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# Report No. CG-D-16-87

# DEVELOPMENT OF A U. S. COAST GUARD CHEMICAL RESPONSE SUIT

Lieutenant Jeffrey O. Stull



July 1987

**Final Report** 

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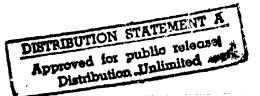
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### CHAPTER 1

### INTRODUCTION AND BACKGROUND

The U. S. Coast Guard is mandated by the Clean Water Act of 1977 (as amended in 1978) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) to respond to any chemical discharge into the waters of the United States. The Coast Guard also has the responsibility for inspecting and certifying marine chemical-carrying vessels. Finally, the Coast Guard provides assistance to the U. S. Environmental Protection Agency in the supervision of hazardous waste site cleanup and disposal. These missions require appropriate protection for Coast Guard personnel against a multitude of hazardous chemicals, especially those transported in bulk which are likely to be encountered in marine spills and during marine inspections. To aid spill response and monitoring, the Coast Guard developed its own Chemical Hazard Response Information System (CHRIS)<sup>1</sup>, which now defines the properties, hazards, and response techniques for over 1100 chemicals.

As the Coast Guard's role in chemical spill response grew, it found that for many CHRIS chemicals, commercial chemical protective clothing either did not provide adequate protection, or had little chemical data available to judge its performance. As a consequence, a formal research and development project was established in 1978 to develop new chemical protective clothing and equipment that would satisfy Coast Guard requirements. Part of this project was directed toward developing a totally-encapsulating chemical protective suit. The goals of the effort were to:

- select a material or group of materials for incoporation into a "uniform" suit design, which would provide broad protection against as many CHRIS chemicals as possible, and eliminate the need for a large inventory of different chemical protective suits;
- (2) design a suit which would accomodate different types of ancilliary protective equipment (breathing apparatuses, cooling devices, communications systems, and portable air monitors); and
- (3) overcome a lack of performance standards for commercial suits by completely documentating suit capabilities and limitations through thorough laboratory and field testing.

### Early Work

When the Coast Guard began its research effort, the majority of chemical protective suits available were constructed of butyl rubber with a polycarbonate visor. From these, the Coast Guard selected a suit manufactured by the U. S. Army for chemical warfare applications. This suit was modified for Coast Guard use and became known as the Hazardous Chemical Protective Clothing Outfit (HCPCO). An early Coast Guard study, "Material Development Study for a Hazardous Chemical Protective Clothing Outfit (CG-D-58-80),"<sup>2</sup> identified 400 CHRIS chemicals which required using a totally encapsulating protective garment and self-contained breathing apparatus for adequate protection. From this same study, measurements of material-chemical permeation indicated that butyl rubber and polyca-bonate were compatible with only 36% and 60% of these chemicals, respectively (for a three hour period).<sup>2</sup>

Recognizing the limitations of the HCPCO, the Coast Guard undertook the development of its own totally-encapsulating chemical protective ensemble to include the selection of compatible materials and the development of a suit design meeting its specific needs. This effort and the results described below are documented in the Coast Guard Final Report, "Early Development of a Easardous Chemical Protective Ensemble (CG-D-24-86)".<sup>3</sup> Several existing and state-of-the-art materials were screened by chemical repistance and physical property testing. This screening yielded two materials to supplement butyl rubber as garment materials in separate suits--Viton<sup>R</sup>/ chlorobutyl laminate and chlorinated polyethylene (CPE). In addition, a Teflon<sup>R</sup> fluorinated-ethylene propylene (FEP)/Surlyn<sup>R</sup> laminate was chosen to replace polycarbonate as the visor material for all three suit materials.

Each of the selected materials were subjected to extensive chemical resistance testing, including one-sided immersion testing against 160 representative CHRIS chemicals and permeation testing against 59 of those chemicals. The immersion testing results indicated few chemical effects on the Teflon<sup>R</sup> visor material, with Viton<sup>R</sup>/chlorobutyl laminate moderately affected, and chlorinated polyethylene greatly affected. No chemicals permeated the FEP Visor material within three hours, but the Viton<sup>R</sup>/chlorobutyl laminate and CPE exhibited breakthrough to 15 and 30 chemicals, respectively.

Prototype suits were constructed from each of the three materials and tested for integrity, function, and fit. All suit prototypes displayed a high level of integrity in both unmanned and manned tests where suits were placed in a closed chamber and exposed to a dioctyl sebacate (DOS) serosol. Nonetheless there was some uncertainty in the efficiency of the test protocol to accurately measure suit inward leakage rates since most chemical exposures involve chemical gases and vapors as opposed to aerosols. Function testing was conducted to simulate different physical tasks representative of hazardous chemical response activities. During these tests, various physiological parameters were measured under a number of environmental conditions to determine levels of heat stress and the effectiveness of a newly designed, water-recirculating cooling system. The results of these tests indicated that the suit enabled the warer to perform most functions, however, the effectiveness of the cooling system was judged questionable even though most test subjects indicated a "feeling of improved comfort" when wearing it. Fit tests identified improvements in the suit design in terms of dimensions, seaming, and placement of components.

Following the development contract, Coast Guard Engineering engaged in preparing specifications for each of the three suit materials (Viton<sup>R</sup>/ chlorobutyl laminate, butyl rubber, and chlorinated polyethylene) and the suit cooling system (described in reference 3). Despite the relative poor performance of CPE, it was retained in the Coast Guard's chemical protective suit "system" because of its resistance to inorganic acids and bases, and other chemicals with high spill frequencies. Concurrent with developing suit specifications, a new materials testing effort was launched to provide additional data on the selected materials.

### CHAPTER 2

### EXPANDED TESTING OF THE ORIGINAL MATERIALS

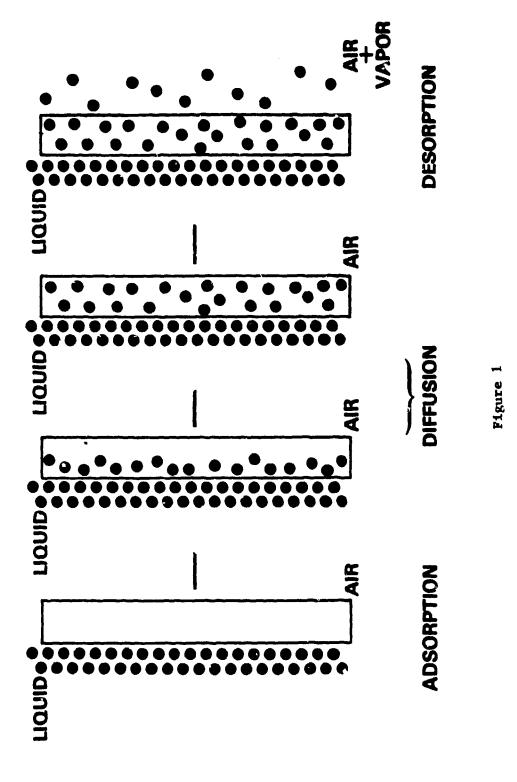
The Coast Guard RéD Center began to test the three garment and visor materials to further determine their resistance to other chemicals and mixtures under various conditions. Since the chemicals selected for testing in the development contract were only those chemicals incompatible with butyl rubber, one aim of this additional chemical testing was to determine whether Viton<sup>R</sup>/Chlorobutyl laminate and chlorinated polyethylene could provide the same protection as butyl rubber, i.e., using a two material suit system as opposed to a three material suit system. Other objectives included measuring chemical resistance against additional chemicals, and investigating the effects of temperature, chemical contact time, and mixtures.

In the previous Coast Guard development contract, material chemical resistance was assessed by two different methods---degradation resistance (innersion testing) and permeation resistance. Since that contract, the American Society for Testing and Materials (ASTM) established standard methods for measuring each material-chemical interaction. ASTM defines degradation as "the deterioration in a material of one or more physical properties upon surface contact by a chemical". Degradation resistance is measured by exposing a material sample to a chemical and noting changes in its physical properties. In previous testing, the Coast Guard measured weight gain (loss) and tensile elongation as well as noting changes in physical appearance. Permeation, on the other hand, is the flow of a chemical through a material on a molecular level (Figure 1 illustrates the steps in the permeation process). Permeation resistance is similarly measured by exposing the external surface of a material sample to a chemical, but involves measuring the time for the chemical to be detected on the other side (interior) of the material. This "breakthrough" time is characteristic of the material/chemical combination. Of the two methods, the Coast Guard decided to exclusively measure permeation resistance for determining material-chemical compatibility. Permeation testing is the preferred technique for cvaluating protective clothing materials since permeation can occur without visible evidence of degradation. A number of such cases were reported in the previous testing.

### Test Plan

A comprehensive test plan was developed to systematically evaluate material/chemical compatability and the conditions affecting perseation. Designing the test plan involved selection of priority chemicals, materials to be tested, testing methods, and ranges of each parameter<sup>4</sup>.

<u>Chemical Selection</u>. The list of 1100+ CHRIS chemicals was reviewed using criteria based on encapsulation requirements, toxicity, and spill frequency (history). Encapsulation requirements were taken from an earlier survey of CHRIS chemicals conducted for the Coast Guard by MSA Research Corporation<sup>2</sup>. Chemical toxicity was judged on the basis of carcinogenicity, skin absorption hazards, and various toxicity hazard ratings (such as those by the National Fire Protection Association), and divided into three groups (high, moderate, MATERIAL-CHEMICAL PERMEATION



and low). Priority chemicals are those with both a spill history and a need for encapsulating protection, and of olther high or moderate toxicity. Also included in the priority list are all chemicals of high toxicity whether or not these chemical need encapsulation or have a spill history. This oversil priority list includes 116 chemicals which are listed in Table 1. The specific selection criteria are documented in the Coast Guard Report, "Selection of Priority Chemicals for Permation Testing and Hagardous Chemical Spill Detection and Analysis<sup>7</sup>. Appendix A shows the groupings of these chemicals by priority classes. Additionally, preliminary parameter studies amployed an evolving battery of test chemicals. Table 2 lists the fifteen standard chemicals which have been adopted by the ASIM for material chemical testing.<sup>8</sup> These chemicals represent a range of chemical classes and properties.

Test Materials. The Coast Guard rested the selected materials-WitgaK/Chlorobutyl laminate, butyl rubber, and chlorinated polyethylene (CPE). These materials are described in Table 3. The majority of experiments in this study involved the Viton laminate and CPE since butyl rubber had boen thoroughly evaluated in the earlier investigation by MSA Corporation. ChemTech Rubber in New Haven, Connecticut, custom manufactured the Viton<sup>K</sup>/Chlorobutyl laminate using specifications developed by ILC Dover. The Viton<sup>R</sup> coating is used on the external surface whereas somewhat Inc. thicker chloroburyl is used on the inside of the suit. Chlorinated polyethylene material samples were provided by ILC Dover. ILC Dover's CPE is a proprietary blend fabricated for both increased integrity and heat sealing characteristics. Unlike the other materials, the CPE considered by the Coast Guard has no fabric substrate and consists of two plys bonded together. The previous study<sup>3</sup> demonstrated poorer chemical resistance for the supported CPE materials. Buty! rubber used in the testing conformed to MIL-C-12189 and was fabricated by Plymouth Rubber in Canton, Massachussetts.

Test Methods. ASTM Standard Method F739 or modified versions of this test method were used in all permeation testing.9 A diagram of the test cell apparatus is given in Figure 2. Typical data from a representative test are illustrated in Figure 3. Both permation breakthrough time and steady state permeation rate were generally measured, although, breakthrough time is primarily used to assess material performance. The test method does not specify the duration of the test, the collection medium, or the chemical detection method. A three hour test period was chosen for testing material/chemical permeation since three hours is considered the maximum suit life during a chemical exposure (though suits are generally worn for one hour or less). All tests were run for at least three hours with breakthrough times reported in minutes. When no chemical breakthrough was detected, tests were usually terminated at the end of three hours. A detection method and corresponding collection medium were selected for each priority chemical taking into account the analytical technique's sensistivity for detecting that chemical. Two collection media were used-air and water. Detection methods specified include gas chromatography (with either flame ionization, electron capture, or flame photometric detectors), colorimetric techniques, ion chromatography (anion or cation columns), use of specific ion electrodes, polarography, and infrared spectroscopy. Table 1 provides the recommended detection methods/collection media for the list of priority chemicals.

Ranges of Test Parameters. The parameters contact time, chemical state,

# LIST OF PRIORITY LIQUID CHEMICALS

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CHEMICAL	CHRIS CODE	ENCAPSULATION NEED? (a)	NO. SPILLS	HAZARD INDEX	NFPA INDEX	RECOMMENDED
					TUDEX	DETECTORS
Acetaldehyde	AAD	Yes	4	3	2	FID
Acetic Acid	AAC	Yes	13	3 3 3	2	FID
Acetic Anhydride	ACA	Yes	2	3	2	IR
Acetone	ACI	Yes	11	3	1	FID
Acetone Cyanohydrin	ACY	Yes	0	25	4	FID
Acetonitrile	ATN	Yes	2	3	2	FID
Acetophenone	ACP	No	0	1	1	FID
Acetyl Chloride	ACE	Yes	1	-	3	IR
Acrolien	ARL	Yes	1		3	FID
Acrylic Acid	ACR	Yes	10	3	3	FID
Acrylonitrile	ACN	Yes	12	15	4	FID
Adipontrile	ADN	Yes	4	4	2	FID
Ally1 Alcohol	ALA	Yes	2	2S	3	FID
Ally1 Chloride	ALC	Yes	0	2	3	HD, FID
Aniline	ANL	Yes	2	2	3	FID
Benzene Benzel Chin ti	BNZ	Yes	91	1	2	FID
Benzyl Chloride	BCL	Yes	1	2	3	FID
Bromine	BRX	Yes	0	-	4	PLRG, CLMT
n-Butyl Acetate	BCN	No	1	3	1	FID
n-Butyl Acrylate	BTC	No	1	3	2	FID
n-Butylamine	BAM	Yes	1	<b>2</b> S	2	FID
n-Butyl Alcohol	BAN	No	2 2	35	1	FID
Butyraldehyde	BTR	Yes		5	2	FID
Carbon Disulfide	CBB	Yes	0	2S	2	ECD
Carbon Tetrachloride	CBT	No	6	15	3	HD, ECD
Chlordane (25%)	CDN	Yes	3	-	-	ECD
Chlorbenzene	CRB	No	1	3	2	HD, ECD
Chloroform	CRF	Yes	3	1	2	HD, ECD
Chlorpicrin	CPL	Yes	Û	-	4	HD, ECD
Chlorosulfonic Acid	CSA	Yes	1	2	3	IC(A)
Creosote	CCT	Yes	0	5	2	FID
m-Cresol	CRL	No	33	35	3	FID, CLMT
Crotonaldehyde	CTA	Yes	0	2	3	FID
Cumene Hydroperoxide	CMH	Yes	0	-	1	FID
Cyclohexane	CHX	Yes	17	3	1	FID
1,2-Dibromoethane	EDB	Yes	0	15	3	HD, ECD
1,2-Dichloroethane	EDC	Yes	0	3	2	HD, ECD
2,2-Dichloroethyl Ether	DEE	Yes	0	25	-	HD, ECD
Dichloromethane	DCM	No	4	3	2	HD, ECD
1,2-Dichloropropane	DPP	Yes	2	3 3	2 2	FID, ECD
1,3-Dichloropropene	DPR	No	0	25	2	HD, ECD
Diethylamine	DEN	No	0	3	2 2	FID
Diethanolamine	DEA	No	2	3	-	FID
Dimethylsulfate	DSF	Yes	0	-	4	FPD
Diisopropylamine	DIA	No	0	25	3	FID
Dimethylformamide	DMF	No	0	35	1	FID

# TABLE 1 (Continued)

# LIST OF PRIORITY LIQUID CHEMICALS

CHEMICAL	CHRIS CODE	ENCAPSULATION NEED? (a)	NO. SPILLS	HAZARD INDEX	NFPA INDEX	RECOMMENDED DETECTORS
1,4-Dioxane	DOX	No	0	20		975
Di-n-Propylamine	DNA	Yes	0	2S 5	2	FID
<b>Epichlorohydrin</b>	EPC	Yes			3	FID
Ethion 4	3TO	Yes	1 1	2S	3	HD, ECD
Ethyl Acetate	BTA	No	1	-	•	PPD
Ethyl Acrylate	EAC	Тев	11	3 3	1	FID
Ethyl Alcohol	EAL	No	9	3	2	FID
Ethylamine (70%)	EAM	Yes		3	0	FID
Ethyl Benzene	ETB	No	3 3	2 3	3	FID
Ethylene Cyanohydrin	ETC	Υεε		5	2	FID
Ethylenedlamine	RDA	No	1 5	5 3	2	FID
Ethylene Glycol	EGL	No	23	3	3	HD, ECD
Ethyl Ether	EET	No	1	2	1	FID
Formaldehyde (37%)	FMS	Yes	17	3	2	FID
Furfural	FFA	No ·		1	2	CLT
Gasoline	GAT	No	1 0	3	2	FID
Glutaraldehyde(sol'n)		Yes		3	1	FID
Hexane	HXA	No	0	2	-	FID
Hydrazine	HDZ	Yes	4	3	1	FID
Hydrofluoric Acid	HFA	Yes	0	-	3	PLRG, CLMT
Hydrogen Peroxide	HPO	Yes	6	3	4	IC(A), CLMT
(30Ž)		168	2	-	2	CLMT
Isopropyl Alcohol	IPA	No	0	3	1	FID
Isopropylamine	IPP	Yes	0	2	3	FID
Malathion (50%)	MLT	Yes	2	-	-	FPD
Methyl Acrylate	MAM	Yes	1	3	2	FID
Methyl Alcohol	MAL	No	11	3	1	FID
Methyl Ethyl Ketone	MEK	No	6	3	1	FID
Methyl Isobutyl	MIK	Yes	5	3	2	FID
Ketone						
Methyl Methacrylate	MMM	No	3	3	2	FID
Methyl Parathion	MPT	Yes	1	-	4	FPD
Motor Fuel Additives	MFA	Yes	0	-	-	ECD
(Lead Alkyls)						
Naled	NLD	Үев	1	-	-	ECD
Mapthalene	MLT	No	10	3	2	FID
Nitric Acid	NAC	Yes	8	2	3	IC(A), CLMT
Nitrobenzene	NTB	Yes	1	2S	3	ECD
2-Nitropropane	NPP	Yes	0	1	1	FID ,FPD
Oleum	OLM	Yes	0	3	3	IC(A), CLMT
Parathion	PTO	Yes	1	-	4	FPD
Petroleum Ether	NSS	No	0	3	2	FID
Phenol	PHN	No	26	2S	3	FID, CLMT
Phosphoric Acid	PAC	Кр	22	3	2	IC(A), CLMT
Phosphorous Oxychloride	PPO	Yes	1	-	-	IC(A), CLMT

Oxychloride

### TABLE 1 (Continued)

### LIST OF PRIORITY LIQUID CHEMICALS

CHEMICAL	CPRIS CODE	ENCAPSULATION NEED?	NO. SPILLS	HAZARD INDEX	n <b>f</b> pa Index	RECOMMENDED DETECTORS
Phosphorous Trichloride	PPT	Yes	0	-	3	BCD
Polychlorinated Biphenyls	PCB	Yes	92	-	-	ECD
Proplonic Acid	PNA	No	1	3	2	FID
n-Propyl Alcohol	PAL	No	1	3	2	FID
n-Propylamine	PRA	Yes	Ö	â.	3	FID
Propylene Oxide	POX	No	1	2	2	FID
Silicon Tetrachloride	STC	Yes	0	3	-	BCD
Sodium Hydrosulfide	SHR	Yes	2	5 3	-	IC(A/Cat), CLMT
Sodium Hydroxide	CSS	Yes	0		3	IC(Cat)
Styrene	STR	No	59	2	2	FID
Sulfur Monochloride	SFM	Yes	1	-	2	IC(A), CLMT
Sulfuric Acid (95%)	SFA	Yes	128	3	3	IC(A), CLMT
1,1,2,2-Tetrachloro- ethane	TEC	Yes	0	2	3	HD, ECD
Tetrachloroethylene	TTL	No	0	3	2	HD, ECD
Tetraethyl lead	TEL	Yes	1	-	3	ECD
Tetraethyl pyrophosphate	TEP	Yes	1	-		FPD
Tetrahydrofuran	THF	Yes	4	3	2	HD, ECD
Tetramethyl lead	TML	Yes	0	-	3	ECD
1,1,1-Trichloroethane	TCL	Yes	5	35	2	HD, ECD
Trichloroethylene	TCE	Yes	5	2	2	HD, ECD
Toluene	TOL	No	81	35	2	FID
o-Toluidine	TLI	No	0	1	3	FID
Toluene-2,4- Disocyanate	TDI	Yes	0	2	3	FID
Turpentine	TPT	No	5	3	1.	FID
Vinyl Acetate	VAM	Yes	8	2	2	FID
Vinylidene Chloride	VCI	Yes	8	2	1	HD, ECD
Xylenes	XLM	No	92	3	2	FID
Xylenol	XYL	Yes	1	5	3	FID

(a) Need for encapsulating protection determined in reference (2).

(b) Number of spills reported in Coast Guard Pollution Incident Response System (1973-1983).

(c) Hazard Index is based on Chemical Toxicity Ratings reported in reference (5).
 1 is most toxic (carcinogen); 6 is least toxic; S - skin absorption hazard.

(d) NFPA Health Hazard Rating (from reference 6)

### TABLE 1 (Continued)

### LIST OF PRIORITY LIQUID CHEMICALS

(e)	Explanation of Detector Code and Cold	lection Media
	METHOD OF DETECTION	COLLECTION MEDIUM
	Gas Chromatographic Techniques	
	FID = Flame Ionization Detector ECD = Electron Capture Detector Hall = Hall Detector FPD = Flame Photometric Detector Colorimetric Techniques CLMT = Colorimetric standard method	air air air air water
	or commerical test kit based on specific chamical method Ion Chromatography	
	IC(A) = Anion column	water
	IC(C) = Cation column	water
	Other Techniques	
	SI = Specific ion electrodes PLRG = Polarography IR = Infrared spectrographic analysis	water water 5 air

LIST OF ASTM 31001 BECOMMENDED CHEMICALS

### Chemical

### Chemical Class

Acetone Acetonitrile Carbon Disulfide Dichloromethane Diethyl Amine Dimethylformamide Bthyl Acetate Hexane Methanol Nitrobenzene Sodium Hydroxide Sulfuric Acid Tetrachloroethylene Tetrahydrofuran Toluene

Ketone Nitrile Sulfur Containing Compound Chlorinated Parrafin Amine Amide Ester Aliphatic Hydrocarbon Alcohol Nitrogen Containing Compound Inorganic Base Inorganic Acid Chlorinated Olefin Orygen Heterocyclic Compound Aromatic Hydrocarbon

### OR GINAL SELECTED CHEMICAL PROTECTIVE SUIT MATERIALS

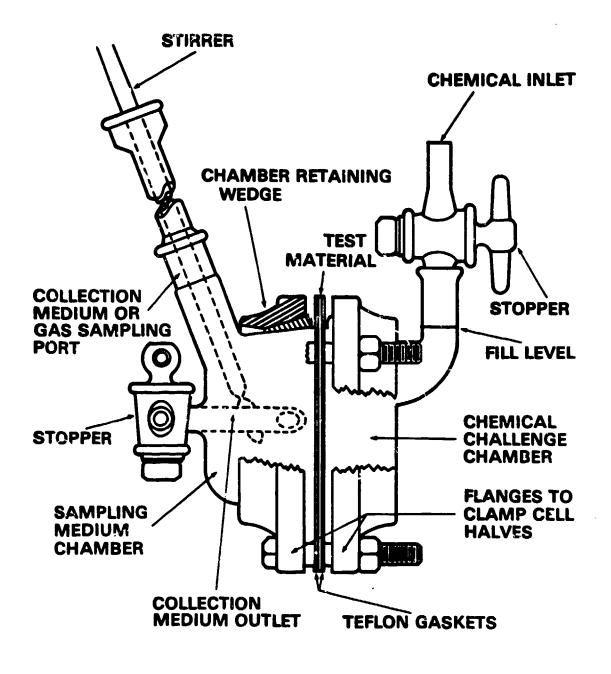
<u>Material</u> (Source)	<u>Colo:</u>	Thickness (mil)	Weight (oz/yd <sup>2</sup> )
Viton <sup>R</sup> /Chlorobutyl Laminate (ChemTech Rubber, New Haven, (	<b>T</b> )	13.8	14
Outer Coating: Viton <sup>R</sup> Substrate: Polyester	Orange-Red	4.7	5-6 3
Inner Coating: Chlorobutyl	Dark Grey	9.1	5-6
Butyl Rubber (Plymouth Rubber, Canton, MA)		14.0	13
Outer Coating: Butyl Substrate: Nylon Inner Coating: same as oute	Grey er coating	7.5	5-6 3
Chlorinated Polyethylene (ILC Dover, Frederica, DE)	White	27	19

No substrate, two ply, heat bonded film

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11

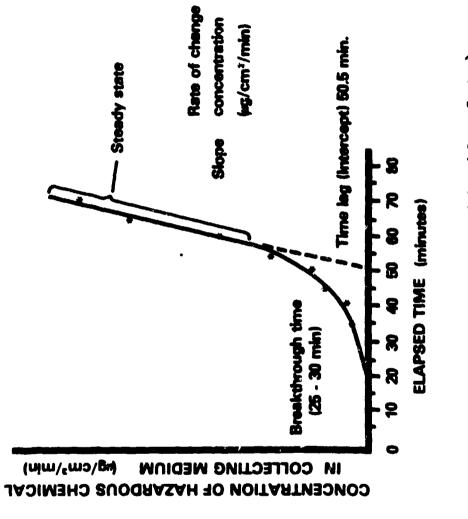
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## **PERMEATION TEST CELL**

Figure 2

# PERMEATION BREAKTHROUGH CURVE



Typical Permeation Test Output (Closed Loop System)

**Pigure 3** 

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### PERMEATION BREAK "HROUGH TIMES OF COAST GUARD CANDIDATE SUIT MATERIALS FOR SELECTED CHEMICALS

Chemical	Viton/CB <sup>b</sup>	Butyl Rubber <sup>b</sup>	CPBD
Acetaldehyde	30-40		10-30
Acatic Acid	No BT <sup>C</sup>	No BT	No BT
Acetone	52-77	No BT	20-25
Acetonitrile	90-105	No BT	80-85
Benzene			71-75
Carbon Tetrachloride	-		No BT
Chloroform	No BT	11-15	30-35
Cyclohezane	-		No BT
Dichloromethane	25-36	0-1	15-25
Dimethyl Sulfoxide	No BT		No BT
Ethyl Acetate	20-40		58-70
Ethyl Acrylate	14-32	34-45	65-70
Freon TF (113)	No BT	35-40	No BT
Hexane	No BT	13-16	No BT
Lindane in Chloroform	No BT	0-10	-
Lindane in Xylenes	No BT	80-90	
Methanol	No BT	No BT	No BT
Methyl Ethyl Ketone	25-40		28-35
Styrene	No BT	0-1	50-70
Tetrahydrofuran	9-11	7-14	27-39
Toluene	No BT	0-6	69-75

### Breakthrough times (minutes)a

- (a) Breakthrough times measured using ASTM F739-81 Standard Method with a Gas Chromatograph/Flame Ionization Detector (approximate sensitivity - 1 ppb).
- (b) The materials tested were as follows:
  - Viton/CB Viton/chlorobutyl laminate; 5 os/yd<sup>2</sup> viton (outer or exposed surface), polyester, and 5 oz/yd<sup>2</sup> chlorobutyl rubber (inner surface); 14 mil total thickness.
  - 2. Butyl rubber nylon butyl cloth as per Military Specification Mil-C-12189 (13 mil thickness)
  - 3. CPE Chlorinated Polyethylene, 30 mil thickness, unsupported
- (c) "No BT" denotes no breakthrough within three hour period.

### PERMEATION BREAKTHROUGH TIMES OF SEVERAL MATERIAL/CHEMICAL COMBINATIONS FOR VARYING EXPOSURE CONDITIONS

Breakthrough Time (mins.) Mccortal/Chemical Liquid Liquid Splash(a) Vapor 25°C Combination 0°C 12X 6X 17 Viton<sup>R</sup>/Culorobutyl laminate: **\$3-58** 43-58 73-78 94-100 Acetone 63-74 3 hrs. Dichloromethane 25-36 30-35 30-35 30-35 35-55 3 hrs. Methyl Ethyl Ketone 25-40 35-40 35-40 50-55 80-85 3 hrs. Tetrahydrofuran 9-11 11-17 11-17 11-17 35-45 3 hrs. Chlorinated Polylethylene: Acetone 32-35 50-53 68-72 75-85 130-140 3 hrs. Chloroform 30-37 46-50 81-86 120-125 132-138 **(b)** Dichloromethane 15-24 20-26 25-30 26-32 32-40 3 hrs.

40-45

39-45

(a) Liquid splash testing: 12X - one splash every 15 minutes; 5X - one splash every 30 minutes; 1X - one splash at beginning of test.

45-50

51-58

46-49

62-72

141-148

105-111

3 hra.

3 hrs.

(b) Test not performed.

28-35

27-39

Methyl Ethyl Ketone

Tetrahydrofuran

breakthrough time with varying contact (excluding vapor date). Figure 4 illustrates both phenomena graphically: the two cases on the left hand side of Figure 4 show increasing breakthrough times with decreasing contact while the right hand side gives two examples of nearly constant breakthrough time with changing chemical contact. It is interesting to note, that in some of the 12X and 6X splash testing, permeation breakthrough occurs before a majority of the individual splashes. For example, tetrahydrofuran breaks through Viton<sup>R</sup>/chlorobutyl laminate after the second splash in the 12X test and after the first splash in the 6X test.

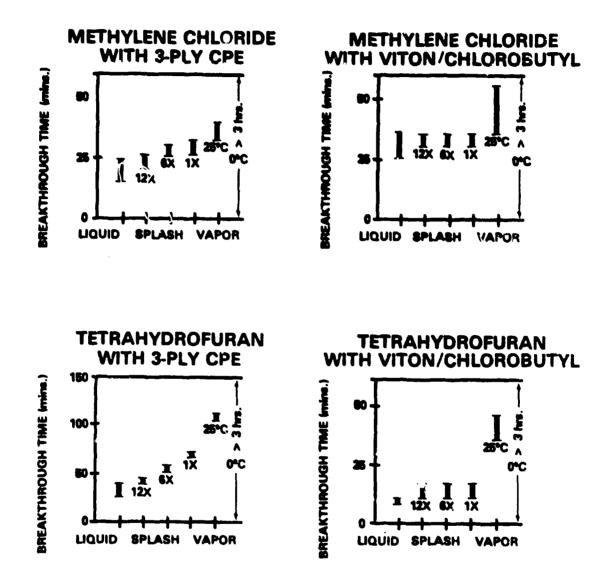
The expected behavior for reducing chemical contact with the material, is an increase in the permeation breakthrough time. If changing liquid contact has little effect on the breakthrough time, then the permeation of the material must be due to the initial 'wetting' of the material. It follows that this initial splash provides extended contact of the chemical with the material. It is therefore reasonable to postulate that the ability of the chemical to 'wet' the material is a factor in this phenomenon. An investigation of this factor is needed to establish if this behavior is predictable on the basis of chemical properties with respect to a particular material. Liquid versus vapor permeation generally followed the expected results for all material/chemical combinations tested.

### Temperature Effect Experiments

The ASTM Standard Method F739 states that permeation tests should be run at temperatures  $21 \pm 5^{\circ}$ C. Early in the work of this materials testing program, differences in permeation testing were being observed for tests run of different days. An examination of the ambient conditions for those days, showed small differences in temperature which affected permeation measurements (see Table 6). Table 7 shows results for measuring the effect of the temperature on the breakthrough time for two chemicals (dichloromethane and methyl ethyl ketone) against Viton<sup>R</sup>/chlorobutyl laminate. These breakthrough times were measured using a thermostated permeation test cell. As expected, permeation breakthrough time increases with decreasing temperature because molecular energy also decreases. The same trend is evident for vapors as well. Significant differences in breakthrough times are noted between the saturated vapors at 25°C and 0°C as reported in Table 5. No breakthrough occurred within three hours for any material/chemical combination tested at 0°C.

### Mixture Experiments

The permeation behavior of three simple mixtures against VITON<sup>R</sup>/ Chlorobutyl laminate was investigated. These included dichloromethane/hexane, dichloromethane/toluene, and acetone/hexane. Table 8 shows the results for both dichloromethane mixtures. In both cases, the second solvent (hexane or toluene) does not break through the laminate as a pure chemical whereas dichloromethane has a breakthrough time of 25 to 36 minutes. However, for a 50/50 (by volume) mixture of either dichloromethane and hexane or dichloromethane and toluene, both mixture components permeated the material samples. The breakthrough times were monitored by gas chromatography, therefore it was possible to distinguish individual breakthrough times for



Graphical Representation of Permeation Breakthrough Times Under Varying Exposure Conditions

Figure 4

### THE EFFECT OF AMBIENT TEMPERATURE ON PERMEATION BREAKTHROUGH TIME

Test Material	Temp (°C)	Acetone BT <sub>a</sub> (min)
Viton <sup>R</sup> /Chlorobutyl	20	95-98
Laminate	26.5	43-53
28 mil Chlorinated	22	32-35
Polyethylene	24.5	27-31

(a) BT - Breakthrough Time

### TABLE 7

### THERMOSTATED TEMPERATURE EFFECT ON DICHLOROMETHANE AND METHYL ETHYL KETONE PERMFATION BREAKTHROUGH TIMES FOR VITON/CHLOROBUTYL LAMINATE

Temperature (°C)	Breakthrough Dichloromethane	n Times (min) <sup>a</sup> Methyl Ethyl Ketone
5	8-10	180-199
15	6-8	80-85
25	4-4.5	35-45
35	3.5-4	20-25
45		14-20

(a) Breakthrough times measured using ASTM F739-85;
 Dichloromethane breakthrough measured with GC with ECD;
 MEK measured by GC with FID.

### PERMEATION BREAKTHROUGH TIMES FOR TWO BINARY MIXTURES AGAINST VITON/CHLOROBUTYL LAMINATE

Percentage CH <sub>2</sub> Cl <sub>2</sub>	No. Runs	Breaktho CH <sub>2</sub> C1 <sub>2</sub>	ugh Time (min) Hexane
In Hexane:			
100	1	25-36	
50	2	\$2-47	57-62
0 (100% Hexane)	4		no BT
In Toluene:			Toluene
100	1	25-36	
50	1	45-55	58-66
0 (100% Toluene)	1		no BT
وبالمتلا اليتمرية مالدي المشاعف يكار التربية المترازية المحاجية معاد الم			

each component. Again, for both mixtures, dichloromethane broke through first at a time somewhat longer than its normal breakthrough time for the laminate, with the second solvent permeating about 10 minutes later than the dichloromethane. It is suspected that the dichloromethane which readily permeates the Viton<sup>R</sup>/Chlorobutyl laminate, carries the second solvent through. This is a similar conclusion reached in previous investigations by Forsberg and Faniadis<sup>11</sup> and Mickelson, Roder, Berardenelli, and Cottingham<sup>12</sup>. The longer breakthrough time for the dichloromethane can be rationalized on the basis of dilution within the mixture.

The third mixture demonstrated rather unusual behavior. Table 9 shows breakthrough times for a number of different mixtures of acetone and hexane. Acctone has a normal breakthrough time of 53 to 61 minutes whereas hexane does not permeate the laminate within three hours. Yet any combination of hexane and acetone results in a significantly shorter breakthrough time. In fact, breakthrough time occurs within ten minutes of initial mixture contact with the laminate in many cases. Furthermore, both acetone and hexane break through the laminate simultaneously as detected by gas chromatography. Most of these experiments were repeated several times to verify this behavior. This synergistic effect of the two chemicals cannot be explained in terms of the individual effects on the material by the two chemicals. In an attempt to rationalize this behavior, it was postulated that acetone permeated the Viton<sup>R</sup> layer carrying with it the hexane. Then the hexane permeated through the chlorobutyl rubber layer, taking the acetone with it to be detected at the same time. This theory is consistent with the known chemical resistance of both laminate coatings discussed earlier in the paper. However, sophisticated experiments are needed in order to verify this explanation of the permeation behavior.

### Intermanufacturer Material Variability

Included in Table 10 are material compatability recommendations for Viton<sup>R</sup>/chlorobutyl laminate and chlorinated polyethylene that appear in the "Guidelines for the Selection of Chemical Protective Clothing"<sup>13</sup>. These recommendations are based on degradation and permeation data from vendors or laboratory test facilities; a material is recommended against a particular chemical if it shows no permeation or degradation within one hour. In comparing the recommendations against the data in Table 5, some cases exist where a material is recommended when the measured breakthrough time is less than one hour (Viton<sup>R</sup>/Chlorobutyl - carbon disulfide, dichloromethane; Chlorinated polyethylene - acetaldehyde, acetone). While there are some discrepancies, it is important to realize that material permeation resistance differs between formulations of the same generic material. Previous studies showed significant differences in breakthrough times to the same chemicals of different neoprene and nitrile rubber formulations<sup>14,15</sup>.

Of concern to the Coast Guard was its ability to specify materials with the same chemical resistance as measured on test samples. To make this determination, additional Viton<sup>R</sup>/Chlorobutyl laminate samples were fabricated by a different manufacturer (Fairprene) having nearly the same specifications as the original laminate. The only difference was the pigmentation of both coatings and the substrate (cotton polyester or nylon). Permeation testing was conducted with the various laminates for a number of

Percentage Acetone	No. Runs	Breakthrough <sup>a</sup> Time (min)
100	7	53-61
95	1	0-5
86	1	6-11
50	5	2-6
35	2	0-6
15	1	6-11
5	1	0-5
1	1	0-5
0 (100% Hexane)	4	nc BT (3 hrs.)

### PERMEATION BREAKTHROUGH TIMES FOR ACETONE/HEXANE MIXTURES AGAINST VITON/CHLOROBUTYL LAMINATE

(a) Breakthrough times reported for both acetone and hexane

### COMPARISON OF PERMEATION TEST DATA AGAINST MATERIAL SELECTION RECOMMENDATIONS

	Viton <sup>R</sup> /Chlorobutyl Laminate		Chlorinated Polyethylene	
Chemical	Breakthrough Time (min.)	GSCPC Recomm. <sup>a</sup>	Breakthrough Time (min.)	GSCPC Recomm.a
Acetaldehyde	30-40	N	10-30	R
Acetic Acid	No BT(b)	R	No BT	R X
Acetone	52-77	N	20-25	
Acetonitrile	90-105	N	8085	R X
Carbon Disulfide	11-15		8-10	N
Chloroform	No BT	R R	30-35	N
Dichloromethane	25-36	r N	15-25	N
Diethyl Amine	27-30	R		X
Diethyl Ether	1-10	N		R
Dimethyl Formamide	No BT	N		X
Dimethyl Sulfoxide	No BT	X	No BT	X
Ethyl Acetate	20-40	N	58-70	N
Ethyl Acrylate	14-32	N	65-70	N
Hexane	No BT	R	No BT	R
Methanol	No BT	R	No BT	R
Methyl Ethyl Ketone	e 25~40	N	28-35	N
Nitrobenzene	<b>170–18</b> 0	R	62	R
Sodium Hydroxide	No BT	R	No BT	R
Styrene	No BT	N	60-70	N
Sulfuric Acid	No BT	R	No BT	R
Tetrahydrofuran	911	N	27-39	N
Toluene	No BT	R	69-75	N

 (a) Material/chemical compatability recommendation from "Guidelines for the Selection of Chemical Protective Clothing (Schwope, Costas, Jackson, and Weitzman, 1985), pp. 37-71. Ratings are generalized as follows: R - recommended

- N not recommended
- X no data for recommendation

(b) "No BT" denotes no detection of breakthrough within three hour period.

\*\*\*NOTE: These reported breakthrough times are for illustrative purposes only and should not be used for selecting protective clothing in hazardous chemical response. chemicals. Table 11 reports the breakthrough times for the different Viton<sup>R</sup>/Chlorobutyl laminates. Most results are similar, but large differences were noted for acetone, acetonitrile, carbon disulfide, and dichloromethane among the tested laminates. Even when the specifications are exactly the same (laminates B and C), significant differences still observed. However, the most evident finding from this testing is the extent of material degradation visually observed on the exposed material samples of the newly prepared Viton<sup>R</sup>/chlorobutyl laminates. The Viton<sup>R</sup> layer of these material samples buckled, wrinkled, or softened with delamination of the overall material. None of these changes were seen during the testing of the original material. Table 12 summarizes the these visual observations.

An investigation of this phenomena revealed that several different types of Viton<sup>R</sup> are used in coating fabrics, and that each of these may be cured a number of ways using various additives. For example, Laminate A employed Viton<sup>R</sup> B while the Fairprene laminates were coated with Viton<sup>R</sup> A. Viton<sup>R</sup> A is a copolymer of vinylidene fluoride and hexafluoropropylene, whereas Viton<sup>R</sup> B is a terpolymer also involving tetrafluoroethylene. Each type of Viton can be cured a number of different methods with various acid acceptor systems, fillers, and processing aids. Each of these additives can affect the chemical resistance of the finished product.<sup>16</sup>

### Summary of Findings

The Coast Guard R&D Center's research found a number of material failures which caused concern for using these materials, even though, the three materials collectively represented the most effective combination to provide broad chemical resistance.<sup>3</sup> Although some findings merely reiterated or reinforced previous observations, taken collectively these findings provided important considerations for evaluating the viability of the three suit system and the formulation of specific suit material-chemical recommendations. In the past, such recommendations have been made on the basis of material performance based on permeation or degradation resistance testing within a specified time period. While this practice may result in a recommendation that has a large 'safety factor', the limited results of this study show that certain effects should also be considered. Among these are:

- 1. The chemical resistance of a material should be directly assessed. A material's chemical resistance cannot be assumed on the results of 'similar' (generic) materials. This implies that the material specifications cannot guarantee a material with a specific chemical resitance as other similar materials.
- 2. Liquid chemical permeation may or may not be affected by contact time (length of exposure). An indication should be provided for determining which material/chemical combinations are affected by contact time and those that are not. In general, one cannot assume that chemical splashes present a lesser hazard than continuous contact with a chemical over the duration of exposure. Therefore, the criterion of no breakthrough for one hour seems reasonable given the the large safety factor.

### PERMEATION I REARTHROUGH TIMES FOR FOUR VITON/CHLOROBUYTL LAMINATES

Chemical	A	<u> </u>	<u> </u>	D
Acetic Acid	No BT		No BT	
Acetone	43-53	176-186 (3)	75-121 (4)	40-45
Acetonitrile	90-105	No BT (2)		No BT (2)
Carbon Disulfide	11-15*		118-125 (2)*	
Dichloromethane	25-36 (3)	17-29 (3)	15-23 (5)	27-30 (2)
Dimethylformamide	No BT		No BT (2)	
Ethyl Acetate	20-40	-	19-27 (4)	
Hexane	No BT		No BT	
Methanol	No BT		No BT	
Nitrobenzene	170-180*		No BT (2)	
Tetrahydrofuran	4-11 (2)	15-27 (4)	11-27	9-14 (2)
Toluene	No BT		178-330 (3)	
Diethyl Ether	1-10		13 (2)	- <u></u>

\* Gas Chromatography with ECD

(#) = Number of Test Replicates

MATERIAL A - ILC Dover, Viton B on Polyester (orginal material) MATERIAL B - Fairprene, Viton A on Polyester (first sample received) MATERIAL C - Fairprene, Viton A on Polyester (first sample received) MATERIAL D - Fairprene, Viton A on Nylon

### QUALITATIVE EFFECTS OF :XPOSURE FOR VITON/CHLOROBUTYL LANINATES TO SOLVENTS

Observations made during standard permeation tests of Fairprene\* laminates with either cotton/polyester or nylon sCrim.

SOLVENT	COTTON/POLYESTER	NYLON
Acetic Acid	Liquid penetrated Viton layer -trapped at CB interface	
Acetone	Viton softened, buckled and bubbled. Thinned.	Some Viton flecks broken away
Acetonitrile	Viton material buckled, bubbled, softened and thinned	
Dichloromethane	No change to Viton; CB layer softened and became sticky	No change
Dimethylformamide	Viton tayer buckled, bubbled and delaminated from CB layer	
2-Ethoxyenthanol	Liquid penetrated Viton and was trapped between layers	
<b>Bthyl Acetate</b>	Liquid penetrated Viton and was trapped between layers	
Hexane	No change	
Tetrahydrofuran	Viton badly wrinkled, CB sticky and soft	Viton flecks broken away
Toltone	Some buckiling of Viton - minimal	

 $^{\prime}$  : TE: None of these changes were observed with the ILC Dover V1  $\sim$  /Chlorobutyl samples.

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- 3. Increasing temperature decreases (shortens) breakthrough time for both liquids and vapors. Some chemicals which do not break through at ambient temperatures, may permeate suit mat rials at elevated temperatures. Conversely, in cold environments, permeation is less likely.
- 4. Mixture behavior cannot always be prediced on the basis of individual mixture component chemicals. Moreover, mixture permeation can result in drawing other chemicals through materials that normally don't permeate those materials. It may be possible that synergistic mixture permeation may be the result of complex material laminates.

Since these findings are primarily based on the preliminary experiments for two materials, it is impossible to generalize the results to different material-chemical combinations. Nevertheless, they raised serious concerns for using the three material system. As a result, the Coast Guard decided to reexamine alternative materials before it decided to begin construction of the suits based on the two or three recommended materials.

### CHAPTER 3

### INVESTIGATION OF ALTERNATIVE MATERIALS

In 1984, the Coast Guard initiated a review of protective clothing materials to determine if new materials with greater chemical resistance could be identified. Ideally, the Coast Guard was seeking a single material which would provide at least the same chemical protection as the combination of Viton<sup>R</sup>/chlorobutyl laminate, butyl rubber, and chlorinated polyethylene. A single material offers the advantages of reducing production costs, and suit selection problems for mixtures and unknown chemicals. Moreover, increased barrier properties can result in a material where most contamination takes place on the surface making the garment easier to decontaminate and possibly reuse (Garment reuse, however, is predicated on effective field methods to measure levels of suit contamination before and after decontamination).

