ETHYL CORPORATION

INTER-OFFICE

To	S. A. D'Armond	Address	Baton Rouge Plant
From	H. M. Taylor	Address	Baton Rouge Tower
Subject	Tank Car Repair Shop; Vapor Hazard	Date	November 1, 1973

Enclosed is the report which you requested of us to determine through a definitive approach the potential, if any, of fire hazard from paint vapors in the tank repair shop.

Two methods of evaluation for fire hazard are presented herein. The first, presents data and impressions resulting from field surveys of the shop. During the field survey, work air was tested for flammability with a gas indicator instrument. The second method presents a theoretical evaluation which considers whether the airborne quantity of flammable materials used within the paint area could build up within the shop in sufficient concentration to support flame.

We will be glad to respond to questions concerning the data and interpretations presented in the report.

H. M. Taylor
Industrial Hygienist

HMT:daw

cc: H. Bourque
R. Conrad
J. Klock
W. E. Rinehart, Sc. D

PLAINTIFF'S EXHIBIT
ETCO-782

ETH00003651

REPORT OF FLAMMABLE SURVEY AND EVALUATION OF THE TANK CAR REPAIR SHOP

BATON ROUGE PLANT

Survey Conducted By

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and
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REPORT FORMAT

BATON ROUGE PLANT

Components of a Fire System

A burning system interrelates a fuel, oxygen, heat and a chemical chain reaction. As presented herein, the potential for fire hazard within the tank car shed assesses the possibility for the union of oxygen with the required concentration of paint vapor in the presence of a required amount of thermal energy. The flammable component of the paint system used in the shop is contained in the paint vehicle. Usually, flammable airborne paint vehicle concentration ranges are expressed as percent by volume of fuel (vehicle) vapor in air at normal conditions of temperature and pressure through which a particular vapor with air will burn when ignited. Of this range, the minimum concentration required is indicated by lel for lower explosive or flammability limit. If any of the three components, oxygen, paint vehicle or heat is not present in the proper proportion, no fire will occur. Fire control in the tank car shed reduces to keeping the concentration of paint vehicle vapor below the lel. In addition the hazard control system should be backed up by a method to prevent ignition of abnormal pooled vapor concentrations, which might result from spills, by adequate control of all potential ignition sources, including those of electrical equipment.

Repair Shop Flammability Survey

The attached memo, Mr. R. Conrad to Mr. H. Bourque presents the survey data collected by plant personnel to which is added the survey data collected by central medical. It became apparent after instituting a plan for medical to check the repair shop lel incidental to other industrial hygiene purpose at the plant, that, painting activity within the shop would not always coincide with the time of industrial hygiene contact. It was therefore decided locate the survey instrument within the plant and instrument training was provided plant personnel by medical.

The indicator instrument used does not detect the presence of combustible mist or sprays. Hence the data does not reflect the flammability hazard close to the point where the paint spray leaves the spray gun. At this point an airborne suspension of tiny liquid droplets is formed as a result of pneuma atomization of paint particles within the spray gun. Of these droplets, chief concern for flammability is with the paint vehicle component which coats the tank cars since this represents most of the flammable material. However in the event some of this material should escape application to the tank car surface, this paint vehicle mist is subject to the same air dilution as the volatile vehicle which leaves the tank car surface during the paint drying process (paint drying was reported to take about eight hours). Consequently, the area immediately around and approximately ten feet down wind of the spray application process can be conceived to constitute a mist type of flammable hazard. Further away, the mist vaporizes and is subject to the same air dilution as that vaporizing from the surface of the drying tank car. Obviously, flame should be kept from the immediate spray point, since this area could contain vehicle vapor in concentrations within the flammable range.

Instrumentation

The instrument used was a M. S. A. Portable Combustible Gas (or vapor) Indicator; dual scale type, model 40.

Interpretation of Results

The instrument used was factory calibrated for flammability with pentane. Of the vehicle components in significant concentration xylol is of chief concern because of its relatively low flash point. At the levels found, 1% and below, a correction of 0.1 should be added to the pentane meter readings found to indicate airborne xylol concentrations.

Survey Impressions

1. Corrected meter readings indicate the maximum flammibility hazard found was 1.1% of the lel. Since the lel for xylol is 1.0 %, only 0.011 of the minimal amount of xylcl required for flammability was found.

THEORETICAL ANALYSIS

Table 1 identifies the paint vehicle component of each of the four paint systems used in the tank car repair shop. In each of these paint systems the flash point of the mixture as reported by the manufacturer is mostly influence by the xylol component. Consequently, it can be assumed the xylol componen represents the greatest flammability hazard. In addition, among the paint components, the vapor pressure of xylol requires a relatively large amount of dilution air per pint of paint to maintain airborne concentration below flammable levels. As presented herein, all of the vehicle with the exception of the liquid dryer, which is cobalt and lead, is considered to be xylol. This introduces quite a safety factor since other significant components possess, for the greater part, higher flash points and the same or smaller vapor pressures. For the purpose of this analysis, it is assumed the flammable vehicle, represented entirely by xylol, is released completely to the air within one hour. The attached drawing indicates the area of the paint repair shop - paint under roof covers 20 by 150 square feet. Theoretically, if the rectangular shape 20 by 100 square feet around the paint area were walled in the paint area would be isolated from the repair area and its welding flame. This theoretical and isolated paint area would enclose a volume of 20 by 100 by 20 or 40, 000 cubic feet.

