommended.

For further information, write or call Noury Chemical Corp., 2153 Lockport-Olcott Road, Burt, New York 14028 716-778-8554.

The information contained herein is based on what we believe to be reliable data, but Noury Chemical Corporation makes no Warranties, express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Nothing contained herein is to be construed as a recommendation for use in violation of any existing patent, foreign or domestic, or of applicable laws and regulations.

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Budget Bureau No. 44-R1387
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Form No. LSB-005-4
May 1969

U.S. DEPARTMENT OF LABOR

WAGE AND LABOR STANDARDS ADMINISTRATION
Bureau of Labor Standards

MATERIAL SAFETY DATA SHEET (BPO)

SECTION I

MANUFACTURER'S NAME: Noury Chemical Corporation	EMERGENCY TELEPHONE NO.: (716) 778-8554
ADDRESS (Number, Street, City, State, and ZIP Code): 2153 Lockport-Olcott Road, Burt, New York 14028	
CHEMICAL NAME AND SYNONYMS: See Addenda Sheet	TRADE NAME AND SYNONYMS: Cadox 40E
CHEMICAL FAMILY: Organic Peroxide mixture	FORMULA:

SECTION II HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS N/A			BASE METAL N/A		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
Benzoyl Peroxide	40	5 mg/m³
Dibutyl Phthalate	45	5 mg/m³

SECTION III PHYSICAL DATA

BOILING POINT (°F.)	N/A	SPECIFIC GRAVITY (H_2O=1) at 25°C	1.152
VAPOR PRESSURE (mm Hg.)	N/A	PERCENT VOLATILE BY VOLUME (%)	7
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (=1)	N/A
SOLUBILITY IN WATER	Insol.		
APPEARANCE AND ODOR	White emulsion, slight odor		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	N/A	FLAMMABLE LIMITS	LEL	UEL
		N/A		
EXTINGUISHING MEDIA	See Addenda Sheet			
SPECIAL FIRE FIGHTING PROCEDURES	See Addenda Sheet			
UNUSUAL FIRE AND EXPLOSION HAZARDS	See Addenda Sheet			

(BPO)

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	5 mg/m^3 ' pure benzoyl peroxide
EFFECTS OF OVEREXPOSURE	Unknown
EMERGENCY AND FIRST AID PROCEDURES	See Addenda Sheet

SECTION VI REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID: See Addenda Sheet
	STABLE	X	
INCOMPATABILITY (Materials to avoid)	See Addenda Sheet		
HAZARDOUS DECOMPOSITION PRODUCTS	Biphenyl T. L. V. - 2 ppm 1 mg/m^3		
HAZARDOUS POLYMERIZATION	MAY OCCUR	-	CONDITIONS TO AVOID: N/A
	WILL NOT OCCUR	-	

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Any spilled peroxide should be cleaned up and burned immediately. See Addenda Sheet - Spillage and Waste Disposal Method.

WASTE DISPOSAL METHOD: See Addenda Sheet

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

VENTILATION -	LOCAL EXHAUST: None	SPECIAL
	MECHANICAL (General): N/A	OTHER
PROTECTIVE GLOVES: No	EYE PROTECTION: Yes	
OTHER PROTECTIVE EQUIPMENT: No		

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: See Addenda Sheet

OTHER PRECAUTIONS: See Addenda Sheet

(BPO)

SECTION VI REACTIVITY DATA

Stability - Although Cadox 40E is stable at ordinary handling and storage temperatures, storage below 80° F is recommended. Separation may occur if Cadox 40E is subjected to high temperatures for prolonged periods of time.

Conditions to Avoid - Although Cadox 40E exhibits reduced flammability compared to benzoyl peroxide paste, this product should be kept away from all sources of heat and ignition such as radiators, steam pipes, direct rays of the sun, open flames and sparks.

Incompatability - Materials to Avoid - Special care must be taken to avoid contamination with combustible materials, strong oxidizing or reducing agents, including accelerators for polymerization reactions. Do not add accelerators such as dimethylaniline directly to this material as a vigorous decomposition may result.