The Coast Guard solicited information from material suppliers to evaluate alternative materials. Evaluation criteria for comparing alternative materials<sup>17</sup> were divided into three areas:

- (1) Chemical resistance,
- (2) Physical properties, and
- (3) Fabrication feasibility.

Chemical resistance performance was evaluated using the ASTM standard method for measuring permeation resistance (F739) against a representative battery of test chemicals given in Table 2. A three hour period was specified to assess the compatability of test chemicals. Permeation breakthrough times were used to judge material performance. Physical property behavior was screened based on test methods and minimum performance levels established by Coast Guard Engineering (Table 13). The performance levels were derived from physical property testing on existing chemical protective clothing materials which had demonstrated adequate material integrity and durability in actual field usage. Lastly, the material supplier had to demonstrate their ability to fabricate strong, liquid-proof seams with the garment, visor, and closure tape materials. Testing in this area included measuring seam penetration resistance (ASTM F903-85<sup>18</sup>) for selected chemicals (water, Methyl Ethyl Ketone, Hydrochloric Acid, Toluene, and Hexane) and seam tensile strength.

The Coast Guard evaluated each of the submitted material data packages using the above criteria. Due to proprietary nature of the proposals, only the selected material is described in this report. Chemical Fabrics Corporation introduced three different Challenge<sup>TM</sup> materals. Each of these materials were proprietary, aramid-reinforced fluoroelastoplastic composites (more commonly known as Teflon<sup>R</sup> laminated Nomex<sup>R</sup>). All three materials had the same type of Teflon<sup>R</sup> coating but involved a different Nomex<sup>R</sup> fabric substrate. Challenge<sup>TM</sup> LU has a non-woven subtrate, whareas both Challenge<sup>TM</sup> EW and XHS employed woven substrates of different weights (4.5 and 6.0 ounces/yard<sup>2</sup>, respectively). The principal performance differences were found in the physical properties of these materials; only Challenge<sup>TM</sup> EW and XHS met the Coast Guard requirements for material tensile, tearing, and bursting strengths (Table 14). Challenge<sup>TM</sup> EW was selected over

### U. S. COAST GUARD SPECIFICATIONS FOR ALTERNATIVE PROTECTIVE CLOTHING MATERIALS

- A. <u>Chemical Resistance</u>: Measure and report permeation breakthrough time of the material using ASTM F739-85, "Standard Test Method for Resistancxe of Protective Clothing Materials to Permeation by Liquids and Gases" for the ASTM F1001-86 Chemicals listed in Table 2; Continue each test for three hours or until steady-state permeation is achieved.
- B. <u>Physical Properties</u>: The material shall meet the following physical property requirements:

Froperty	Test Method	CG Requirement(type)
Weight (oz/yd <sup>2</sup> )	ASTM D751-79	25 (max)
Thickness (mil)	ASTM D751-79	20 (max)
Tensile Strength (1bs/in.)	ASTM D751-79	80 Warp (min) 80 Fill (min)
Tear Strength (1bs)	ASTM D751-79	9 Warp (min) 10 Fill (min)
Busting Strength (psi)	ASTM D751-79	200 (min)
Abrasion Strength	FED STD 191A-5302	No loose fibers
Low Temp. Bending at -20°F	ASTM D2136-66	Pass
Flammibility	ASTM D568-68	Self-extinguishing

C. <u>Fabrication Potential</u>: Demonstrate ability to fabricate seams of garment material to garment material, garment to visor (5-10 mil Teflon<sup>R</sup> FEP), garment to closure tape (neoprene). Measure garment material seam strength using ASTM D751-79, "Standard Test Methods for Rubber Coated Fabrics" (CG Requirement-501bs.) and seam integrity using ASTM F903-85, "Standard Test Method for Resistance of Protective Clothing Materials to Penetration of Liquids (CG Requirement - Pass @ 2 psi for water, hexane, toluene, methyl ethyl hetone, and hydrochloric acid)

2	
<b>1</b>	
≤	

# PHYSICAL PROPERTY CHARACTERIZATION OF CHALLENGETH MATERIALS

PROPERTY	TEST METHOD	CHALLENGE LU	CHALLENGE EN	CHALLENGE XHS	REQUIREMENT
Weight (oz/yd)	ASTH D751-79	10.2	11.1	16.9	25 (max.)
Thickness (mil)	ASTM D751-79	15.2	14.1	18.4	20 (max.)
Tensile Strength (1bs./in.)	ASTM D751-79	46.0 (W) 29.8 (P)	(M) 113.7 (W) 95.8 (F)	218.5 (W) 184.5 (F)	80 (V) 80 (F)
Tear Strength (1b.)	ASTH D751-79	12.4 (W) 6.4 (F)	21.0 (W) 19.6 (F)	18.0 (W) 17.3 (P)	9 (W) 9 (T)
Bursting Strength (ps1)	ASTH D751-79	172.5	273.0	443.3	200
Abrasion Resistance	FED. STD. 191A-5302	No loo <b>se</b> fibers	No loo <del>se</del> fibers	No loose fibers	No loose fibers
Low Temperature Bend (-25°F)	ASTH D2136-66	Pass	Pase	Pass	Pass
Flamability	ASTM D568-68	Non-Burning	Non-Burning	Non-Burning	
Relative Cost Index		1.0	2.5	4.0	ł

Challenge<sup>TM</sup> XHS since its unit material cost was lower by a factor of 2 and still met Coast Guard physical property requirements. Challenge<sup>TM</sup> LU and EW eventually became known as Challenge<sup>TM</sup> 5000 and 5100, respectively.

Challenge<sup>TM</sup> 5100 exhibits a high level of chemical resistance and possessed equal or better physical properties relative to the Coast Guard's originally selected materials. Tables 15 and 16 show a comparison of this material's physical properties and permeation results with prior selected materials. Seam performance data provided by Chemical Fabrics Corporation showed garment material seams to have a tensile breaking strength of 95.5 lbs. (using ASTM D751-79) and as passing the ASTN Penetration Test. On the basis of this data, the Coast Guard elected to forego production of suits based on Viton<sup>R</sup>/chlorobutyl laminate, butyl rubber, and chlorinated polyethylene, and instead redirected its suit development effort for fabricating suits using the new Challange<sup>TM</sup> 5100 material.

The Coast Guard also adopted a Teflon<sup>R</sup> FEP visor which facilitated suit fabrication while eliminating lamination difficulties inherent to the FEP/Surlyn composite. Additionally, different Teflon<sup>R</sup> glove material were chosen and evaluated for use in the Coast Guard Chemical Response Suit. The Coast Guard opted for Teflon components in the suit design where possible to provide a suit with improved uniformity in chemical resistance throughout the garment. The only two major non-Teflon components are the suit closure (a neoprene-brass pressure sealing sipper) and exhaust valves (nylon and silicone rubber).

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## PHYSICAL PLOPERTY REQUIREMENTS AND DATA FOR CANDIDATE CARNERY NATERIALS

			Nateriale <sup>8</sup>	als.		
Property (Units)	Teat Nethod	Coast Guard Requirement	Chloriasted Polyethylene	Butyl Rubber	Vitou <sup>R</sup> / Chlorobutyl	Challenge <sup>TH</sup> 5100
Height (oz/yd <sup>2</sup> )	ISTA MTEA	25 (max.)	19.3	13.6	15.3	11.4
Thickness (sil)	ASTH D75h	20 (mex.)	20	14.2	19.0	18.1
Tensile Strength (lb/in) w - warp; f - fill	<b>FID. ST</b> U. 191 <b>A,</b> 5102	80 v (min.) 80 f (min.)	(#) (8) 99 (f)	135 (w) 86 (f)	25 (E) 25 (E)	114 (w) 96 (r)
Tear Strength (lb/in)	<b>FID. STD.</b> 1914,5134	9 w (mim.) 10 w (mim.)	13 (w) 17 (f)	9.5 (w) 15.5 (f)	9.7 (w) 11.0 (f)	9.6 (w) 10.0 (f)
Hydrostatic Resistance (pai)	<b>710. 510.</b> 191 <b>A</b> ,5512	200 (eta.)	200	325	385	315
Abrasion (gms lost) H-18 Wheel, 600 cycles	710. 510. 1914,5306	0.30 (max.)	.39	16,	<b>8</b> 40	.05
Stiffmess - Warp (cm)	7720. 5770. 1914,5200	5.0 (mir.)	No data	No data	Ko data	4.5
FlammaMility Ignition Time (mec.) Burn Fiame (mec) Burn Distance (cm)	4511 9568°	ses pote c	87 6.7	0.8 22 8.0	0.8 47 7.5	Dees not ignite 1/1 1/2
Low Temperature Bending Homent (H-m)	<b>723. 570.</b> 191 <b>A.</b> 5202	0.025 (max.) € 0.037 0°F (60° 4ef.)	0.037	0.006	No data	0.019
<sup>4</sup> Ail miterials have fabric pupports; data for first three materials from ref. (3).	Labric support	te: data for fire	t three muterial	a from ref.	(3).	

"All unterfale have fabric supported data for first three untarfale from ref. (J). "Reposed fibers of the base untarfal appeared after 600 cycles CA modified form of ASTM D566 is used to measure fizemability; Exposure conditions of PED STD 1914, Mathod 5903 are used with measurement of ignition time, burn time, and distance burn. The Const Generi is in the process of establishing a quantizative requirements for these parameters. The current requirement specifies that material is self-extinguishing.

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### COMPARISON OF PERMEATION RESULTS FOR CHLORINATED POLYETHYLENE, VITON/CHLOROBUTYL LAMINALS, AND CHALLENGE 5100

	Chlorinated Polyethylene	Viton <sup>R</sup> /Clorobutyl Laminate	Challenge <sup>TM</sup> 5100
Acetic Acid	No BTD	No BT	No BT
Acetone*	20-25	43-53	No BT
Acetonitrile*	80-85	90-105	No BT
Benzene	71-75	No BT	No BT
Carbon Disulfide*	8-10	11-15	13-23
Dichloromethane*	1 <b>5-</b> 25	25-36	35-45
Diethyl Amine*		27-33	No BT
Diethyl Ether		1-10	No BT
1,2-Dichloroethane	15-25	No BT	No BT
Dimethyl Formamide*		No BT	No BT
Dimethyl Sulfoxide	No BT	No BT	No BT
Ethyl Acetate*	60-70	20-40	No BT
Ethyl Acrylate	14-32	34-45	No BT
Freon TF	No BT	No BT	No BT
Hexane*	No BT	No BT	No BT
Methanol*	No BT	No BT	No BT
Methyl Ethyl Ketone	28-35	25-40	No BT
Nitric Acid (conc.)	No BT	No BT	No BT
Nitrobenzene*	60-70	170-180	No BT
Sodium Hydroxide (50%) <sup>,</sup>	No BT	No BT	No BT
Styrene	<b>60-</b> 70	No BT	No BT
Sulfuric Acid (conc.)*	No BT	No BT	No BT
Tetrachloroethane	60-70	No BT	No BT
Tetrachloroethylene*			No BT
Tetrahydrofuran*	27-39	9-11	No BT
Trichloroethylene	10-15	25-30	108-143
Toluene*	69-75	No BT	No BT

### Breakthrough Time (minutes)<sup>a</sup>

(a) Breakthrough times determined using ASTM F739-81. Blanks indicate the absence of data; breakthrough times are presented as ranges due to the imprecision in determining actual breakthrough time; breakthrough time is heavily dependent of the analytical sensitivity of the detector used.

(b) No BT denotes no breakthrough detected for a three hour period.
 \* ASTM F1001 Chemicals.

### CHAPTER 4

### SELECTION AND TESTING OF SUIT COMPONENTS

With the selection of Challenge<sup>TM</sup> 5100, the Coast Guard was able to achieve a "one-suit system" for encapsulating chemical response. Choosing other materials with similar chemical resistance was paramount to providing uniform chemical resistance for the entire garment. To this end, the Coast Guard adopted a Teflon<sup>R</sup> FEP visor which facilitated suit fabrication while eliminating lamination difficulties inherent to the FEP/Surlyn composite tested earlier.<sup>3</sup> Additionally, different Teflon<sup>R</sup> glove materials were chosen and evaluated for use in the Coast Guard Chemical Response Suit. Unfortunately, some critical parts of the suit were not available in Teflon<sup>R</sup> type materials. These include both the suit closure (a neoprene-brass pressure sealing zipper) and exhaust valves (nylon and silicone rubber). However, Coast Guard Engineering was able to design suit features which protect these components from chemical exposure. Suit design and overall suit testing are discussed in the Chapter 5.

### Testing Strategy

The selection of the Challenge<sup>TM</sup> 5100 and Teflon<sup>R</sup> materials was based on limited data against a small number of representative chemicals. In order to support the development of a Challenge<sup>TM</sup> suit, and its use in the field, the Coast Guard initiated an extensive testing program that would document the performance of the overall suit, its materials and components.<sup>19</sup> This testing program encompasses an examination of all primary suit materials (garment, visor, and glove), critical suit seams, and suit components (closure and exhaust valves). The final goals of this test program are:

- (1) to integrate test data for assessing overall suit performance, and
- (2) to establish suit use recommendations against priority chemicals.

Material performance was further characterized in terms of chemical resistance to a larger set of chemicals under various conditions, and in terms of additional physical property or functional testing. In general, each material and component should be tested in the same fashion and against the same chemicals. Practically, this is difficult due to the enormous size of the test matrix. Therefore, the Coast Guard adopted the philosophy of first testing the garment material against a large set of priority chemicals and then testing other primary materials and seams against a smaller subset of the priority chemicals. In this manner, material performance can be compared and judgements can be made on how to extend the testing of suit materials to more chemicals. Table 17 provides this matrix of suit materials/ components, types of testing, and chemical batteries covered in this report. Eventually predictive models will be necessary to overcome large testing demands and the problems of making suit use recommendations for mixture exposure.

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### SUIT MATERIAL/COMPONENT TEST MATRIX

Material/Component	Type of Test	Test Chemical/ or Properties
Garment Material	Permeation <sup>a</sup> Strength	<pre>115 Priority Liquids 25 Priority Gases* Variable effects on Selected     Chemicals (temp., contact time,     pressure, mixtures)** Tensile, Tear, Bursting</pre>
	Resistance Other Phys. Prop.	Abrasion*, Cut*, Puncture* Stiffness, Flammability Low Temp. Performance
Creased Garment Mat'l	Permeation	ASTM F1001 Chemicals
Visor Material	Permeation	ASTM F1001 Chemicals plus chemicals permeating garment material
	Strength	Tear, Stiffness, Bursting*
	Resistance	Abrasion/Clarity
	Other Phys. Prop.	Light Transmission, Flammability <sup>*</sup> Low Temp. Performance <sup>*</sup>
Creased Visor Mat'l	Permeation	ASTM F1001 Chemicals
Inner Glove Material	Permeation Strength Resistance Other Phys. Prop.	ASTM F1001 Chemicals Tear, Bursting <sup>*</sup> Abrasion Stiffness, Flammability Low Temp. Performance
Outer Glove Material	Degradation <sup>b</sup>	ASTM F1001 Chemicals
Critical Suit Seams	Penetration <sup>C</sup> Permeation Strength	Water, MEK, HC1, Hexane, Toluene ASTM F1001 Chemicals Tensile, Dead Load
Suit Closure (Zipper)	Penetration Degradation Strength	Water, MEK, HC1, Hexane, Toluene ASTM F1001 Chemicals* Tensile, Bursting*

\*

Test will performed in future study Tests will conducted in study beginning August 1987 \*\*

(a) Permeation Resistance measured using ASTM F739 over three hour period

(b) Degradation Resistance measured using draft ASTM F23.30.03 method
 (c) Penetration Resistance measured using ASTM F903

### Garment Material Evaluation

General Chemical Resistance Testing. The garment material comprises more than 75% of the total exposed surface area for the Coast Guard Chemical Response Suit. The Coast Guard Research and Development Center and its contractor, Texas Research Institute (Contract No. DTCG39-86-A-80331), tested the Challenge<sup>TM</sup> composite against 111 priority liquid CHRIS chemicals using ASTM F739 for measuring permeation resistance (6 priority chemicals were not tested due to their availability or destructiveness on the test apparatus; data for Methyl Isocyanate was provided by NIOSH18). The chemicals tested were the same chemicals described in Chapter 2 with their selection based on encapsulation requirement, spill frequency, and toxicity. The contractor established a unique method involving a continuous photoionization detector to measure material permeation parameters and minimum detection limits for each of the chemicals. Initially, each test against a respective chemical was run using three permeation cells operated in parallel, such that the output from each permeation cell went to the detector simultaneously. If any permeation breakthrough was detected, the tests were repeated with three individual test cells run singly. This arrangement was devised to minimize the time in conducting permeation tests with the expectation that few chemicals would permeate Challenge<sup>TM</sup> 5100. Their apparatus and methods are described in Appendix B.

In general, most tests were conducted for a minimum of three hours. However, several tests were extended beyond the three hour test period when permeation of the material was expected for a particular chemical. This testing identified ten chemicals that permeate the garment material within a three hour period; of these, three chemicals exhibit breakthrough in one hour (see Table 18). Data for all chemicals tested are listed in Table 19. This data include the breakthrough time and steady state permeation rate, if any, along with the specific minimum detection limit (MDL), detector used, and scurce of the test data. Complete test data and output is provided in Appendix C. The material is also being tested against priority chemical gases listed in Table 20, and eventually will be evaluated against the other CHRIS chemicals requiring encapsulation or having high toxicity.

Investigation of Chemical Resistance Variables. Chemical resistance testing of the garment material also involves investigation of parameters expected to affect material performance. These parameters include contact time, internal suit pressure, temperature, and chemical mixture exposure. This testing takes advantage of earlier work performed by the Coast Guard R&D Center on Viton/chlorobutyl laminate and chlorinated polyethylene reported in Chapter 2.<sup>10,20</sup> Dichloromethane permeation of Challenge<sup>TM</sup> 5100 at various temperatures is shown in Figure 5 and demonstrates the expected relationship between breakthrough time and temperature---a decrease in breakthrough time at elevated temperatures. Although a theoretical, predictive model for the permeation behavior of Challenge products has not been developed, an apparent inverse, linear relationship between temperature and log(breakthrough) for the limited data is observed. Additional permeation testing at elevated temperatures is planned, particularly for those chemicals which may permeate at high temperatures but not at room temperatures. Splash testing with dichloromethane using the same methods developed by the R&D Center yielded essentially the same breakthrough time as obtained when liquid remains in constant contact with the surface of Challenge<sup>TM</sup> 5100. This anamolous

### CHEMICALS WHICH PERMEATE CHALLENGETM 5100a

A. Chemicals which permeate within one hour

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Chemical Name	CHRIS Code	Breakthrough Time (min)	Permeation Rate (ug/cm <sup>2</sup> hr)
Carbon Disulfide	СВВ	18	3.65
Acrolein	ARL	38	
Methyl Isocyanate		28	2.82 ND <sup>b</sup>
Acrylonitrile	ACN	45	5.12
Dichloromethane	DCM	47	1.37

### B. Chemicals which permeate between one and three hours

Vinyl Acetate	VAM	74	3.30
Allyl Chloride	ALC	102	0.67
Tetrachloroethylene	TTE	108	ND
Propylene Oxide	POX	137	1.43
<b>Trichloroethyle</b> ne	TCL	143	2.04

(a) Information summarized from Table 19

(b) Not determined

Table 19 Permeation Testing Results for Challenge 5100 (Tefion-Coated Nomex) All Tests Conducted at 23° - 25°C

	CHRIS' Code	BT	Perm Det Rate Met'o	A MDL I (ppm)	5 Source
Acetaldehyde	AAD	>3 hr		ND	TRI
Acetic Acid	AAC	<b>54 hr</b>	1. A DAMA MARK A COMPANY AND A COMPANY	35.46	R&DC
Acetic Anhydride	ACA	>3 hr	PID	0.57	TRI
Acetone	ACI	>3.5 hr		1.16	R&DC
Acetone Cyanohydrin	ACY	NA		2.74	TRI
Acetonitrile	ATN	>4.5 hr		ND	R&DC
Acetophenone	ACP	>92 hr		ND	RåDC
Acetyl Chloride Acrolein	ACE	>3.1 hr 38 min	PID 2.82 PID	35.46 0.06	TRI
Acrylic Acid	ACR	unin madin maar maariin ta	us na suitti anna anna anna anna anna anna anna	unainennen er sener	TRI
Acryionitrile	ACN	>3 hr 45 min		0.86 0.46	TRI TRI
Adiponitrile	ADN	>3.1 hr		0.3	TRI
Allyl Alcohol	ALA	>3.1 hr >14 hr		1.13	TRI
Aliyi Chloride	ALC	102 mir	0.67 PID	0.16	TRI
Aniline	ANL	>3.3 hr	annan an a	0.46	TRI
Benzene	BNZ	>3.2 hr			TRI
Benzyl Chloride	BCL	>3.2 hr		0.11	TRI
Bromine	BRX	>3.3 hr		0.53	TRI
n-Butyl Acetate	BCN	>3 hr		0.25	TRI
n-Butyl Acrylate	BTC	<b>3 hr</b>	- CONVERSION CONTRACTOR AND A CONVERSION	0.22	TRI
n-Butylamine	BAM	>3 hr	PID	0.32	TRI
n-Butyl Alcohol	BAN	<b>&gt;15.6 h</b> r	PID	0.32	TRI
Butyraldehyde	BTR	>7.5 hr		0.29	TRI
Carbon Disulfide	CBB	17.7 mm			TRI
Carbon Tetrachloride	CBT	>3.0 hr	1999 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	0.29	TRI
Chlordane (85%)	CDN			0.26	TRI
Chlorobenzene	CRB	>3 hr	and the second	0.20	TRI
Chloroform Chloropicrin	CRF CPL	>3.6 hr		0.19	TRI
Chlorosulfonic Acid	CSA	>3.1 hr		1.80	TRI
Creosote	CCT	>3.0 h		Chr 0.50 0.32	TRI
m-Cresol	CRL	>18.1 hi >4 hi	1. A state of the state of t	0.03	TRI
Crotonaldehyde	CTA	>3.1 hr		0.62	TRI
Cumene Hydroperoxide	CMH	>3.5 hi		1.20	TRI
Cyclohexane	СНХ	>3.4 hr		0.25	TRI
1,2-Dibromoethane	EDB	>3.4 hi		0.10	TRI
1,2-Dichloroethane	EDC	>5.7 hi		0.09	TRI
1,2-Dichloroethyl Ether	DEE	>3 hi		ND	TRI
Dichloromethane	DCM	46.8 min			TRÌ
	, ,	37 min			R&DC
1,2-Dichloropropane	DPP	>3.1 hi			TRI
1,3-Dichloropropene	DPR	⇒3 hi			TRI
Diethanolamine	DEA	>3 hi			TRI
Diethylamine	DEN	>4.5 hi	FID	ND	R&DC

Notes:

1. The CHRIS Code comes from the Coast Guard CHRIS list.

2. BT - Breakthrough Time (>XHr = time test run; nMin = BT in min for those compounds that did break through.)

3. The permeation rate units are micrograms/square centimeter/hour.

4. DET MET'D - Detector used for determination of BT.

MDL — Minimum Detection Limit of the detector.
 SRC — Source of Data: TRI - Texas Research Institute; R&DC - Coast Guard results.

Chemical	HRIS <sup>1</sup> Code	BT <sup>2</sup>	Perm <sup>3</sup> Del Rate Met		
Dimethyl Sulfate	DSF	N/A	PIC	وهمر ورجي المحصر عدد	T
Disopropylamine	DIA	>11.2 hr	PIC		
Dimethylformamide	DMF	> <b>3</b> .2 hr	FID		Rå
1,4-Dioxane	DOX	>3 hr		0.38	
Di-n-Propylamine Epichlorohydrin	DNA EPC	>3.4 hr >3 hr	PIC		
Ethion 4	ETO	>3 nr >4.8 hr	PIL		
Ethyl Acetate	ETA	<b>3</b> .3 hr			
Ethyl Acrylate	EAC	>17 hr	PIC		
Ethyl Alcohol	EAL	<b>&gt;3</b> hr	PIC		
Ethylamine (70%)	EAM	<b>&gt;3 hr</b>	PIC	A.7 W. WALLAN	A CARACTER AND A CONTRACT OF A CONTRACT
Ethyl Benzene Ethylenediamine	ETB EDA	<b>&gt;3</b> hr	PIC		
Ethlyene Glycol	EGL	>3.2 hr >16.8 hr	PiC PiC		A. A. MARANA A. M.
Ethyl Ether	EET	>3 hr	PIC		
Formaldehyde (37%)	FMS	~~" → Shr	PIC		
Furfural	FFA	>1 hr	PIC		
Gasoline	GAT	>14.9 hr	PIC		
Glutaraldehyde (sol'n)	GTA	N/A	PIC		
Hexane Hudrate	HXA	>5 hr	PIC		
Hydrazine Hydrate Isopropyl Alcohol	HDZ IPA	N/A >3 hr	PIC PIC		
Isopropylamine	IPP	<b>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</b>	PIC		
Malathion (50%)	MLT	<b>3.1 hr</b>	Pic	A 1999 COLEMP 2011 11	
Methyl Acrylate	MAM	>3 hr	PIC		
Methyl Alcohol	MAL	>14.2 hr	PIC	4.07	
Methyl Ethyl Ketone	MEK	<b>&gt;3 hr</b>	PIC		
	MIK	<b>&gt;3 hr</b>	PIC		
Methyl Methacrylate Methyl Purathion	MMM	>3.1 hr	Pi[ Pi[	and the second second	
Naled	NLD	N/A >3.4 hr	PIC		
Naphthalene	MLT	>13.2 hr	PIC		
Nitric Acid	NAC	N/A		Chr 0.20	
Nitrobenzene	NTB	<b>&gt;3 hr</b>	PiC		
2-Nitropropane	NPP	<b>&gt;3 hr</b>	PIC		
Oleum	OLM	>3.0 hr		Chr 0.20	
Parathion Petroleum Ether	PTO	>3.0 hr	PIC PIC		
Phenol	PHN	>3.4 hr >3 hr	PIC		
Phosphoric Acid	PAC	>> nr N/A		Chr 0.50	
Phosphorous Oxychioride		>3 hr		Chr 0.50	
Phosphorous Trichloride	PPT	>3 hr	lor	Chr 0.50	)
Propionic Acid	PNA	<b></b>	PI	AC 14 DO 1 D 1	
n-Propyl Alcohol	PAL	<b>~3 hr</b>	PI		
n-Propylamine Propylene Oxide	PRA	>10.2hr	Pil		
	POX STC	<b>137 min</b> >3.0 hr	1.43 PI	D 0.68 Chr 0.50	
Silicon Tetrachioride					<b>.</b>

	CHRIS <sup>1</sup>		Perm <sup>3</sup>	Det <sup>4</sup>	MDL	
Chemical	Code	BI		Met'd	(ppm)	Source
Sodium Hydroxide	CSS	>71	hr	SE	ND	R&DC
(50% aqueous) Sodium Hydroxide	CSS	>3.0	hr	<b>lon Ch</b>	r 0.50	TRI
(50% aqueous)						
Styrene Sulfur Monochloride	STR SFM	الحر N		PID Ion Ch	0.05 r 0.50	TRI TRI S
Sulfuric Acid (conc.)	SFA	>72	1 U 12 CARE COLORS 19 19	Sulfate	ND	TRI
I,1,2,2,-Tetrachioro- ethane	TEO	>15.2	* *	PID	0.23	TRI
Tetrachloroethylene Tetrahydrofuran	TTE	108 mi >5.5	<ul> <li>A consider concernance of the second concernance of the s</li></ul>	ECD FID	ND ND	R&DC R&DC
1,1,1-Trichloroethan	B TCE	<b>3</b>	hr 🔆	PID	0.60	TRI
Trichloroethylene Toluene	TCL	<b>143 m</b> >3		PID	0.07	TRI
		>18.5		FID	0.69	TRI
o-Toluidine		>3.3	hr	PID 🔅	0.43	RADC
Toluene 2,4- Diisocyanate	TDI	>3.3	<b>hr</b> glath <u>arth</u> Names – St	PID	0.69	TRI
Turpentine	TPT		anderse ander de see <b>hr</b>	PID	0.03	TRI
Vinyl Acetate	VAM	74 ml		PID	0.21	TRI
Vinylidene Chloride Kylenes		>3.0 >3		PID PID	0.49 0.13	TRI TRI
Xylenol	XYL	>3.3		PID	ND	TRI
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### Table 19 Permention Testing Results for Challenge 5100 (continued)

Notes:

1. The CHRIS Code comes from the Coast Guard CHRIS list.

2. BT - Breakthrough Time (>XHr = time test run; nMin = BT in min for those compounds that did break through.)

B1 - Breaktmough Time (SKN) & and Barrah, mass of infinition above composition
 The permeation mite units - 'programs/square centimeter/hour.
 DET MFTD - Coupletor Proceeding to the detector.
 MDL - Baassum Detection Limit of the detector.
 SRC - Source of Data: 'TRI - Texas Research Institute; R&DC - Coast Guard results.

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### LIST OF PRIORITY GASBOUS CHERICALS

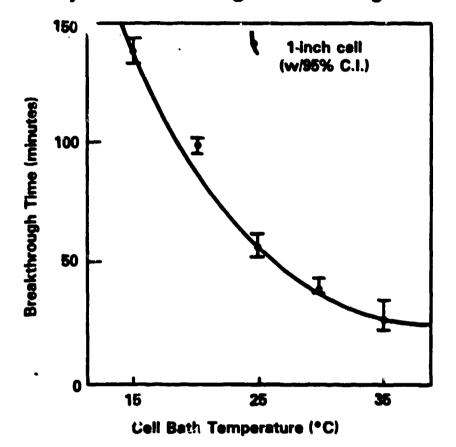
CHEMI CAL NAME	CHRIS CODE	ENCAPSULATION NEED?	PIRS # SPILLS	HAZARD INDEX	NFPA INDEX	PRIORITY® CLASS
Ammonia	AMA	Yes	85	2	3	IA
Bromine Pentafluoride	BPF .	Yes	0		4	IIA
1,3-Butadiene	BDI	No	0	1	2	IIA
Butane	BUT	No	0	3	1	IVC
Chlorine	CLX	Yes	35	2	3	IA
Chlorine Trifluoride	CTF	Yes	0			IIC
Cyanogen	CYG	Yes	0		4	AII
Dimethylamine	DMA	No	0	2	3	IIA
Ethylene Oxide	EOX	Yes	0	1	2	IIA
Fluorine	FXX	Yes	0		4	IIA
Hydrogen Browide	HBR	Yes	0		3	IIC
Hydrogen Chloride	HDC	Yes	0	2	3	IIA
Hydrogen Sulfide	HDS	Yes	0	6	3	IIB
Methyl Amine	MTA	Yes	0		3	IIB
Methyl Bromide	MTB	Yes	0	<b>2</b> S	3	IIA
Methyl Chloride	MTC	No	15	2	2	IA
Nitric Oxide	NTX	Yes	0	6		IIC
Nitrosyl Chloride	NTC	Yes	0			IIC
Phosgene	PHG	Yes	0	-	4	IIA
Sulfur Dioxide	SFD	Yes	0	2	2	IIA
Trimethylamine	TMA	Yes	0		2	IIC
Vinyl Chloride	VCM	Yes	0	1	2	IIA

(a) Need for encapsulating protection determined in reference (2) a

(b) Number of spills reported in Coast Guard Pollution Incident Response System (1973-1983).

(c) Hazard Index is based on Chemical Toxicity Ratings reported in reference (5). 1 is most toxic (carcinogen); 6 is least toxic; S - skin absorption hazard.

(d) NFPA Health Hazard Rating (from reference 6)
(e) See Appendix A for chemical classification information



### Methylene Chlorida Against Challenge 5100

Temperature Effect on Permeation Breakthrough Time of Challenge(TM) 5100 by Dichloromethane

Figure 5

result is not fully understood and may be a manifestation of the test procedure. Mixture testing will also be conducted to determine if synergistic permeation occurs as observed for acetome/hexane against Vitom<sup>R</sup>/chlorobu:yl laminate.

Physical Property Testing. An original concern that the Teflon Laminate may 'microfracture' with use<sup>21</sup> was investigated by a battery of physical property and chemical resistance testing. As a practice, most permeation testing is conducted with pristine material samples. Chemical Fabrics Corporation devised a standard means for creasing samples as a preconditioning technique to determine if the chemical resistance of the material changes with physical abuse (described in Appendix D). This test has been applied against the thirtoen organic chemicals in the ASTM Fl001 list of standard chemicals. Results for this testing are given in Table 21 comparing both 'uncreased' and 'creased' material chemical resistance. These tests show only small changes in the permeation breakthrough times for both carbon disulfide and dichloromethane which permeate Challenge<sup>TM</sup> 5100, and no 'new' chemicals which break through the material as the result of creasing. Test data and output are included in Appendix E. Other physical property tests are being performed in separate studies to determine how well Challenge<sup>TM</sup> 5100 retains its characteristics following temperature changes and exposure to flame and abrasive surfaces.

### Visor Material Optimization and Evaluation.

<u>Problems with the Original Teflon Leminate</u>. Originally, the Coast Guard selected a Teflon<sup>R</sup> laminate (1 mil FEP/ 20 mil Surlyn) for a visor material in its chemical protective suits.<sup>3</sup> This material possessed excellent chemical resistance but was difficult to laminate and did not stay together well after use. The Coast Guard therefore decided to examine alternative visor materials and select a material without sacrificing the chemical resistance of the Teflon<sup>R</sup> laminate. A requirement of using a single film (non-laminate) was tentatively set to avoid lamination problems encountered in the earlier material. Any delamination of a visor was considered unacceptable since the area between film could ellow entrapment of moisture which would then cause significant loss of visor clarity through condensation and fogging.

Primary Visor Material Performance Variables. Critical performance requirements for visor materials in the Chemical Response Suit included:

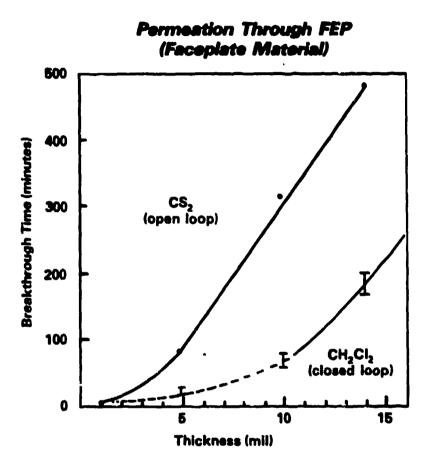
- (1) high visible light transmittance and visual clarity,
- (2) chemical permeation resistance, and
- (3) physical integrity and damage tolerance.

For screening purposes, light transmittance from wavelengths of 390 to 876 nm was measured with a visible light spectrophotometer using ASTM E424, "Test Methods for Solar Energy Transmittance and Reflectance of Sheet Materials." Chemical permeation resistance was performed with selected aggressive chemicals (carbon disulfide and dichloromethane) from the ASTM F1001 battery (Figure 6). Physical integrity and damage tolerance were evaluated in terms of tear strength (FED STD 191A-5136 - trapezoid method) and stiffness (ASTM D1388 - cantilever method). Stiffness was considered the more critical of the two physical properties since it is related to the ease of film creasing which

### FOR INCREASED AND CREASED CHALLENCE 5100 SAMPLESA COMPARISON OF PERMEATION BREAKTHROUGH TIMES

	Uncreased	Uncreased Challenge 5100		Creased (	Creased Challenge 5100	
Chemical Name	Breakthrough Time (min)	Perm. Rate (ug/cm <sup>2</sup> hr)	(udd) (bba)	Breakthrough Time (min)	Perm. Rate (ug/cm <sup>2</sup> hr)	(mur. (ppm)
Acetone	No BT6	W	1.16	No BT	NA	0,00
Acetonitrile	No BT	N	0.60	No BT	N	0.60
<b>Carbon Disulfide</b>	18-22	2.6-3.7	0.07	11-15	10.0-13.3	0.06
Dichloromethane	47-55	1.0-1.4	0.19	53-58	3.1-3.8	0.75
Diethylamine	No BT	NA	0.15	No BT	NA	0,15
<b>Dimethylformanide</b>	No BT	NA	0.40	No BT	X	0.40
Ethyl Acetate	No BT	NA	0.49	No et	NA	0.20
Hexane	No BT	NA	0.25	No BT	NA	0,11
Methanol Methanol	No BT	NA	4.07	No BT	NA	
Nitrobenzene	No BT	NA	0.08	No BT	NA	
Tetrachloroethylene	108	NDC	2	No BT	NN N	0.07
Tetrahydrofuran	No BT	W	0.09	No BT	VI	
Toluene	No BT	NA	0.06	No BT	NA I	0.02
	•					

All test conducted using Gas Chromatograph with photofonization detector No breakthrough detected in three hours Not determined ତ୍ତ୍ତ



The Effect of Thickness on Visor Material Permeation Breakthrough Time for Carbon Disulfide and Dichloromethane

Figure 5

### dramatically reduces visual clarity.

Optimization of Visor Thickness. Of the commercially available Teflon<sup>R</sup> films, fluorinated ethylene-propylene (FEP) posses. A the highest visible light transmittance per unit thickness and was thus selected as the visor material. The above screening tests were employed to determine the optimum visor film thickness. Data on connercially available 5, 10, 14, and 20-mil FEP film are presented in Table 22. The data reveal that as film thickness increases, the chemical permeation and physical properties improve at the expense of light transmittance (Figure 7). Ten-mil FEP was selected since it provides adequate clarity and resistance to creasing while offering permeation resistance and tear strength consistent with the garment material (Table 15). Additional physical properties of the FEP visor material are offered in Table 23.

Chemical Resistance Testing. Permeation resistance of the 10 mil FEP Visor material was measured against the chemicals in the ASTM F1001 battery as well as other specific chemicals which have permeated Challenge<sup>TM</sup> 5100. As explained previously, the strategy of this testing was to determine the chemical resistance of the visor material relative to the garment material (Challenge<sup>TM</sup> 5100). If the chemical resistance was the same or better than the garment material, the Coast Guard could assume that the visor provides as least equivalent protection as the garment and forego the extensive testing done on the garment material. If the latter was not the case, then further testing would be required to determine where differences in chemical resistance occured by essentially testing the same chemicals. Fortunately, in each case the chemical resistance of the visor is better than the garment material as seen in Table 24. Table 25 shows the effects of creasing on the material's chemical resistance for the ASTM F1001 chemicals. Only a slight reduction in permeation resistance was noted with no 'new' chemicals permeating the creased visor material. Complete permeation data and output for visor material testing are presented in Appendix F.

### Glove Material Selection and Evaluation.

Original Material Selection. The first Coast Guard Chemical Response Suits were designed with Teflon (TFE) inner gloves and outer gloves of either butyl rubber or Viton. The inner glove consisted of two simple hand silhouettes with a peripheral heat-sealed seam. The outer elastomer glove provided the shape to the composite glove, which dramatically improved dexterity, though the overall glove form was relatively less comfortable than typical elastomeric gloves. A testing scheme similar to that used for the visor material was employed to evaluate the selected inner glove material (4 mil Teflon-TFE film). This included testing the chemical permeation resistance of the glove material against the 13 organic chemicals in the ASTM battery to determine performance relative to the garment material. Many of the same physical property tests used to evaluate the garment and visor materials were also performed on the TFE film (Table 23).

Material Testing Results. Physical integrity in terms of tear strength, abrasion resistance, and stiffness were generally poorer than the visor garment material. Nower physical properties of the glove material were believed to be acceptable due to the compromise between offering user

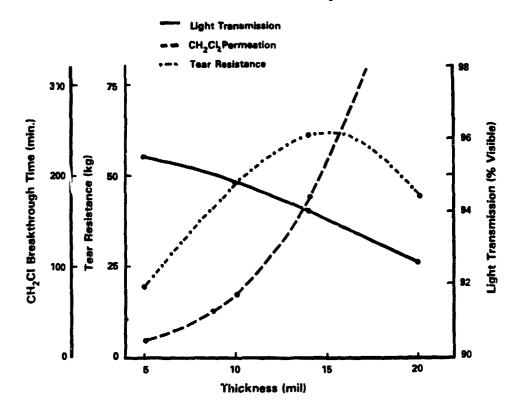
Property (Units)	Test Method	5 Mil	10 Mil	14 M11	20 M11
Tear Strength <sup>a</sup> Trapezoid Method (1bs)	FED. STD. 191A-5136	8.9	21.5	28.2	20.2
Flexural Rigidity <sup>a</sup> Cantilever Method (mg-cm x 10 <sup>-3</sup> )	ASTM D1388	0.149	1.07	2.85	7.62
Light Transmittance <sup>b</sup> (% Visible)	ASTM E424	95.5	94.8	94.0	92.6
Permeation Breakthrough Time (minutes)	ASTM F739	see Figu	re 6		

### PHYSICAL PROPERTIES OF FEP FILM VISOR CANDIDATES

(a) Average of machine-direction and transverse-direction values

(b) Average light transmittance from 390 to 876 nm; Perkin Elmer Lambda 4 Spectrophotometer

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### Visor Material Thickness Optimization

Figure 7

Property (Units)	Test Method	Visor	Glave
Composition		Fluorinsted Ethylene- Propylene	Polytetrafluoro- ethylene
Thickness (mil)	ASTM D374	10	4
Tear Strength (1bs) <sup>a</sup> Trapezoid	FED. STD. 191A,5136	21.5	1.9
Abrasion Resistance <sup>b</sup> Taber (gms lost)	ASTM D3389	0.02	0.05
Flexural Rigidity Cantilever (mg-cm)	ASTM D1388	$1.07 \times 10^4$	8.65 x $10^2$
Low Temperature Bending (°C)	ASTM D2136	Pass at -40°C	Pass at -40°C
Flame Resistance Vertical Char Length (in) After-Flame (sec) After-Glow (sec)	FED. STD. 191A,5903	1.4 0 0	1.5 0 0

### PHYSICAL PROPERTIES OF VISOR AND GLOVE MATERIALS

(a) Average of machine-direction and transverse-direction values
(b) H-18 wheel, 600 cycles, 250 gram weight

### COMPARISON OF PERMEATION BREAKTHROUGH TIMES FOR GARMENT AND VISOR MATERIALS AGAINST SELECTED CHEMICALS

		Garment Material	<b>laterial</b>		Visor Material	terial	
00	CERIS	Breakthrough Time (min)	Perm. Rate (ug/cm <sup>2</sup> hr)	MDL <sup>a</sup>	Breakthrough Time (min)	Perm. Rate (ug/cm <sup>2</sup> hr)	
¥	ACI	No BT <sup>b</sup>	NA	1,16	No BT	NA	0.07
	ATN	Ne BT	NA	0.60	No RT		
Z	Ľ	38-44	1.6-2.4	0,09	NO RT	NN NN	
V	N	54-76	0.9-5.1	0.24	Not Tested		(1.9.0)
<b>A</b>	3	102-166	0.6-0.7	0.17	NO RT	MA	
ច	63	18-22	2.6-3.7	0.07	80-06	7 2-13 6	
ă	ž	47-55	1.0-1.4	0.19	Not Tastad	0.CT_C.	71.0
ā	N	No BT	NA	0.15	No BT	NA	1 . 21
a	11	No BT	NA	0.40	No BT	NA	1 16 1
5	N	No BT	NA	0.49	No BT	NA	
Ĥ	s	No BT	NA	0.25	NO BT	NA	0.21
Z	Ŀ	No BT	NA	4.07	No BT	VN	V.JL 1 43
E	8	No BT	NA	0.08	No BT	NA	74-1
2	POX	137-170	1.1-1.4	0.80	Not Tested	- SM	<b>1</b> 0.0
F	2	108	NDC		No BT	NA	95 U
F	21	No BT	NA	0-09	No BT	NA	1 44
A	н	143-156	1.6-2.0	0.09	NO RT	NA	
Ĕ	)L	No BT	NA NA	0.06			17.0
2			1 7 7		TODA	<b>D</b> N	0.40
	5	/CT	3.3-3./	12.0	No BT	NA	0.50

Minimum detection limit of permeation system for particular chemical No permeation breakthrough detected in 3 hours Not determined କ୍ତିତ୍ତ

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### COMPARISON OF PERMEATION RESISTANCE FOR UNCREASED AND CREASED VISOR MATERIAL<sup>®</sup> SAMPLES

	HDL (ppm)	0.21	0.50	0.10	60.0	1.21	1.16	0.14	0.21	1.42	0.04	0.38	1.44	0.40
TPE Film	Perm. Rate (ug/cm <sup>2</sup> hr)	NA	NA	8.4-12.8	2.5-5.2	Na	NA	NA	NA	NA	NA	NA	NA	NA
Creased TPE Film	Breakthrough <u>Time (min)</u>	No BT	No BT	25-34	30-60	No BT	No BT	No BT	No BT	No BT	No BT	No BT	No BT	No BT
	( <mark>bpa</mark> )	0.07	0.50	0.12				0.27	0.31		0.04			
Uncreased TFE Film	Perm. Rate (ug/cm <sup>2</sup> hr)	NA	NA	7.3-13.6				NA	NA		NA			
Uncrease	Breakthrough Time (min)	No BTC	No BT	<b>86-06</b>	Not Tested			IG ON			NO BT			
	Chemical Name	Acetone	Acetonitrile	Carbon Disulfide	Victionomethane Niethulanian	Discrity tomatic	Vimetnyitoraailde Veteri Accesso	ELUY ACELETE	Hexane Wothered		MILTODEDZEDE Totoochi	Tetraculoroetnylene	Letranyaroturan Telisee	allantot

All tests conducted using gas chromatograph with photofonization detector Minimum detection limit of permeation system for particular chemical ଞ୍ଚିତ

No breakthrough detected in three hours

dexterity and structural integrity. The chemical resistance of the TFE film was clearly unacceptable, with nearly very chemical tested breaking through the material (Table 26). The quick chumical breakthrough times and high steady state permeation rates are possible evidence of material "microfracturing". These results alone demonstrate that the TFE film was unsuitable as Chemical Response Suit glove material. Complete chemical resistance data is provided in Appendix G.