Impressions

1. Table 1 indicates anywhere from 16, 000 to 40, 000 cubic feet of air is sufficient to dilute the solvent or paint vehicle, as now used within the paint area, to one fourth of their flammability levels. Because of

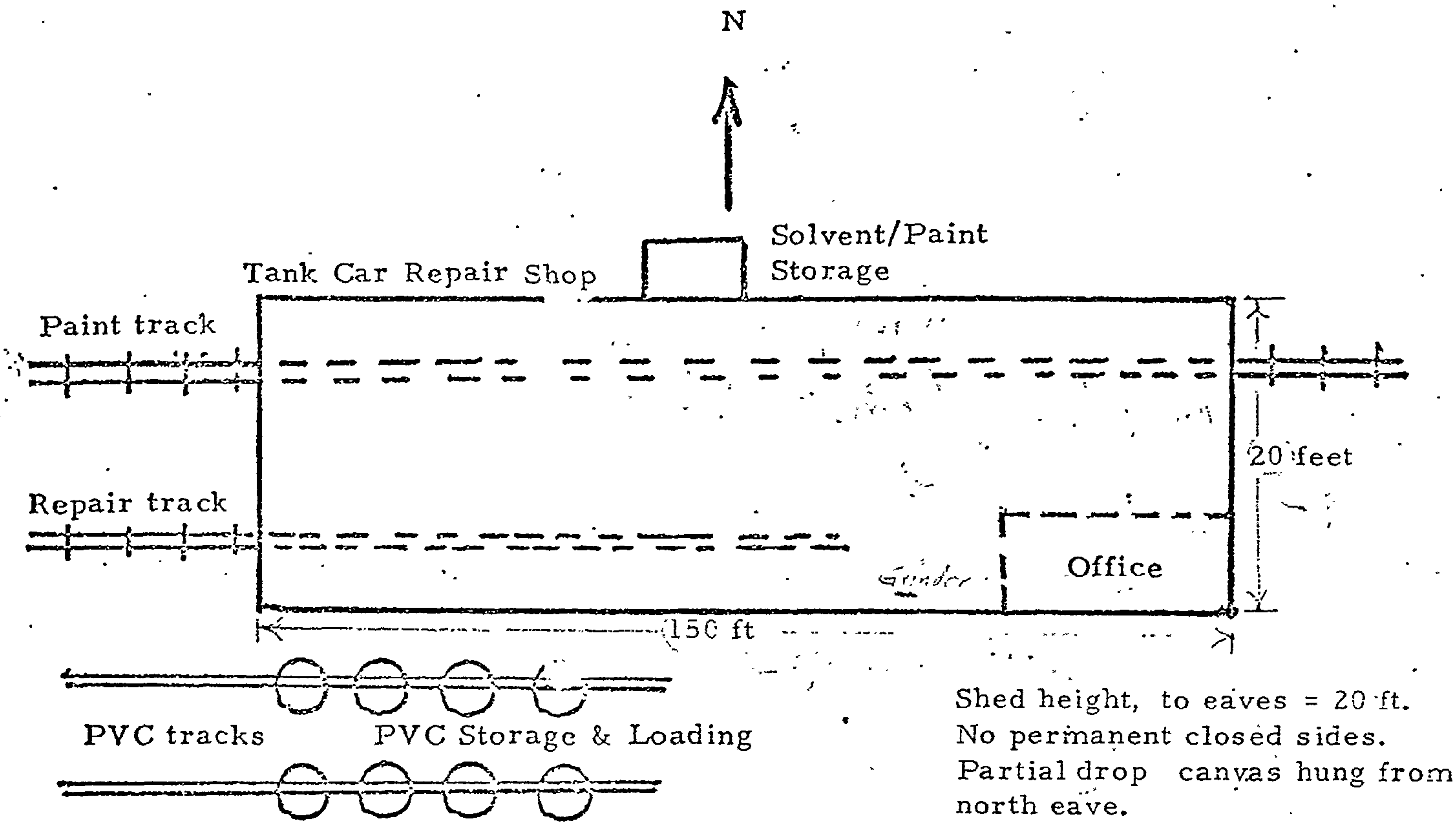
assumptions made herein, this number represents many t actual quantity of the air needed for effective air dilution n prevent fire. Hence, it can be conservatively concluded, evei -/ 3 of the shop were walled in to confine the 40, 000 cubic feet area and if some type of fan were provided to mix the confined air, it would not be possible to achieve a flammable concentration level of paint materials within the paint area. Furthermore, if paint vehicle fire is not possible within a theoretical confined space with no air turn over, it should be completely impossible within the same space when it is open and subject to greater amounts of natural air dilution.