Hazardous Decomposition Products - When exposed to high temperatures, Cadox 40E can decompose to form biphenyl, a toxic flammable material (· 2 ppm 1 mg/m^3).

SECTION VII SPILL OR LEAK PROCEDURES

Waste Disposal Method - Use a non-combustible material like vermiculite, perlite or absorbent earth to soak up spilled material. Using a non-sparking shovel, collect the saturated vermiculite and deposit in small shallow piles on newspaper located in an open safe place. Ignite the newspaper with a lighted torch having a six foot handle and back away. No more than one pound of peroxide should be burned at one time.

(BPO)

SECTION IX SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing - Cadox 40E is a mild oxidizing material which must be handled with care. This peroxide must be stored in the original containers away from other combustibles or materials which could induce decomposition.

Suitable Handling Materials for Cadox 40E - Only inert, non-contaminating materials should be used with peroxides. Polyethylene is a suitable material and is commonly used in piping and disbursing equipment. Stainless steel (types 316 or 304), teflon or nylon are suitable for contact with peroxides. Materials which are susceptible to oxidation should not be used.

Operating Precautions - Metering and Pumping - Pumping systems employed should be designed to prevent heat build-up and conditions of friction and pressure build-up. Friction caused by moving parts should be avoided.

ADDENDA SHEET TO MATERIAL SAFETY DATA SHEET

CADOX 40E (BPO)

SECTION I

Chemical Name - Cadox 40E - 40% active peroxide emulsion composition. Active ingredient benzoyl peroxide $(C_6H_5CO)_2O_2$

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Extinguishing Media - Small fires are best fought using copious amounts of water. Precautions must be taken to avoid distributing the burning material over a larger area by suitable directing of water spray. For small fires, dry chemicals, foam or carbon dioxide (CO_2) extinguishers can also be used. For large fires, evacuate the area and apply water from a safe distance to cool down the surrounding area. If fire occurs near peroxides, spray water on the peroxide containers to prevent overheating.

Unusual Fire and Explosion Hazards - In addition to ignition by heat and flame, Cadox 40E may also be ignited by contamination with strong oxidizing or reducing agents, including accelerators for polymerization reactions. See Section VI - Materials to Avoid. Decomposition vapors are flammable and toxic.

SECTION V HEALTH HAZARD DATA

Emergency and First Aid Procedures - Contact with skin, eyes or clothing should be avoided. In case of contact with skin, wash with soap and water; for eyes, wash with plenty of water and consult a physician. In case of ingestion, administer an emetic and call a physician.

Appendix C.