Interim Glove Material Selections. The Coast Guard was faced with the dilemma of providing gloves for the suit which had comparable chemical resistance as the rest of the garment. The gloves are considered a critical area of protection since chemical exposure to the users at the hands is one of the most likely chemical response hazards. A glove development program with Challenge<sup>TM</sup> materials has begun in August 1987, but in the interim, the Coast Guard decided to employ existing glove material recommendations in the "Guidelines for the Selection of Chemical Protective Clothing"<sup>13</sup> to suggest gloves which would provide adequate chemical resistance for each specific chemical. The results were disappointing. Table 27 gives both the suit and outerglove recommendations. Six different types of gloves are required to cover the range of priority chemicals already tested (Table 28), but for 29 chemicals, no glove recommendations can be made (see Table 29). The reason for these findings are two-fold:

- Many glove materials have not been quantitatively evaluated (via chemical permeation testing with ASTM F739) against enough chemicals; and
- (2) The chemical resistance of Challenge<sup>TM</sup> 5100 far exceeds that of conventional glove materials.

The consequence of this finding is that the gloves are the weak 'link' in the suit design. While options such as 'double' gloving or awaiting more testing on existing gloves may obviate the problem in the future, there is ... data that exist to recommend suit use against certain chemicals, even though the rest of the garment provides adequate protection.

Suit Seam Design and Testing.

Seam Design. Critical seams of the Coast Guard Chemical Response Suit include:

- (1) Garment Material Garment Material
- (2) Garment Material Visor Material
- (3) Garment Material Inner Glove Material
- (4) Garment Material Suit Closure Tape Material
- (5) Glove Material Glove Material

The individual seam constructions are described in Table 30 and illustrated in Figure 8. Original seam constructions for the garment material to garment material seam involved the combination of sewing in a "T' fashion and heat sealing tape over the sewing holes (Figure 8a). Some seam failures were observed in field testing and Chemical Fabrics Corporation proposed totally heat-sealed seams (Figure 8b). The latter seam demonstrated higher integrity

### PERMEATION RESISTANCE OF INNER GLOVE MATERIAL AGAINST ASTM F1001 CHEMICALS<sup>®</sup>

Chemical Name	CHRIS Code	Breakthrough Time (min)	Permeation Rate (ug/cm <sup>2</sup> hr)	MDL (ppm)
Acetone	ACI	2.5	128.9-146.7	0.75-0.89
Acetonitrile	ATN	5.0	57.0-66.0	9.60
Dichloromethane	DCM	2.5	487.1-508.0	2.57-2.60
Diethylamine	DEN	2.5	1072	4.60-4.75
Dimethylformamide	DMF	2.5	38.7-49.2	0.28-0.30
<b>Bthyl Acetate</b>	ETA	2.5	258.2-282.9	0.87-0.90
Hexane	HXA	2.5	1810-1898	9.12-9.68
Methanol	MAL	2.5	15.5-21.8	0.64-0.65
Nitrobenzene	NTB	2.5	56.0-57.8	0.13-0.14
Tetrachloroethylene	PER	2.5	1049-1189	2.78-2.92
Tetrahydrofuran	THF	2.5	1655-1905	8.04-9.57
Toluene	TOL	2.5	(b)	0.39-0.47

(a) All tests conducted using a gas chromatograph with photoionization detector in triplicate,-values given represent range of measurments for all three tests
(b) Permeation rate exceeded system's capability to measure it

### CHEMICAL RESPONSE SUIT/OUTER GLOVE RECOMMENDATIONS

CHEMICAL	CHRIS CODE	RECOMMENDED	BASIS	RECOMM. OUTER GLOVE MAT'LS.b
Acetaldehyde	AAD	Yes	A	Butyl, Silvershield
Acetic Acid	AAC	Yes	A	Neoprene, Nitrile, NNR, Viton
Acetic Anhydride	ACA	Yes	A	Butyl
Acetone	ACI	Yes	A	Butyl, Silvershield
Acetone Cyanohydrin	ACY	Yes	A	None Recommended
Acetonitrile	ATN	Yes	A	Butyl, PVA, Silvershield, Viton
Acetophenone	ACP	Yes	A	None Recommended
Acetyl Chloride	ACE	Yes	Δ	Butyl
Acrolien	ARL	No	С	
Acrylic Acid	ACR	Yes	A	Butyl, Viton
Acrylonitrile	ACN	No	С	
Adipontrile	ADN	Yes	A	Not listed in Guidelines
Ally1 Alcohol	ALA	Yes	A	Butyl, Neoprene, PVC
Allyl Chloride	ALC	Yes	В	None Recommended
Aniline	ANL	Yes	A	Butyl, NNR, PVA, Silvershield
Benzene	BNZ	Yes	A	Viton, Silvershield
Benzyl Chloride	BCL	Yes	A	Viton
Bromine	BRX	Yes	A	Neoprene
n-Butyl Acctate	BCN	Yes	A	Butyl, PVA, Silvershield
n-Butyl Acrylate	BTC	Yes	٨	None Recommended
n-Butylamine	BAM	Yes	A	None Recommended
n-Butyl Alcohol	BAN	Yes	Ā	Neoprene, Nitrile, Polyethylene
Butyraldehyde	BTR	Yes	A	Butyl
Carbon Disulfide	CBB	No	C	
Carbon Tetrachlorid	•	Үев	Å	PVA, Silvershield, Viton
Chlordane (25%)	CDN	Yes	Ā	Not listed in Guidelines
Chlorbenzene	CRB	Yes	Ā	Viton
Chloroform	CRF	Yes	A	PVA, Viton
Chlorpicrin	CPL	Yes	A	Not listed in Guidelines
Chlorosulfonic Acid	CSA	Yes	A	Polyethylene
Creosote	CCT	Yes	A	Neoprene, Viton
n-Cresol	CRL	Yes	A	Neoprene, Nitrile, NNR
				Polyethylene
Crotonaldehyde	CTA	Yes	A	Butyl
Cumene Hydroperoxid		Yes	A	Not listed in Guidelines
Cyclohezane	CHX	Yes	A	Nitrile, Silvershield, Viton
1,2-Dibromoethane	EDB	Yes	A	PVA
1,2-Dichlotoethane	EDC	Yes	A	Silvershield, Viton
2,2-Dichloroethyl	DEE	Yes	A	None Recommended
Ether			~	
Dichloromethane	DCM	No	C	
1,2-Dichloropropane		Yes	A	PVA, Viton
1,3-Dichloropropene		Yes	A	PVC, Viton
Diethylamine	DEN	Yes	A	Silvershield
Diethanolamine	DEA	Yes	A	Butyl, Neoprene, Viton
Dimethyls fate	DSF	Уев	A	Not listed in Guidelines
Disopropylamine	DIA	Yes	A	Nitrile, Viton
Dimethylformamide	DMF	Yes	A	Buryl, Silvershield

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### TABLE 27 (Continued)

### CHEMICAL RESPONSE SUIT/OUTER GLOVE RECOMMENDATIONS

CHEMICAL	CHRIS CODE	RECOMMENDED	BASIS	RECOMM. OUTER GLOVE MAT'LS. b
1,4-Dioxane	DOX	Yes	A	Butyl, Silvershield
Di-n-Propylamine	DNA	Yes	Ā	Viton
Epichlorohydrin	EPC	Yes	Å	Butyl
Dimethylsulfate	DSF	Yes	Ā	Not listed in Guidelines
Disopropylamine	DIA	Yes	Å	Nitrile, Viton
Dimethylformamide	DMF	Yes	Ä	Butyl, Silvershield
1,4-Dioxane	DOX	Yes	Å	Butyl, Silvershield
Di-n-Propylamine	DNA	Yes	A	Viton
Epichlorohydrin	EPC	Yes	A	Butyl
Ethion 4	ETO	Yes	A	Not listed in Guidelines
Ethyl Acetate	ETA	Yes	A	Butyl, Silvershield
Ethyl Acrylate	EAC	Yes	Å	PVA
Ethyl Alcohol	EAL	Yes	A	Nitrile, NNR, Polyethylene, PVA
Ethylamine (70%)	BAM	Yes	A	Butyl, Nitrile
Ethyl Benzene	ETB	Xes	A	Viton
Ethylene Cyanohydrin		Yes	Ā	Butyl, Neoprene, PVA, Viton
Ethylenedlamine	EDA	Yes	Ā	Butyl, Neoprene
Ethylene Glycol	EGL	Yes	Ā	Neoprene, Nitrile, NNR, PVA
Ethyl Ether	RET	Yes	Ā	PVA, Silvershield
Formaldehyde (37%)	FMS	Yes	Ā	Butyl, Polyethylene
		100	••	Silvershield, Viton
Furfural	FFA	Yes	A	Butyl, PVA, Silvershield, Viton
Gasoline	GAT	Yes	Ā	Neoprene, Nitrile, PVA
Glutaraldehyde(sol'n		Yes	Ā	Butyl, Neoprene, PVC, Viton
Hexane	HXA	Yes	Ă	PVA, Viton, Silvershield
Hydrazine Hydrate	HDZ	Yes	Ā	Butyl, Neoprene, Nitrile, PVC
Hydrogen Peroxide	HPC	Yes	Ā	Nitrile, NNR, Polyethylene, PVA,
(30)			4	Viton
Isopropyl Alcohol	IPA	Yes	A	Butyl, Neoprene, Nitrile
Isoprorylamine	IPP	Yes	A	Butyl
Malathion (50%)	MLT	Yes	A	Not listed in Guidelines
Methyl Acrylate	MAM	Yes	8	Butyl, PVA
Methyl Alcohol	MAL	Yes	A	Butyl
Methyl Ethyl Ketone	MEK	Yes	A	Butyl 🏾 🗣
Methyl Isobutyl Ketone	MIK	Yes	A	PVA
Methyl Isocyanate		No	С	فتنفاخر قانهي والا
Methyl Methacrylate	MMM	Yes	Ă	PVA
Methyl Parathion	MPT	Yes	Ā	Not listed in Guidelines
Naled	NLD	Yes	Ā	Not listed in Guidelines
Mapthalene	MLT	Yes	Å	Not listed in Guidelines
Nitric Acid	NAC	Yes	Ă	Neoprene, NNR, Polyethylene,
			**	Silvershield, Viton
Nitrobenzene	NTB	Үев	A	PVA, Silvershield, Viton
2-Nitropropane	NPP	Yes	Å	Butyl, PVA
Oleum	OLM	Yes	Ă	Not listed in Guidelines
Parathion	PTO	Yes	Å	Not listed in Guidelines
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### TABLE 27 (Continued)

### CHEMICAL RESPONSE SUIT/OUTER GLOVE RECOMMENDATIONS

CHEMICAL	CHRIS CODE	RECOMMENDED	BASIS	RECOMM. OUTER GLOVE MAT'LS.
Petroleum Ether		Yes	٨	Neoprene, Nitrile, PVA
Phenol	PHN	Yes	A	NNR, Polyethylene
Phosphoric Acid	PAC	Yes	A	Neoprene, Nitrile,
				Polyethylene, PVC
Phosphorous Oxychloride	PPO	Yes	A	None Recommended
Phosphorous Trichloride	PPT	Yes	A	None Recommended
Polychlorinated Biphenyls	PCB	Yes	A	Neoprene, Silvershield, Viton
Proplonic Acid	PNA	Yes	A	None Recommended
n-Propyl Alcohol	PAL	Yes	A	Neoprene, Nitrile
n-Propylamine	PRA	Yes	A	Butyl, Neoprene
Propylene Oxide	POX	Yes	В	Butyl
Silicon Tetrachlorid	le STC	Yes	A	Not listed in Guidelines
Sodium Hydrosulfide	SHR	Yes	A	Not listed in Guidelines
Sodium Hydroxide	CSS	Yes	A	Butyl, Neoprene, Nitrile, NNR, Polyethylene, PVC, Silvershield, Viton
Styrene	STR	Yes	A	PVA
Sulfur Monochloride	SFM	Yes	A	None Recommended
Sulfuric Acid (95%)	SFA	Yes	A	NNR, Polyethylene, Silvershield, Viton
1,1,2,2-Tetrachloro- ethane	- <b>TE</b> O	Yes	A	PVA, Viton
Tetrachloroethylene	TTE	Yes	В	Silvershield, Viton
Tetrahydrofuran	TCE	Yes	A	None Recommended
1,1,1-Trichloroethan		Yes	A	PVA, Silvershield, Viton
<b>Trichloroethylene</b>	TCE	Yes	B	Silvershield, Viton
Toluene	TOL	Yes	A	Silvershield, Viton
o-Toluidine	TLI	Yes	A	None Recommended
Toluene-2,4- Disocyanate	TDI	Yes	A	Butyl, Nitrile, Polyethylene, PVA, Silvershield, Viton
Turpentine	TPT	Yes	A	PVA
Vinyl Acetate	VAM	Yes	B	None Recommended
Vinylidene Chloride	VCI	Yes	A	PVA
Xylenes	XLM	Yes	A	Viton
<b>Xylen</b> ol	XYL	Yes	A	Not listed in Guidelines

<sup>a</sup>Basis of Recommendation:

- A No breakthrough in three hours RECOMMENDED
- B No breakthrough in one hour, but breakthrough time occurs before three hours - RECOMMENDED
- C Breakthrough occur within one hour NOT RECOMMENDED

### TABLE 27 (Continued)

### CHEMICAL RESPONSE SUIT/OUTER GLOVE RECOMMENDATIONS

<sup>b</sup>Outerglove Recommendations based on quantitative recommendations provided in the 3rd Edition of "Guidelines for the Selection of Chemical Protective Clothing" (reference 13). Naterial abbreviations: PVA - Polyvinyl Alcohol, PVC - Polyvinyl Chloride, NNR - Neoprene and Natural Rubber. \*\*\*CAUTION: End users should check with vendor for specific recommendations on selected glove.

\*

### SUMMARY OF OUTERGLOVE MATERIAL RECOMMENDATIONS

No. Materials Recommended	No. Chemicals
3 or more materials	26
2	27
1	25
No materials recommended	13
Not in selection guidelines	16
No recommendations possible	5
TOTAL	112

### TABLE 29

### AVAILABLE GLOVE MATERIALS

Material	No. Recommendations <sup>d</sup>
Butyl Rubber	28
Neoprene	19
Neoprene/Natural Rubber	10 (Ъ)
Nitrile	17 (b)
Polyethylene	12
Polyvinyl Alcohol	26
Polyvinyl Chloride	б (Ъ)
Polyvinyl Chloride Silvershield <sup>TM</sup>	27
Viton <sup>R</sup>	29

(a) Recommendations based on quantitative measures indicating adequate protection greater than 1 hour.

(b) Not needed in CRS outerglove system due to other gloves providing adequate protection

DESCRIPTION OF SUIT SEAM CONSTRUCTIONS

Garment Katerial Sean: (original construction) sewn, then heat sealed with 5-6 mil Teflon tape over seam assembly on both sides (Figure 8a)

<u>Garment Material Sean</u>: (new construction) new suit seams 1/2 inch heat sealed lap seams with tape over seam assembly on both sides (Figure 8b)

Garment-Visor Mat'l Seam: heat sealed with 5-6 mil Teflon tape over seam assembly on both sides

Garment-Closure Seam: fiberglass heat sealed to garment material; zipper neoprene tape sewn and bonded to fiberglass with toluene based adbesive (Figure 8c)

fiberglass heat sealed to garment material

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at sleeve end; fiberglass bonded to plastic glove ring and inner glove

Attached with butyl elastic band and

Garment-Inner Glove Seam: (Original construction)

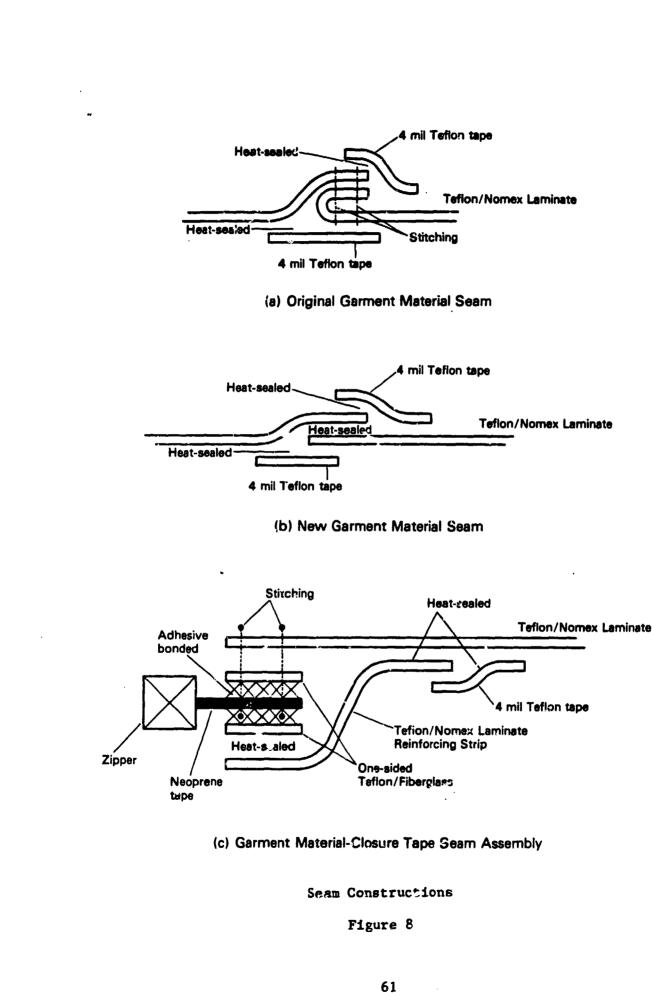
Garment-Inner Glove Seam: (new construction)

Glove Material Seam:

1/4 inch heat sealed lap seam

stainless steel hose clamp

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and fewer seam failures were noted in field tests where significant physical abuse of the suits occurred. Table 31 presents data for three different garment seams, of which the 1/2 lap seam was chosen due to its physical strength and ease of implementation into the suit design. Garment material interfaces with non-Teflon materials presented a problem in heat sealing. The attachment of the suit visor could be done directly by heat sealing but required some adjustments in the heat sealing procedure. The neoprene closure (zipper) tape could not be heat sealed and required using a fiberglass interface between the Teflon and the neoprene tape; the fiberglass was heat sealed to the Teflon laminate and the neoprene tape was both stitched and bonded to the fiberglass section (Figure 9c).

<u>Seam Physical Integrity Testing</u>. Each of the seam constructions have been subjected to two types of seam strength tests: tensile and dead load stresses (Table 32). The ultimate tensile strength of each seam type generally reflects the tensile strength of the weakest base material, as opposed to the actual strength of the heat-sealed joint. In other words, the heat sealed seams are designed to be as strong or stronger than the base materials (with the possible exception of the glove-glove seam which exhibited both film and seam type failures). Dead load or creep testing was conducted to simulate the long term but low stress conditions resulting from the positive pressure in a totally encapsulating suit. Representative seam stresses were calculated for two locations within the suit (torso and glove) based on a internal positive pressure of 5.7 mm Hg and on measured suit dimensions. Dead load testing was conducted at loads for the glove and torso repsectively. No failures occurred in any of the seam configurations in 48 hours under the above loading conditions.

Seam Chemical Resistance Testing. Penetration testing (ASTM F903) of the first three seams was conducted by Anderson Associations for the Coast Guard R&D Center against a five chemical battery (water, hexane, toluene, methyl ethyl ketone, and hydrochloric acid). No penetration was noted for any seam-chemical combination. Appendix H is a copy of the contractor's report. Attempts were made to measure seam permeation testing with the standard ASTM method but anomolous results have been observed. The non-homogeneous surface of the seam may have caused leakage in the test cell; this may explain the relatively short breakthrough times compared to what is expected for seam performance. Placement of a solid sheet material between the seamed material and the collection chamber gave no breakthrough. Use of successively more compressible gaskets also gave longer breakthrough times as confirmed by both the Coast Guard R&D Center and Texas Research Institute (Table 33; other data in Appendix I). The use of a 1/4" expanded PTFE (polytetrafluoroethylene) was the only gasket arrangement which provided the expected results. At the time this report was prepared (July 1987), additional seam permeation test was in progress against the ASTM F1001 chemicals and other chemicals which permeated the garment material (Table 18).

### Selection and Testing of Other Suit Components.

Suit Closure Selection. The Coast Guard could not identify suit closures constructed of Teflon<sup>K</sup> (or other highly chemically resistance materials) which also provided an airtight seal. Past Coast Guard suit designs employed pressure sealing sippers, two-track closures (like Ziplock<sup>R</sup>), or the

### OPTIMIZATION OF GARMENT SEAM TYPES<sup>a</sup>

Seam	Direction of Separation	Fabric Stress	Mode of
Type		at Failure (1b/in)	Failure
"T" Sewn/Heat-sealed	Warp	51.5	Stitching <sup>b</sup>
	F.11	49.9	Stitching
1/2" Heat-sealed Lap	Warp	95.0	Adhesion <sup>C</sup>
	Fill	75.0	Adhesion
3/4" Heat-sealed Lap	Warp	110.0	Adhesion
	Fill	88.0	Adhesion

(a) Optimization determined by seam tensile strength testing. Tests were performed using a a modified form of ASTM D751-79; Samples sizes were 1" x 12", with seam down long sample axis; a 0.2 in/min rate of separation was used.

(b) Stitching failures involve seam separation at stitched areas

(c) Adhesion failure involve either delamination of coating from the fabric or the breakdown of the bonding in the lap seam

### S.IT SEAM PHYSICAL PROPERTIES

Seam Туре	Ultimate Tensile Strength (lbs/in)	Dead Load <sup>a</sup> (1bs/in)	Test <sup>b</sup> Duration (hr)
Challenge-Challenge (heat-sealed seam)	132	15	48+
Challenge-Visor	25.3	15	4 <del>8+</del>
Challenge-Closure <sup>C</sup>	129.5	15	48+
Challenge-Glove	12.3	2.3	48+
Glove-Glove	8.2	2.3	48+

(a) Dead loads were conducted at approximately 15 times the static seam stress resulting from normal suit positive pressure (3.0 in Water). Maximum interior dimensions of 10.2 in radius in the suit torso and 2.9 in. radius in the glove yield stresses of C 55 and 0.15 lbs/in respectively.

(b) n+ indicates no failure in the time stated.

(c) Closure is a neoprene-brass pressure sealing zipper.

### TABLE 33

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# PERMEATION TESTING R. SULTS FOR VAKIOUS GARMENT MATERIAL SEAM TESTS AGAINST ETHYL ACETATE

Run	Gasket Type (Number)	Breakthrough Tiue(min)
A	Neoprene (2)	6
В	Neoprene (1) Teflon (2)	7.5
C	Neoprene (2) Teflon (2)	96
D	1/4" Expanded PTFE Cord	3 Hrs

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combination of the two.<sup>3</sup> Two-track closures can only be fabricated from plastics with the appropriate physical characteristics (i.e., polyethylene and CPE). Pressure sealing zippers operate with the zipper chain (clamp and lock) compressing the two sides of the coated tape together to form an air-tight seal (Figure 9). These zippers are typically used in diving dry suit applications and are fabricated from neoprene (tape) and brass alloys (clamp, lock, and slider). While other metal components are available (e.g. stainless steel), neoprene is the only coated tape used in the manufacture of these closures. Therefore, both types of closures consist of materials with relatively lower chemical resistance compared to the garment material. The Coast Guard picked a Talon OEB<sup>R</sup> pressure sealing zipper over two-track closures due to its better field performance and air-tight qualities. In order to protect the closure from chemical exposure, the zipper was placed in the rear of the suit and enclosed in a protective cofferdam described in Chapter 5.

Suit Exhaust Valve Selection. Totally-encapsulating chemical protective suits use low-pressure one-way vent valves to allow the escape of exhaust air from the wearer's self-contained breathing apparatus, and to maintain a small positive pressure (1 to 3 inches water column pressure) inside the suit. This latter feature minimizes diffusion or penetration of chemical vapors through poor seams, material punctures, or improperly closed zippers. Satisfactory operation of these valves is critical to the functional and protective qualities of the suit. In earlier suit designs, the Coast Guard used four Halkey Roberts (#780-RPA.1) valves. Though these valves offered adequate performance, they were no longer available for production of the Coast Guard Chemical Response Suit. The Coast Guard identified an alternative valve, the Stratotech P/N 739-2.5 with a 'cracking pressure' of 2.5 inches water column pressure (illustrated in Figure 10). Like other valves, the sealing components are fabricated materials with relatively low chemical resistance. In this case, a silicone rubber valve 0-ring seals against the valve body (aluminum). The Coast Guard principal concerns for these valves are:

- (1) providing adequate venting of the suit (to prevent overpressurization which limits user mobility and stresses suit seams),
- (2) resisting chemical degradation of the valve sealing surface, and
- (3) resisting 'backflow' while the valve is operating.

Valve flow rates at different levels of wearer work were measured in manned laboratory tests described in Chapter 5. Attempts at measuring the two other phenomena are discussed below. The valves are partially protected by an inverted pocket to prevent direct liquid chemical impingement.

<u>Closure and Exhaust Valve Testing</u>. Measurement of closure and exhaust valve performance with respect to chemical exposure is difficult to assess since they are not sheet-like materials and standard methods do not exist to measure their chemical resistance. Penetration testing of the suit zipper has been performed using a modified test cell against the five chemical penetration battery with no evidence of penetration as reported in Appendix H. Sample suit zippers have also been subjected to zipper crosswise strength testing to determine tensile properties relative to the garment material. All suit zippers far exceed the Coast Guard requirement of 50 lbs/in. crosswise strength (90 lbs/in.). The Coast Guard intends to measure other closure physical properties such as bursting strength for evaluating suit closure

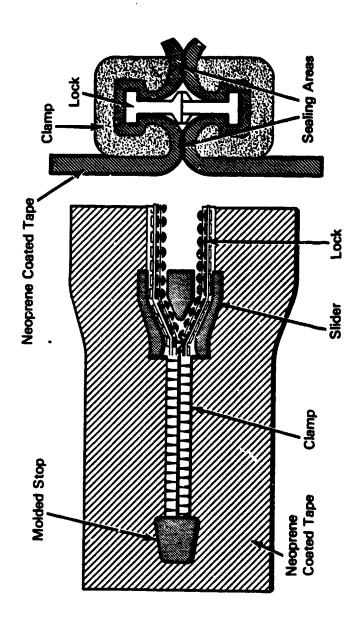




Figure 9

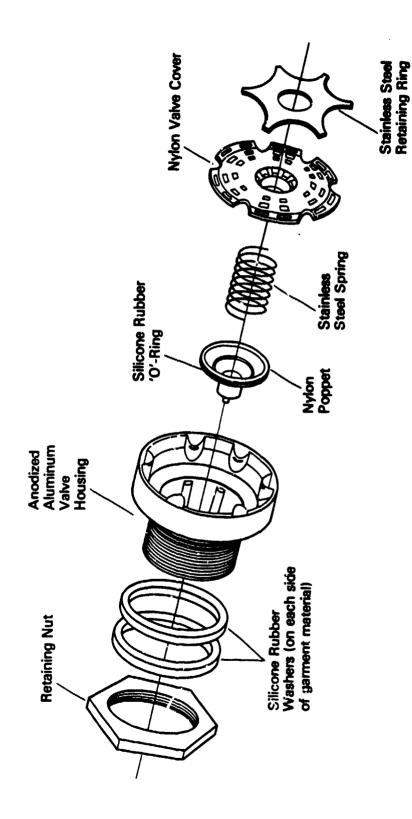


Figure 10

Suit Exhaust Valve Design

performance once methods are developed. An initial assessment of suit exhaust valve performance was conducted by Lawrence Livermore National Laboratory in a separate Coast Guard sponsored investigation. The study attempted to measure valve resistance to backflow and tried to clearly establish valve performance characteristics. The results reported in Appendix J are unconclusive. While leak rates for a number of valves including the Stratotech valve were quantitatively defined, the significance of these rates must be still determined. An additional study was begun in June 1987 to answer the following questions:

- (1) What is the effect of valve configuation on valve leak rate?;
- (2) Is the leak rate of the valve proportional to outside chemical concentration?; and
- (3) How do exhaust valve covers (or protective pockets) influence valve leak rate?

Once this study is completed, additional work will be undertaken to examine changes in valve performance following chemical vapor exposure.

### Integration of Test Data.

The results from material chemical resistance and physical property testing must be related to overall suit performance in order to provide meaningful results to end-users. Physical property data are used to determine if materials and components possess sufficient integrity and resistance to physical/environmental abuse relative to evolving standards. Generally, each material should have similar physical property requirements, but these may differ based on the material's function. Such requirements should be set to reflect actual use conditions. While standards have been used in the past based on Chemical Warfare clothing material requirements, the Coast Guard is conducting new studies to better define which properties should be measured and what are reasonable requirements for those properties.

Using chemical resistance data to assess suit performance is a much more complex problem. Because dermal exposure limits don't exist, any permeation of hazardous chemicals through a protective garment is considered unacceptable. The problem arises in comparing material swatch testing against overall suit exposure to chemicals. In general, nost permeation resistance testing represents "worst case" exposure, where the liquid or gaseous chemical is in constant contact with the material over the length of the test period. This is not the usual case for field exposures during spill response and monitoring. Yet, many researchers recognize that certain variables (i.e., temperature, chemical mixtures) can accelerate a chemical's effect on materials.<sup>19</sup> This combined with the inability to test any material-chemical combination under all conditions makes the establishment of suit recommendations difficult.

The Coast Guard has adopted a one-hour criterion for permeation breakthrough time for initially recommending suit use against a particular chemical. One hour should provide a reasonable safety factor for all anticipated exposures. However, this rule is being applied to all primary materials and components, i.e., the recommendation is based on the performance of all primary materials (garment, visor, and glove). These recommendations appear back in Table 27. Mixture testing was initiated August 1987 to determine if synergistic permeation is observed. If this is not the case, then performance of the garment can be judged on the basis of individual mixture component permeation results. Otherwise, predictive models and field test kits will be required to determine the safety of suit use on a case-by-case basis. Predictive models may also be applied, once developed, to different conditions of exposure such as temperature and chemical concentration.

### CHAPTER 5

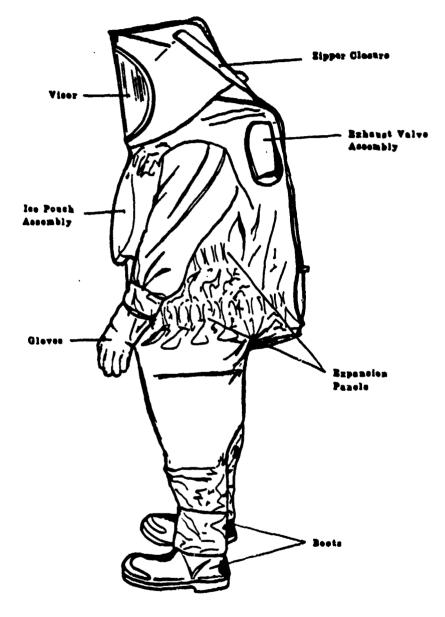
### SUIT DESIGN AND OVERALL SUIT TESTING

The Coast Guard was able to capitalize on earlier development efforts for both designing the Chemical Response Suit and testing its overall performance. The original design of the Viton<sup>R</sup>/chlorobutyl chemical response suit served as the basis for specfications to construct new suits made of Challenge<sup>TM</sup> 5100. Likewise, shortcomings of the protection factor and physiological testing conducted on early suit prototypes (described in reference 3), were identified and used to improve test methods to assess overall suit performance. Suit design and testing has been an evolving and iterative process. Through development to deployment, a number of successive suit designs were considered with each new improvement identified through testing. Overall testing has been critical to understand the capabilities and limitations of the Chemical Response Suit. Material and component testing by itself cannot identify all problems, particularly in terms of configuration, fit, comfort, function, and the overall protection offered the ensemble (the suit in combination with the respiratory apparatus and other auxiliary equipment).

### Suit Design.

Basic Configuration. The configuration of the Chemical Response Suit was based on the original design for suit prototypes constructed from Viton<sup>R</sup>/chlorobutyl laminate. However, a number of changes have been made to either accomodate the Challenge<sup>TM</sup> material or improve the comfort and suit fit to the user. Some patterning changes took place for the use of heat-sealed seams versus the combined heat-sealed and sewn seams used in earlier suit constructions. Other changes included modification of the hood and torso areas for better integration with the breathing apparatus and to provide greater visibility out of the visor, especially for shorter people. As before, sizing of the suit was based on a single size using data for the 95 percentile person (male) obtained from the U. S. Army. In general, the suit as designed fits people from heights of 5'8" to 6'4". Smaller subjects have more difficulty with sleeve and trouser leg length. Figure 11 shows the original suit design, whereas the most recent design is illustrated in Figure 12. The entire suit less the cooling pouch and hest exchanger weighs approximately 9 pounds.

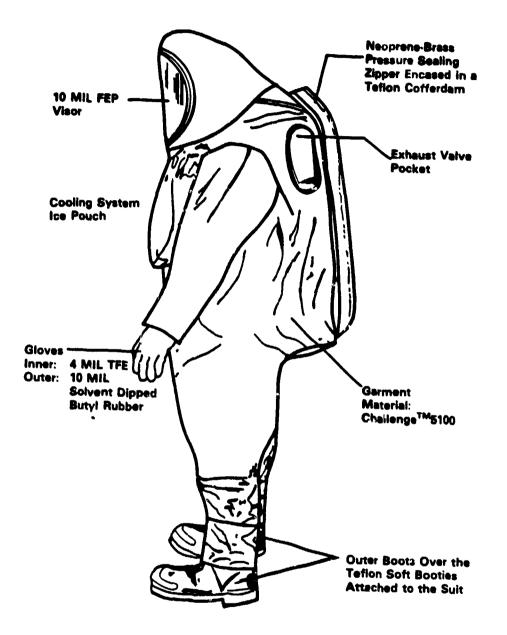
Suit Cofferdam The suit closure, a pressure-sealing sipper is considered one of the weak areas on the suit because of the relatively poor chemical resistance of the materials (neoprene, brass) used in its construction. A cofferdam was designed as part of the Chemical Response Suit to prevent permeation and penetration of chemical vapors or liquid splashes. The cofferdam consists of two long rectangular pieces of Challenge<sup>TM</sup> 5100 heat sealed to the garment wall along both sides of the closure. These two pieces of material flaps extend approximately six inches from the wall of the garment material, and can be heat-sealed using a portable, modified Doboy heat sealer (Metric Model HS-C). The heat-sealer is used to temporarily seal the outer edges of the material flaps resulting in a vapor tight seal that provides



# TOTAL ENCAPSULATING SUIT DESIGN

(Original)

Figure 11



### Current Chemical Response Suit Design

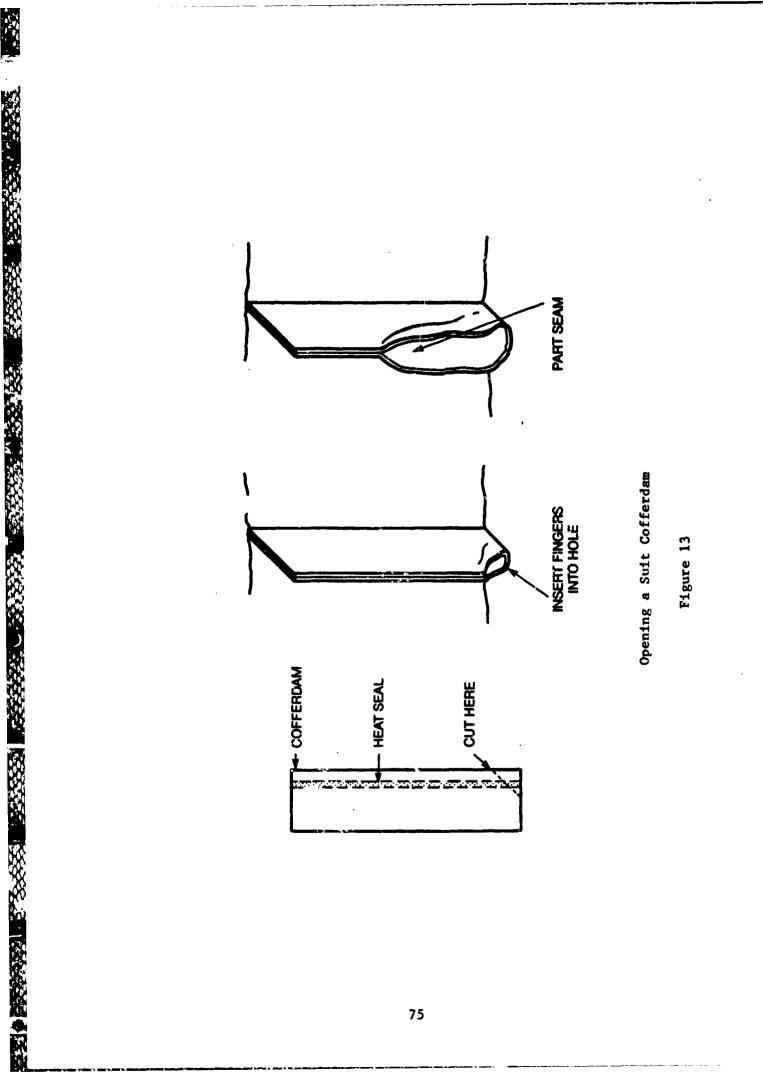
### Figure 12

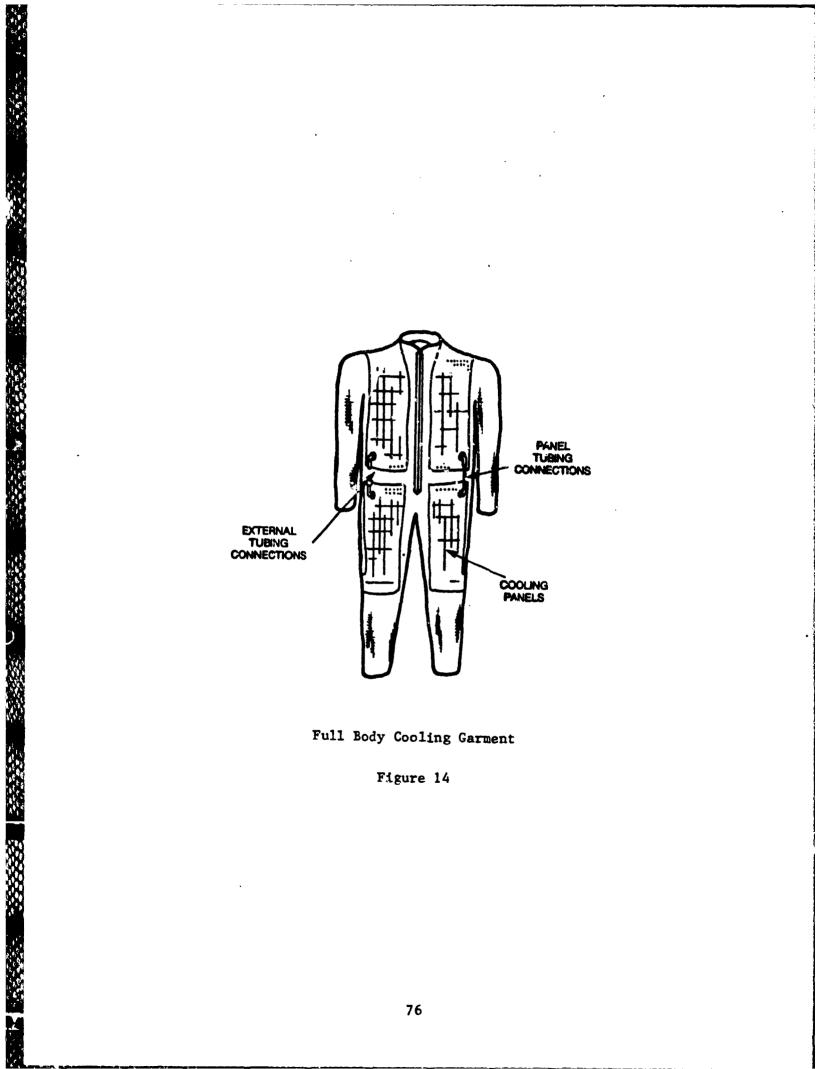
equivalent chemical resistance as the garment material and complete protection to the suit wearer. Doffing of the suit is accomplished by cutting a small postion of the cofferdam away and then separating the heat-seal by simply pulling the flaps apart (see Figure 13). The outer edge of the flaps are long enough such that the heat-sealed portion of the flaps may be cut away 3 to 6 times for reusing the suit (\*\*\*CAUTION: Reuse of the Chemical Response Suit is only permitted under certain circumstances at the discretion of the On-scene commander for the chemical incident).

Integration with Auxiliary Equipment Consistent with previous Coast Guard chemical protective suit prototypes, the Chemical Response Suit was designed for flexibility in accomodating different types of auxiliary equipment, principally breathing apparatuses. The rear of the suit is expanded (see Figure 12) to allow the wearer to use a NIOSH approved, self-contained breathing apparatus (SCBA) with a 60 minute-rated bottle. The Coast Guard uses 60 minute SCBA's as standard equipment for hasardous chemical response. These types of SCBA's are somewhat larger than the conventional SCBA's and allowances must be made in the suit design for their use. Other features of the Chemical Response Suit impact this choice of respiratory protective equipment. For example, the attachment of the gloves to the glove rings lets a user remove his hands from the garment sleeve and adjust his or her breathing apparatus, if needed. Also, one reason for locating the closure in the rear of the suit was to allow easier exchange of SCBA air bottles for extended missions.

The cooling garment developed for earlier suit prototypes (described in reference 3) was adopted for use with early versions of the Chemical Response Suit. The cooling system consists of a separate full body garment which has 'cooling' panels on the front and back of the upper torso and thighs. Cold water is circulated through these panels, absorbs body heat and is returned to a heat exchanger built onto the front of the Chemical Response Suit. An ice water slurry is used to cool the water which returns to the cooling garment via small battery driven centrifugal pump. This system is illustrated in Figures 14, 15, and 16. When deployed, the additional weight of the system including water and ice is approximately 12 pounds, more than doubling the weight of the suit. The effectiveness of the cooling system in preventing heat stress has not been fully determined. Some suit wearers have expressed that they feel 'cool' when wearing the system. However, the additional weight of the system, plus the reduction in mobility from the incorporation of this equipment, add to the physiological strain on the suit wearer. As a consequence, more recently ordered Chemical Response Suits have been fabricated without the cooling pouch and heat exchanger. A study was initiated in June 1987 to fully investigate the Coast Guard cooling system's effectiveness relative to other cooling devices worn with the Chemical Response Suit. The results of these tests will compared for test subjects wearing the suit without any cooling system. This investigation is being conducted in conjuction with the National Institute for Occupational Safety and Health (NIOSH).

Other clothing or equipment that can be worn with the Chemical Response Suit include Nomex jumpsuits, Tyvek<sup>R</sup> disposable suits, communications systems, and heart rate monitors. Tyvek<sup>R</sup> disposable suits are worn underneath the Chemical Response Suit to reduce the likelihood of wearer contamination during gross suit decontamination (to allow doffing of the suit





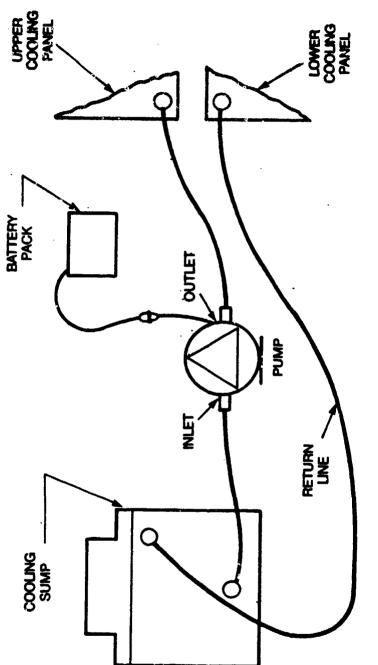
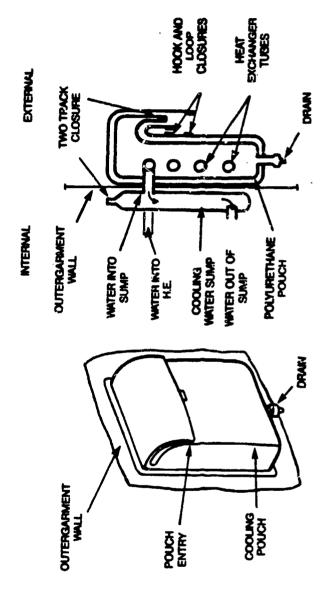


Figure 15

# **COOLING SYSTEM WIRE AND HOSE ROUTING**



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Figure 16

# **COOI ING POUCH AND HEAT EXCHANGER DESIGN**

by the wearer). Nonex jumpsuits can be worn underneath the suit to minimize the hazards of flashover or contact with fire. Equipment items including communications systems or heart rate monitors vary widely, but in general their selection is dependent on how well they integrate with both the Chemical Response Suit and the SCBA. Remic Corporation developed a communications system which is usable with all types oil chemical protective clothing.<sup>22</sup> Their development investigated several considerations for the design and selection of communication devices in hazardous chemical response.

### Overall Suit Testing.

Pressure Testing. The most widely used methods for assessing chemical protective suit integrity involve the practice of inflating the suit to determine leakage. Pressure testing was used to measure the integrity of all Coast Guard Chemical Response Suit Tests following fabrication by both the manufacturer and the recepient Strike Yeam. This method rests the suit and visor materials, suit seams, and suit closure for gas-tightness. In the test, the suit is inflated to a specified pressure and either the pressure drop is measured over time, or a soap solution is applied to the outside of the suit for observing the appearance of bubbles (to detect leaks). The suit exhaust valves must be closed (or plugged) to perform the test, and a pressure gauge is attached with a special fixture that replaces one of the suit exhaust valves. ASTM F1052 specifies a maximum inflation pressure (3 inches water gauge), a test pressure (2 inches water gauge), and an allowable pressure drop (20%) over a three minute period.<sup>23</sup> It also requires using the soap solution to locate leaks if the suit does not meet the pass/fail criteria. The Coast Guard used this method but specified higher maximum inflation and test pressures (4" and 3" water gauge, respectively). The method is illustrated in Figure 17 and was found very sensitive to small leaks in the garment.