Recommendations

1. Use a maximum of four gallons of anyone of the following materials; primer,gray enamel, black epoxy; or three gallons of black enamel; or two gallons of MEK in any one hour work period.
2. All electrical wiring within the tank car repair - paint shop including that to clocks etc. should be installed as if a class 1 hazard area did in fact exist.
3. The general location as defined by OSHA standards doesn't qualify as a spraying area. In section 1910. 107 (a-2) of the Department of Labor standards, a spraying area is defined as: "Any area in which dangerous quantities of flammable vapor or mist ... are present due to the operation of spraying processes." Dangerous quantities of vapors could not be demonstrated, even theoretically, and only that area in immediate proximity to the spray point could be remotely

construed as a flame hazard area. From this, it is recommended there should be no open flame, space heaters, steam pipes, hot surfaces or spark producing equipment within 20 feet of the point of spray. For conformance to OSHA, this 20 foot area should be posted and the incidental requirements of the OSHA section instituted. There is no ventilation system which could be more efficient than the present natural ventilation since hazardous vapors of aromatic hydrocarbons which include xylol, as tested for by length of stain technique, could not be identified at the 10 p.p.m. level.[1] The lower flammability level for xylol is a thousand times the level which could not be detected.

1 Using a M.S.A. Universal testing pump and gas detector tubes number 93074 whose effective range is 10 to 800 p.p.m.



ETHYL CORPORATION			
Industrial Hygiene Baton Rouge, Louisiana			
for Baton Rouge plant			
FLAMMABLE SURVEY TANK CAR REPAIR SHOP			
Drawn HT	10/24/73	200	
Scale None	Job 5	Drawing No.	Rev. # 1

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TABLE 1
TANK CAR PAINTS
BATON ROUGE

Paint Identity[1]	Vehicle Component(% of total wt.)		Flash Point (F°)	Pounds per gal.	Equivalent pts. of Xylol (1 pt. = 1.12 lbs.) per gal. of paint	Total cubic ft. of air per total pts. of equivalent Xylol required to dilute air to 25% of the lel at 100°F[5]
			>80	11.4		
Primer (No. 13R 402)	alked resin[2]	18.9	95	2.1	2.4	
	Xylol	17.6	80	2.0	2.2	31,000[6]
	aromatic hydrocarbon	17.6	142	2.0	2.2	
	liquid dryer[3]	0.6				
			≥80	9		
Gray Enamel (No. 26F 25)	alked resin	30.9	100	2.8	3.1	
	Xylol	1.5	80	.14	.16	
	alaphatic hydrocarbon[5]	40.9	81	3.7	4.1	40,000[6]
	aromatic hydrocarbon	1.6	142	.14	.16	
	calcium naphthanate	4.0		.36	.40	
	liquid dryers	<0.5				
			~80	7.84		
Black Enamel (No. 220J 32)	alaphatic hydrocarbons	53.6	81	4.2	4.7	
	alked resin	42.5	110	3.3	3.7	39,000[7]
	Xylol	1.0	80	.08	.09	
	liquid dryers	2.2				
			82	10.4		
Black Epoxy (No. 84J5)	phenolic ether resin	36.0	90	3.7	4.1	
	alcohol	1.1	68	.10	.11	
	ketones(MIBK)	5.8	73	.60	.67	37,000[6]
	nitrated alphatic hydrocarbon	3.7	103	.38	.42	
	Xylol	19.7	80	2.0	2.24	
	urea resin	1.4		.14	.16	
MEK (for solvent cleaning)		100	72	(pts. MEK) 16		16,000 for MEK

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1. All paints herein are Mobile Chemical Products.

2. Alked resin most often contains various combinations of tung oil, linseed oils, wood resin, phthalic anhydride and glycerin.

3. Liquid dryer consists of cobalt and lead.

4. See sample calculation below.

5. Alaphatic hydrocarbons here are a fast alaphatic naphtha.

6. Calculated as 4 gallons of paint.

7. Calculated as 3. 5 gallons of paint

Sample Calculation:

Cubic feet of air
dilution per minute

$$\text{(cfm)} = \frac{(403)(\text{sp. gr})(\text{pints evaporated per minute})(100)(\text{safety factor})}{(\text{molecular weight})(\text{lel})}$$

Assumptions:

1. The rate of vehicle release is the same as the rate of vehicle application which is considered here to be one hour. (This introduces a safety factor since it was reported the paint dries through approximately eight hours.)

2. All the vehicle is Xylol. (This introduces a safety factor since the other components are less flammable.)

3. All paint is applied within an hour. (This introduces a safety factor since it may take 4 to 8 hours.)

4. Assume a safety factor of 4, which effectively provides air dilution to reduce the concentration to 1/4 the lel.

Calculations:

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$$\text{cfm} = \frac{(403)(0.864)(0.103)(100)(4)}{(106)(1.1)} = 123 \text{ per gallon of paint}$$

corrected from 70°F to 100°F: $123\left(\frac{460+100}{460+70}\right) = 130$ cfm per gallon of paint at 100°F

130 X 4 X 60 = 31, 299 cubic feet per hour for four gallons of paint.