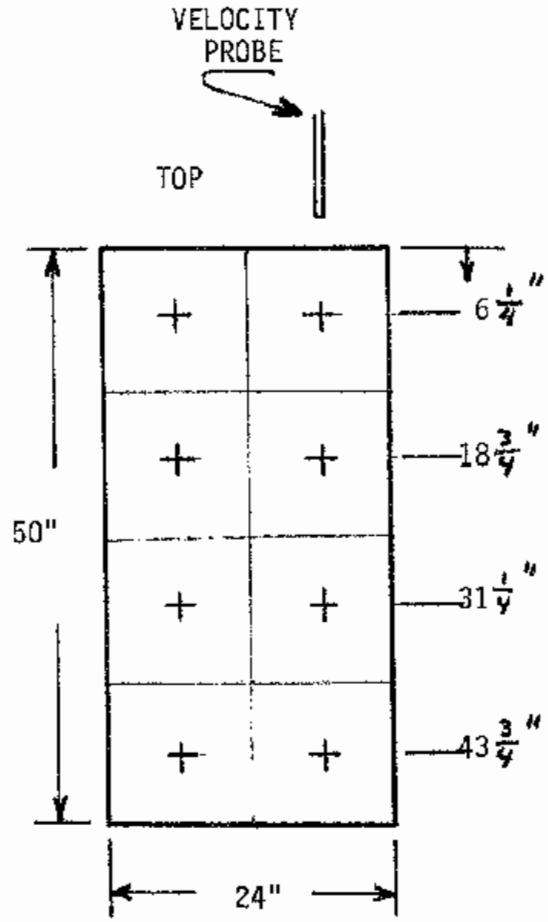
Air Velocity in Exhaust Ductwork

Velocity Traverse of Subfloor Exhaust Duct

Plant: Hatteras Yachts, Highpoint Operations Date: 9-8-82
Operation evaluated: Ducting, Boat hull molds 46'C & 43'C
By: Todd/Heitbrink

	Pitot Tube Traverse				TSI Velometer	
	Run 1		Run 2		Run 1	Run 2
POINTS	VP	VEL FPM	VP	VEL FPM	VEL FPM	VEL FPM
1	.055	938	.050	896	900	800
2	.050	896	.050	896	900	850
3	.040	801	.040	801	700	800
4	-	(800)	-	(800)	700	600
5	.045	848	.045	848	900	900
6	.040	801	.040	801	800	700
7	.020	566	.020	566	650	600
8	-	(566)	-	(566)	600	600
Average Vel.		777		772	769	731
CFM		3238		3217	3204	3046
Total CFM		6455			6250	

Note: Pitot traverse points 4 & 8 were not read due to the short probe. Values bracketed were proportioned to TSI Velometer data.



DUCT CROSS SECTION

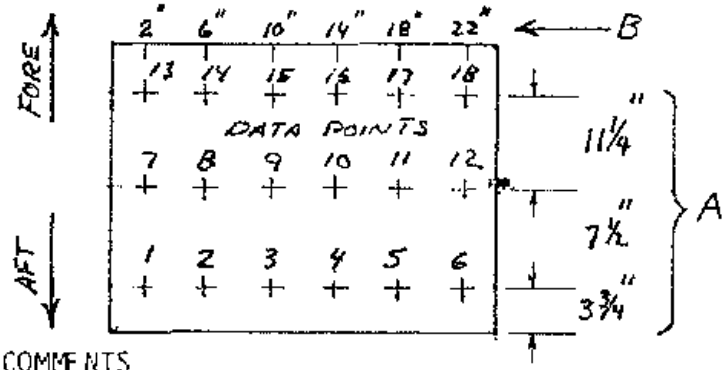
43'C HULL HOOD INLET FILTERS

HATTERAS YACHT CTA IN-DEPTH STUDY

VENTILATION DATA SHEET #

DATE 9-8-82 TIME 11:00 AM

DESCRIPTION OF DEVICE
43'C HOOD INLET FILTERS
ENTRY TO DUCTWORK
FILTER II (LEFT SIDE)



DATA POINT #	LOCATION A	LOCATION B	VELOCITY FPM	COMMENTS DIRECTION, TURBULENCE, etc.
1	3¾	2	800	THERE ARE TWO HOOD AIR INLETS
2	3¾	6	700	AT THE STERN OF EACH HULL MOLD.
3	3¾	10	800	EACH AIR INLET MEASURES 24" x 15½"
4	3¾	14	725	AND IS COVERED BY A FILTER WITH
5	3¾	18	600	THOSE DIMENSIONS. THE FILTER ON
6	3¾	22	700	THE STARBOARD (RIGHT) SIDE IS REFERRED
7	7½	2	700	TO HERE AS FILTER I. TO THE
8	7½	6	650	LEFT IS FILTER II.
9	7½	10	660	
10	7½	14	775	DATA WAS TAKEN BY:
11	7½	18	675	TODD AND HEITBRINK 9/8/82
12	7½	22	650	OBRIEN AND HEITBRINK 9/9/82
13	11¾	2	950	
14	11¾	6	750	
15	11¾	10	700	
16	11¾	14	750	
17	11¾	18	725	
18	11¾	22	725	
		Σ =	13035	AVERAGE VELOCITY = 724
				FILTER AREA = 2.58333
				FLOW = 1870 CFM