Quantitative Leak Testing Qualitative leak testing was used to measure the integrity of the entire Chemical Response Suit to both a gaseous and aerosal challenge agent in a manner simulating actual use. This testing involved the exposure of a test subject wearing the suit and a self-contained breathing apparatus in a closed chamber, while measuring the challenge agent concentrations both inside and outside the suit. The ratio of the external and internal challenge agent concentrations is known as the "intrusion coefficent". Large coefficients indicate high suit integrity. During the exposure, the test subject also engaged in a series of exercises to test the suit under dynamic conditions. Lawrence Livermore National Laboratory tested several Coast Guard suit prototypes using both Freon and polyethylene glycol (PEG) aerosol as challenge agents. The analytical equipment for measuring Freon (an infrared spectrometer for high concentrations and a flame ionization gas chromatograph for low concentrations) could measure a larger range of concentration than the light scattering photometer used to measure PEG concentrations. As a consequence, it was possible to measure larger intrusion coefficients for Freon. On the other hand, Freon concentration could only be measured dicretely whereas the PEG aerosol was continuously monitored. For the combined tests, instrusion coefficients ranging from 9,000 to 100,000 were measured. Variations in these determinations appeared to be the result of specific test subject exercises and the location of the sampling probe. For example, when the sample probe was located inside the suit near the exhaust

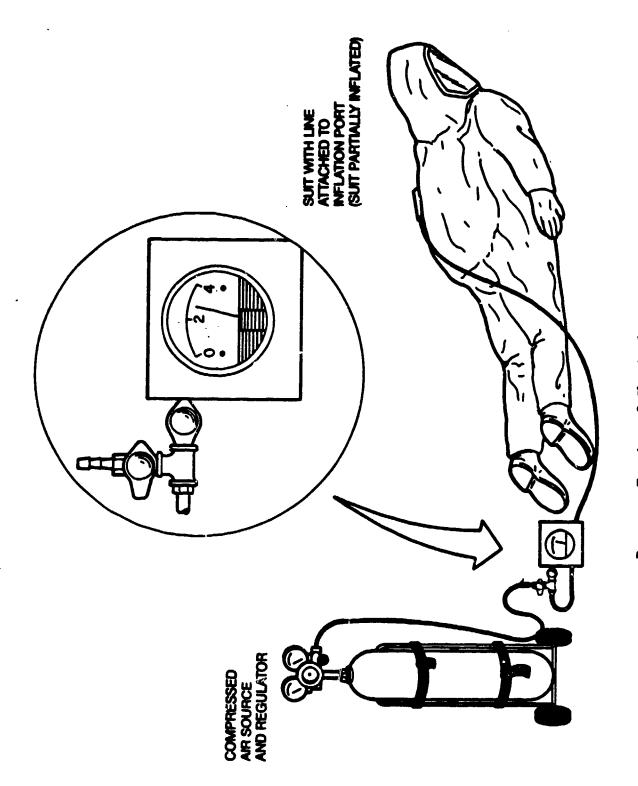


Figure 17

Pressure Testing of Chemical Response Suit

valve, lower protection factors were observed indicating some diffusion of the chemical agent through the valves. Lawrence Livermore National Laboratory also measured internal suit pressure during these tests to assess the range of positive pressure experienced in the suit during operation. These latter results were used to identify overpressurization problems with the selected exhaust valves which were later corrected. Additional information and the results of this testing are provided in the attached Lawrence Livermore Report (Appendix K).

Simulated Chemical Exposure. An ultimate test of the Coast Guard's Chemical Response Suit was performed by Lawrence Livermore National Laboratory in a hostile chemical environment. Two prototype suits were field tested at the Department of Energy's Nevada Test Site in controlled releases of hydrogen fluoride. These suits were placed on specially designed mannequins in two separate tests and subjected to hydrogen fluoride vapo. concentrations up to 12,000 ppm for a 6 minute period. The mannequins contained a pulsed breathing air supply to simulate normal operation of the suit's exhaust valves and four different hydrogen fluoride detection systems. The analytical results of the two tests indicated no penetration of hydrogen fluoride into the suit. There was also no evidence of visible damage to the contaminated suits. A Lawrence Livermore National Laboratory Report on this testing is provided as Appendix L.

Manned Functionality Testing. The Coast Guard conducted several informal manned tests of the Chemical Response Suit to assess ensemble comfort, fit, and function. Manned suit testing is often performed to determine the range of activities that a user can do while wearing the chemical protective suit and a breathing apparatus. These tests included different types of exercises or tasks which simulated the use of the Chemical Response Suit. Results from these tests were generally subjective regarding the design and fit of the garment. A number of improvements were identified for changing various features of the Chemical Response Suit. In one series of tests, the wearer's physiological condition (core temperature, skin temperature, heart rate, and blood pressure) were measured during testing to serve as a means for quantifying the physical stress on the wearer when compared to the same tests of the subject not wearing the suit. This study was also aimed at identifying parameters that could be easily measured in the field for evaluating worker condition to prevent heat stress. The most promising heat stress indicator found was the recovery heart rate, i.e, the measurement of heart rate following a period of rest. The results of these tests are reported in Coast Guard Final Report, "The Measurement of Heat Strain for Workers in Encapsulating, Impermeable Protective Clothing."<sup>24</sup>

### Suit Operations

Use of Encapsulating Garments The Chemical Response Suit is the U. S. Coast Guard's Level A suit for hazardous chemical operations where no contact with a chemical or group of chemicals is permitted. These suits are therefore used when the chemical involved in a response includes high respiratory and skin absorption hazards. The criteria for selecting the Chemical Response Suit for level A protection are described in the Coast Guard's "Policy Guidance for Response to Hazardous Chemical Releases<sup>26</sup> and reference 27. The Coast Guard considers the Chemical Response Suit a 'one-use' suit, i.e., the suit is disposed of if it receives any significant chemical exposure. Significant exposure is defined by the on-scene commander for a particular chemical incident. Yet in general, if the suit is worn into an environment where measureable chemical vapors are present, or if the suit is splashed by liquid chemicals, or if an exposure cannot be determined the suit will not be reused. The basis for this policy rests in the fact that no non-destructive methods exist for determining the level of contamination a suit receives nor the effectiveness of any decontamination procedure. Other invesigators have demonstrated that chemical protective suit materials are contaminated below the surface which may render many conventional decontamination methods useless.<sup>28</sup>

General Suit Use The Coast Guard Office of Engineering and Development has prepared a suit operations manual listing procedures for donning, doffing and maintaining the suit. This manual is specific for the use of the Chemical Response Suit and dictates step-by-step procedures and backgound information pertinent to using the suit.

### CHAPTER 6

### CONCLUSIONS AND FUTURE PLANS

This report has described an extensive suit material/component testing program to support the Coast Guard's use of Challenge<sup>TM</sup> in their Chemical Response Suit. The program represents a comprehensive approach for selecting materials and evaluating their performance for chemical spill response and clean-up. Moreover, this type evaluation allows end-users to understand suit capabilities and limitations. The Coast Guard believes that the new material, Challenge<sup>TM</sup> 5100, will provide protection for more chemicals than any one suit or combination of suits it now uses. Few chemical protective suits offer the same level of documentation. It appears, however, that all primary suit materials and components should be tested to identify weaknesses that might otherwise go undetected. This situation was observed with the failure of the Teflon glove materials. Garment material performance alone does not provide a sufficient basis for making suit use recommendations. Recommendations for using the suits must be based on the performance of the weakest material or component.

Despite the extensive material testing conducted thus far, a number of other tests are required for establishing complete confidence in using the Chemical Response Suit. At the time this report was being prepared, several types of testing were underway; these included:

- Permeation Testing of Challenge<sup>TM</sup> 5100 against priority chemical gases;
- (2) Additional permeation tests on Chemical Response Suit seams;
- (3) Permeation testing of Challenge<sup>TM</sup> 5200 (a Teflon/fiberglass material) against ASTM F1001 Chemicals plus those chemicals which break through Challenge<sup>TM</sup> 5100. Preliminary results from Chemical Fabrics Corporation indicate that Challenge<sup>TM</sup> 5200 may have increased physical integrity and chemical resistance;
- (4) Permeation testing of promising outerglove materials such as Siebe-North's Silvershield<sup>TM</sup> against representative chemicals; and
- (5) Exhaust valve testing against various chemical atmospheres

In August 1987, the Coast Guard plans to initiate a new contract for material permeation testing against a large number of chemicals to expand the list of suit use recommendations. As before, the majority of these chemicals will be selected on the basis of their spill history and toxicity using more recent chemical data. Some of the chemicals will be chosen for modelling purposes, i.e., to help determine why some chemicals permeate the material while other similiar chemicals do not (e.g. allyl chloride versus allyl alcohol). The latter testing will be used to study the chemical interactions with Challenge<sup>TM</sup> 5100 to determine which chemical parameters may be used to predict material performance. The overall design process for the Chemical Response Suit has been iterative. Successive changes in suit design have increased the confort, fit, and function of the suit. However, some areas require improvement, as recommended by field units using the suit. Among these are:

- (1) Expanding the boot splash cuff to allow wearers to move easily in outer boots; More recent versions of the Chemical Response Suit have been made with elasticized cuffs which may solve this particular problem.
- (2) Eliminating the cooling system and replacement with a lighter, more functional cooling device; The current cooling system is heavy, reduces mobility, and is difficult to don. A new study has been initiated to evaluate the effectiveness of the current cooling system relative to other commercial cooling devices. The recommendations from this investigation will be used in concidering modifications to the Chemical Response Suit.

- (3) Developing Teflon/Nomex gloves; The Coast Guard will attempt to develop gloves made out of similiar materials as those used in the garment. The gloves remain a principal area of weakness in the Chemical Response Suit. Successful development of such gloves would eliminate glove selection problems and provide uniform chemical resistance to the wearer.
- (4) Investigating alternatives to the cofferdam; Though the cofferdam provides equivalent protection to the user at the closure area, it can be difficult to heat-seal in a field setting. The alternative of a double sipper may be examined and tested to determine if this protective feature permeation or penetration of the suit closure.
- (5) Examining other suit exhaust values; The current Stratotech values have a relatively high cracking pressure (2.5 inches water gauge). Tests at Lawrence Livermore National Laboratory have shown that pressures fluctuate within Chemical Response Suit from 0.1 to 8.0 inches water gauge. The suit manufacturer, Chemical Fabrics Corporation, has identified an alternative valve which has both a lower cracking pressure and high flow volume. Further testing of this valve is being conducted by Lawrence Livermore National Laboratory.
- (6) Considering suit sizing; The "one wize fits all" concept makes suit fit difficult for the range of Coast Guard personnel who must wear the Chemical Response Suit. The Coast Guard will investigate the possibility of a two or three size suit system in its future procurement of Chemical Response Suits.

The U. S. Coast Guard is actively participating in the development of consensus standards for chemical protective clothing in both the American Society for Testing and Materials (ASTM) and the National Fire Protection Association (NFPA). The latter organization is developing performance standards which will apply to the manufacturing of chemical protective suits. The Coast Guard hopes to transfer much of the testing technology it has developed into these standards. If this process is successful, the Coast

Guard will benefit by being able to use NFPA standards as the basis for its protective suit procurement specifications. The existence of such standards by "themselves will also encourage improvements among manufacturers for better materials and end-products. This type of industry effort will therefore reduce the Coast Guard's need to undertake expensive development programs such as the one described in this final report.

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### APPENDIX A

### SELECTION OF PRIORITY CHEMICALS

(Condensed from Reference 7)

### Encapsulation Requirement:

- + Exposure to chemical requires encapsulating protection based on recommendations in "Material Development Study for a Hazardous Chemical Protective Clothing Outfit," Technical Report CG-D-58-80 (reference 2).
- Exposure to chemical does not require encapsulating protection, or no determination on the need for encapsulation has been made.

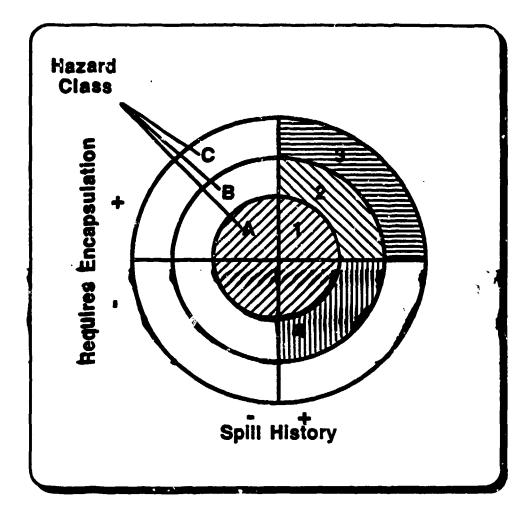
### Spill History:

- Huminal was involved in a spill as reported to the Pollution Information as reported in the U. S. Coast Guard Pollution Incident Reporting System, 1979-1983 (See Table 4-1).
- No spill history exists for the chemical during 1979-1983 in the Pollution Incident Reporting System.

### Hazard Level:

A Chemical has been assigned either a carcinogen class "1" or highly toxic "2", or is toxic through skin absorption as reported in "A Marine Hazardous Substances Data System," Final Report CG-D-9-86 (reference 5); or the National Fire Protection Association has assigned the chemical a "4", its highest health hazard rating (reference 6).

- B Chemical has a hazard assessment index of "3" as reported in reference 5, or a NFPA rating of "3".
- C Other chemicals not included in either classes A or B.



# FIGURE 1. - SELECTION CRITERIA USED FOR PRIORITY HAZARDOUS CHEMICALS PERMEATION TESTING

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### CHEMICAL PRIORITY CATEGORIES SELECTED FOR TESTING

<u>Category I-IVA</u> - All chemicals at Hazard Level A. Only 12 of these chemicals had not been designated as requiring encapsulation. A decision was made to include them in the testing group to avoid relying on a single source of personnel protection safety information (reference 2). This group included 51 chemicals.

<u>Category IB</u> - Hazard Level B chemicals with both an encapsulating suit requirement and a spill history. There were 24 chemicals in this group.

<u>Category IC</u> - Fourteen chemicals which had both a spill history and a need for encapsulating protection, but were not either of Hazard Level A or B.

<u>Category JIIB - Chemicals in Hazard level B with a spill history but did not</u> require ensapsulating protection. This group included 27 chemicals.

# KEY TO DETECTOR CODES AND COLLECTION MEDIA FOR PERMEATING TESTING

Method of Detection

Collection Medium

Gas Chromatographic Techniques

F		Flame Ionization Detector	air
Ε	=	Electron Capture Detector	air
H	8	Hall Detector	air
FP	=	Flame Photometric Detector	atr.

### Colorimetric Techniques

Ion Chromatography

A =	Anion Column	water
Cat =	Cation Column	water

Other Techniques

SI	=	Specific ion	electrodes	water
P	=	Polarography	• • • • • • • • • • • • • • • • • • • •	water
IR	=	Infrared spec	ctrographic analysis	air

# Group I-IVA Liquid Chemicals Arranged by Number of PIRS Spills ('73-'83)

PS = PIRS spills S = Need for encapsulated suit (Y=Yes)

CHR	IS CHEMICAL NAME	DETECTOR CODE	PS S
BNZ	benzene	F	91 Y
TOL	toluene	F	81
ST	styrene	F	59
CRS	cresol	F/C	33
PHN	phenol	F/S	26
	formaldehyde	C	17 Y
MTC	methyl chloride	H/E	15
	acrylonitrile	F	12 Y
NAC	nitric acid	A/C	8 Y
	vinyl acetate	F	8 Y
ACI	vinylidene chloride	N/E	8 Y
	carbon tetrachloride	W/E	6
HFA	hydrofluoric acid	A/C	6 Y
TLL	trichlaraethylane	N/E	5 Y
ADN	adiponitrile	Ŧ.	ĂŸ
CRF	chloroform	H/E	ĴΥ Y
EAM	ethylamine	F	3 Y
ANL	aniline	2	3 Y 3 Y 2 Y 2 1 Y
BAN	n-butyl alcohol	F	2
BCL	benzyl chloride	F	י א ד
BV A	t-butyl amine	F	1 Y
CSA	chlorosulfonic acid	A	1 Y
EPC	epichlorohydrin	H/E	1 Ý
HCN	hydrogen cyanide	51/C	1 Y
MPT	methyl parathion mp=65F	FP	1 Ý
NTB	nitrobenzene	E	1 Y
PTO	parathion	FP	1 Ý
POX	propylene oxide	F	1
TEC	1,1,2,2-tetrachloroethane	H/E	0 Y
DPC	l,3-dichloropropene	H/E	0
DOX	1,4-dioxane	F	0
NPP	2-nitropropane	F/FP	0 Y
ALC	allyl chloride	H/E	0 Y
BRX	bromine	C/P	Ŭ Y
CBB	carbon disulfide(bisulfide)	E	O Y
CPL	chloropicrin	H/E	0 Y
CTA	crotonaldehyde	F	0 Y
	-		

CHRI	S CHEMICAL NAME	DETECTOR CODE	PS	<u>s</u>
DEE	dichloroethylether	H/E	0	Y
DIA		F	0	
DSF		FP	Ō	Y
EDB		H/E	Ō	Ŷ
EDC		H/E	Ō	Ý
GTA		F	Ō	Ý
HFX	hydrogen fluoride	C/A	Ó	Ý
IPP	isopropylamine	F	Ō	Ŷ
	motor fuel anti-knock com	pounds (lead alkyls) E	Ŏ	Ý
TLI		F	Ō	
STC		E	Ō	Y
	toluene diisocyanate	Ē	Ō	Ý
ACY	acetone cyanohydrin	F	Õ	Ŷ
BAM	n-butylamine	F	Ō	Ŷ

# TABLE A-2 (continued)

There are a total of 51 chemicals.

There are a total of 398 spills.

A-6

Group IB Encapsulated Swit Liquid Chemicals with a Spill History Arranged by Number of PIRS Spills ('73-'83)

PS = PIRS spills H = Hazard Index N = NFPA classification

CHRIS CHEMICAL NAME DETECTOR CODE PS H N SFA sulfuric acid A/C 128 3 3 AAC acetic acid F 13 3 2 F ACT acetone 11 3 1 EAC ethyl acrylate ACR acrylic acid F 11 3 2 F 10 3 3 F MIK methyl isobutyl ketone 5 3 2 AAD acetaldehyde 4 3 2 F TCE trichloroethane ACR epette enhydride H/E 432 232 TR ATN acetonitrile F 232 ALA ally! Alcohol Ŧ 233 DP? dichioropropene 232 Ŧ/E ACC acetyl chloride IR 1 3 ARL acrolein Ŧ 1 3 MAM methyl acrylate F 1 3 2 TEL tetraethyl lead E 1 3 XYL xylenol F 1 5 3 DNA di-n-propylamine F 0 5 3 KDZ hydrazine P/C 0 3 PRA n-propyl amine F 043 OLM oleum 033 A/C PPT phosphorus trichloride CSS sodium hydroxide solution 0 Ε 3 Cat 033 TML tetramethyl lead 0 E 3

There were a total of 199 spills.

There are a total of 24 chemicals in this group.

A-7

Group IC Encapsulated Suit Liquid Chemiczls with a Spill History Arranged by Number of PIRS Spills ('73-'83)

PS = PIRS spills H = Hazard index N = NFPA index

CHRI	S CHEMICAL NAME	DETECTOR CODE	PS H N
PCB	polychlorinated biphenyl compounds	Ε	92
CDN	chlordane	Ε	3
HPO	hydrogen peroxide 60%	C	22
	malathion	FP	2
BTR	n-butyraldehyde	F	252
SHR		C/A/Cat	25
ETO	ethion	FP	1
	ethylene cysnehydrin	f	152
· NLD	naled	Ĕ	1
PPO		Č/A	1
SFN	sulfur monochlaride	C/A	1 2
TEP		FP	1
CCT	creosote	F	052
CMH	cumene hydroperoxide	F	0 1

There were a total of 109 spills.

There are a total of 14 chemicals in this group.

Group IIIB Non-encapsulated Suit Liquid Chemicals with a Spill History Arranged by PIRS Spills ('73-'83)

PS = PIRS spills H = Hazard assessment index N = NFPA classification

XLMxylene (meta-xylene as model)F92 3 2EGLethylene glycolF23 3 1PACphosphoric acidC/A22 3 2CHXcyclohexaneF17 3 1MALmethyl alcoholF11 3 1MTMnaphChaleneF10 3 2EALethyl alcoholF9 3 0MEKmethyl ethyl ketoneF6 3 1 <b>EDAethyl ethyl ketone</b> F5 3 3TPTturpentimeF5 3 1DCMmethylene chlorideH/E4 3 2MEAw-formeF3 3 2MEMmethyl methacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
EGLethylene glycolF23 3 1PACphosphoric acidC/A22 3 2CHXcyclohexaneF17 3 1MALmethyl alcoholF11 3 1NTMnaphchaleneF10 3 2EALethyl alcoholF9 3 0MEKmethyl ethyl ketoneF6 3 1EDAethylenediamineM/E5 3 3TPTturpentineF5 3 1DCMmethylene chlorideH/E4 3 2MKAwhemeF3 3 2MMMmethyl methacrylateF3 3 2DEAdiethanolamineF/E2 3CRBchlorobenzeneH/E1 3 2
PACphosphoric acidC/A22 3 2CHXcyclohexaneF17 3 1MALmethyl alcoholF11 3 1MTMnaphChaleneF10 3 2EALethyl alcoholF9 3 0MEKmethyl ethyl ketoneF6 3 1EOAmethylenediamineW/E5 3 3TYTturpentimeF5 3 1DCMmethylene chlorideH/E4 3 2MKAmethylene chlorideF3 3 2MMMmethyl benzeneF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
CHXcyclohexaneF17 3 1MALmethyl alcoholF11 3 1NTMnaphchaleneF10 3 2EALethyl alcoholF9 3 0MEKmethyl ethyl ketoneF6 3 1EDAmethyl ethyl ketoneF6 3 1EDAmethylene/iamineN/E5 3 3TPTturpentineF5 3 1DCMmethylene chlorideH/E4 3 2MRAm-homeneF4 3 1ETBethyl bunzeneF3 3 2NMMmethyl methacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
NALmethyl alcoholF11 3 1MTMnaphChaleneF10 3 2EALethyl alcoholF9 3 0MEKmethyl ethyl ketoneF6 3 1EDAmethylenediamineM/E5 3 3TPTturpentimeF5 3 1DCMmethylene chlorideH/E4 3 2MRAmethylene chlorideF3 3 2MEMmethyl methacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
MEKmethyl ethyl ketoneF6 3 1EDAathylenemianineM/E5 3 3TPTturpentineF5 3 1DCMmethylene chlorideH/E4 3 2MMAa-hommeF4 3 1ETBethyl benzeneF3 3 2MMMmethyl methacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
MEKmethyl ethyl ketoneF6 3 1EDAathylenemianineM/E5 3 3TPTturpentineF5 3 1DCMmethylene chlorideH/E4 3 2MMAa-hommeF4 3 1ETBethyl benzeneF3 3 2MMMmethyl methacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
MEKmethyl ethyl ketoneF6 3 1EDAathylenemianineM/E5 3 3TPTturpentineF5 3 1DCMmethylene chlorideH/E4 3 2MMAa-hommeF4 3 1ETBethyl benzeneF3 3 2MMMmethyl methacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
EDA athylemediamineN/E5 3 3TPT turpentineF5 3 1DCM methylene chlorideH/E4 3 2NKA n-homeneF4 3 1ETB ethyl banzeneF3 3 2NPM methyl methacrylateF3 3 2DEA diethanolamineF2 3CRB chlorobenzeneH/E1 3 2
TPTturpentimeF5 3 1DCMmethylene chlorideH/E4 3 2HXAm-incaseF4 3 1ETBethyl benzeneF3 3 2NMMmethyl methacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
DCMmethylenechlorideH/E4 3 2HXAn-houseF4 3 1ETBethylbenzeneF3 3 2NMMmethylmethacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
NKA n-homeF4 3 1ETB ethyl benzeneF3 3 2NMM methyl methacrylateF3 3 2DEA diethanolamineF2 3CRB chlorobenzeneH/E1 3 2
ETBethylbenzeneF3 3 2MMMmethylmethacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
NMMmethyl methacrylateF3 3 2DEAdiethanolamineF2 3CRBchlorobenzeneH/E1 3 2
CRB chlorobenzene H/E 132
CRB chlorobenzene H/E 132
ETA ethyl acetate F 131
EET ethvl ether F 132
FFA furfural F 132
BCN n-butyl acetate F 131
BTC n-butyl acrylate F 132
PAL n-propyl alcohol F 132
PNA propionic acid F 132
GAT gasoline F 031 IPA isopropylalcolol F 031
NSS naphtha F 032
TTE tetrachloroethylene H/E 032

There were a total of 224 spills.

There are a total of 27 chemicals in this group.

# PRIORITY LIST HAZARDOUS CHEMICALS

# In order of Spill Frequency

CHRIS CHEMICAL NAME	PIRS SPILLS
SFA sulfuric acid	128
SHD caustic soda (sodium hydroxide)	95
PCB polychlorinated biphenyl compounds	92
XLM xylene	92
BNZ benzene	91
AMA ammonia	85
TOL toluene	81
HCL hydrochloric acid	63
STY styrene	59
CLX chlorine	35
CRL cresol	33
PHN phenol	26
EGL ethylene glycol	23
PAC phosphoric acid	22
Fits formeldehyde	17
CHX cyclohexane	17
MTC methyl chloride	15
AAC acetic acid	13
TTE tetrachloroethylene	12
ACN acrylonitrile	12
ACT acetone .	זו
EAC ethyl acrylate	11
MAL methyl alcohol	11
ACR acrylic acid	10
NTM napthalene	10
EAL ethyl alcohol	9
NAC nitric acid	8
VAM vinyl acetate	8
VCI vinylidene chloride	8
ALM aluminum sulfite	7
CBT carbon tetrachloride	6
HFA hydrofluoric acid	6
MEK methyl ethyl ketone	6
TCL trichloroethylene	5 5 5
EDA ethylenediamine	5
NIK methyl isobutyl ketone	5
TPT turpentine	5
AAD acetaldehyde	4
DCN methylene chloride	4
HXA n-hexane	4

# TABLE AG(continued)

CHRIS CHEMICAL NAME

.

PIRS SPILLS

TCE trichloroethane	4
CRF chloroform	3
EAM ethylamine	3
PPW phosphorus	3
ETB ethyl benzene	ž
HMM methyl methacrylate	3
ANL antiine	2
ACA acetic anhydride	4. 2
ATN acetonitrile	۰ <b>۲</b>
	2
ALA allyl alcohol	2
DEA diethanolamine	2
MLA maleic anhydride	2
BAN n-butyl alcohol	2
BCL benzyl chloride	1
diy butyi anine	1
CSA chlorosulfonic acid	1
DMA dimethylamine	1
EPC epithiershydrin	1
NTB nitrobenzene	1
POX propylene oxide	· · ·
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### APPENDIX B

# TEST METHODOLOGY FOR PERMEATION TESTING AND DETERMINATION OF MINIMUM DETECTION LIMIT

(Contractor Report by Tezas Research Institute)



86176:LNB 8 April 1986

# MONTHLY STATUS REPORT

CHEMICAL TESTING OF PROTECTIVE CLOTHING MATERIAL

# Contract No. NICG39-86 A-80331 Task Order 0001

Submitted to:

Contracting Officer U. S. Coast Guard Academy New London, CT 06320-4195

Submitted by:

Texas Research Institute, Inc. 9063 Bee Caves Road Austin, TX 78733-6201 512-263-2101 512-263-3151

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#### 1.0 INTRODUCTION

The majority of the time in the reporting period was devoted to setting-up for testing. This included modifications of the test apparatus to accommodate three permeation cells, and addition of valves and plumbing to permit the introduction of the permeant at a known concentration for the purpose of establishing minimum detectable limits. The apparatus and test results are described below.

### 2.0 PERMEATION TEST APPARATUS

A photograph of the apparatus is attached as Figure 1, and a schematic of the valving and plumbing is shown in Figure 2. This configuration is different from the original design presented to Lt. Stull, the Project Officer, and Dr. Alan Betz, the COTR. The apparatus will simultaneously monitor the collection gas  $(N_2)$  from three cells. Rather than switching

from cell to cell, the system is currently monitored by routing the collection gas from the cells into a common line and then diverting a portion of this to the photoionization detector (FID). This type of <u>composite</u> testing was established to permit a more rapid testing. No breakthrough will be observed with the majority of the chemicals during the 3hour maximum exposure period. Therefore, testing these themicals with individual cells for 3 hours each would result in 9 hours of negative data. If breakthrough is observed, the cells will be re-run individually and average breakthrough times and permeation races will be calculated.

The testing is conducted in the following manner. Instrument-grade nitrogen is introduced into the system through three flow meters, each controlling the flow to the collection side of the permeation cells (refer to the yellow lines in Figure 2). Flow rates are set at 90 ml/min., which is equivalent to two volume changes per min. in the collection side. Preliminary experiments have shown that with toluene as a permeant and plasticized polyolefin as the barrier, flow rates did not affect breakthrough times except below 30 ml/min. It was reasoned that flow rates above 90 ml/min. would only decrease the sensitivity of the system. More importantly, an increase in flow rate would result in a substantial increase in pressure. This pressure against the sample would more than likely alter the permeation rate. All of the tubing and fittings throughout the system are narrowbore glass, Teflon, and stainlass steel and are not conducive to high (> 100 ml/min.) flow rates without rises in pressure. It might by argued that this flow rate is insufficient to result in vaporization of rapidly permeating and poorly volatile chemicals. If this case were to happen, TRI feels that results from every test system could be questioned. Breakthrough times are not expected to vary appreciably. However, permea-tion rates would reflect both diffusion plus the volatilization rate of the chemical. Thus, the flow rate and resulting volatilization rate in one system would give different results from another system even though the recommended minimal flow rates, as specified by the ASTM Standard, were met.



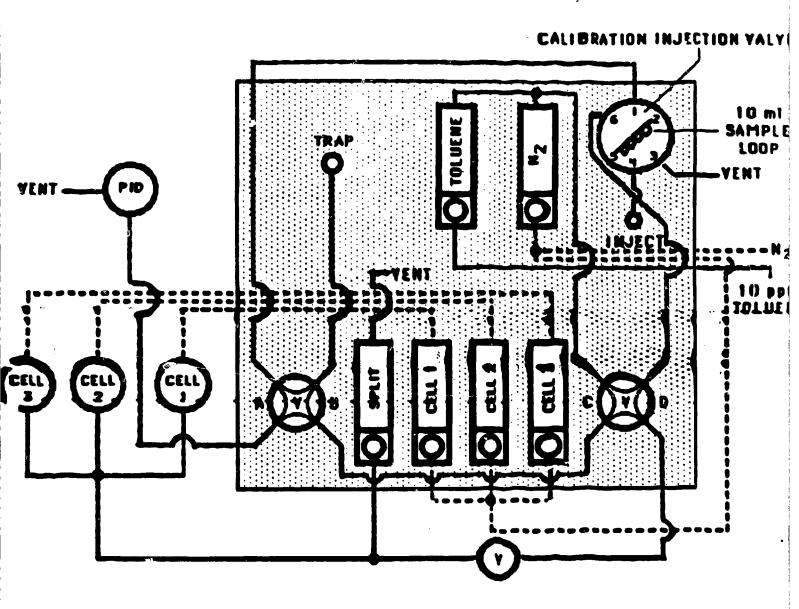
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# Figure 1 - Photograph of PID System

# Permeation test apparatus

Figure 2



POSITION

PROCESS

•	C	CELLS TO DETECTOR VIA INJECTION VALVE.
		N <sub>2</sub> /TOLUENE TO TRAP.
A	D	CELLS TO TRAP.
		N <sub>2</sub> /TOLUENE TO DETECTOR VIA INJECTION VALVE.
8	C	CELLS TO TRAP VIA INJECTION VALVE.
		NZ/TOLUENE TO DETECTOR.
B	D	CELLS TO DETECTOR.
		N <sub>2</sub> /TOLUENE TO TRAP VIA INJECTION VALVE.



The carrier gas exiting the cells is split, so that 60 ml/min. is routed to the PID and the remainder is vented (refer to blue lines in Figure 2). The portion going to the detector flows first through a Swagelok needle value to control the split and then that to a two-position value with positions marked "C" and "D". From this value the gas can either flow directly to a second value with positions "A" and "B" or arrive at that value via a calibration injection value. The gas can then be routed to the PID or to the port for trapping with adsorbents.

A typical test might proceed as follows. A cell is prepared and attached to the system without the challenge chemical. The glassware and

Teflon gaskets are baked in a vacuum oven at 100°C to prevent out-gasing of contaminants. The flow rate and electrometer/detector settings are established to record a steady baseline. The timing of the test begins upon addition of the challenge chemical. The recorder indicates the breakthrough time and the lag period before steady-state permeation is reached. When steady-state permeation is indicated, the valve is switched to position "B" thus diverting the gases to the adsorbent trap (e.g., charcoal, Tenax, chrometor, calling gal). Several adsorbent tubes are used to callect discrete sample volumes. These tubes are desorbed and analyzed by gas chrometographic techniques specified by the NIOSH Manuals. If no breakthrough occurs during the 3 hour maximum test period, two methods for checking the sensitivity and minimum detectable limits for the system are amployed.

The first method involves the establishment of a known concentration of toluene in the system. Figure 2 depicts the process of calibration with toluene. A 10.2 ppm toluene in nitrogen mixed gas (Scott Specialty) is routed through a flow meter (marked toluene) and joins downstream to a nitrogen line. The two flow meters (toluene and nitrogen) allow the mixing of a standard gas containing from zero to 10.2 ppm toluene. The mixed gas is then routed through the system to the PID. Figure 3 shows a typical detector response in millivolts as a function of toluene concentration from one to five parts per million. The scatter in data points is not due to the detector response, but rather to the inability to accurately produce a toluene standard using the flow meters. However, for these purposes the accuracy of the toluene standards is acceptable. The sensitivity of the system exceeds the limits of the flow meters to mix a very low (< 1 ppm) toluene standard. The noise in the system is  $\pm$  0.4 mv. A signal that is twice the noise would be easily recognized. Based on this assumption, a signal of 0.8 my above baseline would be the minimum detectable limit. For toluene, the 0.8 my response would correspond to 0.04 ppm toluene at a 60 ml/min. flow rate through the detector.

Other chemicals with a substantially different response will have different minimum detectable limits with the PID system. Therefore, if no breakthrough occurs, MDLs will be checked in an empirical manner by a second method. This involves a 6-port injection valve and calibration sample loop that is illustrated in Figure 2. A static gas sample is prepared with glass, gas

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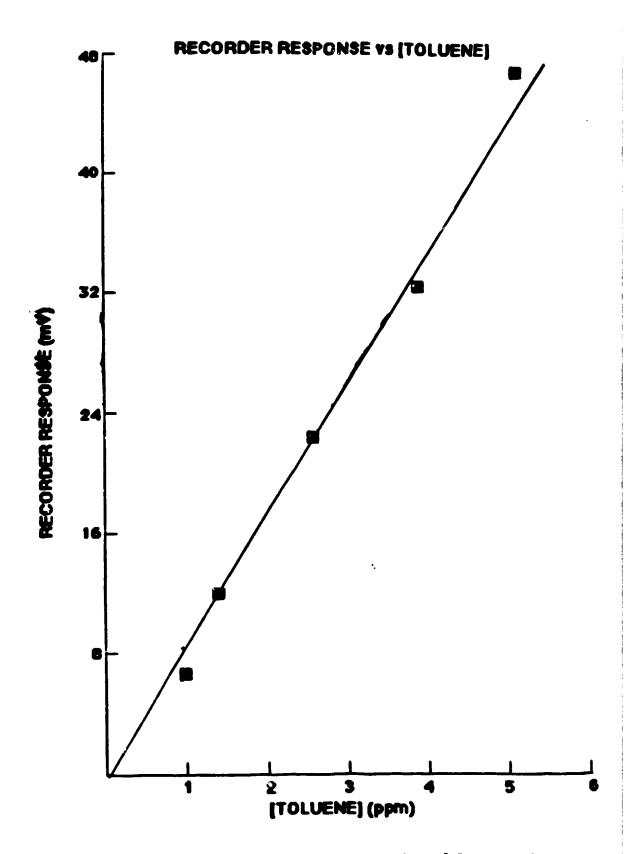


Figure 3 - Sensitivity and Linearity of PID to Toluene.

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collection bottles equipped with septa. Typically, the standard is prepared by volatilization of a known amount of the chemical followed by appropriate dilution. The prepared standard ( $\leq 1$  ppm) is then loaded in the injection sample loop (10 ml) and injected in the system at 60 ml/min. The detector will respond for approximately seven seconds to this chemical. Assuming linearity in the detector response, an NDL will be calculated at a signal that is twice the noise. This value will always be overstat ', simply because the standard chemical that is injected will be less than the calculated concentration due to unavoidable sorption of the chemical to glass and metal surfaces.

### 2.1 Problem Areas

The permeation testing of the Challenge 5100 material has been slow to get started. There are several reasons for this. One is the re-fixturing to accommodate three cells and to provide for a method of establishing NDLs for each chemical. The following is a list of gliches and set-backs that have been corrected:

- Off-gassing of hydrocarbons from O-rings and adsorption of permeants by O-rings. Corrected by going to all stainless steel and glass construction with short segments of Teflen tubing.
- (2) Loaks in cells because of back-pressure from low dead volume tubing and improper tightoning of flanges. Corrected by replumbing the system to eliminate back pressure. Verification of leak-proof assembly was achieved by testing of cells with a device containing a magnahelic gauge. Small leaks can be quickly detected during assembly of the cells.
- (3) Sensitivity of the system to vibrations and temperature changes. Corrected, as best as possible, by placement in a stable environment.
  - (4) Problems with off-gasing of previously used Teflon gaskets and glassware. Corrected by incubation of the gaskets in a vacuum oven at 100 C.
  - (5) System shut-down due to damaged UV light source. Corrected by replacement of the light source. The light source was of a new design, thus necessitating a restart of permeation testing because of different sensitivity.
  - (6) Adsorption of chemicals on the walls of the stainless steel tubing. It is apparent that some adsorption of chemicals will unavoidably occur on the walls of the tubing. This has been observed with system checks using toluene. TRI is still in the process of grappling with this problem which is common to all sensitive permeation test apparatuses. The only area that is affected is the minimum detectable limits because the path of the

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MDL standards is not exactly the same as the permeants. If no solutions can be found, MDL values will be expressed as "less than or equal" values. that is, if 0.1 ppm of a standard gave a detector signal of twice the noise, then the MDL would be reported as  $\leq 0.1$  ppm. The less than figure would signify that the concentration at the detector was prebably less than 0.1 ppm because of adsorption, but if there were 0.1 ppm at the detector, the detector response would have been at least twice the noise.

### 3.0 **RESULTS**

Complete tests of the material with toluene, styrene and cresol have been completed. These are attached in the requisite formatting and with Xerox copies of actual recorder tracings. Phenol has been tested with no breakthrough. However, these results are pending the establishment of MDLs.

#### 4.0 PROJECTED SCHEDULE

The apparatus is currently working well except for the previously stated problem with establishing MDLs. Rather than delay testing, TRI will continue to do the testing and establish MDLs at a later date, when other ideas have tested. TRI will continue to use the toluene standard to verify reproducibility and sensitivity of the system.

The projected schedule is 10 chemicals per week. This schedule was started April 3 and barring unforeseen problems, the 117 chemicals will easily be completed before the end of the fiscal year.

It is suggested that the COTR visit TRI for discussions on HDLs, future work with mixtures, and analytical methods that do not use gas chromatography. it is also suggested that test sheets of well-characterized neopreme be provided to TRI for testing with one or more chemicals. This testing will ensure that test results with the PID system are comparable to those reported by other investigators.

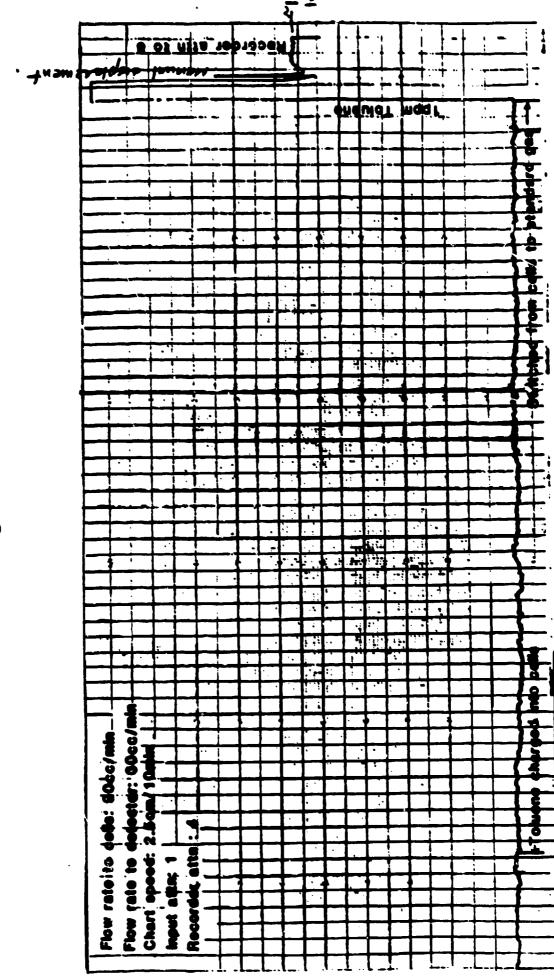
# CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION DATA (One Material-One Chemical Series)

# 1. DESCRIPTION OF PRODUCT EVALUATED

	TYPE: Teflon laminated NOMEX		
	MATERIAL GENERIC NAME: Challe	nge 5100	
<u> </u>	CONDITION BEFORE TEST: Unused	. Bo visible imperfe	ctions
D:	SUPPLIER: Chemical Fabric Cor	'B.	
R:	CATALOG NUMBER: N/A		
	LOT OR NANUFACTURER DATE: N/A		
	NOMINAL THICKNESS: 15-20-11		
	DESCRIPTION:		والكرب ويهيك فيستخدم فستخد ومنبع وتشتهد فالمراجع والمنافع
. TE:	ST METHOD (ASTM P739-81 or EQUIV	ALENT)	
	DATE TESTED: April 2, 1986		
	TESTING LABORATORY: Texas Rese	arch Institute	
	ENT PERCENTION CONTRACT REAL	eves Road, Austin, 7	7 78711
<b>C</b> .	ANALYTICAL METHOD: COntinuous	photoioni estion de	
D.	TENDERATINAT: 22-24	purcease and det	
2.	TEMPERATUR : 22-25 COLLECTION WEDLA: 42		
	SYSTEM: N2	•	
₽	OTHER TEST CONDITIONS:		
	DEVIATIONS FROM ASTM P739-81 M		
	COMMENTS:	Eldop. Flow late to	GEILS WES JUCC/BIN
A. B.	CHEM NAME(s) : Toluene CAS NUMBER(s): 292 CONC. (IF MIX): N/A	: Toluene : 292 : N/A	: Toluene : 292
A. B. C.	CHEM NAME(s) : Toluene CAS NUMBER(s): 292 CONC. (IF MIX): N/A CHEMICAL SOURCE: J.T. Baker	: Toluene : 292 : N/A : J.T. Baker	: Toluene : 292 : N/A : J.T. Baker
A. B. C. D.	CAS NUMBER(s): 292 Conc. (IF MIX): N/A CHEMICAL SOURCY: J.T. Baker	: 292 : N/A : J.T. Baker	: 292 : N/A : J.T. Baker
B. C. D.	CAS NUMBER(s): 292 Conc. (IF MIX): N/A CHEMICAL SOURCY: J.T. Baker	: Toluene : 292 : N/A : J.T. Baker : Beagent grade	: 292 : N/A : J.T. Baker
B. C. D. V. TI	CAS NUMBER(s): 292 CONC. (IF MIX): N/A CHEMICAL SOURCE: J.T. Baker Reagent grade EST RESULTS NUMBER OF SAMPLES TESTED: Three	: 292 : N/A : J.T. Baker : Beagent grade	: 292 : N/A : J.T. Baker : Reagent grade
B. C. D. V. TI	CAS NUMBER(s): 292 CONC. (IF MIX): N/A CHEMICAL SOURCY: J.T. Baker Reagent grade EST RESULTS NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthr	: 292 : N/A : J.T. Baker : Beagent grade	: 292 : N/A : J.T. Baker : Reagent grade
B. C. D. V. TI	CAS NUMBER(s): 292 CONC. (IF MIX): N/A CHEMICAL SOURCE: J.T. Baker Reagent grade EST RESULTS NUMBER OF SAMPLES TESTED: Three	: 292 : N/A : J.T. Baker : Beagent grade	: 292 : N/A : J.T. Baker : Reagent grade
B. C. D. V. TE A. B.	CAS NUMBER(s): 292 CONC. (IF MIX): N/A CHEMICAL SOURCY: J.T. Baker Reagent grade EST RESULTS NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthr MIN DETECTABLE LIMIT: 0.04 ppm STEADY STATE PERMEABILITY RATE:	: 292 : N/A : J.T. Baker : Reagent grade : Gugh was observed and N/A	: 292 : N/A : J.T. Baker : Reagent grade
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B. C. D. X. TE A. B. C.	CAS NUMBER(s): 292 CONC. (IF MIX): N/A CHEMICAL SOURCY: J.T. Baker Reagent grade EST RESULTS NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthr MIN DETECTABLE LIMIT: 0.04 ppm STEADY STATE PERMEABILITY RATE: AN/LYTICAL SENSITIVITY: 0.3 Co	: 292 : N/A : J.T. Baker : Reagent grade : Reagent grade N/A wlowhs/gram (benzene	: 292 : N/A : J.T. Baker : Reagent grade
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Chemical Resistance Testing of USCG Material with Toluene



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86176:DJN 15 January 1986

FINAL TASK REPORT

SYRINGE PUMP NETHOD FOR DETERMINING NININUM DETECTION LINIT

Chemical Resistance Testing of Protective Clothing Material

Contract No. DTCG39/85-A-80331 Task Order 003

### Submitted To:

Contracting Officer U.S. Coast Guard Academy New Iondon, CT 06320-4195

Submitted By:

Texas Research Institute, Inc. 9063 Bee Caves Road Austin, TX 78733-6201 512/263-2101

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#### 1.0 INTRODUCTION

The determination of minimum detection limits is necessary to obtain meaningful permeation results for the USCG project. A syringe pump method has been used with satisfactory results with TRI's permeation test system. This final report outlines the further development of this methodology. Completion of this third task order also includes an application manual and fabrication of the system.

### 2.0 EQUIPMENT

The apparatus used to perform the permeation testing consisted of ASTM standard two inch or one inch glass permeation cells with PTFE gaskets and a photoionization detector. Stainless steel tubing and short pieces of flexible PTFE tubing allowed a flow of nitrogen to continually sweep through the collection side of the cell to the detector. The photoionization detector was an HNU model PI-52-02 outfitted with either an 11.7 or 10.2eV lawp. The response from the detector was recorded on a Houston Instruments strip chart recorder.

A Sage Instruments syringe pump Model 341 was used with an SGE, gas tight, removable-needle, 5 µl glass syringe to pump the chemical of interest. The syringe was outfitted with meedles cut from small diameter vitreous silica tubing. The syringe was modified to better fit the needs of the system.

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3.0 METHODS

The permeation test apparatus was operated by methods consistent with ASTM method D-739. Standard 2 inch permeation cells were used in which aluminum foil was sandwiched between the challenge side and the collection side of the cell to greate an impermeable Sarrier for MDL determination. Nitrogen flowed at 100 cc/min into the collection side of the cell, across the sample surface and out to the photoionization detector in an open loop system. The collection side of the cell was continually monitored for the presence of the challenge chemical.

Minimum detection limits were determined by pumping the chemical of interest into the collection side of a standard permeation cell at a very slow rate using a syringe pump. The chemical was filtered prior to filling the syringe using a 0.2 micron disposable filter assembly. The tip of the needle was placed into a specifically fabricated glass joint fitted to the permeation cell (see Figure 1).

A constant low level concentration of the chemical of interest was delivered to the detector via the same pathway a permeant would travel. The pump rate could be adjusted from a minimum of 0.116 µl/hr to many higher settings. The concentration of the chemical of interest being delivered to the detector was calculated using the following equation:

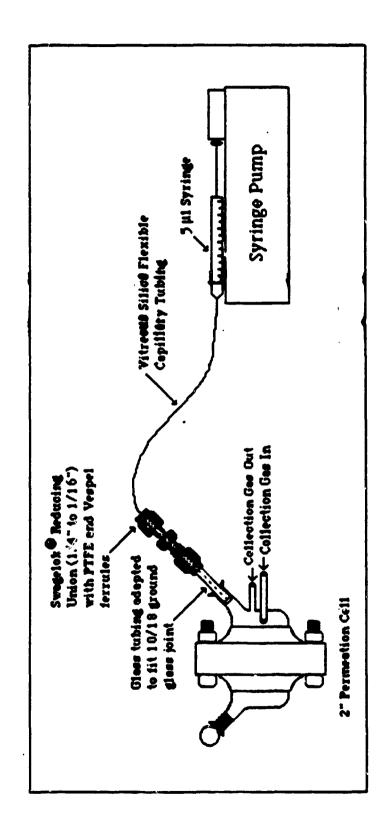
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where d is the density, MV is the molar volume (24,450 ( $\mu$ l/mmole)), PR is the syringe pump rate ( $\mu$ l/hr), MW is the molecular weight (mg/mmole), and F is the nitrogen flow rate (1/hr).

The millivolt response generated from the determined concentration was used to calculate the minimum detectable limit. The minimum detectable limit was subjectively defined as the concentration corresponding to the response that was twice the noise level. The noise level was determined as the long term fluctuation from the average baseline.

#### 4.0 APPLICATIONS

Initially the response generated by the slow introduction of the chemical into the permeation cell was not a smooth recorder tracing. The tip of the needle was placed directly in the stream of nitrogen entering the collection side of the permeation cell. This resulted in a wildly pulsating response that centered around the expected value. This was possibly caused by microdroplet formation at the tip of the needle. An increased response was produced when the droplets were dispersed by the force of the nitrogen stream and evaporated. This was followed by a period of lower response while the microdroplet was reforming.



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To alleviate this problem, the needle was then placed into the adapter at the glass joint of the permeation cell. This removed the tip of the needle from the turbulent nitrogen stream and forced the chemical to diffuse down the glass adapter before entering the outlet stream. This diffusion process helped to average out minor concentration variations. It was found that the placement of the needle closer to the nitrogen stream caused a more varied response. Placement of the needle tip in the center of the length of the ground glass stopper provided the optimum response.

Three sizes of capillary tubing (0.025, 0.050, and 0.075 mm inside diameter) were used as needles in the system. It was expected that a smaller diameter tubing would decrease the size of the microdroplet formed and help decrease the amplitude of the pulsing response. The tubing had no apparent effect on the response.

A disk of glass fiber filter was cut to fit the inside diameter of the ground glass adapter and placed at the tip of the meedle. It was expected that the filter would act as a microporous diffuser and reduce the pulsing effect of the microdroplet formation. In actuality the filter was found to act as an absorbent, retaining the chemical of interest and holding it for a period of time that decreased the efficiency of the MDL determination. It was also difficult to keep the filter in place at the tip of the needle.



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Temperature had a strong effect on the response generated. Minor increases in temperature such as those produced by touching the needle created a spiked response. The signal would then fall below the expected value before resuming the initial response. This effect could be explained by thermal expansion of the liquid within the barrel of the syringe and the needle itself. Efforts were made to insulate the needle, although this had little effect on improving the pulsing of the response.

The cells and syringe pump were placed in an incubator in an effort to thermostat the system. This effectively smoothed the signal. Some pulsing was observed that could be attributed to the turning on and off of the heating element to produce slight fluctuations in temperature. The liquid in the needle and the barrel of the syringe emulated a very sensitive thermometer. The expansion and contraction due to temperature changes altered the rate of delivery. Because of this "thermometer effect" it was critical that the temperature be precisely and smoothly maintained.

The concentration delivered to the detector is strongly dependent on the flow rate of nitrogen to the detector and the flow rate of the chemical of interest into the cell. Any leaks in the system or variances in the flow rate had a substantial effect on the response.

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The syringe itself was evaluated and modified to better fit the needs of the system. A metal stop was added near the end of the barrel to keep the barrel from slipping in the pump's syringe holder. The syringe guide tip was glued to the base of the syringe to eliminate one source of leaks. It was found that the PTFE tip on the plunger must fit tightly in the barrel of the syringe to insure that the correct amount of chemical is delivered into the permeation cell. It was believed that at slow pump rates a portion of the liquid escapes around the tip of the plunger resulting in a lesser amount of chemical being delivered to the cell.

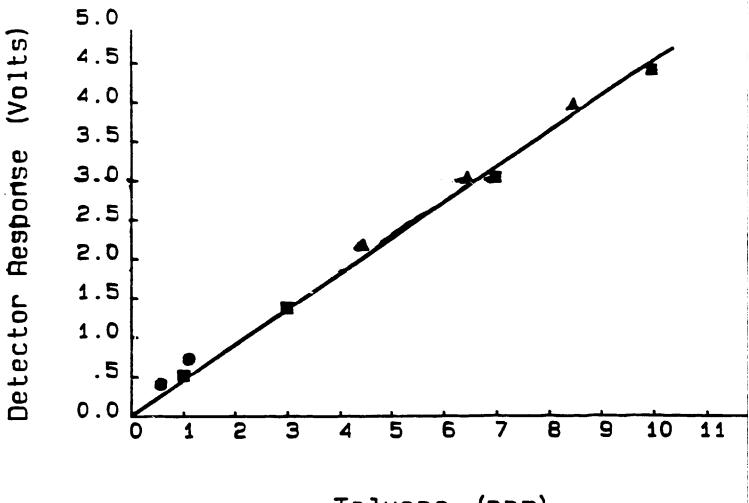
Detector response for toluene was investigated as a function of standard 1" and 2" permeation cells. There was no discernible difference in the response values.

#### 5.0 VALIDATION

Known concentrations of standard toluene gas were introduced into the system and compared with the detector response from toluene introduced via the syringe pump (Figure 2). As expected, the responses generated from the standard toluene gas were linear with respect to concentration (square symbols in Figure 2). Neat toluene delivered into the system by the syringe pump is shown with the triangular symbols in Figure 2. The lowest concentration, 4.45 ppm, was calculated from the slowest pump rate (0.116 µl/hr) at a flow rate of 100 ml/min. Lower levels of toluene (circular symbols) were achieved by diluting the toluene in acetonitrile, which is not seen by



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Toluene (ppm)

Figure 2. Comparison of the Responses of Toluene Introduced via the Syringe Pump with Known Concentrations of Toluene Gas.

Standard toluene gas concentrations  $(\blacksquare)$ ; Calculated toluene levels from neat Toluene introduced with the syringe pump  $(\blacktriangle)$ ; Calculated toluene levels from toluene diluted in acetonitrile and introduced with the syringe pump  $(\bigcirc)$ .



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the photoionization detector. Figure 2 illustrates that the calculated concentrations of toluene delivered by the syringe pump are the same as known levels of standard toluene gas and that the syringe pump method can reproducibly introduce toluene vapors into the permeation test system in a linear fashion.

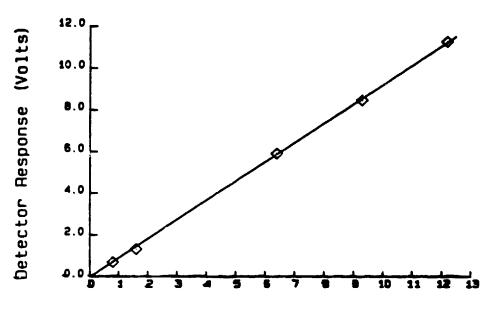
The dilution of toluene in acetonitrile is an example of an effective method to achieve low concentrations for MDL determinations. The chemical of interest is diluted in a volatile solvent that is not detected by the method of analysis. For example, for systems using electron tapture detectors, 2,2,4-trimethylpentane or other appropriate alkness example is emerful as a dilution solvent. In addition to dilution, solvents provide an effective method for introducing less volatile and viscous compounds into the system for MDL determination. The highly volatile solvents would act in vaporizing the chemicals that would tend to remain at the tip of the needle in the neat, liquid state.

Five other chemicals (acetone, benzene, hexane, tetrachloroethylene, and styrene) with varying volatilities were also tested in the syringe pump system for linearity of response. The results of these tests are outlined in Figures 3-7. The linearity of the responses indicates that the syringe pump method is applicable to MDL determinations for other organics.

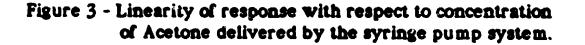
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ACETONE (ppm)



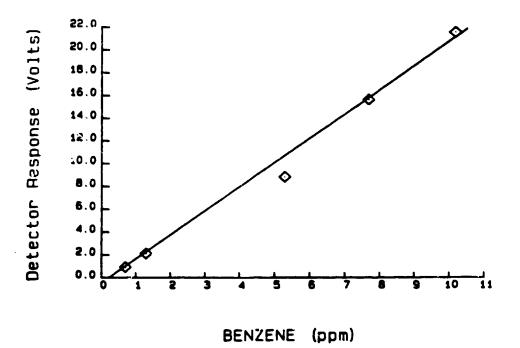
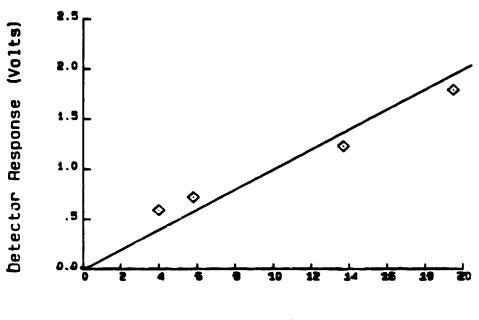
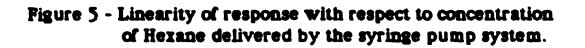


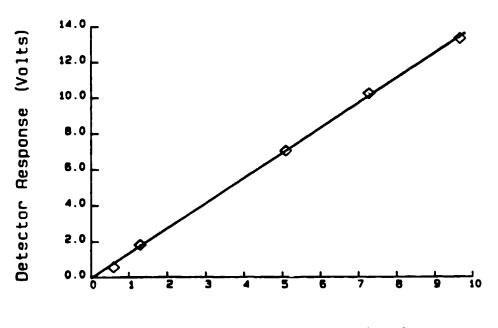
Figure 4 - Linearity of response with respect to concentration of Benzene Celivered by the syringe pump system.





HEXANE (ppm)



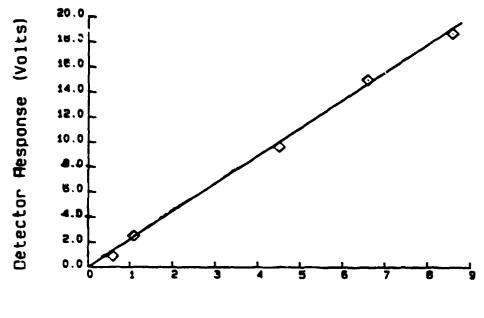


TETRACHLOROETHYLENE (ppm)

# Figure 6 - Linearity of response with respect to concentration of Tetrachloroethylene delivered by the syringe pump system.



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STYRENE (ppm)

Figure 7 - Linearity of response with respect to concentration of Styrene delivered by the syringe pump system.



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#### 6.0 CONCLUSION

Reported breakthrough times in permeation testing are string by dependent upon the sensitivity of the analytical method used. The standard method, ASTN D-739 gives guidelines for performing permeation testing but does not specify the analytical methods or the complete test apparatus. A universal technique for comparing and correlating results from different systems is needed. The syringe pump method is an effective technique which delivers known concentrations through the same pathway that the permeant would travel. It allows detection limits and permeation testing to be performed at different times and correlated by the relationship of a standard gas (toluene), thus compensating for differences in sensitivity. Differences in the size of tubing, size of permeation cell, and position of the needle tip have little effect on the efficiency of the system. Modification of the syringe, attention to flow rates, and maintenance of a constant temperature are important items to consider when optimizing the syringe pump method for determining NDLs.

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86176:DJM 15 January 1987

### APPLICATIONS MANUAL

# SYRINGE PUMP METHOD FOR DETERMINING MINIMUM DETECTION LIMIT

Chemical Resistance Testing of Protective Clothing Material

Contract No. DTCG39-86-A-80331 Task Order 003

Submitted To:

Contracting Officer U.S. Coast Guard Academy New London, CT 06320-4195

Submitted By:

Texas Research Institute, Inc. 9063 Bee Caves Road Austin, TX 78733-6201 512/263-2101

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### 1.0 INTRODUCTION

An innovative method for determining minimum detection limits in permeation testing has been developed. A syringe pump is used to deliver the chemical of interest into a standard ASTM permeation cell at a very slow rate. A constant low level concentration of the chemical of interest is sent to the detector via the same pathway the permeant would travel. The purpose of this manual is to instruct the reader in the application of this system.

#### 2.0 INSTRUMENTATION

Sage Instruments Model 341 syringe pump SGE gas tight, removable needle, 5ul glass syringe SGE vitreous silica tubing, 0.075mm Glass adapter and fittings Standard ASTM permeation cell, 1 or 2 inch

### 3.0 CALIBRATION

Calibration of the syringe pump is necessary to determine the rate of delivery of the chemical of interest.

A. Plug in the syringe pump and note that the power light is on when the toggle switch is set to either pump rate (ml/min or ml/hr).



- B. Place the drive carriage (black box) on the gears at the far right position, making sure the box is parallel to the edge of the pump.
- C. Mark the position of the drive carriage (a piece of masking tape works well for this).
- D. Set the rate selector switch to 1. Turn he mode switch to the "on ml/hr" position.
- E. Make note of the time. Allow the pump to operate at least 24 hours.
- F. Turn off the pump and again note the time. Measure the distance the drive carriage has traveled in centimeters.
- G. Calculate the delivery rate using the following equation:

Distance traveled in cm×5µlTime in hours2.55cm

Where 2.55cm corresponds to the length of 5µl of liquid in the SGE syringe.



For example, if the drive carriage traveled 3.5cm in 60 hours the calculation would be:

 $\frac{3.5 \text{cm}}{60 \text{ hrs}}$  ×  $\frac{5 \text{µl}}{2.55 \text{cm}}$  = 0.114 µl/hr

This is the amount of chemical delivered per hour at a pump rate setting of 1ml/hr with the SGE 5µl syringe.

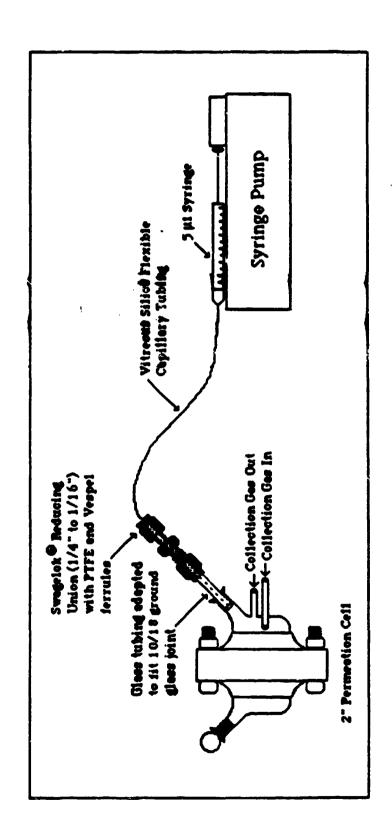
### 4.0 METHOD

- A. Standard 1 or 2 inch permeation cells may be used with this method.
  - 1. To use a standard 2 inch permeation cell, sandwich aluminum foil between the challenge and the collection side of the cell. (This creates an impermeable barrier, keeping the chemical of interest on the collection side of the cell.) Position the cell so that the collection side of the cell is facing the syringe pump (See Figure 1). Place the ground glass stopper in place in the cell.
  - 2. To use a standard 1 inch permeation cell, seal the challenge and the collection sides of the cell together. Position the cell so that the challenge side is facing the syringe pump. Place the ground glass stopper in place in the cell.



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- B. Set the detection system for standard conditions as per normal operating procedure. Set the appropriate nitrogen flow through the permeation cell and to the detection system. Adjust the baseline to zero. Allow the system to stabilize while proceeding with steps C-J.
- C. Cut a piece of vitreous silica tubing to a length convenient to reach from the syringe to the inside of the permeation cell. Remove the end cap from the syringe and thread the tubing through the cap and through the teflon spacer so that the tubing extends approximately one inch past the end of the syringe side of the cap. (Note if the tubing will not fit through the teflon spacer, the hole in the spacer can be enlarged with the reaming tool provided with the syringe.)
- D. The syringe can be filled with the chemical of interest by one of two methods:
  - 1. The syringe can be back-filled by using another syringe to fill the barrel. A 5-10µl syringe with a small diameter needle slightly longer than the length of the SGE syringe works well for this. Fill the back-fill syringe with the chemical of interest; insert the needle in the SGE svringe and fill the barrel, making sure there are no bubbles in the liquid.



### 86176:DJM Fage 6

- 2. The syringe can be filled by directly placing the tip of the syringe (without the tubing or the end cap on) in the chemical of interest and siphoning the chemical into the syringe. A 10 ml size pipette pump works well for this. Attach the pipette pump to the end of the syringe, place the syringe in the chemical of interest and slowly suck the chemical into the syringe. When the chemical is above the plunger line, carefully detach the pipette pump. The pipette pump can also be used to eliminate bubbles in the barrel by pulling a gentle vacuum on the chemical und forcing the bubbles to rise to the surface.
- E. Attach the end cap with the vitreous silica tubing to the filled syringe. Make sure that the syringe end of the tubing is "square" and butts up tightly against the metal guide tip. Finger tighten the end cap as tight as possible. Gently tug on the silica tubing to make sure the tubing fits tightly.
- F. Carefully place the teflon tipped plunger in the syringe, making sure that no air bubbles are trapped at the tip. The plunger should fit snugly in the barrel, but one should not have to force it. A slight bend to the metal portion of the plunger when pressure is applied is permissible.
- G. Apply pressure to the plunger until the chemical comes out of the tubing.



- H. Lift the knob of the spring loaded syringe holder high enough to accommodate the syringe barrel. Place the loaded syringe in the syringe holder, resting the metal stop on the back of the holder. Lower the knob to hold the syringe in place.
- I. Place the drive carriage on the gears, making sure the carriage is parallel to the edge of the pump. Advance the drive carriage by turning the rate selector switch to 9 ml/min. As the carriage approaches the syringe, check to make sure that the pump actually delivers the chemical from the tip of the meedle. As soon as the chemical can be observed coming from the tip of the meedle, turn the pump off.
- J. Thread the vitreous silica tubing through the fittings in the specially fitted glass adapter. Position the tip of the tubing in the center of the ground glass stopper. Tighten the fitting at the other end of the adapter to hold the tubing in place.
- K. Remove the stopper from the equilibrated permeation cell system and replace with the adapter. To insure a tight seal, a small amount of stopcock grease may be placed on the stopper. Hold the stopper in place by sealing with a small piece of parafilm.



L. Set the rate selector to 1 and switch the mode to ml/hr to begin pumping the chemical into the system. A response should be detected within a few minutes, depending on the volatility of the chemical of interest. Allow the response to reach a steady state before concluding the analysis. Remove the adapter and replace with the ground glass stopper to check the baseline at the completion of the run.

5.0 CALCULATIONS

The concentration of the chemical of interest delivered to the detector is determined by the following formula:

Where d is the density of the chemical of interest
MV is the molar volume (24,450 µl/mmole)
PR is the syringe pump rate (µl/hr)
MW is the molecular weight of the chemical of interest (mg/mmole)
F is the nitrogen flow rate (l/hr)



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The minimum detection limit was subjectively defined as the concentration corresponding to the response that was twice the noise level. The noise was determined as the long term fluctuation from the average baseline. The MDL is calculated by the following formula:

> MDL in ppm = <u>ppm delivered x 2 x N</u> R

Where N is the noise in millivolts

R is the response of the chemical of interest in millivolts

NOTE: This equation can also be used with detection systems that respond in units other than millivolts. The use of different units will have no effect on the determination as long as the noise and the response are measured in the same units.

For example, the NDL for toluene would be determined as follows:

ppm delivered =  $0.8669 \times 24450 \times 0.114 = 4.37$  ppm 92.15 x 6

If the millivolt response generated by toluene was 2160, and the noise was 32, the MDL would be determined as follows:

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## 6.0 TROUBLESHOOTING

- A. No Response, lower than expected response
  - 1. Check all fittings for leaks
  - 2. Check the syringe for clogs and/or bubbles
  - 3. Make sure pump is actually delivering the liquid
  - 4. Check syringe for leaks
    - Break off the tip of the silica tubing that fits into the guide tip of the syringe and resecure the cup.
    - b. Check tip of plunger, resize if necessary. The teflon tip can be resized by heating it to 350 degrees, causing the teflon to expand. (If the plunger does not fit tight enough, liquid will escape around the tip of the plunger.)
    - c. Replace the teflon spacer inside the end cap of the syringe.
- B. Excessive noise, Pulsing of response
  - 1. Check all fittings for leaks
  - Check placement of needle in adapter (Generally, the closer the tubing is to the nitrogen flow, the greater the pulsing response).
  - 3. Check syringe for clogs. Clean with cleaning wire.



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7.0 NOTES

- A. The importance of tightly fitting tubing and ferrules cannot be over emphasized.
- B. The syringe should be treated with great care at all times, as it is very easy to apply too much pressure to the plunger and split the barrel. Do not force the plunger. If the plunger requires force to inject the chemical check the barrel and guide tip for clogs and clean with a cleaning wire before proceeding.
- C. The syringe should be cleaned with acetone and dried between uses. It should be flushed several times with the chemical of interest when loading.
- D. Various sized vitreous silica tubing can be used. Tubing with inside diameters of .025 and .050 mm have also been used with success. The 0.075 mm sized tubing does provide the tightest fit and most durability.
- E. Filtering the chemical of interest to remove particulates is not usually necessary when using a good quality reagent.



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- F. To achieve very low concentrations of the chemical of interest, dilute with a volatile solvent that is not detected by the method of analysis. For example, for systems using electron capture detectors, 2.2.4-trimethylpentane or other appropriate alkanes would be useful as a dilution solvent. This technique is also useful for introducing less volatile and highly viscous compounds into the system. The highly volatile solvents act in vaporizing the chemicals that tend to remain at the tip of the needle in the neat, liquid state.
- 6. Known concentrations of a standard toluene gas were introduced into the system to provide a means for comparing NDLs run at different times. With this method, it is only necessary to make one NDL estimation. By using the ratio between the responses of the standard gas at the time of the NDL determination and at the time of the actual permeation testing, the response value of the chemical of interest can be adjusted for any differences in the sensitivity of the instrument. This not only provides a means for correlation of results, it acts as a check on the reliability of the system.

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# APPENDIX C

# PERMEATION TEST DATA FOR PRIORITY LIQUID CHEMICALS

(Contractor Report by Texas Research Insitute)



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86176:KLV 17. October 1986

MONTHLY STATUS REPORT

# CHEMICAL RESISTANCE TESTING DF PROTECTIVE CLOTHING MATERIAL

Contract No. DTCTG39-86-A-80331 Task 0001

Submitted to:

Contracting Officer U.S. Coast Guard Academy New London, CT 06320-4195

Submitted by:

Texas Research Institute, Inc. 9063 Bee Caves Road Austin, TX 78733-6201 512-263-2101 512-263-3151



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### 1.0 INTRODUCTION

This report outlines the methods and results of the work done on the permeation testing of flat samples of Challenge 5100 for the U.S. Coast Guard. The first task of permeation testing with the 115 CHRIS chemicals was completed October 15, 1986.

### 2.0 METHODS

The majority of the chemicals were tested using a continuous photoionization detection technique. The standard permeation cells and Teflon gaskets were baked in a vacuum oven at 100C prior to each run to prevent off-gassing of contaminants. Instrument-grade nitrogen was used to sweep the collection side of each cell at a rate of 100 cc/min. A portion of the composite flow from three cells was routed to an HNU photoionization detector model PI-52-02 putfitted with either a 10-2 pr 33-7 eV lamp. After a steady baseline was recorded, the challenge chemical was added and the timing of the test began. Three cells were monitored concurrently for three hours or until permeation reached steady state. If breakthrough did occur, one individual cell was rerun.

After each run a response reading was taken for a 1.0 ppm standard toluene mixture. This enabled the monitoring of the sensitivity of the detector daily and allowed repeat runs to be performed under the same conditions by altering the lamp intensity.

Minimum detection limits (MDL's) were determined using a syringe pump. The syringe pump was used to deliver the chemical of interest directly into the permeation cell at a rate of .1257 ul/hour. This slow rate of introduction into the stream of N2 delivered a steady low level concentration of the chemical to the detector. This concentration was calculated as follows:

ppm = u1/1 N2

= density(mg/ml) x 24,450 (ul/mmole) x .1257 (ul/hour)
molecular weight (mg/mmole) x N2 rate (l/hour)

The response generated by this calculated concentration was then used to determine the MDL. The MDL was defined as the concentration which would give a response of twice the noise level. The noise level was determined as the long term peak to peak deviation from the average baseline.

The syringe pump response was also used to calculate steady state concentrations and permeation rates for those chemicals where breakthrough was observed. Breakthrough was observed for methylene chloride, trichloroethylene, and vinyl acetate before

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the development of the syringe pump method for determining MDL'S. Permeation rates were determined for methylene chloride and trichloroethylene by trapping on adsorbent charcoal and analyzing by gas chromatography. The NIDSH method for determination of vinyl acetate called for trapping on Chromosorb 107 with thermal desorption. As an alternative, 500 ul samples were taken directly from the carrier gas exit stream and analyzed by GC with a 10:1 split to column. A standard was prepared in carbon disulfide and analyzed using a 1 ul injection.

Xylench and naphthalene were tested by placing a few crystals in the challenge side of the permeation cell allowing the cell to become saturated with their vapors. MDL's were determined using the analogous crescil for xylench and benzene for naphthalene.

Included in the 117 chemical CHRIS list were the mixtures gaspline, turpentine, mephtha, and crepsote. The pesticides included on the CHRIS list were not tested in their pure state, but as 25-50% solutions in petroleum distillates. MDL's for the mixtures were calculated using the smallest molecular weight of the components in the solution tested. This gave the largest MDL possible for the varying concentrations.

Nine chemicals were tested for breakthrough using ion chromatography as the method for analysis. The challenge side of the permeation cell was filled with the test chemical and the collection side was filled with deionized water. Samples were taken at 15 minute intervals for a total test time of three hours. Prior to sampling, 0.5 ml of deionized water was added to the collection cell. The syringe was flushed with the collection media 3-4 times to allow mixing before a 0.5 ml sample was taken. Standards and samples were analyzed on a Dionex 2000 ion chromatograph equipped with a ASA-4 column. MDL's were determined by diluting the standard to the lowest detectable level. A blank cell was run to determine background levels.

Sodium hydroxide and sodium hydrosulfide solutions were tested for breakthrough using atomic absorption of sodium as the method of analysis. The same sampling method as above was employed to take 1.0 ml samples. Certified atomic absorption standards from sodium chloride and the samples were analyzed on a Microtek Unicam SP-90 atomic absorption spectrophotometer. MDL's were determined by diluting the standard to the lowest detectable level. A blank cell was run to determine background levels.

A 30% solution of hydrogen peroxide was tested for breakthrough using a colorimetric method of analysis. One ml samples were taken as above. To each sample, standard and blank, 0.2 ml of 10mM ferrous ammonium sulfate and 0.1 ml of 2.5M potassium thiocyanate was added. The red colored reaction was

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observed and the absorbance at 480nm was read on a Gilford 300 microsample spectrophotometer. The MDL was determined by diluting the standard to the lowest detectable level.

Acetonitrile, adiponitrile, and ethylene cyanohydrin were not detected by the photoionization detector. They were tested for breakthrough by trapping the collection gas on adsorbent charcoal for 15 minutes at a flow rate of 200 cc/min over three hours. The last sample was trapped for fifty minutes to assure breakthrough did not occur. The charcoal was desorbed in benzene and analyzed by gas chromatography. The MDL's were determined by diluting the standards to the lowest detectable level.

# 3.0 RESULTS

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The results of the completed test are included in the requisite format along with photocopies of actual recording copies. The following table summarizes the results for those chemicals which were tested with continuous photoionization detection and no breakthrough was observed.

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Challenge Cheaical	•	* *	ppa/aV Cheeical	••
1,1,2,2-Tetrachloroethane	11.70	.088	.083	.23
1,2-Dibroscethane	11.70	.094	.038	.10
1.2-Dichloroethane	11.70	.061	.057	.07
1,2-Dichloroethylether	11.70	.088	.091	.15
1,2-Dichloropropane	11.70	.085	.097	.31
1,3-Dichloropropene	11.70	.082	.069	.17
1,4-Dioxane	11.70	.094	.117	.38
2-Nitropropane	11.70	.080	.248	.59
Acetaldehyde	11.70	.082	NA	NA
Acetic acid	11.70	.065	7.780	35.46
Acetic Anhydride	11.70	.085	.178	.57
Acetone	11.70	.09B	.414	1.16
Acetone Cyanohydrin	10.20	.001	.043	2.74
Acetyl Chloride	10.20	.001	35.460	35.46
Acrylac Acid	11.70	.088	.325	.86
llyl Altunol	11.76		.235	1.13
Aniline	11.70	.049	.164	.46
leazene	11.70	.434	.028	.05
Benzyl Chloride	11.70	.185	.038	.11
Bronine	11.70	.038 -	.331	.53
Guty] Acetate	11.70	.088	.106	.25
Butyl Acrylate	11.70	.088	.099	.22
Butylamine	11.70	.098	.096	.32
Butyraldehyde	10.20	.001	.002	.29
Carbon Tetrachloride	11.70	.059	.114	.29
Chlordane	10.20	.001	.036	.26
Chlorobenzene	11.70	.085	.085	.20
Chloroform	11.70	.049	.102	.19
Chloropicrin	10.20	.001	.064	1.80
Creosote	10.20	.001	.030	.32
Cresol	11.70	.035	.019	.03
Crotonaldehyde	11.70	.088	.193	.62
Cuaene Hydroperoxide	11.70	.082	.502	1.20
Cyclohexane	11.70	.082	.077	.25
Diethanolanine	11.70	.082	NA	NA
Diisopropy]amine	11.70	.080	.109	.39
Disethyl Sulfate	10.20	.001	.038	1.52
Dipropylanine	11.70	.088	.137	.25
Epichlorohydrin	11.70	.088	.234	.75
Ethion 4	10.20	.008	.001	.03
	11.70	.106	.205	.03
Ethy] Acetate		.094	.307	1.72
Ethy] Acrylate	11.70		.895	2.86
Ethyl Alcohol	11.70	.096	.075	
Ethyl Benzene	11.70	.087		.14
Ethyl Ether	10.20	.001	.001	.13
Ethylamine 70%	11.70	.091	.206	.74
Ethylene Blycol	11.70	.085	.469	2.63
Ethylenediamine	11.70	.080	.870	2.78
Formaldehyde 37%	11.76	.094	NA	NA



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Challenge Chemical	Lamp (eV)	pps/sV Toluene	pps/sV Chesical	MDL (ppa)
Gasoline	10.20	.001	.007	.16
Glutaraldehyde	10.20	.001	.013	.43
Hexane	11.70	.094	.089	.25
Hydrazine hydrate	10.20	.001	.023	.09
Isopropyl Alcohol	11.70	.080	.241	1.16
Isopropylamine	11.70	.094	.327	1.57
Malathion (50%)	10.20	.001	.129	1.03
Methyl Acrylate	10.20	.001	.151	.48
Nethyl Alcohol	11.70	.085	.519	4.07
Nethyl Ethyl Ketone	11.70	.091	.311	.65
Nethyl Isobutyl Ketone	11.70	.104	1.212	3.98
Nethyl Nethacrylate	11.70	.080	.117	.19
Methyl Parathion (44.0%)	10.20	.001	.002	.03
n-Butylalcohol	11.70	.098	.147	.32
n-Propyl Alcohol	10.20	.001	.012	.76
n-Propylanine	11.70	.073	.307	.74
Naled	10.20	.001	NA	NA
Maphtha	10.20	.001		4.55
Naphthaleve	10.20	.001	.001	.82
Nitrobenzene	11.70	.033	.051	.0B
o-Toluidine	11.70	.436	.185	.43
Parathion (45.07%)	10.20	.001	.002	.01
PCës	10.20	.001	.001	.02
Phenol	11.70	.034	.020	.03
Propionic Acid	10.20	.001	.024	.31
Styrene	11.70	. 025	.020	.05
Tetrachloroethylene	11.70	.082	.033	.11
Toluene	11.70	.024	.026	.06
Tolylene 2,4-diisocyanate	11.70	.046	.206	.69
Trichloroethane	11.70	.089	.167	.60
Turpentine	10.20	.001	.0005	.03
Vinylidene Chloride	10.20	.001	.003	.49
Xylene	11.70	.100	.072	.13
Iylenol	10.20	.001	.001	.01

MDL's were not determined for acetaldehyde, formaldehyde, diethanolamine, and naled. Acetaldeyhde has a boiling point of 21C and therefore was too volatile to place in the syringe. The formaldehyde solution was 63% water which had a quenching effect on the detector. Diethanolamine and naled were too viscous to load into the syringe.

Breakthrough was observed for eight chemicals. The following table gives the seven chemicals that broke through, their appropriate breakthrough times, steady state permeation rates, and MDL's.



Chesical	Noise	MDL	BT time	SS rate
	(øV)	(ppe)	(min)	(ug/hr#c#2)
***********************	*****	******	*******	**********
Acrolein (Composite)	4	. 12	44.0	2.37
Acrolein (Run 1)	5	.06	38.0	1.61
Acrylonitrile (Run I)	.80	.46	54.0	5.12
Acrylonitrile (Run II)	.80	.18	76.0	.86
Allyl Chloride (Composite)	.80	.16	102.0	.67
Allyl Chloride (Run I)	.80	.16	165.6	.60
Carbon Disulfide (composite)	.80	.10	21.6	2.76
Carbon Disulfide (Run I)	.40	.05	20.5	3.65
Carbon Disulfide (Runll)	.40	.05	17.7	2.59
Hethylene Chloride (Runl)	1.60	.27	46.B	1.37
Methylene Chloride (Renl1)	. 20	.13	.50.4	.96
Nethylene Chloride (RunIII)	1.00	.17	55.2	1.27
Propylene Duisle (Dageside)	1.20	<b>48</b>	137.0	LAB
Propyleve Buide (Run 1)	0A.S	1.01	\$70.0	1.07
Trichloroethylene (Run I)	.96	.07	143.0	2.04
Trichlereethylene (Run 11)	1.40	.10	156.0	2.04
Trichloroethylene (Run III)	1.28	.09	146.0	1.63
Vinyl Acetate (Composite)	1.00	.21	74.0	3.30
Vinyl Acetate (Run I)	1.00	.21	137.0	3.73

No breakthrough was observed for the chemicals tested using methods other than continuous photoionization detection. The following table gives the results.

CHEMICAL	METHOD	STANDARD	RET. TIME	MDL
		**************		
CHLORDSULFONIC ACID	ION CHROMATOGRAPHY	5 pps 5020HC1	2.08 ain	0.5 ppm
NITRIC ACID	ION CHROMATOGRAPHY	10 ppm nitrate	4.16 ein	eqq 5.0
OLEUM	ION CHROMATOGRAPHY	10 pps sulfate	8.35 ain	0.2 pps
PHOSPHORIC ACID	ION CHROMATOGRAPHY	10 ppm phosphate	6.88 min	0.5 ppm
PHOSPHOROUS DIYCHLORIDE	ION CHROMATOGRAPHY	5 ppm POC13	2.04 min	0.5 ppm
PHOSPHOROUS TRICHLORIDE	ION CHROMATOGRAPHY	5 ppm PC13	2.11 min	0.5 pps
SILICON TETRACHLORIDE	ION CHROMATOGRAPHY	5 ppm SiCl4	2.05 ain	0.5 ppa
SULFUR NONOCHLORIDE	ION CHROMATOGRAPHY	5 pps \$2012	2.07 min	0.5 ppe
SULFURIC ACID	ION CHROMATOGRAPHY	10 ppm sulfate	8.57 ain	0.2 pps
SODIUM NYDROXIDE SOLN 50X	ATOMIC ABSORPTION	0.5-4.0 pps	NA	0.5 ppe
SODIUM HYDROSULFIDE SOLN 10X	ATOMIC ADSORPTION	0.5-4.0 ppm	NA	0.5 pps
ACETONITRILE	GAS CHROMATOGRAPHY	15.6 ppa	.82 ain	0.6 pps
ADIPONITRILE	GAS CHROMATOGRAPHY	7.2 pps	1.8 ein	0.3 pps
ETHYLENE CYANDHYDRIN	GAS CHROMATOGRAPHY	11.9 pps	2.48 ain	0.4 pps
NYDROGEN PERUXIDE 30%	COLORIHETRIC	0.6-6.0 pps	M	0.6 pps



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4.0 PLANS

Included in this report are the results from testing 97 different chemicals. Motor fuel antiknock compounds, tetraethyl lead, and tetramethyl lead were not available from the distributor at this time. It may be possible to acquire a small sample of tetramethyl lead within a few weeks and the chemical will be tested at that time. The pesticide, tetraethylpyrophosphate, is no longer manufectured and therefore was not tested. Hydrofluoric acid required fixturing to prevent the etching of glassware. Hydrogen fluoride, hydrogen cyanide, and methyl chloride are gaseous compounds and will be included in a separate task order covering gaseous chemicals.

The chemicals that broke through and show differences in breakthrough times and permeation rates between the composite and individual runs will be repeated. It is also planned to do permeation testing on ten different mixtures as soon as the list of mixtures is received. The testing of the seamed samples and visor samples will continue as scheduled.

# 1. DESCRIPTION OF PRODUCT EVALUATED

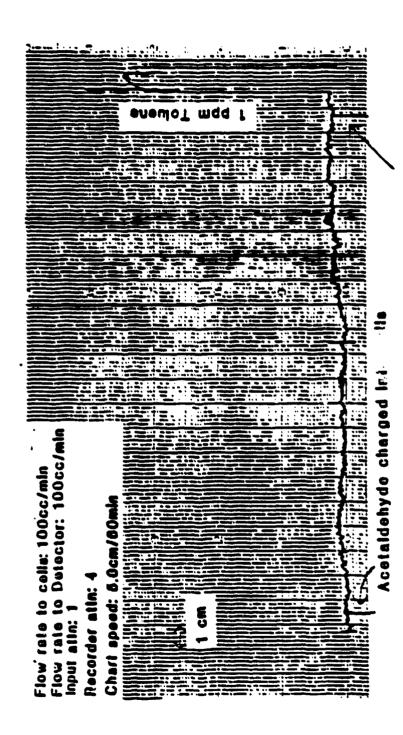
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	1: TYPE: Teflon lam	insted Nomey		
	2: PROTECTIVE MATER			
		TEST: Unused, no v	isible imperfection	IS
	4: MANUFACTURER: CI			
		ATION: Challenge 5	100	· · · · · · · · · · · · · · · · · · ·
	6: LOT OR MANUFACTUR 7: NOMINAL THICKNESS			
			lored on one side a	ind buff colored on the
	other side.	Cer let wes or enge co		
2.	TEST METHOD 1. TESTING LABORATOR	XY: Texas Research I	nstitute, 9063 Bee	Caves Road, Austin, TX
	2. ANALYTICAL METHON	): Continuous photo	ionization detection	on with a 11.7 eV lamp.
	3. TEMPERATURE: 22-2 4. COLLECTION MEDIUM			
	5. COLLECTION SYSTEM	1: N2		
	6. OTHER CONDITIONS:	I inch cells were	used./ Detector Ten	mperature = 60C.
	7. DEVIATIONS FROM A	STH F739 NETHOD: F1	ow rate to cells wa	s 100cc/min
з.	CHALLENGE CHEMICAL	1 .	: COMPONENT 2	: 3
	1. CHEM NAME(s) :	cetal dehyde	N/A	• • • • • • • • • • • • • • • • • • • •
	2. CAS NUMBER(s):	/5-05-0	: <u> </u>	:N/A
	3. CONC. (IF MIX)	1/A	: <u>N/A</u>	:N/A
	4. CHEMICAL SOURCE:		: <u> </u>	:N/A :N/A
4.	TEST RESULTS	leagent Grade	: <u> </u>	N/A
	1. DATE TESTED: June 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LIN 5. STEADY STATE PERMI 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN	TESTED: <u>Three</u> No breakthrough wa AIT N/A ATION RA. <u>N/A</u> 18-20 mil	s observed after th	nree hours.
	TIME :	CUNCENTRATION	: CONCENTRATION	CONCENTRATION
	1:			•
	3	· · · · · · · · · · · · · · · · · · ·		:
	4:		•	:
	5:			
	6. <u> </u>			
	8		•	
	9			
	10:			: · ·
		•		
	8. OTHER OBSERVATION	»:		
5.	SOURCE OF DATA			<b></b>
	Samples wer	<u>e run by Sylvia R. C</u>	ooper on June 3, 1	980
	·····			

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Chemical Resistance Testing of USCG Material with Acetaldehyde



St. from cells to Blandard gas

# 1. DESCRIPTION OF PRODUCT EVALUATED

1: 2:				
2:	TYPE: Teflon la			
	PROTECT REMATE			
3:	CONDITION BEFOR	E TEST: Unused, no vi	sible imperfections	
4:	MANUFACTURER:	Chemfab Corp.		
5:	PRODUCT IDENTIF		00	<u></u>
6;	LOT OR MANUFACT			
7:	NOMINAL THICKNE			
8:		aterial was orange col	ored on one side and	buff colored on the
•••	other side.			
TES	T METHOD		:	
1.	TESTING LABORAT	ORY: Texas Research In	stitute, 9063 Bee Cav	es Road, Austin, T
2.	ANALYTICAL METH	OD: Continuous photoi	onization detection w	ith a 11.7 eV lamp
3.	TEMPERATURE: 22	-25 °C		
4.	COLLECTION MEDI	UM: N2		
	COLLECTION SYST			
		S: 1 inch cells were	used./ Detector Tempe	rature = 60C.
7.	DEVIATIONS FROM	ASTM F739 METHOD: F1	ow rate to cells was	100cc/min.
CHA	LLENGE CHEMICAL	. 1 :	COMPONENT 2 :	3
1	CHEM NAME(s) :	Aratic arid -	N/A :	N/A
		64-19-7	N/A	<u>N/A</u>
3.	CONC. (IF MIX) CHEMICAL SOURCE		N/A :	N/A
••				
TES	T RESULTS			, v ,
1.	DATE TESTED: 9-1	3-86		
	NUMBER OF SAMPTE			
2.	NUMBER OF SAMPLE			
2. 3.	BREAKTHROUGH TIM	E: N/A		
2. 3. 4.	BREAKTHROUGH TIM MIN DETECTABLE L	E: N/A IMIT 35.46 ppm		
2. 3. 4. 5.	BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER	E: N/A IMIT 35.46 ppm MEATION RATE N/A		
2. 3. 4. 5. 6.	BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS	E: N/A IMIT <u>35.46 ppm</u> MEATION RATE <u>N/A</u> : 18-20 mil		
2. 3. 4. 5. 6.	BREAKTHRCUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A		
2. 3. 4. 5. 6.	BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS	E: N/A IMIT <u>35.46 ppm</u> MEATION RATE <u>N/A</u> : 18-20 mil	: CONCENTRATION :	CONCENTRATION
2. 3. 4. 5. 6. 7.	BREAKTHRCUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A	: CONCENTRATION :	CONCENTRATION
2. 3. 4. 5. 6. 7.	BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A	CONCENTRATION :	CONCENTRATION
2. 3. 4. 5. 6. 7.	BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A	CONCENTRATION :	CONCENTRATION
2. 3. 4. 5. 6. 7.	BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A	CONCENTRATION :	CONCENTRATION
2. 3. 4. 5. 6. 7.	BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A	CONCENTRATION :	CONCENTRATION
2.3.4.5.6.7.	BREAKTHRCUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A	CONCENTRATION :	CONCENTRATION
2. 3. 4. 5. 6. 7.	BREAKTHRCUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A	CONCENTRATION :	CONCENTRATION
2.3.4.5.6.7.	BREAKTHRCUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A	CONCENTRATION :	CONCENTRATION
2.3.4.5.6.7.	BREAKTHRCUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A : CONCENTRATION : : : : : : : : : : : : :	CONCENTRATION :	CONCENTRATION
2.3.4.5.6.7.	BREAKTHRCUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A : CONCENTRATION : : : : : : : : : : : : :	CONCENTRATION :	CONCENTRATION
2.3.4.5.6.7.	BREAKTHRCUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A : CONCENTRATION : : : : : : : : : : : : :	CONCENTRATION :	CONCENTRATION
2. 3. 4. 5. 6. 7.	BREAKTHRCUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	E: N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil INTS N/A : CONCENTRATION : : : : : : : : : : : : :	CONCENTRATION :	CONCENTRATION

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Chemical Resistance Testing of USCG Materal with Acetic Acid

-----Flow rate to cells: 100cc/min Flow rate to Detector: 100cc/min Input attn: 1 Chart speed: 8.0cm/80mln 211 Recorder altn: 4 ÷. Lamp: 11.7eV •<u>1</u>11 11 Detecto 1 11 : -15-4--

Switched from cells to standard gas

Acetic acid charged into cel

# 1. DESCRIPTION OF PRODUCT EVALUATED

- TYPE: Teflon laminated Nomex 1:
- PROTECTIVE MATERIAL CODE: 068 2:
- CONDITION BEFORE TEST: Unused, no visible imperfections 3:
- MANUFACTURER: Chemfab Corp. 4:
- PRODUCT IDENTIFICATION: Challenge 5100 LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 15-20 mil 5:
- 6: 7:
- DESCRIPTION: Material was orange colored on one side and buff colored on the 8: other side.