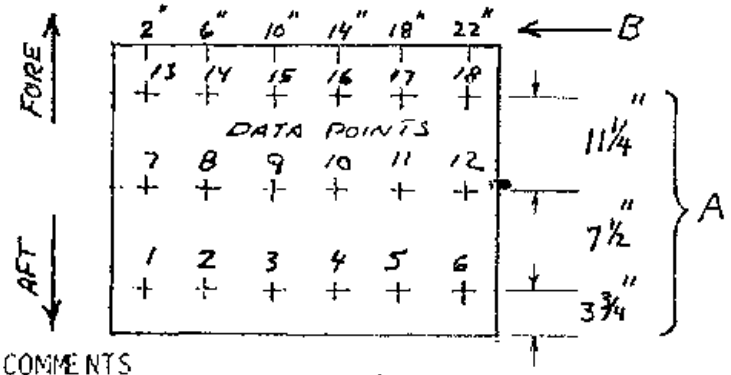
43'C HULL HOOD INLET FILTERS

HATTERAS YACHT CTA IN-DEPTH STUDY

VENTILATION DATA SHEET #

DATE 9-8-82 TIME 10:40 AM

DESCRIPTION OF DEVICE
43'C HOOD INLET FILTERS
ENTRY TO DUCTWORK
FILTER I (RIGHT SIDE)



DATA POINT #	LOCATION A	LOCATION B	VELOCITY FPM	COMMENTS DIRECTION, TURBULENCE, etc.
1	3¾	2	650	THERE ARE TWO HOOD AIR INLETS
2	3¾	6	600	AT THE STERN OF EACH HULL MOLD.
3	3¾	10	750	EACH AIR INLET MEASURES 24" x 15½"
4	3¾	14	525	AND IS COVERED BY A FILTER WITH
5	3¾	18	550	THOSE DIMENSIONS. THE FILTER ON
6	3¾	22	500	THE STARBOARD (RIGHT) SIDE IS REFERRED
7	7½	2	475	TO HERE AS FILTER I. TO THE
8	7½	6	615	LEFT IS FILTER II.
9	7½	10	600	
10	7½	14	550	DATA WAS TAKEN BY:
11	7½	18	500	TODD AND HEITBRINK 9/8/82
12	7½	22	550	OBRIEN AND HEITBRINK 9/9/82
13	11¾	2	625	
14	11¾	6	690	
15	11¾	10	730	
16	11¾	14	700	
17	11¾	18	575	
18	11¾	22	600	
		Σ=	10785	AVERAGE VELOCITY = 599
				FILTER AREA = 2.58333
				FLOW = 1547 CFM

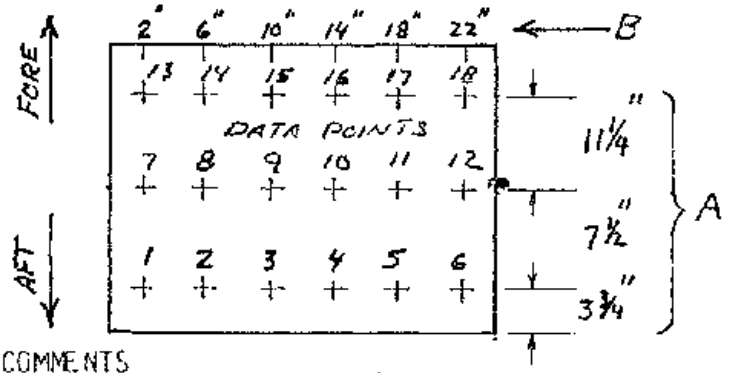
46' HULL HOOD INLET FILTERS

HATTERAS YACHT CTA IN-DEPTH STUDY

VENTILATION DATA SHEET #

DATE 9-9-82 TIME ____

DESCRIPTION OF DEVICE ____
46'c HOOD INLET FILTERS
ENTRY TO DUCTWORK
FILTER I (RIGHT SIDE)



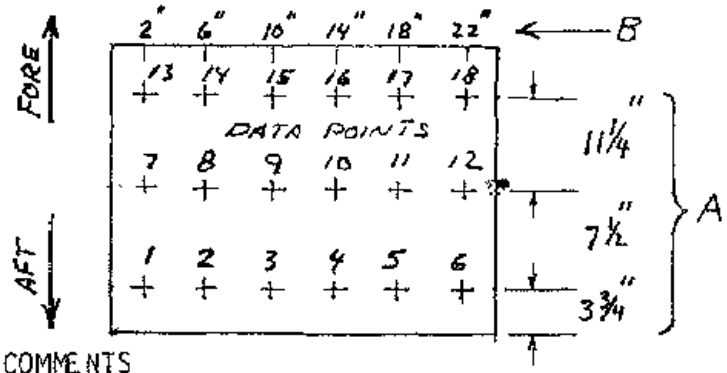
DATA POINT #	LOCATION A	LOCATION B	VELOCITY FPM	COMMENTS DIRECTION, TURBULENCE, etc.
1	3¾	2	550	THERE ARE TWO HOOD AIR INLETS
2	3¾	6	700	AT THE STERN OF EACH HULL MOLD.
3	3¾	10	650	EACH AIR INLET MEASURES 24" x 15½"
4	3¾	14	600	AND IS COVERED BY A FILTER WITH
5	3¾	18	630	THOSE DIMENSIONS. THE FILTER ON
6	3¾	22	600	THE STARBOARD (RIGHT) SIDE IS REFERRE
7	7½	2	540	TO HERE AS FILTER I. TO THE
8	7½	6	600	LEFT IS FILTER II.
9	7½	10	620	
10	7½	14	700	DATA WAS TAKEN BY:
11	7½	18	620	TODD AND HEITBRINK 9/8/82
12	7½	22	700	OBRIEN AND HEITBRINK 9/9/82
13	11¾	2	450	
14	11¾	6	600	
15	11¾	10	700	
16	11¾	14	650	
17	11¾	18	630	
18	11¾	22	600	
		Σ =	11140	AVERAGE VELOCITY = 619
				FILTER AREA = 2.5833 FT²
				FLOW (CFM) = 1600 CFM

HATTERAS YACHTS CTA IN-DEPTH STUDY

VENTILATION DATA SHEET #

DATE 9-9-82 TIME _____

DESCRIPTION OF DEVICE
46'C HOOD INLET FILTERS
ENTRY TO DUCTWORK
FILTER II (LEFT SIDE)



DATA POINT #	LOCATION A	LOCATION B	VELOCITY FPM	COMMENTS DIRECTION, TURBULENCE, etc.
1	3¾	2	550	THERE ARE TWO HOOD AIR INLETS
2	3¾	6	550	AT THE STERN OF EACH HULL MOLD.
3	3¾	10	550	EACH AIR INLET MEASURES 24" x 15½"
4	3¾	14	700	AND IS COVERED BY A FILTER WITH
5	3¾	18	700	THOSE DIMENSIONS. THE FILTER ON
6	3¾	22	550	THE STARBOARD (RIGHT) SIDE IS REFERRE
7	7½	2	500	TO HERE AS FILTER I. TO THE
8	7½	6	470	LEFT IS FILTER II.
9	7½	10	620	
10	7½	14	700	DATA WAS TAKEN BY:
11	7½	18	750	TODD AND HEITBRINK 9/8/82
12	7½	22	750	OBRIEN AND HEITBRINK 9/9/82
13	11¾	2	550	
14	11¾	6	520	
15	11¾	10	600	
16	11¾	14	600	
17	11¾	18	650	
18	11¾	22	650	
		Σ =	10960	AVERAGE VELOCITY = 609
				FILTER AREA = 2.5833 FT²
				FLOW = 1573 CFM