# 2. TEST METHOD

- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1.
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp.
- TEMPERATURE: 22-25 °C 3.
- 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2
- OTHER CONDITIONS: 6. 1 inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.

### 3. CHALLENGE CHEMICAL COMPONENT 2 3 1 • : 1. CHEM NAME(s) : Acetic Anhydride **MA** N/A 2. CAS NUMBER(s): 108-24-7 N/A N7A 3. CONC. (IF MIX) N/A N/A N/A 4. CHEMICAL SOURCE: Mallinckrodt reagent: N/A N/A N/A grade N7A

### 4. TEST RESULTS

- 1. DATE TESTED: June 28, 1986 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours.

- 4. MIN DETECTABLE LIMIT .57 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 18-19 mil
- 7. SELECTED DATA POINTS N/A

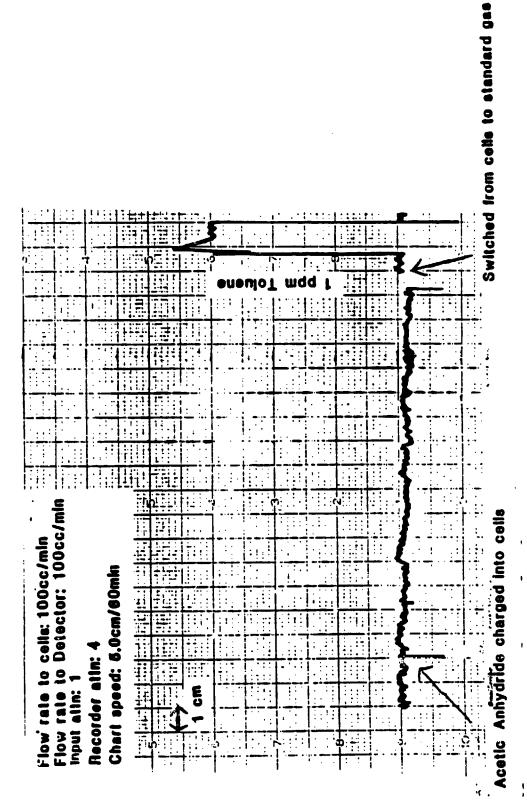
1	TIME	:	CONCENTRATION	CONCENTRATION	:	CONCENTRATION
2					:	
4.						
5. 6.					:	
8					:	
9. 10.					<u>:</u>	

8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia Cooper on June 28, 1986.

Chemical Resistance Testing of USCG Material with Acetic Anhydride



# C-15

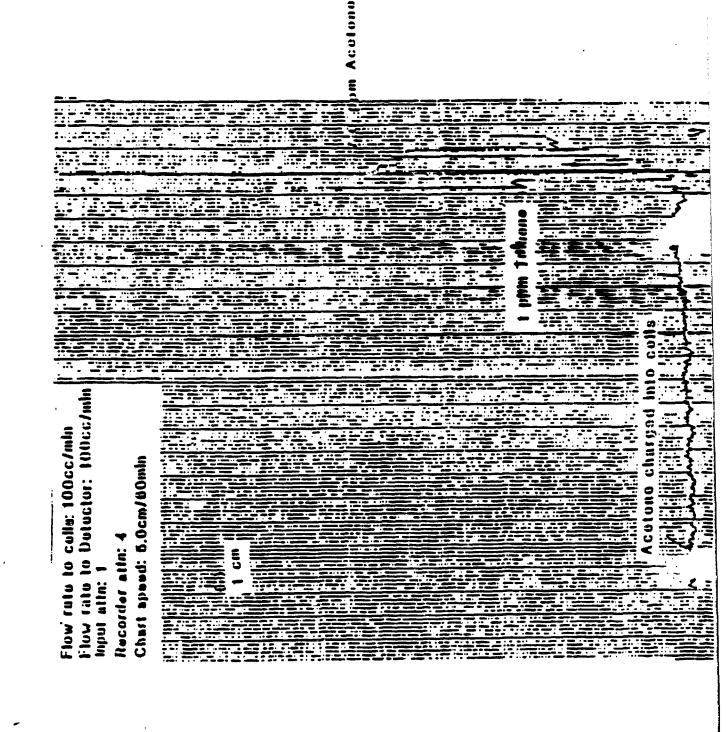
# 1. DESCRIPTION OF PRODUCT EVALUATED

5.

	5: PRODUCT IDENTIF 6: LOT OR MANUFACT 7: NOMINAL THICKNE 8: DESCRIPTION: M otherother	RIAL CODE: 068 E TEST: <u>Unused, no v</u> Chemfab Corp. ICATION: <u>Challenge 5</u> URER DATE: N/A	100	buff colored on the
2.	<ol> <li>TESTING LABORATI</li> <li>ANALYTICAL METHO</li> <li>TEMPERATURE: 22-</li> <li>COLLECTION MEDIO</li> <li>COLLECTION SYSTE</li> <li>OTHER CONDITIONS</li> <li>DEVIATIONS FROM</li> </ol>	IM: No		with a 11.70 eV lamp.
3.	CHALLENGE CHEMICAL	1 :	COMPONENT 2	3
4.	<ol> <li>CAS NUMBER(s):</li> <li>CONC. (IF MIX)</li> <li>CHEMICAL SOURCE:</li> <li>TEST RESULTS</li> <li>DATE TESTED: May</li> <li>NUMBER OF SAMPLES</li> </ol>	grade : 29, 1986 TESTED: Three : No Breakthrough wa MIT 1.16 ppm EATION RATE N/A 18-20 mil	N/A N/A N/A N/A S ODSERVED after 3 no	N/A N/A N/A N/A N/A
	TIME : 1: 2: 3: 4: 5: 6: 7: 8: 9: 10: 8. OTHER OBSERVATIONS SUURCE OF DATA		CONCENTRATION :	
		un by Sylvia Cooper o	n May 29, 1986.	

Chemical Resistance Testing of USCG Muterial with Acetone

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C-17

# 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange c other side.	5100	buff colored on the
2.	TEST METHOD		
	<ol> <li>TESTING LABORATORY: <u>Texas Research</u></li> <li>ANALYTICAL METHOD: <u>Continuous phot</u></li> <li>TEMPERATURE: <u>22-25°C</u></li> <li>COLLECTION MEDIUM: <u>N2</u></li> <li>COLLECTION SYSTEM: <u>N2</u></li> <li>OTHER CONDITIONS: <u>1 inch cells wer</u></li> <li>DEVIATIONS FROM ASTM F739 METHOD: <u>1</u></li> </ol>	oionization detection w	with a 10.2 eV lamp.
3.	CHALLENGE CHEMICAL	: COMPONENT 2 :	. 3
	1. CHEM NAME(s): <u>Acetone Cyanohydrin</u> 2. CAS NUMBER(s): <u>75-86-5</u> 3. CONC. (IF MIX) <u>N/A</u> 4. CHEMICAL SOURCE: <u>Aldrich</u>	N/A N/A N/A N/A	N/A N/A N/A N/A
4.	TEST RESULTS		
	<ol> <li>DATE TESTED: September 22, 1986</li> <li>NUMBER OF SAMPLES TESTED: <u>Three</u></li> <li>BREAKTHROUGH TIME: N/A</li> <li>MIN DETECTABLE LIMIT 2.74 ppm</li> <li>STEADY STATE PERMEATION RATE <u>N/A</u></li> <li>SAMPLE THICKNESS: <u>19-20 mil</u></li> <li>SELECTED DATA POINTS <u>N/A</u></li> </ol>		
	TIME : CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	2:		
	4		
	6 7	•	
	8:	•	
	9	:	
	8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA	· · · · · · · · · · · · · · · · · · ·	

Chemical Resistance Testing of USCG Material with Acetone Cyanohydrin

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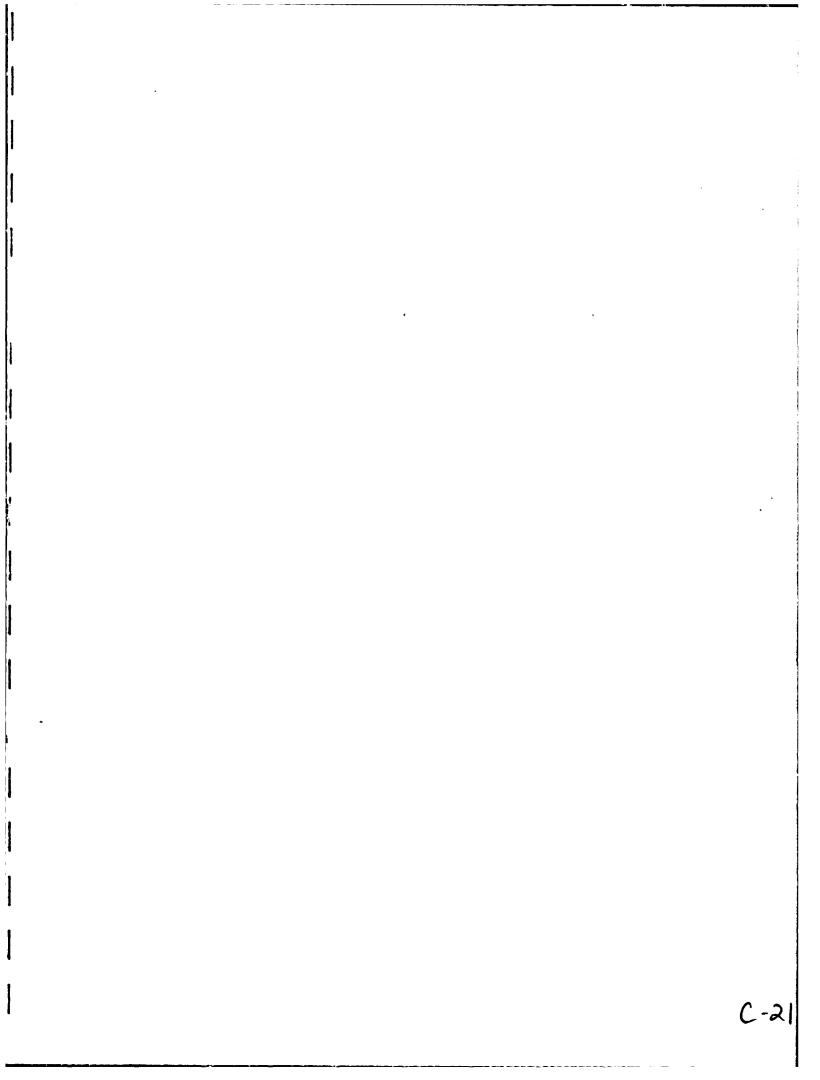
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	91 :	1118 Sueu	Iol	
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<b>s</b>				
nin c/				
o0cc/mti				
11 <b>s</b> : 100 tector: 0cm/60mi 32 100C				
:11s: tect 0cm// 100C				
		- 4	0	
			-	

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# 1. DESCRIPTION OF PRODUCT EVALUATED

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2:	TYPE: Teflon laminated Nomex PROTECTIVE MATERIAL CODE: 068		
3:		visible imperfections	
4:	MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Challenge 5	100	
5:	LOT OR MANUFACTURER DATE: N/A	100	
6: 7:	NOMINAL THICKNESS: 15-20 mil		
8:	DESCRIPTION: Material was orange co	lored on one side and	buff colored on the
0.	other side.		
TE	ST METHOD		
1.			ves Road, Austin, TX
2.3.		ony	
3. 4.		•·	
5.			
6.		ere used.	
7.			
CH	ALLENGE CHEMICAL 1	: COMPONENT 2 :	3
1.	CHEM NAME(s) : <u>Acetonitrile</u>	. N/A	N/A
2.	CAS NUMBER(s): 2206-26-0 CONC. (IF MIX) N/A	: N/A	N/A
3.	CONC. (IF MIX) N/A	. N/A	N/A
4.	CHEMICAL SOURCE: Fisher-Pesticide	: <u>N/A</u>	<u>N/A</u>
	Grade	: N/A	<u> </u>
4. 5. 6.	BREAKTHROUGH TIME: N/A MIN DETECTABLE LIMIT 0.6 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS Cells 1,2 and 3		+o:+
<b>′</b> •			
	TIME : CONCENTRATION 1. 3 hours : <0.6 ppm	: CONCENTRATION : : <0.6 ppm	CONCENTRATION
	2. : :		
	3	•	
	4		
	5:	:	
	6:	:	
	7:	•	
	8:		•
	9:		
	10:		
		upported for 50	minutes for a total
8.	OTHER OBSERVATIONS: <u>3 hour samples</u> volume of 10 liters.	Were corrected for Jo	
	volume of 10 liters.	NETE COTTECLED TOP JO	
	volume of 10 liters. URCE OF DATA		
	volume of 10 liters.		



# 1. DESCRIPTION OF PRODUCT EVALUATED

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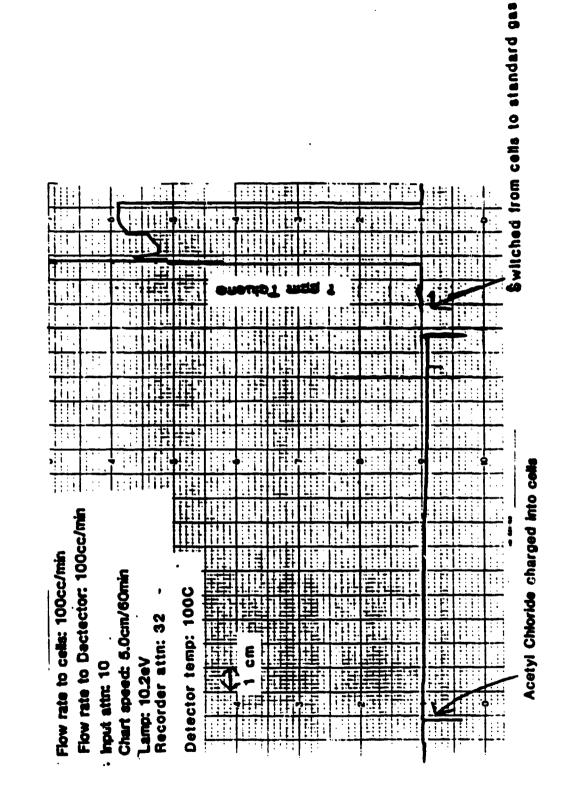
a<sup>t</sup>

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	1:	TYDE . Tofle	n lan	ninated Nomex				
	2:			TAL CODE: 068				
	3:			TEST: Unused, no	visib	le imperfecti	ons	
	4:	MANUF ACT URE	R: C	hemfab Corp.				
	5:			CATION: Challenge	5100			
	6:			RER DATE: N/A				· · · · · · · · · · · · · · · · · · ·
	7:			S: <u>15-20 mil</u>				
	8:	DESCRIPTION	l: <u>Ma</u>	terial was orange c	olore	<u>d on one side</u>	and bu	iff colored on the
		other side	•					
2.	TES	T METHOD						
	1.	TESTING LAB	ORATO	RY: <u>Texas Research</u>	Insti	tut <mark>e, 9</mark> 063 Be	e Caves	Road, Austin, TX
	2.	ANAL YT ICAL	METHO	D: Continuous phot	oioni	zation detect	ion wit	h a 10.20 eV lamp.
	3.	TEMPERATURE				=		
	4.	COLLECTION	MEDIU	M: <u>N2</u>				
	5.	COLLECTION	5151E	M: N <sub>2</sub>				1000
	7.	DEVIATIONS	FROM	: 1 inch cells we ASTM F739 METHOD: F	re us	ed. /Detector	Lempera	
	••		I NMPI	ASTR 1755 METROD. <u>r</u>			Mg2 100	
3.	CHR	LLENGE CHEMI	C AL	1	=	COMPONENT 2	:	3
	1.	CHEM NAME (s	):	Acetyl Chloride	•	N/A	:	N/A
	2.	CAS NUMBER (	s):	75-36-5		N/A		N/A
		CONC. (IF M	IX)	N/A	:	N/A	:_	N/A
	4.	CHEMICAL SO		Aldrich reagent		N/A		<u> </u>
	Tre	TRESULTS		grade	_;	N/A		<u>N/A</u>
	2. 1 3. 4. 1 5. 2	NUMBER OF SA BREAKTHROUGH MIN DETECTAB	MPLES TIME LE LI PERM NESS:		was o	bserved after	3.1 hc	burs
		TIME 1.	:	CONCENTRATION	:	CONCENTRATIO	DN :	CONCENTRATION
		2	·	<u></u>	<u> </u>			
		3	:		:		:	
		4	:		:	· · · · · · · · · · · · · · · · · · ·	:	
		5	:		:		:	
		6	:		:		:	
		7		<u> </u>	:			
		8 9						· · · · · · · · · · · · · · · · · · ·
		10	<u> </u>					
	•				•		•	
	8. (	OTHER OBSERV	ATION	S:				
5.	SOU	RCE OF DATA						
		<u>Samples</u>	were	<u>run by Sylvia R. C</u>	ooper	on August 13	<u>, 1986</u> .	

Chemical Resistance Testing of USCG Material with Acetyl Chloride



C-23

# 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were used./Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s):       Acrolein (composite):       N/A         2. CAS NUMBER(s):       107-02-8       N/A         3. CONC. (IF MIX)       N/A       N/A         4. CHEMICAL SOURCE:       Kodek reegent       N/A         grade       N/A       N/A
<b>4</b> .	TEST RESULTS         1. DATE TESTED: <u>October 6, 1986</u> 2. NUMBER OF SAMPLES TESTED: <u>Three</u> 3. BREAKTHROUGH TIME: <u>44 minutes</u> 4. MIN DETECTABLE LIMIT .12 ppm         5. STEADY STATE PERMEATION RATE <u>2.37 ug/cm²*hour</u> 6. SAMPLE THICKNESS: <u>19-20 mil</u> 7. SELECTED DATA POINTS N/A
	TIME       CONCENTRATION       CONCENTRATION       CONCENTRATION         1.
5.	SOURCE OF DATA Samples were run by Denise McDonald on October 6, 1986

C -24

Chemical Resistance Testing of USCG Material with Acrolein

j Switched from cells to standard tta TOTO [0] ū Flow rate to cells: 100cc/min Flow rate to Detector: 100cc/min Acroleh charged into cell Chart speed: 5.0cm/60min Detector temp: 60C Recorder attn: 4 Input attn: 10 Lamp: 13.20 eV • : 115

C-25

# 1. DESCRIPTION OF PRODUCT EVALUATED

•

	1:	TYPE	: Teflon l	aminated	Nomex					
	2:	PROT	ECTIVE MAT	ERIAL CO	DE: 068					
	3: 4:		)ITION BEFO FACTURER:			no visi	ble imperfect	lions		
	<b>5</b> :				i: Challen	a 5100				
	6:	LOT	OR MANUFAC	TURER DA	TE: N/A					
	7: 8:		NAL THICKN				ed on one sic	te and b	iff on oned	on the
	υ.		ner side.	riacer rat	was vrany					
2.		T MET								
	2.	ANAL	YT ICAL MET	HOD: <u>C</u>	ntinuous pl	<u>cn inst</u> hotoion	itute, 9063 E ization detec	tion with	s Road, Aust th a 10.20 e	<u>in, IX</u> V lamp
			PERATURE: 2							
	4. 5.		ECTION MED							
	6.	OTHE	R CONDITIC	)NS: 1	inch cells		sed. /Detecto			С.
	7.	DEVI	ATIONS FRO	M ASTM F	739 METHOD:	Flow	rate to cell	s were	LOO cc/min.	
.3.	CHA	LLENG	E CHEMICAL		1	2	CONFONENT 2	:	3	
	1.	CHEM	NAME(s) :	Acrol	ein (Run I)	:	N/A		N/A	
	<b>Z</b> .	CAS	MUMBER (S):	107-02	2-8		N/A		N/A	
	3. 4.	CHEN	. (IF MIX) Mical Sourc	F:Kodak	reagent	!	<u>N/A</u> N/A	;	N/A N/A	
				grade	I SUJEIIS		N/A		NZA	
4.	TES	T RES	SULTS		·					
	2. 3. 4. 5. 6.	NUMBE BREAM MIN E STEAE SAMPL	TESTED: 0 CR OF SAMPL CTHROUGH TI DETECTABLE DY STATE PE LE THICKNES CTED DATA P	ES TESTE IME: 38 LIMIT RMEATION S: 19-	D: <u>One</u> 3 minutes .06 ppm N RATE <u>1.6</u> .20 mil	l ug/cm	2 *hour			
		1.	TIME	:	CONCENTRATI	ION :	<b>CONCENTRAT</b>	ION :	CONCENTRAT	ION
		2		•		:				,,
		<u> </u>		<u>.</u>		<u> </u>			······	
	1			:						
		6								
		á: –		<u>.</u>	· · · · · · · · · · · · · · · · · · ·			:	<u> </u>	
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		10		•					···	
	8.	OTHER	R OBSERVA"I	IONS:			<u> </u>			<u>`</u>
-						<u> </u>				
5.	SOU		OF DATA Samples wer	re run by	Denise Md	Donald	on October 8	, 1986.		
		_								

Chemical Resistance Testing of USCG Material with Acrolein

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# Run

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Flow rate to cells: 100cc/min Flow rate to Detector: 100cc/ Input attn: 10 Chart speed: 5 0 cm/60 min Lamp: 10.2 Recorder attn: 2 Detector temp: 100	

Switched from cells to standard gas

Acrolein charged into cell

### CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD DESCRIPTION OF PRODUCT EVALUATED 1. 1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 5. OTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 100C. 7. DEVIATIONS FROM ASIM 7739 METHOD: Flow rate to cell was 100 cc/min-3. CHALLENCE CHEMICAL : COMPONENT 2 1 3 : 2 . 1. CHEM NAME(s) : Acrolein N/A N/A : 2. CAS NUMBER(s): 107-02-8 N/A N/A . 3. CONC. (IF MIX) $\overline{N/A}$ :\_ N/A N/A : 4. CHEMICAL SOURCE: Kodak N/A N/A : : 4. TEST RESULTS 1. DATE TESTED: 1-22-87 2. NUMBER OF SAMPLES TESTED: One (Run II) 3. BREAKTHROUGH TIME: 45 minutes 4. MIN DETECTABLE LIMIT .17 ppm 5. STEADY STATE PERMEATION RATE 2.82 (ug/cm<sup>2</sup>\*hr) 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : 2. : : : 3. : : : 4. : : : 5. : : 2 6. : : : 7. : : : 8. : : : 9. : : : 10. : : : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA

Sample was run by Denise McDonald on January 22, 1987

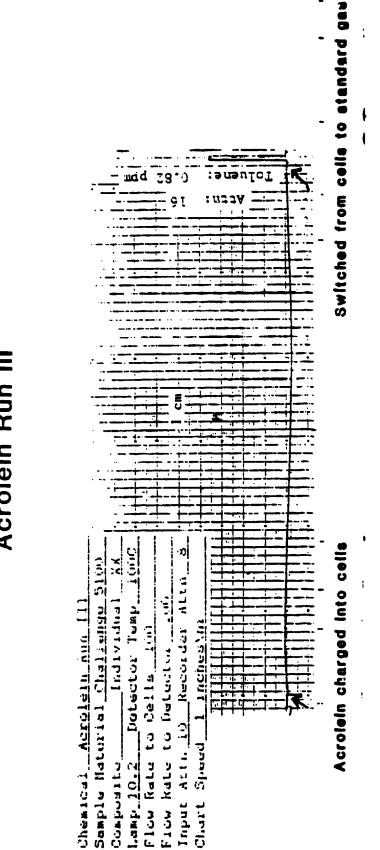
Chemical Resistance Testing of Challenge 5100 Material

# Acrolein Run II

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Chemical: Acrolein Run II Flow rate to cells: 100 Flow rate to Detector: 100 Input attn: 10 Chart speed: 2 in/hr Lamp: 10.2 Recorder attn: 8 Detector temp: 100 CHALLENGE 5100, INDIVIDUAL	•
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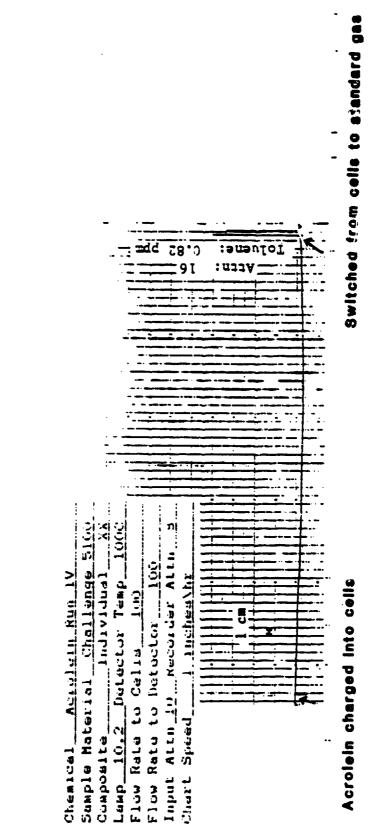
# 1. DESCRIPTION OF PRODUCT EVALUATED

TE 	ST METHOD TESTING LABO ANALYTICAL M	D. TODY.					
2. 3.		D. TODY.					
							Road, Austin, TX h a 10.20 eV lamp
4.							
-							
5.			N <sub>2</sub> 1 inch cell was	need / De	Teres Teres		
			F739 METHOD: F				
CH	ALLENCE THEMIC	AL	1	: COMP	DNENI 2	:	3
	CHEM NAME (s)		1	:	N/A	:	N/A
2	CAS MIMBER(s				N/A	—; <b>—</b>	N/A N/A
3.					N/A		N/A
<b>.</b>	CHEMICAL SOU	RCE: <u>Koda</u>	k	:1	N/A	_:_	N/A
1.	ST RESULTS DATE TESTED:						<u>``.</u>
_	NUMBER OF SAM BREAKTHROUGH		TED: <u>One (Run 1</u> N/A	(11)			
	MIN DETECTABL						
	MIN DELECIADE	E LIMIT					
2.	STEADY STATE	PERMEATI	.43 ppm ON RATE N/A				
6.	STEADY STATE SAMPLE THICKN	PERMEATI TESS: 19	.43 ppm ON RATE N/A -20 mils				
6.	STEADY STATE	PERMEATI TESS: 19	.43 ppm ON RATE N/A -20 mils				
6.	STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1.	PERMEATI TESS: 19	.43 ppm ON RATE N/A -20 mils	: CO	NCENTRATIO	N :	CONCENTRATION
6.	STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1.	PERMEATI TESS: 19	.43 ppm ON RATE <u>N/A</u> -20 mils N/A	:	NCENTRATIO	N : :	CONCENTRATION
6.	STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3.	PERMEATI NESS: <u>19</u> N POINTS : :	.43 ppm ON RATE <u>N/A</u> -20 mils N/A	:	NCENTRATIO	N : : : :	CONCENTRATION
6.	STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4.	PERMEATI NESS: <u>19</u> N POINTS : :	.43 ppm ON RATE <u>N/A</u> -20 mils N/A	: : : :	NCENTRATIO	N : : : : :	CONCENTRATION
6.	STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3.	PERMEATI NESS: <u>19</u> N POINTS : :	.43 ppm ON RATE <u>N/A</u> -20 mils N/A	:	NCENTRATIO	N : : : : : :	CONCENTRATION
6.	STEADY STATE         SAMPLE THICKN         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.	PERMEATI NESS: <u>19</u> N POINTS : :	.43 ppm ON RATE <u>N/A</u> -20 mils N/A	: : : :	NCE NTRATIO	N : : : : : : :	CONCENTRATION
6.	STEADY STATE         SAMPLE THICKN         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.	PERMEATI NESS: <u>19</u> N POINTS : :	.43 ppm ON RATE <u>N/A</u> -20 mils N/A		NCENTRATIO	N : : : : : : : :	CONCENTRATION
6.	STEADY STATE         SAMPLE THICKN         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.	PERMEATI NESS: <u>19</u> N POINTS : :	.43 ppm ON RATE <u>N/A</u> -20 mils N/A		NCENTRATIO	N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
6.	STEADY STATE         SAMPLE THICKN         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.	PERMEATI NESS: <u>19</u> N POINTS : :	.43 ppm ON RATE <u>N/A</u> -20 mils N/A		NCENTRATIO	N : : : : : : : : : : : : : :	CONCENTRATION
<b>6.</b> 7.	STEADY STATE         SAMPLE THICKN         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.	PERMEATI NESS: 19 N POINTS : : : : : : : : : : : : : : : : : : :	.43 ppm ON RATE <u>N/A</u> -20 mils N/A		NCENTRATIO	N : : : : : : : : : :	CONCENTRATION



Chemical Resistance Testing of Challenge 5100

Acrolein Run III



Chemical Resistance Testing of Challenge 5100

Acrolein Run IV

### 1. DESCRIPTION OF PRODUCT EVALUATED

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	1:	TYPE: Teflon				·· <u></u>		
	2:	PROTECTIVE M						
	3:			T: Unused, no v	isib.	le imperfection	8	
	4:	MANUFACTURER						
	5:			ON: Challenge 5	100			
	6:	LOT OR MANUF						
	7:	NOMINAL THIC						
	8:			al was orange co	lore	<u>i on one side a</u>	nd bu	ff colored on the
		other side.						
2.	1.							Road, Austin, TX
	2.	ANALYTICAL M	ETHOD: 🗌	Continuous photo	ioni	ation detectio	n wit	h a 10.20 eV lamp.
	3.	TEMPERATURE:				· · · · · · · · · · · · · · · · · · ·		
	4.	COLLECTION M	EDIUM:	N <sub>2</sub>				
	5.	COLLECTION S	YSTEM: 🗍	N <sub>2</sub>		•		
	6.	OTHER CONDIT	IONS:	l inch cell was	used	/ Detector Tem	perat	ure = 100C.
	7.	DEVIATIONS F	ROM ASTM	F739 METHOD: F	low	rate to cell wa	s 100	cc/min.
1	TE A	LLINGE CHEMIC	21		:	COMPONENT 2		3
-			—	-	:		:	-
	1-	CHEM NAME (3)	: Acro	lein	:	N/A	:	N/A
	2	CAS STABER(	107-	02-3	·	N/A		N/A
	3.	CONC. (IF MI	$\mathbf{X}$ ) $\mathbf{N}/\mathbf{A}$		· · · · · · · · · · · · · · · · · · ·	N/A		<u>N/A</u>
	4	CHEMICAL SOU		ich	· · · · · · · · · · · · · · · · · · ·	N/A		N/A
	2. 3. 4. 5. 6. 7.	BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1.	TIME: E LIMIT PERMEATI ESS: <u>19</u>	TED: <u>One (Run I</u> N/A •46 ppm ON RATE N/A	V) : :	CO NCENTRATION		CONCENTRATION
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		10						·····
		OTHER OBSERVA	TIONS:					
5.	8.	OTHER OBSERVA		Denise McDonald	l on	March 7, 1987.		
5.	8.	OTHER OBSERVA		Denise McDonald	l on	March 7, 1987.		

### 1. DESCRIPTION OF PRODUCT EVALUATED

- TYPE: Teflon laminated Nomex 1:
- PROTECTIVE MATERIAL CODE: 068 2:
- CONDITION BEFORE TEST: Unused, no visible imperfections 3:
- MANUFACTURER: Chemfab Corp. 4: 5:
- PRODUCT IDENTIFICATION: Challenge 5100 LOT OR MANUFACTURER DATE: N/A 6:
- NOMINAL THICKNESS: 15-20 mil 7:
- DESCRIPTION: Material was orange colored on one side and buff colored on the 8: other side.

### 2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.
- 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: N2
- 5. COLLECTION SYSTEM: N2
- 6. OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.

CHALLENGE CHEMICAL 1	: COMPONENT 2 :	3
1. CHEM NAME(s) : Acrylic Acid	*/A	N/A
2. CAS NUMBER(s): 79-10-7	: N/A · :	N/A
3. CONC. (IF MIX) N/A		N/A
4. CHEMICAL SOURCE: Aldrich reagent	-: <u>N/A</u> :	N/A
grade	_:N/A:	N/A

### 4. TEST RESULTS

3.

1. DATE TESTED: May 28, 1986

2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after three hours. 4. MIN DETECTABLE LIMIT 0.86 ppm

- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 18-20 mil. 7. SELECTED DATA POINTS N/A

	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia Cooper on May 28, 1986.

Chemical Resistance Testing of USCG Material with Acrylic Acid Flow rate to calk tooccum Flow rate t	<b>Pi</b>	
Ce Testing of celle: 100cc/min B.0cm/00min B.0cm/00min	Ac .	
Celle: 100cc/min Celle: 100cc/min E. A B. Ocm/00min E. A B. O	Acrylic	
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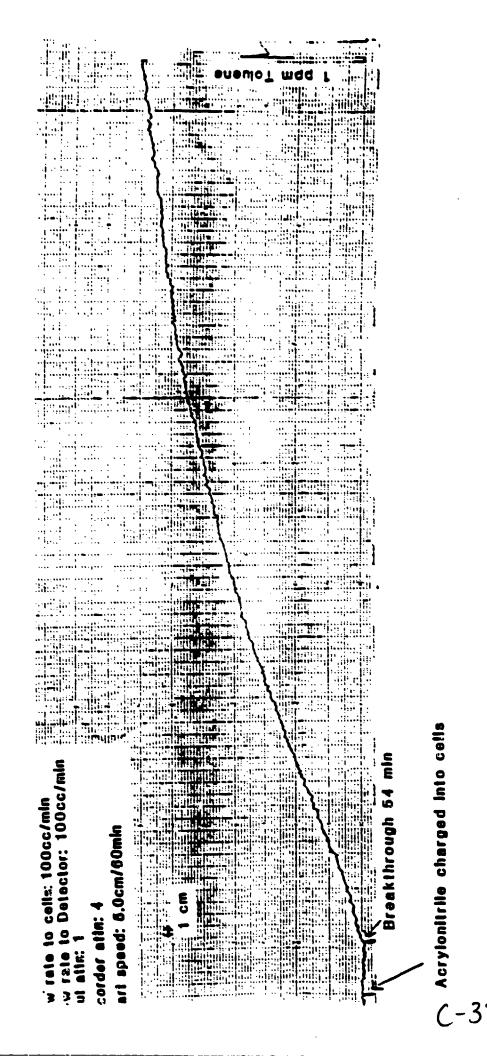
### 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Jontinuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C  4. COLLECTION MEDIUM: N2  5. COLLECTION SYSTEM: N2  6. OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 60C.  7. DEVIATIONS FROM ASIM F739 METHOD: Flow rate to cells was 100 cc/min
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
4.	1. CHEM NAME(s):       Acrylonitrile (RunI):       N/A         2. CAS NUMBER(s):       107-13-1       N/A         3. CONC. (IF MIX)       N/A       N/A         4. CHEMICAL SOURCE:       Aldrich       N/A         reagent grade       N/A       N/A
	1. DATE TESTED: May 29, 1986 2. NUMBER OF SAMPLES TESTED: Une (Run I) 3. BREAKTHROUGH TIME: 54 min 4. MIN DETECTABLE LIMIT 0.46 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-20 mil 7. SELECTED DATA POINTS N/A
	TIME       CONCENTRATION       CONCENTRATION       CONCENTRATION         2.       .       .       .       .         3.       .       .       .       .         4.       .       .       .       .         5.       .       .       .       .         6.       .       .       .       .         9.       .       .       .       .         10.       .       .       .       .
	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA Simple was run by Sylvia Cooper in May 29, 1986

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Permeation of Acrylonitrile through USCG Material

Run

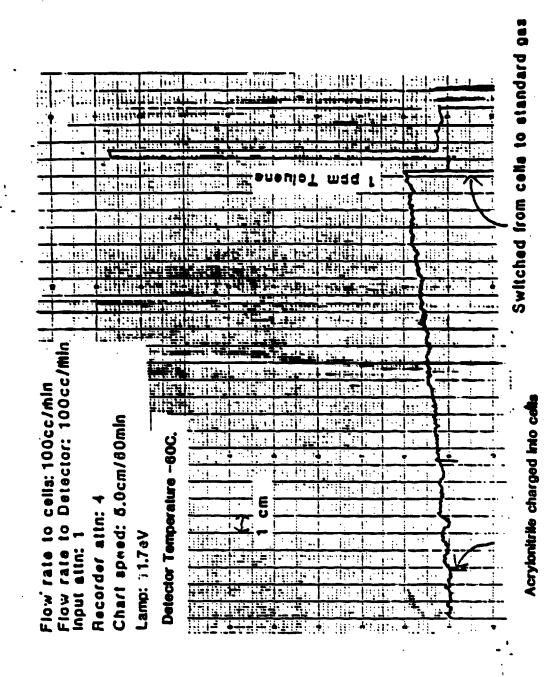


### 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD         1. TESTING-LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX         2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV Tamp.         3. TEMPERATURE: 22-25°C         4. COLLECTION MEDIUM: N2         5. COLLECTION SYSTEM: N2         6. OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C.
3.	7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
•.	1. CHEM NAME(s):       Acrylonitrile(RumII):       N/A       N/A         2. CAS NUMBER(s):       107-13-1       N/A       N/A         3. CONC. (IF MIX)       N/A       N/A       N/A         4. CHEMICAL SOURCE:       AIdrich       N/A       N/A         5. DATE TESTED:       September 03, 1986       N/A       N/A         1. DATE TESTED:       September 03, 1986       N/A       N/A         2. NUMBER OF SAMPLES TESTED:       One       September 03, 1986       September 03, 1986         3. BREAKTHROUGH TIME:       76 minutes       September 03, 1986       September 03, 1986         3. BREAKTHROUGH TIME:       76 minutes       September 03, 1986       September 03, 1986         3. BREAKTHROUGH TIME:       76 minutes       September 03, 1986       September 03, 1986         3. BREAKTHROUGH TIME:       76 minutes       September 03, 1986       September 03, 1986         4. MIN DETECTABLE LIMIT       .18 ppm       September 0, 186 ug/cm <sup>-</sup> x hour.       September 0, 186 ug/cm <sup>-</sup> x hour.
	6. SAMPLE THICKNESS: 18-19 7. SELECTED DATA POINTS N/A
	TIME       CONCENTRATION       CONCENTRATION       CONCENTRATION         1.       1       1       1       1         2.       1       1       1       1         3.       1       1       1       1         3.       1       1       1       1         3.       1       1       1       1         4.       1       1       1       1         5.       1       1       1       1         5.       1       1       1       1         6.       1       1       1       1         7.       1       1       1       1         9.       1       1       1       1         9.       1       1       1       1         8. OTHER OBSERVATIONS:       1       1       1       1
5.	SOURCE OF DATA Samples were run by Karen Verschoor on September 03, 1986.

Chemical Resistance Testing of USCG Material with Acrylonitrile

**P**an **P**an



C-30

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### 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A
- 7: NOMINAL THICKNESS: 15-20 mil
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: N2
- 5. COLLECTION SYSTEM: N<sub>2</sub>
- 6. OTHER CONDITIONS: 1 inch cell was used. /Detector Temperature = 60C.
- 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min.

3.	CHALLENCE CHEMICA	NL 1	: CONFORENT 2	:	3	
	1. CHEM NAME(s)	: Arrylonitrile	: : N/A	:	N/A	
	2. CAS NIMBER(s)	): 107-13-1	: N/A	:	N/A	
	3. CONC. (IF MI)	K) N/A			N/A	
	4. CHEMICAL SOUR	RCE:Aldrich	:N/A		N/A	

### TEST RESULTS

- 1. DATE TESTED: 2-11-87
- 2. NUMBER OF SAMPLES TESTED: One (Run III)
- 3. BREAKTHROUGH TIME: 45 minutes
- 4. MIN DETECTABLE LIMIT .05 ppm
- 5. STEADY STATE PERMEATION RATE .74 (ug/cm<sup>2</sup>\*hr)
- 6. SAMPLE THICKNESS: 19-20 mils
- 7. SELECTED DATA POINTS N/A

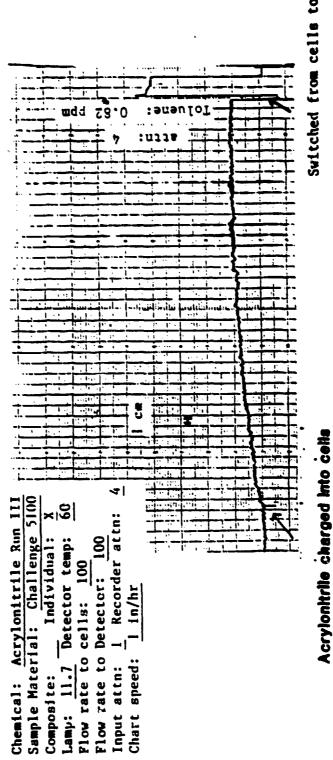
TIME	:	CONCENTRATION	: COFCENTRATION	:	CONCENTRATION
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5. SOURCE OF DATA

Sample was run by Denise McDonald on February 11, 1987.

Chemical Resistance Testing of Challenge 5100

## Acrylonitrile Run M



Switched from cells to standard gas

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N.K.C.S.S.S.N.

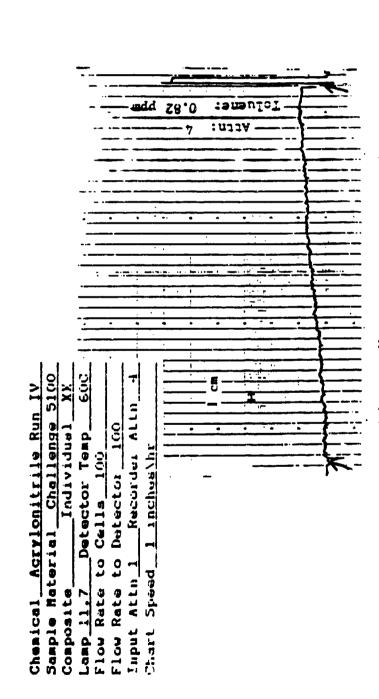
### 1. DESCRIPTION OF PRODUCT EVALUATED 1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALTTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: 1 inch cell was used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METROD: Flow rate to cell was 100 cc/min. CHALLENGE CHEMICAL COMPONENT 2 3 3. 1 : : : 1 1. CHEM NAME(s): Acrylonitrile N/Å N/A :\_ 107-13-1 2. CAS NUMBER(s): N/A N/A <u>;</u> \_:\_ N/A 3. CONC. (IF MIX) N/A N/A \_:\_ N/A 4. CHEMICAL SOURCE: Aldrich N/A : : 4. TEST RESULTS 1. DATE TESTED: 3-9-87 2. NUMBER OF SAMPLES TESTED: One (Run IV) 3. BREAKTHROUGH TIME: 97 minutes 4. MIN DETECTABLE LIMIT .08 ppm 5. STEADY STATE PERMEATION RATE .89 (ug/cm<sup>2</sup>\*hr) 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED\_DATA POINTS N/A -TIME CONCENTRATION CONCENTRATION : CONCENTRATION : : 1. 1 2. : : : 3. : : : 4. : : : 5. : : : 6. : : : 7. : : : 8. : : : 9. : : : 10. 3 : : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Sample was run by Denise McDonald on March 9, 1987.

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## Chemical Resistance Testing of Challenge 5100 Ŧ

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## Acrylonitrile Run IV



Switched from cells to standard gas

## Acrylonitrile charged into cella

1.	DES	CRIPTION OF PROD	UCT EVALUATED				
<ol> <li>DESCRIPTION OF PRODUCT EVALUATED</li> <li>TYPE: Teflon laminated Nomex</li> <li>PROTECTIVE MATERIAL CODE: 068</li> <li>CONDITION BEFORE TEST: Unused, no visible imperfections</li> <li>MANUFACTURER: Chemfab Corp.</li> <li>PRODUCT IDENTIFICATION: Challenge 5100</li> <li>LOT OR MANUFACTURER DATE: N/A</li> <li>NOMINAL THICKNESS: 15-20 mil</li> </ol>							
	8:	other side.	aterial was orange col				
2.	TES	T METHOD					
	2. 3. 4. 5.	ANALYTICAL METH TEMPERATURE: Am COLLECTION MEDI COLLECTION SYST DTHER CONDITION	UM: Charcoal	y	es Road, Austin, TX		
3.	CHA	LLENGE CHEMICAL	1 :	COMPONENT 2 :	3		
4.	2. 3. 4.	CHEM NAME(s): CAS NUMBER(s): CONC. (IF MIX) CHEMICAL SOURCE T RESULTS	111-69-3 :	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A		
	2. 3. 4. 5. 6.	DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO	E: N/A IMIT 0.3 ppm MEATION RATE N/A : 19-20 mils	at end of three hour	test.		
		TIME	: CONCENTRATION	: CONCENTRATION :	CONCENTRATION		
		1. <u>3 hours</u> 2.	: <0.3 ppm :	: <0.3 ppm :	<0.3 ppm		
		3	:				
		5	:				
		7	:	•			
		9	· · · · · · · · · · · · · · · · · · ·				
	8.	OTHER OBSERVATIO	NS: <u>3 hour samples we</u> liters.	ere collected for 50 m	ninutes for a total		
	SOL	RCE OF DATA		ald on October 8, 1980	5.		

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C-45

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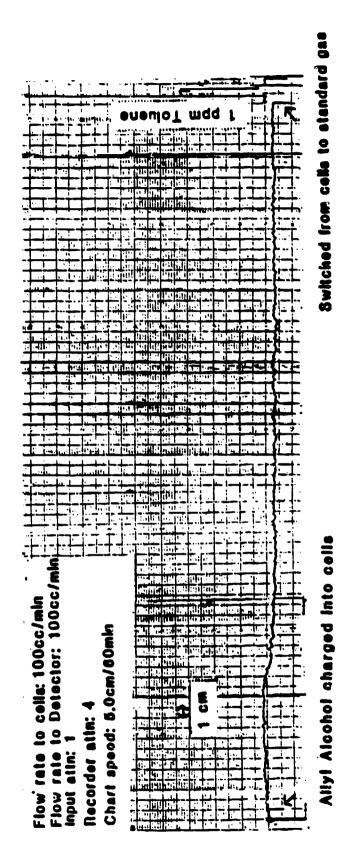
IN THE REAL PLANE IN A DESCRIPTION OF A REAL PROCESSION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A

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1.	DESCRIPTION OF PRODUC 1: TYPE: Teflon lami			
	2: PROTECTIVE MATERI 3: CONDITION BEFORE 4: MANUFACTURER: Ch 5: PRODUCT IDENTIFIC 6: LOT OR MANUFACTUR	TEST: <u>Unused, no v</u> emfab Corp. ATION: <u>Challenge 51</u> ER DATE: N/A		
	7: NOMINAL THICKNESS 8: DESCRIPTION: <u>Mat</u> <u>other side</u> .		ored on one side and	buff colored on
2.	TEST METHOD			
	<ol> <li>TESTING LABORATOR</li> <li>ANALYTICAL METHOD</li> <li>TEMPERATURE: 22-2</li> <li>COLLECTION MEDIUM</li> <li>COLLECTION SYSTEM</li> <li>OTHER CONDITIONS:</li> <li>DEVIATIONS FROM A</li> </ol>	: <u>Continuous photo</u> 5°C : <u>N2</u> : N2 I inch cells were u	used. /Detector Temper	vith a 11.70 eV
3	CHALLENGE CHEMICAL	1 :	COMPONENT 2 :	3
	4. CHEMICAL SOURCE:	07-18-6 /A Idrich	N/A N/A N/A N/A	N/A N/A N/A N/A
4.	TEST RESULTS	eagent Grade		N/A
	1. DATE TESTED: June 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN	TÉSTED: <u>Three</u> <u>No Breakthrough was</u> IT 1.13 ppm ATION RATE <u>N/A</u> 18-20 mil	detected after 14 ho	DURS.
	TIME : 1. :	CONCENTRATION	CONCENTRATION	CONCENTRATIO
	2:			
	4: 5:			
	7i 8i			
	9: 10:			
	8. OTHER OBSERVATIONS	:		
5.	SOURCE OF DATA Samples were ru	n by Karen Verschoo	on June 4-5, 1986	

C-46

Chemical Resistance Testing of USCG Material with Allyl Alcohol



	DESCRIPTION OF PROL					
	1: TYPE: Teflon 1 2: PROTECTIVE MATE	ERIAL CODE: 068				_
		RE TEST: Unused, no	visible imperfection	ns		_
	4: MANUFACTURER: 5: PRODUCT IDENTI	FICATION: Challenge	100			
	6: LOT OR MANUFACT	TURER DATE: N/A				
	7: NOMINAL THICKNE					
	8: DESCRIPTION: 1 other side.	Material was brange c	olored on one side a	and buff	colored on the	
2.	TEST METHOD					
		TORY: Texas Research	Institute, 9063 Bee	Caves R	oad, Austin, TX	-
	2. ANALYTICAL METH 3. TEMPERATURE: 22	HOD: <u>Continuous phot</u> 2-25°C	DIONIZATION DELECTIO	DN WITH	a 11./U ev lamp.	<u> </u>
	4. COLLECTION MED	IUM: N2				
	5. COLLECTION SYS		· · · · · · · · · · · · · · · · · · ·			
	6. OTHER CONDITION	NS: <u>2 inch cells we</u> M ASTM F739 METHOD: 1	e used. /Detector 1	emperat	ure = 60C.	
•	ENALLENSE CHEMICAL	-	: EOFPONENT 2	Vas 100	3	-
			•	:	-	
	J_ CHEN NAME(s): 2. CAS WEMBER(s):	107-051	_:N/A :N/A	~~.	N/A	-
	3. CONC. (IF MIX)		N/A		N/A	
	4. CHEMICAL SCURCI	E: Aldrich	:N/A		N/A	
	TEST RESULTS	reagent grade	:N/A		N/A	
	2. NUMBER OF SAMPLE 3. BREAKTHROUGH TI					—
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE N 5. STEADY STATE PEN 6. SAMPLE THICKNESS	ME: <u>102 min</u> LIMIT 0.16 ppm RMEATION RATE <u>0.64 u</u> S: 18-20 mil				
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE 1 5. STEADY STATE PEN 6. SAMPLE THICKNESS 7. SELECTED DATA PO	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A	g/hr x cm²			
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE 1 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1.	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A : CONCENTRATION :	g/hr x cm²	N : 0	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE 1 5. STEADY STATE PEN 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2.	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS <u>N/A</u> : CONCENTRATION :	g/hr x cm²	N : C	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE 1 5. STEADY STATE PEN 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3.	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS <u>N/A</u> : CONCENTRATION : :	g/hr x cm²	N : C	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE 1 5. STEADY STATE PEN 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2.	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mi1 OINTS N/A : CONCENTRATION :	g/hr x cm²	N : C	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE I 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6.	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A : CONCENTRATION : :	g/hr x cm²	N : C	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE 1 5. STEADY STATE PEN 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8.	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mi1 OINTS N/A : CONCENTRATION :	g/hr x cm²		ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE I 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1 3 4 5 6 9	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mi1 OINTS N/A : CONCENTRATION :	g/hr x cm²		ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE 1 5. STEADY STATE PEN 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8.	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A : CONCENTRATION : : :	g/hr x cm²		ONCENTRATION	
	3. BREAKTHROUGH TIN         4. MIN DETECTABLE I         5. STEADY STATE PEI         6. SAMPLE THICKNESS         7. SELECTED DATA PO         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A : CONCENTRATION : : :	g/hr x cm²		ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE I 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1 3 4 5 6 9	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A : CONCENTRATION : : :	g/hr x cm²		ONCENTRATION	
5.	3. BREAKTHROUGH TIN         4. MIN DETECTABLE I         5. STEADY STATE PER         6. SAMPLE THICKNESS         7. SELECTED DATA PO         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.         8. OTHER OBSERVATION	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A : CONCENTRATION : : :	g/hr x cm²		ONCENTRATION	
5.	3. BREAKTHROUGH TIN 4. MIN DETECTABLE I 5. STEADY STATE PEN 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 8. OTHER OBSERVATIONS SOURCE OF DATA	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A : CONCENTRATION : : :	g/hr x cm <sup>2</sup> CCNCENTRATION		ONCENTRATION	
5.	3. BREAKTHROUGH TIN 4. MIN DETECTABLE I 5. STEADY STATE PEN 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 8. OTHER OBSERVATIONS SOURCE OF DATA	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A : CONCENTRATION : : : : : : : : : : : : :	g/hr x cm <sup>2</sup> CCNCENTRATION		ONCENTRATION	

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Permeation of Allyl Chloride through USCG Material

(Composite Run)

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### 2. DESCRIPTION OF PRODUCT EVALUATED

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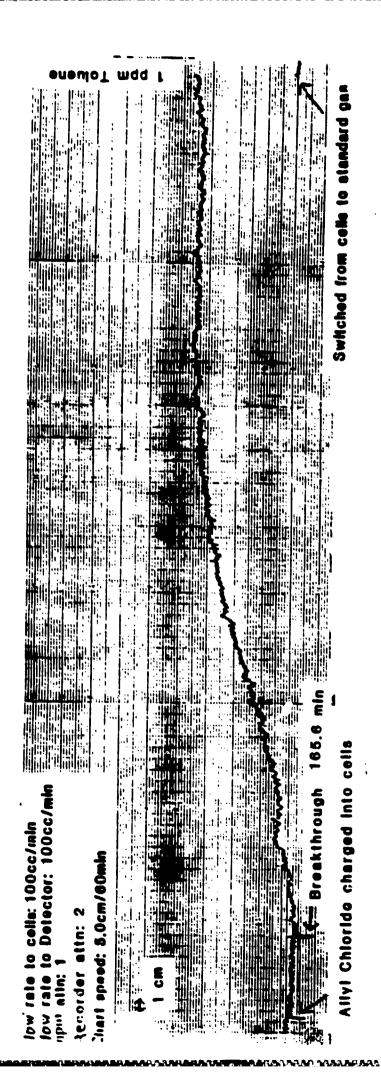
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2: 3: 4:   5: 6: 7:	TYPE: <u>Teflon lam</u> PROTECTIVE MATER CONDITION BEFORE MANUFACTURER: <u>CI</u> PRODUCT IDENTIFIC LOT OR MANUFACTUR	AL CODE: 068 TEST: Unused, no v memfab Corp.	isible imperfections	
3: 4:   5:   6:   7:	CONDITION BEFORE MANUFACTURER: CI PRODUCT IDENTIFIC	TEST: <u>Unused</u> , no v memfab Corp.		
4:   5:   6:   7:	MANUFACTURER: CI PRODUCT IDENTIFIC	emfab Corp.		
5: 6: 7:	PRODUCT IDENTIFIC			
6: 1 7: 1	LOT OR MANUFACTUR		17383	
7: 1		ER DATE N/A	100	
8: 1	NOMINAL THICKNESS	: 15-20 mil		
	DESCRIPTION: Mat	erial was orange co	lored on one side and	t buff colored on th
	other side.			
TEST	METHOD			
1.	TESTING LABORATOR	Y: Texas Research I	nstitute, 9063 Bee Ca	ives Road. Austin. T
<b>- 2.</b> . /	ANALTIILAL MEIHUL	Continuous photo	ionization detection	with a 11.70 eV lam
5.	TEMPERATURE: 22-2	5-0		
	COLLECTION MEDIUN			
5. (	COLLECTION SYSTEM	: <u>N2</u>		
7.	DEVIATIONS EDON	2 inch cell was	used /Detector Temper	ature = 60C.
/•	DEVIAITUNS FRUM A	SIM F/39 METHOU: _F	low rate to cell was	100cc/min.
CHALI	LENGE CHEMICAL	1	COMPONENT 2	: 3
1. 1	CHEM NAME (S) : A		N/A	. N/A
2.	CAS NUMBER(s): ]	07-051	:N/A	: N/A
3. (	CONC. (IF MIX) R	<u>/A</u>	N/A	:N/A
4. (	CHEMICAL SOURCE:		:N/A	:N/A
TEST	RESULTS	rade	N/A	:N/A
3. BF 4. MI 5. ST 6. SA	MPLE THICKNESS:	165.6 min IT 0.16 ppm ATION RATE 0.62 ug, 18-21 mil		
7. SE	ELECTED DATA POIN			
1	TIME :	CONCENTRATION	: CONCENTRATION	: CONCENTRATION
2.			· · · · · · · · · · · · · · · · · · ·	•
3.			•	•
4.				•
5.			•	·
6.	:			•
7.	·		•	•
8.				•
9. 10			<u>•</u>	•
10	·			
	HER OBSERVATIONS	•		
8. OT	HER LEDITERAL HUMAN	•		
8. OT	HER ODJERTALIUNS			
8. OT				
	E OF DATA			
	E OF DATA	by Sylvia cooper or	June 13, 1986.	

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Permeation of Allyl Chloride through USCG Material

Run |

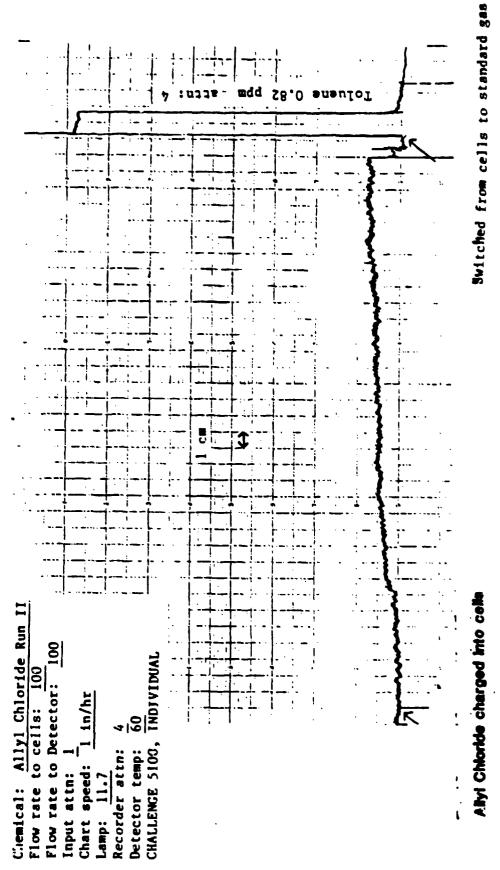


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		CRIPTION OF P						
•								
		TYPE: Teflon						
		PROTECTIVE MA CONDITION BEI			o wieihl	a imperfectio	<u></u>	
		MANUFACTURER				e imperiettio		مادي الجارية ميوافية البرواني المتحد المادي موسليروه البرة
	5:	PRODUCT IDEN	TFICAT	ION: Challeng	e 5100			
		LOT OR MANUE						
		NOMINAL THICK						
	0:	other side.	nater	Lai was orange	celored	on one side	and Du	iff colored on the
•	TES	T METHOD						
	1.	TESTING LABOR	ATORY:	Texas Resuard	h Instit	ute. 9063 Bee	Caves	Road, Austin, TX
								h a 11.70 eV lamp.
		TEMPERATURE:						
		COLLECTION MI	_					
		COLLECTION SY				/Deseables Ter		
	7.	DEVIATIONS FI	ROM AST	1 F739 METHOD:	Flow r	ate to cell w	as 100	cc/min.
		LIENCE CHEMICA	<u>u</u>	1	: C	OMPONENT 2	:	3
	1.	CHEM NAME (s)	: Ally	1 Chloride	:	N/A	:	N/A
		CAS NUMBER(s)				N/A		N/A
	3.	CONC. (IF MI)			;	N/A		N/A
	4.	CHEMICAL SOUR	CE:Ald	rich	;	N/A		N/A
	TES	T RESULTS						
	1	DATE TESTED:	1-27-8	7				
		NUMBER OF SAME			IT II)			
	3.	BREAKTHROUGH 1	IME: 1	52 minutes				
		MIN DETECTABLE						
		STEADY STATE I			(ug/cm <sup>2</sup>	*hr)		
		SAMPLE THICKNE SELECTED DATA		9-20 mil				
	<b>'</b> •	SELECTED DATA	PUINIS	<u>N/A</u>				
		TIME 1.	:	CONCENTRATI	ON :	CONCENTRATIO	N :	CONCENTRATION
		2.	- <u>·</u>		i			
		<b></b>			<u> </u>		:	
		3.	:		•		the second s	
		3					<u> </u>	
		3 4 5	: :		; ;			
		3 4 5 6						
		3 4 5 6 7					: : : :	
		3 4 5 6					: : : : :	
		3.						
		3.						
		3.	: : : : : : : : : : : : : : : : : : :					
	8.	3 4 5 6 7 8 9 10 OTHER OBSERVAT	: : : : : : : : : : : : : : : : : : :					
•	8.	3 4 5 6 7 8 9 10 OTHER OBSERVAT		y Denise McDor	: : :	anuary 27. 19	: : : : :	
•	8.	3 4 5 6 7 8 9 10 OTHER OBSERVAT		y Denise McDor	: : :	anuary 27, 19	: : : : : : : : : : : : : : : : : : :	

Chemical Resistance Testing of Challenge 5100 Material

### Allyl Chloride Run N



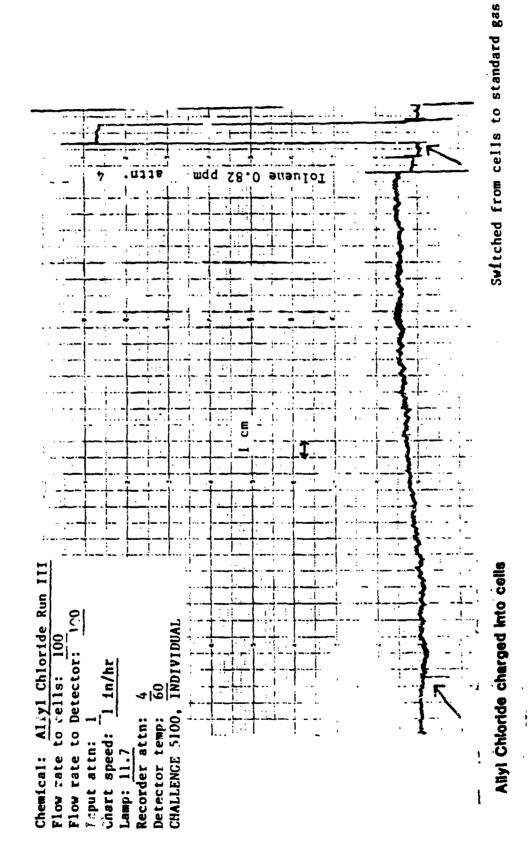
C-5:

	. TYPE, Tofler	Jania and Naman		
	l: TYPE: <u>Teflon</u> 2: <b>PROTECTIVE MA</b>			
3	: CONDITION BEF	ORE TEST: Unused, no	visible imperfections	
	: MANUFACTURER:		7122	
	S: LOT OR MANUFA	IFICATION: Challenge	5100	
-	7: NOMINAL THICK			جي ران است من عصر مي است جندي
			colored on one side and 1	ouff colored on the
. 1	rest method			
1	. TESTING LABOR	ATORY: Texas Research	Institute, 9063 Bee Cave	s Road, Austin, TX
2	2. ANALYTICAL ME	THOD: Continuous phot	oicnization detection wi	
	. TEMPERATURE:			
	COLLECTION ME			
	5. COLLECTION SY		used./Detector Temperat	
			Flow rate to cell es 10	
L . E	CHALLENGE CHEMICA	L I	: COMPONENT 2 :	3
1	. CHEM NAME (s)	: Allyl Chloride	: N/A :	T /A
	. CAS NUMBER(s)		: <u>N/A</u> :	N/A
	CONC. (IF MIX		: <u>N/A</u> :	N/A
4	• CHEMICAL SOUR	CE: <u>Aldrich</u>	: <u>N/A</u> :	<u>N/A</u>
3 4 5 6	3. BREAKTHROUGH T 4. MIN DETECTABLE 5. STEADY STATE P 5. SAMPLE THICKNE	ERMEATION RATE .15 ( SS: 19-20 m11		
1	SELECTED DATA	POINTS N/A		
•	TIME 1	: CONCENTRATION	CONCENTRATION :	LONCENTRATION
	2		:	
	4.			
	5.			
	6.	:	: :	
	7			
	8		· · · · · · · · · · · · · · · · · · ·	·
	10		:	
-	3. OTHER OBSERVAT	10NS:		
ε				
	·			
	OURCE OF DATA			
		run by Denise McDonsl	ld on January 28, 1987.	

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## Chemical Resistance Testing of Challenge 5100 Material

### Allyl Chloride Run M



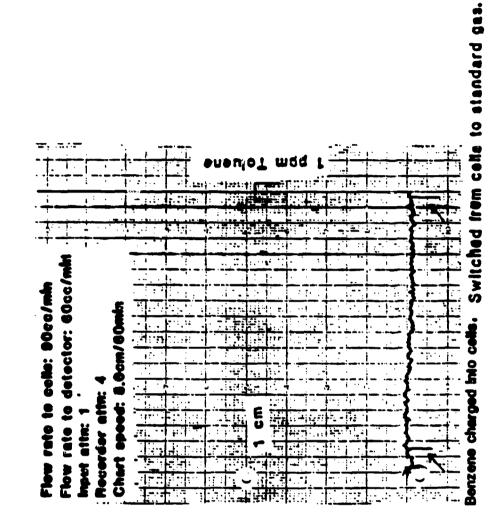
2: 3: 4: 5: 6: 7: 8:	CONDITION BEFO MANUFACTURER: PRODUCT IDENTI LOT OR MANUFAC NOMINAL THICKN	ERIAL CODE: 068 RE TEST: <u>Unused, no v</u> Chemfab Corp.	100	
1. 2. 3. 4. 5. 6.	ANALYTICAL MET - TEMPERATURE: 2 COLLECTION MED COLLECTION SYS OTHER CONDITIO	IUM: No	e used. /Detector Tem	with a 11.70 eV la
CH	ALLENGE CHEMICAL	1 :	COMPONENT 2	3
2.	CHEM NAME(S): CAS WUMBER(S): CONC. (IF MIX) CHEMICAL SOURC	62-53-3	N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
2. 3. 1. 5. 6.	MIN DETECTABLE	ES TESTED: <u>Three</u> ME: <u>No breakthrough wa</u> LIMIT <u>0.46 ppm</u> RMEATION RATE <u>M/A</u> S: 17-19 mil	as observed after 3.25	hours.
*•	TIME	CONCENTRATION	: CONCENTRATION	CONCENTRATION
	2			
	4			
	6.		•	
	7			
	9.			
	10	·		
8	OTHER OBSERVATI			

C-56

sistance Testing of USG cells: 90cc/ml detector:	Material with Aniline				       				1		-					
sistance Testing of USG cells: 90cc/ml detector:	laterial			:		<u> </u>								· · · ·		tenderr
Sistance T Gene: 90cc/mh Gene: 90cc/mh Gene: 90cc/mh				!							 					Cone 16
Sistance T Generation: 60cc/mh 6.0 6.0 6.0 6.0 6.0 7.1 7.1 7.1 7.1 7.1 7.1 7.1 7.1 7.1 7.1	ng of U						l									witched fro
		ع	attn: 4	ied: 6.0cm/00min				· . :		· · · · · · · · · · · · · · · · · · ·					-	

	1: TYPE: Teflon lami 2: PROTECTIVE MATERI 3: CONDITION BEFORE 4: MANUFACTURER: Ch 5: PRODUCT IDENTIFIC 6: LOT OR MANUFACTUR 7: NOMINAL THICKNESS 8: DESCRIPTION: Mat	AL CODE: 068 TEST: <u>Unused, no vi</u> emfab Corp. ATION: <u>Challenge 51</u> ER DATE: <u>N/A</u> : <u>15-20 mil</u>	00	
2.	TEST METHOD 1. TESTING LABORATOR 2. ANALYTICAL METHOD 3. TEMPERATURE: 22-2 4. COLLECTION MEDIUM 5. COLLECTION SYSTEM 6. OTHER CONDITIONS: 7. DEVIATIONS FROM A	: <u>Continuous photoi</u> 5 C : <u>N2</u> : <u>N2</u> 2 inch cells were		erature = 60C.
3.	CHALLENGE CHEMICAL	1 :	COMPONENT 2 :	3
	3. CONC. (IF MIX) _	Benzene 71-43-2 N/A isher reagent grade:	N/A N/A N/A N/A N/A	N/A N/A N/A N/A
	4. MIN DETECTABLE LIM 5. STEADY STATE PERME	TESTED: Three No breakthrough wa IT .05 ppm ATION RATE N/A 17-19 mil	s observed after 3.2	hours
	I       Implement         1.       Implement         2.       Implement         3.       Implement         4.       Implement         5.       Implement         6.       Implement         7.       Implement         8.       Implement         9.       Implement         10.       Implement	CONCENTRATION	: CONCENTRATION : :	CONCENTRATION
5.	8. OTHER OBSERVATIONS SOURCE OF DATA Samples were	: run by Karen Verscho	or on April 9, 1986	
				کی وہ جیت سراح سے اور میں آئی میں وہ ان ان کی

# Chemical Resistance Testing of USCG Material with Benzene



### DESCRIPTION OF PRODUCT EVALUATED

1:	TYPE: Teflon laminated Nomex
	PROTECTIVE MATERIAL CODE: 068
3:	CUNDITION BEFORE TEST: Unused, no visible imperfections
4:	MANUFACTURER: Chemfab Corp.
	PRODUCT IDENTIFICATION: Challenge 5100
6:	LOT OR MANUFACTURER DATE: N/A
	NOMINAL THICKNESS: 15-20 mil
8:	DESCRIPTION: Material was buff colored.

### 2. TEST METHOD

1. TESTING LABORATORY: Texas Research <u>institute</u> , 9063 Bee Caves Road, Austin,	, 17	K –
---	------	-----

- ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 2.
- TEMPERATURE: 22-25°C 3.
- 4. COLLECTION MEDIUM: N2 COLLECTION SYSTEM: N2
- 2 inch cells were used./Detector Temperature = 50C. OTHER CONDITIONS: 6. DEVIATIONS FROM ASTM F739 METHUD: Flow rate to cells was 90cc/min. 7.

3.	CHALLENGE CHEMICAL	1	:	COMPONENT 2	1	3
	1. CHEN NAME (S) :	Benzyl Chloride		<u>N/A</u>		N/A
	2. LAS NUMBER(s):		_:_	<u>N/A</u>		N/A
	3. CUNC. (IF MIX)	N/A	;_	N/A		N/A
	4. CHEMICAL SOURCE	:Alarich reagent	;_	N/A		N/A
		grade	_:_	<u>N/A</u>		<u>N/A</u>

### 4. TEST RESULTS

- 1. DATE TESTED: \_\_\_\_\_\_ April 10, 1986
- 2. NUMBER OF SAMPLES TESTED: Three
- 3. BREAKTHROUCH TIME: No breakthrough was observed after 3.2 hours.
- 4. MIN DETECTABLE LIMIT 0.11 DDM
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A

	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
1		:		:		:	
2				:		:	
3		;		:		;	
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6.		:		:		:	
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10.		:		;		:	

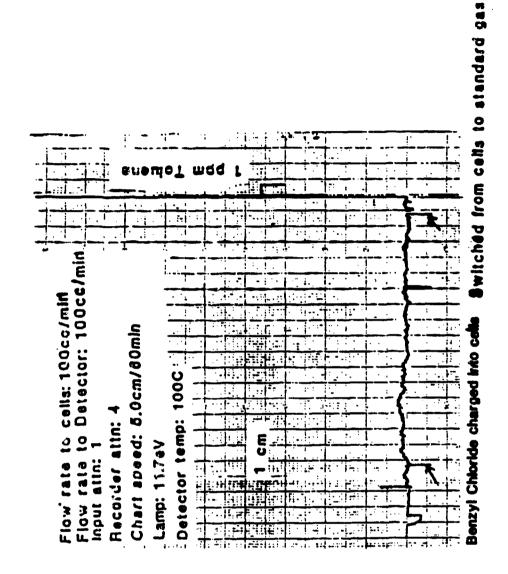
8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Karen Verschoor on April 10, 1986.

C-60

Chemical Resistance Testing of USCG Material with Benzyl Chloride



C-61

**MEADER** 

2 3 4 5 6 7	CONDITION BEFO MANUFACTURER: PRODUCT IDENT LOT OR MANUFAC NOMINAL THICKN	ERIAL CODE: 068 DRE TEST: Unused, no vi	00	buff colored on the
1 2 3 4 5 6	2. ANALYTICAL MET 3. TEMPERATURE: 2 4. COLLECTION MED 5. COLLECTION SYS 5. OTHER CONDITION	IUM: N2	used. /Detector Temp	ith a 11.70 eV lamp.
1 2 3 4	EST RESULTS DATE TESTED: S NUMBER OF SAMPE B. BREAKTHROUGH TI MIN DETECTABLE	Bromine 7726-95-6 N/A E:Aldrich reagen: grade Es TESTED: Three ME: No breakthrough wa LIMIT .53 ppm RMEATION RALE N/A S: 19-20 mil	COMPONENT 2 : N/A : N/A : N/A : N/A : N/A : S observed after 3.26	3 N/A N/A N/A N/A N/A N/A
	TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 3. OTHER OBSERVATION	CONCENTRATION	CONCENTRATION :	CONCENTRATION

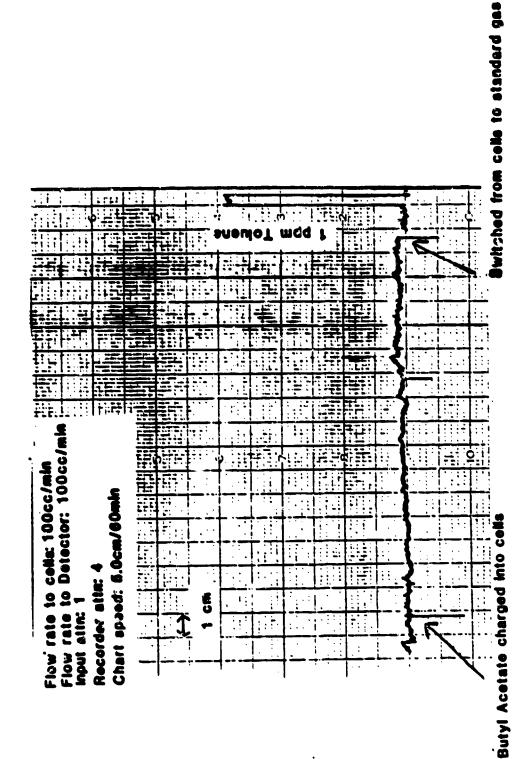
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Chemical Resistance Testing of USCG Material with Bromine

Switched from cetts to standard gas wsd Tomene Flow rate to cells: 100cc/min Flow rate to Detector: 100cc/min Input attn: 1 Chart apeed: 6.0cm/80min Detector Temperature-60C. Ne charged the cell Recorder alln: 4 Lamp: 11.7eV 

	1: 2: 3: 4: 5: 6: 7: 8:	MANUFACTURER: PRODUCT IDENTIF LOT OR MANUFACT NOMINAL THICKNE	RIAL CODE: 068 RE TEST: <u>Unused, no s</u> Chemfab Corp. ICATION: <u>Challenge</u> S URER DATE: N/A	5100	buff coloreu on the
•	TES 1. 2. 3. 4. 5. 6. 7.	ANALYTICAL METH TEMPERATURE: 22 COLLECTION MEDI COLLECTION SYST OTHER CONDITION	UM: N2	pionization detection	with a 11.7 eV Tamp.
-	THR	LLENGE CHEMICAL	1	: COMPONENT 2	: 3
		CHEM NAME (s) : CAS NUMBER (s): CONC. (IF MIX) CHEMICAL SOURCE	540-88-5	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
	2. 3. 4. 5. 6.	BREAKTHROUGH TIN MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS	S TESTED: Three ME: No breakthrough w IMIT 0.25 ppm RMEATION RATE <u>N/A</u> 5: 18-19 mil	was observed after 3	nours.
	7.	SELECTED DATA PO			
		TIME 1	CONCENTRATION	: CONCENTRATION	: CONCENTRATION
		3.			· ·
		<b>4.</b>			:
		6	:		:
		8			
		10			:
	٥	OTHER OBSERVATIO	ONS :		
	ο.				

Chemical Resistance Testing of USCG Materlal with Butyl Acetate



	1:	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068				
		3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil				
	8: DESCRIPTION: Mathrial was orange colored on one side and buff colored on to other side.					
2.	TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin,					
	<ol> <li>TEMPERATURE: 22-25°C</li> <li>COLLECTION MEDIUM: N2</li> <li>COLLECTION SYSTEM: N2</li> <li>OTHER CONDITIONS: 1 inch cells were used./Detector Temperature =60C.</li> </ol>					
3.	CRA	LIENCE CHEMICAL	. 1	: COMPONENT 2	: 3	
	1.	CHEM MANE (s) :	Buryl Acrylate	: N/A	: N/A	
	<b>z</b> .	CAS NUMBER(s):	141-32-2	: N/A	: N/A	
		CONC. (IF MIX)		:N/A	: <u>N/A</u>	
	4.	CHEMICAL SOURC	E:Aldrich reagent grade	: N/A : N/A	: <u>N/A</u>	
4.	TES	T RESULTS	Trade		M/A	
		1. DATE TESTED: July 21, 1986 2. NUMBER OF SAMPLES TESTED: Three				
				was observed after 3 ho		
		MIN DETECTABLE		Was observed after 5 nd	JUIS.	
		5. STEADY STATE PERMEATION RATE N/A				
	6. SAMPLE THICKNESS: 13-19 m11					
	7.	SELECTED DATA P	POINTS N/A	·····		
		TIME .	: CONCENTRATIO	N : CONCENTRATION	: CONCENTRATION	
		1. 2	- <u>·</u>	······	·	
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		9.	:	······	:	
		10	:		:	
	8. (	THER OBSERVATI	IONS :			
		- <u></u>				
		RCE OF DATA				

C-66

Chemical Resistance Testing of USCG Material with Butyl Acrylate

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io cella: 100cc/min to Detector: 100cc/min 1 bitn: 4 d: 6.0cm/80min	80				
10 C atta: ad: 5		5			
Flow' rate to celle: Flow rate to Deto Input attn: 1 Recorder attn: 4 Chart apeed: 5.0ci Lamo: 11.7eV	Dectector temp: 60 C				2 K
Flow rate Flow rate Input attn: Recorder Chart ape	Petecto				

C-67

1. DESCRIPTION OF PRODUCT EVALUATED

	TYPE: Teflon laminated Nomex
	PROTECTIVE MATERIAL CODE: 068
3:	CONDITION BEFORE TEST: Unused, no visible imperfections
	MANUFACTURER: Chemfab Corp.
5:	PRODUCT IDENTIFICATION: Challenge 5100
	LOT OR MANUFACTURER DATE: N/A
	NOMINAL THICKNESS: 15-20 =11
8:	DESCRIPTION: Material was buff colored.

TEST METHOD 2.

### 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.

3. TEMPERATURE: 22-25°C

COLLECTION MEDIUM: N2 4.

S. COLLECTION SYSTEM: N7

6. OTHER CONDITIONS: OTHER CONDITIONS: 2 inch cells were used /Detector Temperature =600 TEVIATIONS FROM ASIM F739 METE D: Flow rate to cells was 100cc/min.

TALLENGE THEMICAL	1	CONFORENT 2	2	3
1. CHEM NAME(s): 2. CAS NUMBER(s): 3. CONC. (IF MIX)	71-36-3	: N/A : N/A : N/A	-:- -:-	N/A N/A N/A
• •	Baker reagent grade	N/A	_:_	N/A

TEGT RESULTS

) •••

- 1. DATE TESTED: May 16, 1986

2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 15.6 hours.

4. MIN DETECTABLE LIMIT .32 ppm 5. STEADY STATE PERMEATION RATE N/A

- 6. SAMPLE THICKNESS: 17-19 mil.
- 7. SELECTED DATA POINTS N/A

TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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### 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia Cooper on May 16, 1986.

## Chemical Resistance Testing of USCG Material with n-Butyl Alcohol

critication cells Š

Switched from cells to standard gas

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### DESCRIPTION OF PRODUCT EVALUATED 1.

1: TYPE: Teflon laminated Nomex

2:	PROTECTIVE	MATERIAL	CODE:	068	_

CONDITION BEFORE TEST: Unused, no visible imperfections 3:

4: MANUFACTURER: Chemfab Corp.

5: PRODUCT IDENTIFICATION: Challenge 5100

6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil

B: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

7. TEST METHOD

.

1.	TESTING LABORATORY:	Texas Research	Institute, 9063 1	lee Caves Road.	Austin, TX

2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C

4. COLLECTION MEDIUM: N2

S. COLLECTION SISTEM: No

OTHER CONDITIONS: 2 inch cells were used/Detector Temperature = 6DC.
 DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min.

3.	THELENE TRENDLAL	1	:	COMPONENT 2	1	3	
	1. CHEM NAME(6) :	-Rutylanine	:	<b>#/</b> A	:	X/A	
	2. CAS NUMBER(s):	109-73-9		N/A	·····	N/A	
	3. CONC. (IF MIX):			N/A	;	N/A	
	4. CHEMICAL SOURCE	:Aldrich reagent	_:_	N/A	:	N/A	
		grade	_:_	N/A	;	N/A	

TEST RESULTS

- 1. DATE TESTED: May 19, 1986
- 2. NUMBER OF SAMPLES TESTED: Three
- 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours.
- 4. MIN DETECTABLE LIMIT .32 ppm
- 5. STEADY STATE PLEMEATION BATE N/A
- 6. SAMPLE THICKNESS: \_ 17-19 mil.
- 7. SELECTED DATA POINTS N/A

TIME	: CONCENTRATION	¥	CONCENTRATION	:	CONCENTRATION
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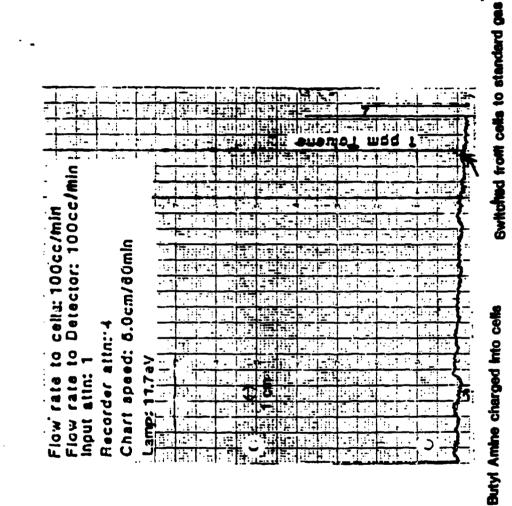
8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia Cooper May 19, 1986

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Chemical Resistance Testing of USCG Material with Butyl Amine

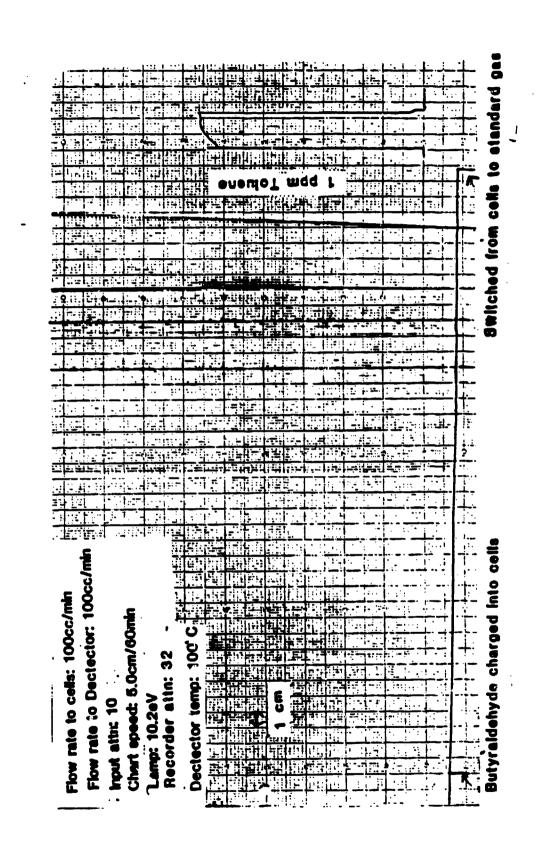


C-71

### 1. DESCRIPTION OF PRODUCT EVALUATED

6: LOT OR MANUFACT 7: NOMINAL THICKNE	ICATION: Challenge URER DATE: N/A SS: 15-20 mil	5100 colored on one side and	i buff colored on th
TEST METHOD			
1. TESTING LABORAT	ORY: Texas Research	Institute, 9063 Bee Ca	ives Road, Austin, T
2. ANALYTICAL METH	OD: Continuous pho	toionization detection	
3. TEMPERATURE: 22			
4. COLLECTION MEDI			
5. COLLECTION SYST			
6. OTHER CONDITION	S: 1 inch cells w	ere used. /Detector Temp	perature =100C.
7. DEVIATIONS FROM	ASTM F/39 METHOD:	Flow rate to cells was	100 cc/min.
CHALLENGE CHEMICAL	1	: COMPONENT 2	: 3
1. CHEM NAME (s) :	Butyraldebyde	: N/A	: : N/A
2. CAS NUMBER(s):	123-72-8		N/A
3. CONC. (IF MIX)			N/A
			: N/A
4. CHEMICAL SOURCE	E:Aldrich reagent	: N/A	i N/A
<ul> <li>4. CHEMICAL SOURCE</li> <li>TEST RESULTS</li> <li>1. DATE TESTED: <u>Jul</u></li> </ul>	grade	: N/A : N/A	N/A N/A
TEST RESULTS 1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PER 6. SAMPLE THICKNESS	grade grade S TESTED: Three E: No breakthrough MIT .29 pom MEATION RATE N/A S: 18-19 mil		:N/A
TEST RESULTS 1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PER 6. SAMPLE THICKNESS 7. SELECTED DATA PO	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A	: N/A	:N/A
TEST RESULTS 1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PER 6. SAMPLE THICKNESS	grade grade S TESTED: Three E: No breakthrough MIT .29 pom MEATION RATE N/A S: 18-19 mil	: N/A	:N/A
TEST RESULTS 1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PER 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A	: N/A	:N/A
TEST RESULTS 1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PER 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1.	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A	: N/A	:N/A
TEST RESULTS 1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PER 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4.	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A	: N/A	:N/A
TEST RESULTS 1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PER 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4. 5.	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A	: N/A	:N/A
TEST RESULTS 1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PEF 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 6.	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A : CONCENTRATIO : :	: N/A	: CONCENTRATION
TEST RESULTS  1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PEF 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7.	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A : CONCENTRATIO : :	: N/A	: CONCENTRATION
TEST RESULTS  1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PEF 6. SAMPLE THICKNESS 7. SELECTED DATA PC TIME 1. 2. 3. 4. 5. 6. 7. 8	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A : CONCENTRATIO : :	: N/A	: CONCENTRATION
TEST RESULTS  1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PEF 6. SAMPLE THICKNESS 7. SELECTED DATA PC TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A : CONCENTRATIO : :	: N/A	: CONCENTRATION
TEST RESULTS  1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PEF 6. SAMPLE THICKNESS 7. SELECTED DATA PC TIME 1. 2. 3. 4. 5. 6. 7. 8	grade grade S TESTED: Three E: No breakthrough MEATION RATE N/A S: 18-19 mil DINTS N/A : CONCENTRATIO : :	: N/A	: CONCENTRATION
TEST RESULTS  1. DATE TESTED: Jul 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE I 5. STEADY STATE PEF 6. SAMPLE THICKNESS 7. SELECTED DATA PC TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	grade grade ly 24, 1986 IS TESTED: Three (E: No breakthrough IMIT .29 DOM CMEATION RATE N/A S: 18-19 mil DINTS N/A : CONCENTRATIO : : : : : : : : : : : : :	: N/A	: CONCENTRATION

Chemical Resistance Testing of USCG Material with Butyraldehyde



C-73

### 1. DESCRIPTION OF PRODUCT EVALUATED

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57

1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aus 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 6. OTHER CONDITIONS: I inch cells were used. /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A : N/A 4. CHEMICAL SOURCE: Mallinckrodt : N/A : N/A 7. DEVIATIONS FROM CE: Mallinckrodt : N/A : N/A 7. CHEMICAL : N/A : N/A	
3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aus 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No 5. COLLECTION MEDIUM: No 5. COLLECTION MEDIUM: No 5. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: I inch cells were used. /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. CHALLENEE CHEMICAL 2 : 3 1. CHEM NAME(s): Carbon Disulfide: N/A N/A 4. CHEMICAL 2 : 3 1. CHEM NAME(s): Carbon Disulfide: N/A N/A 4. CHEMICAL 30URCE:Mallinckrodt: N/A N/A 4. CHEMICAL SOURCE:Mallinckrodt: N/A N/A 5. SILADY STATE PERMENTION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLES TESTED: Three (composite) 3. BREAKTHROUGH TIME: 21.60 min 4. MIN DETECTABLE LIMIT_IO ppm 5. SILADY STATE PERMENTION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1. DATE TESTED: June 27, 1986 2. NUMBER OF SAMPLES TESTED: Three (composite) 3. BREAKTHROUGH TIME: 21.60 min 4. MIN DETECTABLE LIMIT_IO ppm 5. SILADY STATE PERMENTION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1. DATE TESTED: JUNE 27, 1986 2. MIN DETECTABLE LIMIT_IO ppm 5. SILADY STATE PERMENTION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1. ME : CONCENTRATION : CONCENTRATION : CONCENTRATION 2	·····
<pre>4: MANUFACTURER: Chemitab Corp. 5: PRODUCT IDENT IFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aus 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. CMALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s) : Carbon Disulfide : N/A : N/A 3. CONC. (IF MIX) N/A 4. CHEMICAL 2 : COMPONENT 2 : 3 1. CHEM NAME(s) : T3-IS-D : N/A : N/A 4. CHEMICAL SOURCE: Mallinckrodt : N/A : N/A 5. STEADY STEME: 21.60 min 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm<sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1. DATE TESTED: June 27, 1986 2. NUMBER OF SAMPLES TESTED: Three (composite) 3. BREAKTHROUGH TIME: 21.60 min 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm<sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1. IME : CONCENTRATION : CONCENTRATION : CONCENTRA 1. CIENTRATION STATE 2.76 ug/hr x cm<sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1</pre>	
5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aus 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 3. TEMPERATURE: 22-25*C 4. COLLECTION NEDTUM: No 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: I inch cells were used. /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. CHALLENGE CHEMICAL 2. CAS NUMBER(s): Carbon Disulfide: N/A 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Mallinckrodt: N/A 4. CHEMICAL SOURCE: Mallinckrodt: N/A 1. DATE TESTED: June 27, 1986 2. NUMBER OF SAMPLES TESTED: Three (composite) 3. BREAKTHROUGH TIME: 21.60 min 4. MIM DETECTABLE LIMIT. JO ppm 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS 18-19 mil 7. SELECTED DATA POINTS N/A 1. DATE TESTED: JUNE 27, 1986 2. NUMBER OF SAMPLES TESTED: Three (composite) 3. BREAKTHROUGH TIME: 21.60 min 4. MIM DETECTABLE LIMIT. JO ppm 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1. DATE TESTED: JUNE 27, 1986 2. NUMBER OF SAMPLES TESTED: Three (composite) 3. BREAKTHROUGH TIME: 21.60 min 4	
6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aus 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Carbon Disulfide: N/A 3. CONC. (IF MIX) N/A 4. CHEMICAL 2 : COMPONENT 2 : 3 1. CHEM NAME(s): 75-15-0 1. DATE TESTED: June 27, 1986 2. NUMBER OF SAMPLES TESTED: Three (composite) 3. BREAKTHROUGH TIME: 21.60 min 4. MIX DETECTABLE LIMIT .10 ppm 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1. LIME : CONCENTRATION : CONCENTRATION : CONCENTRA 2	
7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aus 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. CNALLENGE CHEMICAL 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A N/A 2. CAS NUMBER (s): Carbon Disulfide : N/A N/A 3. CONC. (IF MIX) N/A N/A N/A 4. CHEMICAL SOURCE: Mallinckrodt : N/A N/A 4. CHEMICAL SOURCE: Mallinckrodt : N/A N/A 5. STEADY STATE PERMEATION RATE 2.60 min 4. MIN DETECTABLE LIMIT .10 ppm 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLEE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A	
8: DESCRIPTION: <u>Material was orange colored on one side and buff colored</u> other side. TEST METHOD 1. TESTING LABORATORY: <u>Texas Research Institute</u> , 9063 Bee Caves Road, Aus 2. ANALYTICAL METHOD: <u>Continuous photoionization detection with a 11.70</u> 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No 5. COLLECTION STSTEM: <u>No</u> 6. OTHER CONDITIONS: <u>I inch cells were used</u> . <u>/Detector Temperature = 60</u> 7. DEVIATIONS FROM ASTM F739 METHOD: <u>Flow rate to cells was 100 cc/min</u> . <b>CHALIENSE CHEMICAL</b> 2 : <b>COMPONENT 2</b> : 3 1. CHEM NAME(s): <u>Carbon Disulfide</u> : N/A N/A 3. CONC. (IF MIX) N/A N/A N/A 4. CHEMICAL SOURCE: <u>Mallinckrodt</u> : N/A N/A 1. DATE TESTED: June 27, 1986 2. NUMBER OF SAMPLES TESTED: <u>Three (composite)</u> 3. BREAKTHROUGH TIME: 21.60 min 4. MIN DETECTABLE LIMIT. IO ppm 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: <u>18-19 m1</u> 7. SELECTED DATA POINTS N/A	
Other side:         TEST METHOD         1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aus         2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70         3. TEMPERATURE: 22-25°C         4. COLLECTION MEDIUM: N2         5. COLLECTION SYSTEM: N2         6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60         CONSTENT 2: 3         6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60         COLLECTION MEDIUM: N2         6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60         CONTINUOUS FROM ASTM F/39 METHOD: Flow rate to cells was 100 cc/min.         CONDENT 2: 3         I. CHEM NAME (s): Carbon Disulfide : N/A N/A N/A         CONC. (IF MIX) N/A N/A N/A N/A         CONC. (IF MIX) N/A N/A N/A N/A         I. CHEM NAME (s): Carbon Disulfide : N/A N/A N/A         I. CONFORENT 2 :: 3         I. CHEM NAME (s) : Carbon Disulfide : N/A N/A         I. CONC. (IF MIX) N/A N/A N/A         I. CONCE. MUMBER OF SAMPLES TESTED: Three (composite)         3. BREAKT HROUGH TIME: 21.60 min	
1. TESTING LABORATORY: <u>Texas Research Institute, 9063 Bee Caves Road, Aus</u> 2. ANALYT ICAL METHOD: <u>Continuous photoionization detection with a 11.70</u> 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: <u>N2</u> 5. COLLECTION SYSTEM: <u>N2</u> 6. OTHER CONDITIONS: <u>Inch cells were used.</u> /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: <u>Flow rate to cells was 100 cc/min.</u> <b>CNALLENSE CHEMICAL</b> 1 : <b>CONFONENT 2</b> : 3 1. CHEM NAME(s): <u>Carbon Disulfide</u> : N/A : N/A 2. CAS MUMBER(s): <u>75-15-0</u> : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE: <u>Mallinckrodt</u> : N/A : N/A 1. DATE TESTED: June 27, 1986 2. NUMBER OF SAMPLES TESTED: <u>Three (composite)</u> 3. BREAKTHROUGH TIME: 21.60 min 4. MIN DETECTABLE LIMIT_JO ppm 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1	
2. ANALE PENDLY: CONTINUOUS PROTOTONIZATION detection with a 11.70 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: I Inch cells were used. /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. CHALLENEE DHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A : N/A 2. CAS NUMBER(s): 75-15-0 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE: Mallinckrodt : N/A : N/A 4. CHEMICAL SOURCE: Mallinckrodt : N/A : N/A 5. TESULTS : N/A : N/A : N/A 1. DATE TESTED: June 27, 1986 2. NUMBER OF SAMPLES TESTED: Three (composite) 3. BREAKTHROUGH TIME: 21.60 min 4. MIN DETECTABLE LIMIT .IO ppm 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1	
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3. TEMPERATOR: 22-25°C         4. COLLECTION MEDIUM: N2         5. COLLECTION SYSTEM: N2         6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60         7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.         CMALLENGE DHEMICAL 1 : COMPONENT 2 : 3         1. CHEM NAME(s): Carbon Disulfide : N/A         2. CAS NUMBER(s): 75-15-0         M/A         3. CONC. (IF MIX) N/A         4. CHEMICAL SOURCE: Mallinckrodt         M/A         MA         CHEST RESULTS         1. DATE TESTED: June 27, 1986         2. NUMBER OF SAMPLES TESTED: Three (composite)         3. BREAKT HROUGH TIME: 21.60 min         4. MIN DETECTABLE LIMIT_IO ppm         5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil         7. SELECTED DATA POINTS N/A         IIME : CONCENTRATION : CONCE	
5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: I finch cells were used. /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. CMALLENGE CHEMICAL 2 : 3 1. CHEM NAME(s) : Carbon Disulfide : N/A	
6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. CHALLENCE CHEMICAL 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A : N/A 2. CAS NUMBER(s): 75-15-0 : N/A : N/A 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE:Mallinckrodt : N/A : N/A 4. CHEMICAL SOURCE:Mallinckrodt : N/A : N/A 7. EST RESULTS 1. DATE TESTED: June 27, 1986 . 2. NUMBER OF SAMPLES TESTED: Three (composite) 3. BREAKT HROUGH TIME: 21.60 min 4. MIN DETECTABLE LIMIT TO ppm 5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1	
7. DEVIATIONS FROM ASIM F/39 METHOD: Flow rate to cells was 100 cc/min.         CMALLENCE CHEMICAL       1       : COMPONENT 2 : 3         1. CHEM NAME (s) : Carbon Disulfide : N/A       : N/A         2. CAS MUMBER(s): 75-15-0       : N/A         3. CONC. (IF MIX) N/A       : N/A         4. CHEMICAL SOURCE: Mallinckrodt       : N/A         1. DATE TESTED: June 27, 1986       : N/A         2. NUMBER OF SAMPLES TESTED: Three (composite)         3. BREAKT HROUGH TIME: 21.60 min         4. MIN DETECTABLE LIMIT .10 ppm         5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm²         6. SAMPLE THICKNESS: 18-19 mil         7. SELECTED DATA POINTS N/A         1. DIME : CONCENTRATION :	
7. DEVIATIONS FROM ASIM F/39 METHOD: Flow rate to cells was 100 cc/min.         CMALLENSE CHEMICAL       1       :       COMPONENT 2       :       3         1. CHEM NAME (s):       Carbon Disulfide       N/A       :       N/A         2. CAS MUMBER(s):       75-15-0       :       N/A       :       N/A         3. CONC. (IF MIX)       N/A       :       N/A       :       N/A         4. CHEMICAL SOURCE:Mallinckrodt       :       N/A       :       N/A         7. DATE TESTED: June 27, 1986       :       :       N/A       :       N/A         1. DATE TESTED: June 27, 1986       :       :       :       N/A       :       N/A         1. DATE TESTED: June 27, 1986       :       :       :       :       :       N/A         2. NUMBER OF SAMPLES TESTED: Three (composite)       :       :       :       :       :       :         3. BREAKT HROUGH TIME: 21.60 min       :	<u>c</u>
1. CHEM NAME (s) : Carbon Disulfide       N/A       N/A         2. CAS MUMBER (s): 75-15-0       N/A       N/A         3. CONC. (IF MIX) N/A       N/A       N/A         4. CHEMICAL SOURCE: Mallinckrodt       N/A       N/A         7eagent grade       N/A       N/A         1. DATE TESTED: June 27, 1986       N/A       N/A         2. NUMBER OF SAMPLES TESTED: Three (composite)       N/A       N/A         3. BREAKTHROUGH TIME: 21.60 min       Min DETECTABLE LIMIT .IO ppm       STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> 6. SAMPLE THICKNESS: 18-19 mil       TIME       CONCENTRATION : CONCENT	
2. CAS NUMBER(s): 75-15-0       N/A       N/A         3. CONC. (IF MIX)       N/A       N/A       N/A         4. CHEMICAL SOURCE: Mallinckrodt       N/A       N/A       N/A         4. CHEMICAL SOURCE: Mallinckrodt       N/A       N/A       N/A         7 reagent grade       N/A       N/A       N/A         1. DATE TESTED:       June 27, 1986       N/A       N/A         2. NUMBER OF SAMPLES TESTED:       Three (composite)       N/A         3. BREAKTHROUGH TIME:       21.60 min       N/A         4. MIN DETECTABLE LIMIT_IO ppm       STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> SAMPLE THICKNESS:         5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> SAMPLE THICKNESS:       18-19 mil         7. SELECTED DATA POINTS       N/A       Image: Concentration :       Concentration :         1	
2. CAS NUMBER(s): 75-15-0       N/A       N/A         3. CONC. (IF MIX)       N/A       N/A       N/A         4. CHEMICAL SOURCE: Mallinckrodt       N/A       N/A       N/A         4. CHEMICAL SOURCE: Mallinckrodt       N/A       N/A       N/A         7 reagent grade       N/A       N/A       N/A         1. DATE TESTED:       June 27, 1986       N/A       N/A         2. NUMBER OF SAMPLES TESTED:       Three (composite)       N/A         3. BREAKTHROUGH TIME:       21.60 min       N/A         4. MIN DETECTABLE LIMIT_IO ppm       STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> SAMPLE THICKNESS:         5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm <sup>2</sup> SAMPLE THICKNESS:       18-19 mil         7. SELECTED DATA POINTS       N/A       Image: Concentration :       Concentration :         1	
3. CUNC. (IF MIX) N/A       : N/A       N/A         4. CHEMICAL SOURCE: Mallinckrodt       : N/A       N/A         reagent grade       : N/A       : N/A         TEST RESULTS       : N/A       : N/A         1. DATE TESTED: June 27, 1986       : N/A       : N/A         2. NUMBER OF SAMPLES TESTED: Three (composite)       : N/A       : N/A         3. BREAKT HROUGH TIME: 21.60 min       : N/A       : N/A         4. MIN DETECTABLE LIMIT .10 ppm       : STEADY STATE PERMEATION RATE 2.76 ug/hr x cm²       : SteADY STATE PERMEATION RATE 2.76 ug/hr x cm²         6. SAMPLE THICKNESS: 18-19 mil       : SELECTED DATA POINTS N/A       : : : : : : : : : : : : : : : : : : :	
4. CHEMICAL SOURCE: Mallinckrodt : N/A : N/A   TEST RESULTS     1. DATE TESTED: June 27, 1986   2. NUMBER OF SAMPLES TESTED: Three (composite)   3. BREAKT HROUGH TIME: 21.60 min   4. MIN DETECTABLE LIMIT .IO ppm   5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm²   6. SAMPLE THICKNESS: 18-19 mil   7. SELECTED DATA POINTS N/A   1	
reagent grade : N/A : N/A         TEST RESULTS         1. DATE TESTED: June 27, 1986 .         2. NUMBER OF SAMPLES TESTED: Three (composite)         3. BREAKT HROUGH TIME: 21.60 min         4. MIN DETECTABLE LIMIT .10 ppm         5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm²         6. SAMPLE THICKNESS: 18-19 mil         7. SELECTED DATA POINTS N/A         TIME : CONCENTRATION : CONCENT	
1. DATE TESTED: June 27, 1986         2. NUMBER OF SAMPLES TESTED: Three (composite)         3. BREAKTHROUGH TIME: 21.60 min         4. MIN DETECTABLE LIMIT .IO ppm         5. STEADY STATE PERMEATION RATE 2.76 ug/hr x cm²         6. SAMPLE THICKNESS: 18-19 mil         7. SELECTED DATA POINTS N/A         1.         2.         3.         3.         4.         5.	
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8. OTHER OBSERVATIONS:	
SOURCE OF DATA	
Samples were run by Sylvia Cooper on June 27, 1986.	

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Permeation of Carbon Disulfide through USCG Material

### Composite

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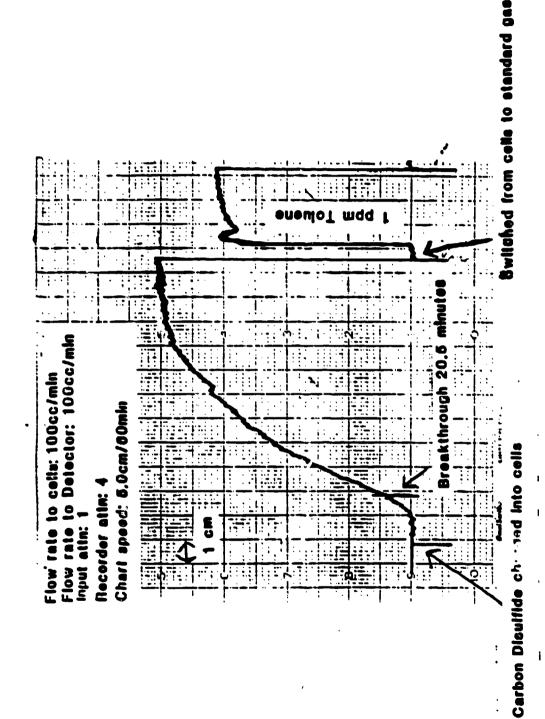
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DESCRIPTION OF PROD 1: TYPE: Tetion 1a			
2: PROTECTIVE MATE 3: CONDITION BEFOR 4: MANUFACTURER:	RIAL CODE: 068 RE TEST: <u>Unused, no</u> Chemfab Corp.		
6: LOT OR MANUFACT 7: NOMINAL THICKNE	ICATION: Challenge : URER DATE: N/A SS: 15-20 mil Material was orange co		d buff colored on th
TEST METHOD			
2. ANALYTICAL METH 3. TEMPERATURE: 22 4. COLLECTION MEDI 5. COLLECTION SYST	UM: N2	Dionization detection	with a 11.70 eV lam
7. BEVIATIONS FROM	ASTM F739 METHOD: F	DW TALE TO CE! WAS	100 cc/min.
CHALLENGE CHEMICAL	1	: COMPONENT 2	: <b>3</b> :
1. CHEM NAME(s): 2. CAS NUMBER(s):	Carbon Disulfide	: <u>N/A</u> N/A	_:N/A
3. CONC. (IF MIX)	N/A	: N/A	: N/A
4. CHEMICAL SOURCE	reagent grade	: <u>N/A</u> : N/A	_:N/A :N/A
6. SAMPLE THICKNESS	S 1ESTED: <u>One (Run</u> 1E: 20.50 min IMIT .05 ppm. IMEATION RATE <u>3.65</u> 18-19 mil		
7. Selected DATA PC			<u>↓</u>
TIME	CONCENTRATION	: CONCENTRATION	CONCENTRATION
·····			
·	······································		
6.	•		······
7	•		:
9			
8. OTHER OBSERVATIO	·	• <u> </u>	<u></u>

Permeation of Carbon Disulfide through USCG Material

NAX SAL

Run I



C-7"

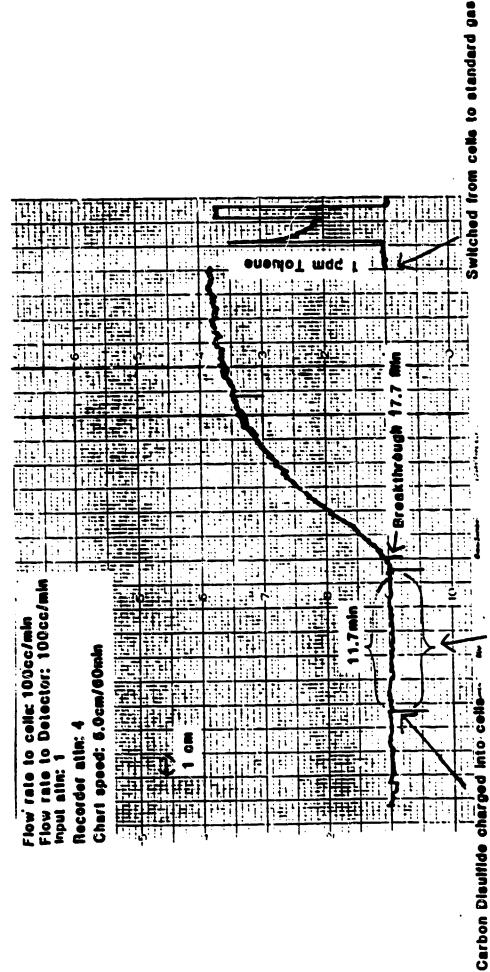
### 1. DESCRIPTION OF PRODUCT EVALUATED

{

	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CUDE: 068 3: CONDITION BEFORE TEST: Unused, nc v 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange co other side.		
2.	TEST METHOD		
	<ol> <li>TESTING LABORATORY: <u>Texas Research I</u></li> <li>ANAL YT ICAL METHOD: <u>Continuous photo</u></li> <li>TEMPERATURE: <u>22-25°C</u></li> <li>COLLECTION MEDIUM: <u>N2</u></li> <li>COLLECTION SYSTEM: <u>N2</u></li> <li>OTHER CONDITIONS: <u>1 inch cell was</u></li> <li>DEVIATIONS FROM ASTM F739 METHOD: <u>F1</u></li> </ol>	used. /Detector Tem	erature = 60C.
3.	THRLIENCE THENTTAL 1	: COMPONENT 2	: .3
	<pre>L. CHEM NAME(s): Carbon Disulfide 2. CAS NUMBER(s): 75-15-0 3. CONC. (IT MIX) N/A 4. CHEMICAL SOURCE: Mailinckrodt reagent grade</pre>	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
4.	TEST RESULTS 1. DATE TESTED: June 30, 1986 2. NUMBER OF SAMPLES TESTED: One (Run II 3. BREAKTHROUGH TIME: 17.70 min 4. MIN DETECTABLE LIMIT .05 ppm 5. STEADY STATE PERMEATION RATE 2.59 uc 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED CATA POINTS N/A		
	TIME : CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	1.       .         2.       .         3.       .         3.       .         4.       .         5.       .         6.       .         7.       .         8.       .         9.       .         10.       .		
	8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA Sample was run by Sylvia Cooper of	on June 30, 1986.	

### Permeation of Carbon Disulfide through USCG Material

Run II



... Chart speed-60cm/10min

C-19

### 1. DESCRIPTION OF PRODUCT EVALUATED

1:	TYPE: Teflon laminated Nomex
	PROTECTIVE MATERIAL CODE: 063
	CONDITION BEFORE TEST: Unused, no visible imperfections
	MANUFACTURER: Chemfab Corp.
	PRODUCT IDENTIFICATION: Challenge 5100
5:	LOT OR MANUFACTURER DATE: N/A
	NOMINAL THICKNESS: 15-20 mil
B:	DESCRIPTION: Material was buff colored.

### 2. TEST METHOD

3.

1.	TESTING LABORATORY:	: Texas Research 3	Institute, 9063 Bee	Caves Road,	Austin, TX
-		ويسترك والمتحدث والمتح		يسالوني وعلالي ويجرد بعنيانك برج	أوسيت والمراجع والمراجع والمراجع والمراجع

- 2. ANALYTICAL METHOD: Continuous photoion/zation detection with a 11.70 eV lamp. TEMPERATURE: 22-25°C
- 3.

- 4. COLLECTION MEDIUM: N2
  5. COLLECTION SYSTEM: N2
  6. OTHER CONCITIONS: 2 inch cells were used. /Detector Temperature = oOC. 7. DEVIATIONS FROM ASTN F739 METHOD: Flow rate to cells was 90 cc/min\_

CHALLENGE CHEMICAL	1	COMPONENT 2	3
1. CHEM NAME (s) :	Carbon Tetrachloride	N/A	N/A
2. CAS NUMBER(s):	56-23-5	N/A	: N/A
3. CONC. (IF MIX)	N/A	N/A	: <u>N/A</u>
4. CHEMICAL SOURCE	:Mallinckrodt	N/A	: <u>N/A</u>
	reagent yrade	N/A	: <u> </u>
EST RESULTS			

### 1. DATE TESTED: \_ April 16, 1986

2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours.

- 4. MIN DETECTABLE LIMIT N/A
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A

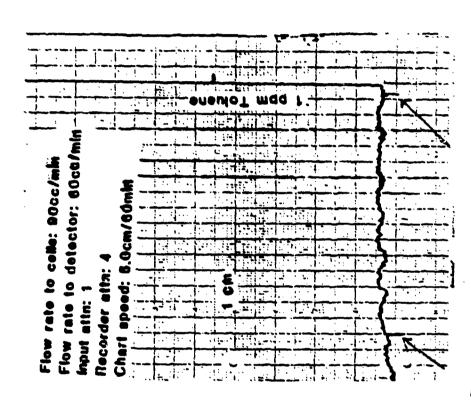
1	TIME	CONCENTRATION	: CONCENTRATION	CONCENTRATION
2			·	
4			•	
6	·		·	
8			:	
9. – 10			:	

8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Karen Verschoor on April 16, 1986

Chemical Resistance Testing of USCG Materlal with Carbon Tetrachioride

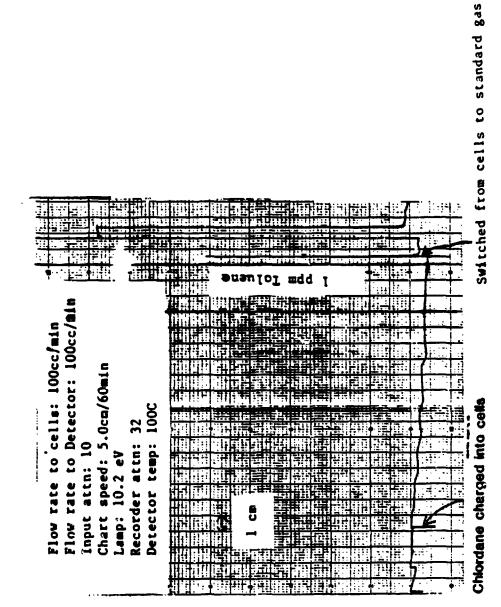


### Orbon Tetrachioride churged into celle. Switched from celle to etunderd ges.

	2: P 3: C 4: M 5: P 6: L 7: N 8: C	IANUFACTURER: <u>C</u> RODUCT IDENTIFT OT OR MANUFACTU IOMINAL THICKNES	IAL CODE: 068 TEST: <u>Unused</u> , no hemfab Corp. CATION: <u>Challenge</u> RER DATE: <u>N/A</u> S: 15-20 mil	5100	and buff colored on
2.	1. T 2. A 3. T 4. C 5. C 6. C	NALYTICAL METHO EMPERATURE: <u>22-</u> Collection mediu Collection syste Other conditions	D: <u>Continuous phot</u> 25°C M: N2 M: N2	oionization detecti re used. /Detector	Temperature = 100C. was 100 cc/min.
1		ende Chenical	1	: CONFONENT 2	: 3
	2. 5.	AS NUMBER(s): DNC. (IF MIX) HEMICAL SOURCE:	Chlordane (25%) N/A N/A Voluntary Product group	: N/A : N/A : N/A : N/A : N/A	N/A N/A N/A N/A N/A N/A
	2. NL 3. BF 4. MI 5. ST 6. SA	N DETECTABLE LI	TESTED: <u>Three</u> : <u>No breakthrough w</u> MIT 0.26 ppm EATION RATE <u>N/A</u> 18-19 mil	as observed after 3	3.44 hours.
	1.	TIME :	CONCENTRATION	: CONCENTRATIO	ON : CONCENTRATION
	3.				
	5.				
	7. 8. 9.				
	10	:			
	8.01	HER OBSERVATION	S:		· · · · · · · · · · · · · · · · · · ·
5.	SOURC	E OF DATA Samples were	run by Denise McDor	ald on September 9	. 1986.

<u>BOQQ</u>

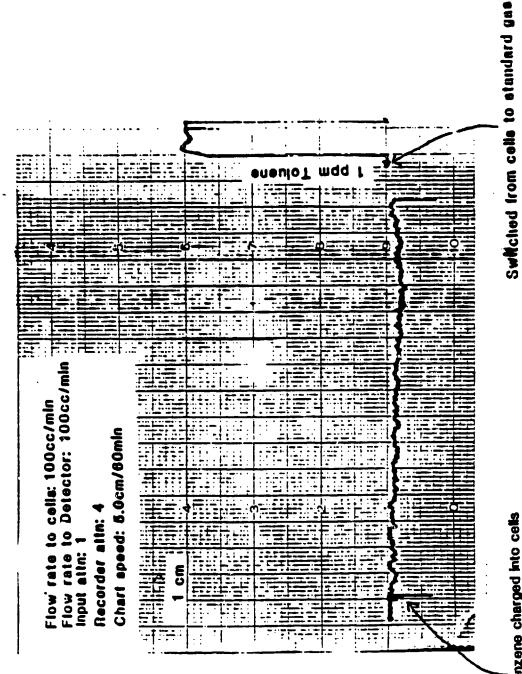
Chemical Resistance Testing of USCG Material with Chlordane



C-83

3: CONDITION BEFO 4: MANUFACTURER: 5: PRODUCT IDENTI 6: LOT OR MANUFAC 7: NOMINAL THICKN	ERIAL CODE: 068 RE TEST: Unused, no Chemfab Corp. FICATION: Challenge TURER DATE: N/A ESS: 15-20 mil	visible imperfections 5100 olored on one side and	buff colored on the
TEST METHOD	TORY Tavas Pasanash	Institute, 9063 Bee Car	the Boad Austin TV
		oionization detection (	
3. TEMPERATURE: 2	2-25°C		
4. COLLECTION MED		•	
5. COLLECTION SYS		manual /Deserves mare	
7. TEVIATINE TO	NS: I INCH CELLS WE M ASTM F739 METHOD.	re used./Detector Tempo Flow rate to cells was	100 ec/min-
CHALLENGE CHEMICAL	1	: COMPONENT 2	: 3
1. CHEM NAME (s) :	Chlorobenzene	: X/A	: \\/A
2. CAS NUMBER(s):		: N/A	N/A
3. CONC. (IF MIX)	N/A	: N/A	: N/A
4. CHEMICAL SOURC	والمتعادي والمتعالي والمتعالية والمتعادي والمتعادي والمتعادي المتعادي والمتعادي  :N/A	:N/A	
TEST RESULTS	grade	:N/A	:N/A
4. MIN DETECTABLE	ME: No breakthrough LIMIT .20 ppm RMEATION RATE N/A S: 18-19 mil	was observed after 3 h	OUTS .
TIME	: CONCENTRATION	: CONCENTRATION	: CONCENTRATION
1.	·		•
2.		• • • • • • • • • • • • • • • • • • •	•
2	:	:	
	:	:	
3 4 5	:		:
3 4 5 6	:		:
3. 4. 5. 6. 7.	: : : : : :		:
3. 4. 5. 6. 7. 8.	: : : : : :		: : : : : :
3 4 5 6 7	: : : : : : : : : :		
3.         4.         5.         6.         7.         8.         9.         10.	:		: : : : : :
3 4 5 6 7 8 9	:		: : : : : :
3.         4.         5.         6.         7.         8.         9.         10.	:		
3.         4.         5.         6.         7.         8.         9.         10.	:		: : : : : :

Chemical Resistance Testing of USCG Material with Culorobenzene



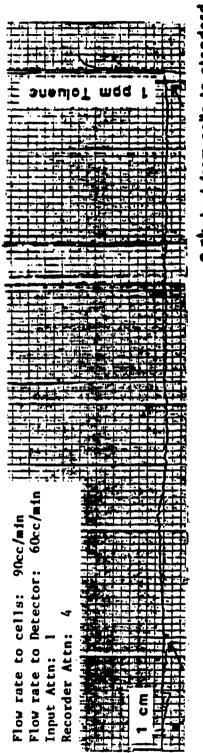
Chlorobanzene charged into cells

### 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no vi 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 510 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material buff colored		
2.	TEST METHOD		
	3. TEMPERATURE: <u>22-25°C</u> 4. COLLECTION MEDIUM: <u>N2</u> 5. COLLECTION SYSTEM: <u>N2</u>	used. /Detector Temp	erature = 60C.
Э.	THALLENEE CHEMICAL 1	COMPONENT 2 :	3
	1. CHEM NAME(s): Chloroform 2. CAS NUMBER(s): 865-49-6 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Kodak reagent grade	N/A N/A N/A N/A N/A	N/A N/A N/A N/A
4.	TEST RESULTS		N/A
	1. DATE TESTED: <u>April 24, 1986</u> 2. NUMBER OF SAMPLES TESTED: <u>Three</u> 3. BREAKTHROUGH TIME: <u>No breakthrough w</u> 4. MIN DETECTABLE LIMIT <u>0.19 ppm</u> 5. STEADY STATE PERMEATION RATE <u>N/A</u> 6. SAMPLE THICKNESS: <u>17-19 mil</u> 7. SELECTED DATA POINTS <u>N/A</u>	as observed after 3.6	hours
	TIME : CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	2.		
	3:		······································
	5	:	
	7	::	
		•	
	9.	• • • • • • • • • • • • • • • • • • •	
	9		
	9.	· · · · · · · · · · · · · · · · · · ·	

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Chemical Resistance Testing of USCG Material with Chloroform



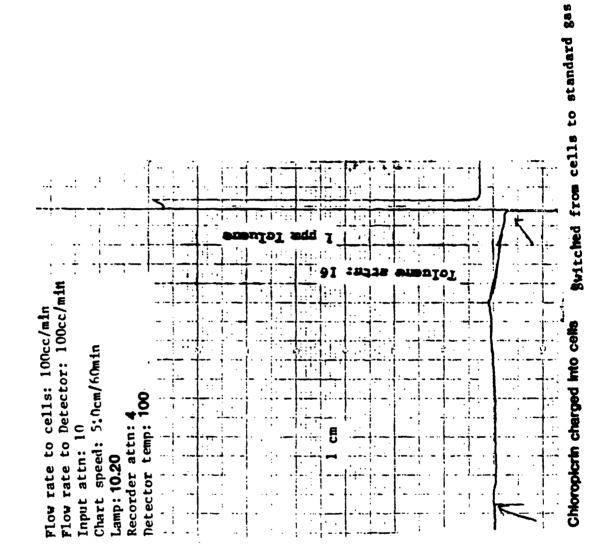
Chlaroform charged into cells

C-87

Swhched from cells to standard gas

	CHEMI	CAL PROTECTIVE CL	OTHING PRO	DUCT EVALUATION	N RECORD	
DESCRI	PTION OF PROD	UCT EVALUATED				
2: PR 3: CO 4: MA 5: PR 6: LO 7: NO 8: DE	NDITION BEFOR NUFACTURER: ODUCT IDENTIF NT OR MANUFACT MINAL THICKNE	RIAL CODE: 068 E TEST: Unused,	ige 5100		d buff color	red on the
TEST M	ETHOD					
2. AN 3. TE 4. CO 5. CO 6. OT	ALYTICAL METH MPERATURE: 22 DLLECTION MEDI DLLECTION SYST HER CONDITION	UM: N2	were used	tion detection	with a 10.2	0 eV 1am 100C.
CHALLE	NGE CHEMICAL	1	: : : : : : : : : : : : : : : : : : : :	MPONENT 2	: 3	3
2. CA 3. CD	IEM NAME(S): Is Number(S): INC. (IF MIX) Iemical Source	76-06-2		N/A N/A N/A N/A N/A	: : :	I/A I/A I/A I/A
2. NUM 3. BRE 4. MIN 5. STE 6. SAM	IBER OF SAMPLE AKTHROUGH TIM DETECTABLE L			rved after 3.1	hours.	
1. 2.	T I MÉ	CONCENTRAT	10N :	CONCENTRATION	: CONCENT	RATION
3. 4.		· · · · · · · · · · · · · · · · · · ·			:	
5.		: :			:	
7.		•	•		•	······································
9.	••••••••••••••••••••••••••••••••••••••	· <u>·····</u> ······························	•		· ·	
10.		·			•	
8. OTH	IER OBSERVATIO	NS:				
SOURCE	UF DATA Samples were	run by Denise Mo	Donald on	October 15, 19	86	

Chemical Resistance Testing of USCG Material with Chloropicrin



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l.	. DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex	
	2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections	
	4: MANUFACTURER: Chemfab Corp.	
	5: PRODUCT IDENTIFICATION: Challenge 5100	
	6: LOT OR MANUFACTURER DATE: N/A	
	7: NOMINAL THICKNESS: 15-20 mil	
	8: DESCRIPTION: <u>Material was orange colored on one side and buff</u> co other side.	olored on the
2-	TEST METHOD	
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Roa	d, Austin, TX
	2. ANALYTICAL METHOD: Ion Chromatography on Dionex 2000	
	3. TEMPERATURE: Ambient	
	4. COLLECTION MEDIUM: Aqueous 5. COLLECTION SYSTEM: Aqueous	
	6. OTHER CONDITIONS: 2 inch cells were used.	
	7_ DEVIATIONS FROM ASTM F739 METHOD:	
) <b>.</b>	CHALLENGE CHEMICAL 1 : COMPONENT 2 :	3
	1. CHEM NAME (s) : Chlorosulfonic Acid : N/A :	<b>11/A</b>
	2. CAS NUMBER(s): 7790-94-5 : N/A ::	N/A
	3. CONC. (IF MIX) 90% : N/A :	N/A
	4. CHEMICAL SOURCE: Aldrich reagent	<u>N/A</u>
	. TEST RESULTS	N/A
	1. DATE TESTED: October 10, 1986	
	2. NUMBER OF SAMPLES TESTED: Three	
	3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.5 ppm	
	5. STEADY STATE PERMEATION RATE N/A	
	6. SAMPLE THICKNESS: 19-20 mil	
	7. SELECTED DATA POINTS Cells 1,2, and 3 at end of 3 hour test	
		CENTRATION
		<0.5 ppm
	2:	
	4	l
	5	
	6. : : :	
	7::	
	8:	
	9. 10.	
	8. OTHER OBSERVATIONS: Pelention time for 5 ppm Chlorosulfonic Acid 2.08 minute	standard was
	SOURCE OF DATA	
•	Samples were run by Denise McDonald on October 10, 1986.	

### Calibration-5 ppm Chlorosultonic Acid STD

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WHELA INJECT	2110612	۱ĕ		•	
	2. 33		Chlorasutto	nic Asid Ce	ul 1 3 hours
		21186129 CH# "A" PS	ja 1.		
ERMEATION ILE 1. METHOD	5. RUN 42	INDEX 1 CALIB		. •	
NALVSTE DJM	-	-	CHASHEL A	INJECT	21:29:19
ame fi	FN RT	AREA BC FF		. 97	
٩ ٩		27812 81 57985 81_311597.			
L 5 27463 5		85797	PERMEATION	IETHOD 5.	21:30: Run 49 Indek
01423 5	• •		file 1. P Fhelysti Djn		
÷.		•	HARE	PPM	RT APEA BC
			CL 1	9.3 <i>5</i> 4	0.07 110710 0: 2.05 116192'
		•	TOTALS	ð.	1272-
•					
MDL-0.5ppm Chi	orcaulfonic Acid	STD	Chlorosulfonic	Acid C	eli 2 3 Hours
CHANNEL A INJ	ECT 211	15:09	CHANNEL A	Inject	21133187
	1, 25			. 97	
	1.25 .99		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2. 03	
PERMEATION		21:16:00 14 INDEX 1	PERMEATION		21:33:
	193 <b>5. RUN</b> 4	te //⊒⊌nit te		(ETHOD 5.	RUN 49 INDEX
ANALYST: DJM			ANALYST: DJA		
HANE	FAM RT	AREA SC RF	NAME	20M	RT AREA BC
2 22	0. 1.25 0.615 1.09		cL <sup>1</sup>	0. 0. 514	0,37 114607 01 2.05 1347643 01
17413	9. 61 <i>5</i>	2421062	TJTALS	ð.	1162250
					<b></b>
Reagent W	ater Blank		Chlorosulton	ic Acid	Cell 3 3 Hours
CHANNEL A	INJECT	21:47:13	CHANNEL A	INJECT	21:43:09
	. 97	,		. 64	
	<del>[21</del> 96			- 1. 21	<b></b>
SEPMEATION File 1.	·	21:47:12	FERMEATION	ME1900 5.	21:4) Pun Il Indi
FILE 1.	METHOD 5.	RUN 52 INDEX 1	FILE 1. Analveti DJM		1017 L 110
ANALVST: DJ	174				
NAME	20 <b>M</b>	RT AREA BC	HAME .	,≓≎n a	RT AFER
NAME L	0. 0. 121	0.07 130303 01 2.06 401334 01	¢L <sup>±</sup>	0. 2.453	0.04 116334 2.01 1900933
		582059	TOTALS	٥.	1617517
T 27ALS	ş.				

### 

1.	DESCRIPTION OF PROD	UCT EVALUATED								
	1: TYPE: Teflon la	minated Namex								
	3: CONDITION BEFOR	E TEST: Unused, no v	isible imperfections							
	4: MANUFACTURER:	Chemfab Corp.								
	5: PRODUCT IDENTIF	ICATION: Challenge 5	100							
	6: LOT OR MANUFACT	URER DATE: N/A								
	7: NOMINAL THICKNES		······							
	8: DESCRIPTION: M	aterial was buff colo	red							
2.	TEST METHOD									
	1. TESTING LABORAT	ORY: Texas Research I	nstitute, 9063 Bee C	aves Road, Austin, TX						
	2. ANALYTICAL METHO	OD: Continuous photo	ionization detection	with a 11.70 eV lamp.						
	3. TEMPERATURE: 22	-25 °C								
	4. COLLECTION MEDI	UM: N2								
	5. COLLECTION SYST	EM: N2								
	6. OTHER CONDITION	S: 2 inch cells wer	e used. /Detector Te	mperature = 60C.						
	7. DEVIATIONS FROM	ASTM F739 METHOD: F	low rate to cells wa	s_90cc/min						
3.	CHALLENGE CHEMICAL	1	: COMPONENT 2	: 3						
	1. CHEM NAME (s) :	m-Cresol	. N/A	: N/A						
	2. CAS NUMBER(s):		: N/A	: N/A						
	3. CONC. (IF MIX)	N/A	: N/A	: N/A						
	4. CHEMICĂL SOURČE	: J.T. BAKER	:N/A	: N/A						
		reagent grade	:N/A	: <u>N/A</u>						
4.	TEST RESULTS									
		-11 7 1096								
		. DATE TESTED: <u>April 7, 1986</u> 2. NUMBER OF SAMPLES TESTED: Three								
		E: No breakthrough	when when we determ A	hourse						
	4. MIN DETECTABLE L	INIT O OF POR	was observed atter 4	nours						
	5. STEADY STATE PER	MEATION DATE N/A								
	6. SAMPLE THICKNESS									
	7. SELECTED DATA PO									
	TIME 1.	CONCENTRATION	: CONCENTRATION	: CONCENTRATION						
	2.	•	•	:						
	3.	•	•	•						
	4	•	:	•						
	5	•	:	•						
	6	•	•	:						
	7	:	:	:						
	8.	:		<u>:</u>						
	9	•	<u>:</u>							
	10	•								
	8. OTHER OBSERVATIO	NS:								
5.	SUURCE OF DATA Samples were	run by Karen Verscho	or on April 7. 1986							

I Cresol
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Material w
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<b>Testing o</b>
<b>Resistance 1</b>
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90cc/min c: 60cc/m		T.
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13: 6:t		
cella: detector î : 4 S^cm/min		Ļ
cel det i 5%		-
der to		
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rate rate atti der		- <u>i</u>
Flow rate Flow rate Input attn Recorder a Chartspeed		T
Flow 1 Flow 1 Input Record		<u>.</u>
		N

Switched from cells to standard gas

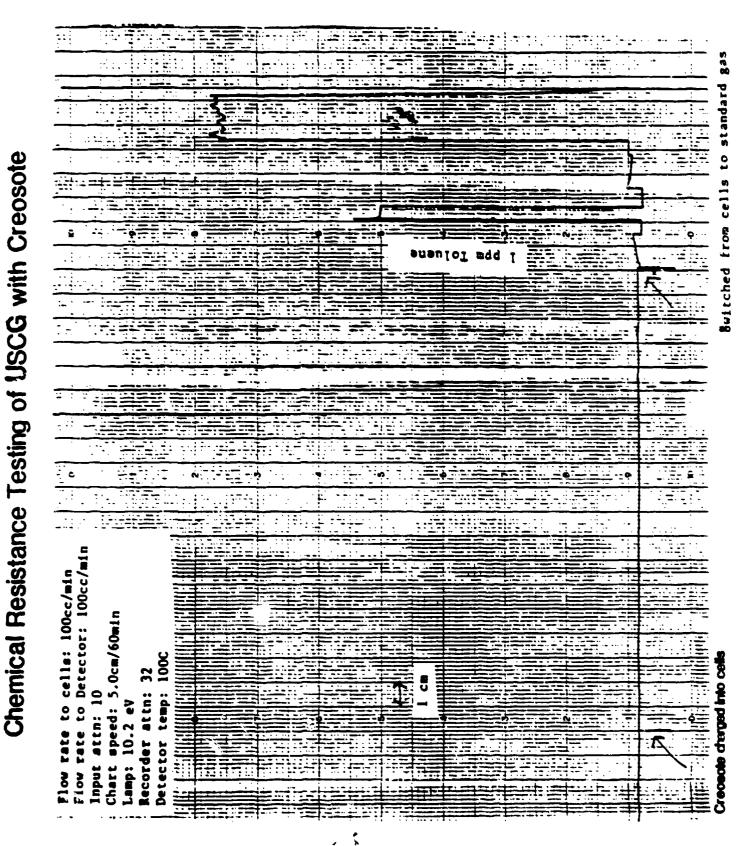
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Creaci charged into cella

	CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD
1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD
	<ol> <li>TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX</li> <li>ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp</li> <li>TEMPERATURE: 22-25 °C</li> <li>COLLECTION MEDIUM: N2</li> <li>COLLECTION SYSTEM: N2</li> <li>OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 100C.</li> <li>DEVIATIONS FROM ASTM F739 METHOD: N/A</li> </ol>
1	ENALLENGE CHEMICAL 1 : CONPONENT 2 : 3
	1. CHEM NAME(s):       Creosote       N/A       N/A         2. CAS MUMBER(s):       N/A       N/A       N/A         3. CONC. (IF MIX)       N/A       N/A       N/A         4. CHEMICAL SOURCE:       TAR Chemicals, Inc.       N/A       N/A
4.	TEST RESULTS         1. DATE TESTED: August 18, 1986         2. NUMBER OF SAMPLES TESTED: Three         3. BREAKTHROUGH TIME: No breakthrough was observed after 18.1 hours.         4. MIN DETECTABLE LIMIT .32 ppm         5. STEADY STATE PERMEATION RATE N/A         6. SAMPLE THICKNESS: 18-19 mil         7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	1; 2;
	3
	4: 5:
	6. 7.
	8
	9: 10:
	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA Samples were run by Sylvia Cooper on August 18, 1986

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N.

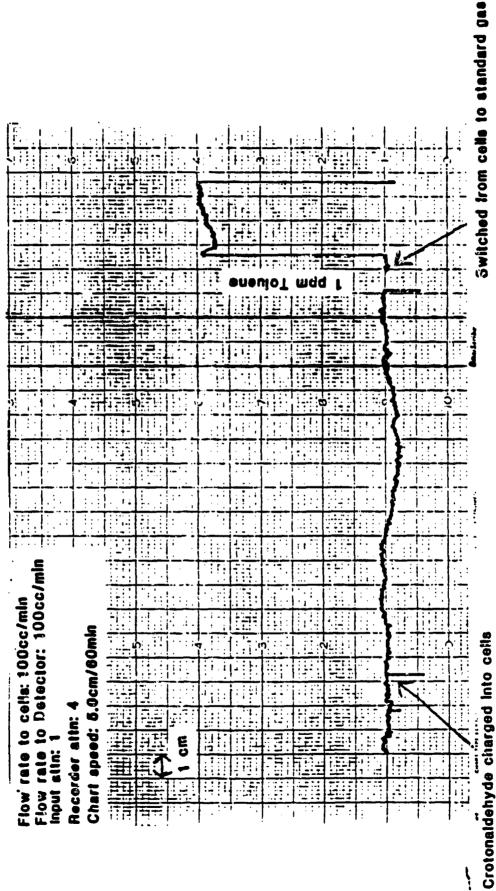
C-9:

### 1. DESCRIPTION OF PRODUCT EVALUATED

	4: MANUFACTURER: Che 5: PRODUCT IDENTIFICA 6: LOT OR MANUFACTURE 7: NOMINAL THICKNESS:	mfab Corp. TION: <u>Challenge 5</u> R DATE: N/A 15-20 mil	isible imperfection 100 lored on one side a		f colored on the
٦	TEST METHOD				
	1. TESTING LABORATORY 2. ANALYTICAL METHOD:	Continuous photo			
	3. TEMPERATURE: 22-25				
	<ol> <li>COLLECTION MEDIUM:</li> <li>COLLECTION SYSTEM:</li> </ol>				
	6. OTHER CONDITIONS:		e used. /Detector	Temper	cature = 60C.
			ow rate to cells wa		
۱	CHALLENGE CHEMICAL	1 –	: COMPONENT 2	;	3
•	1. CHEN NAME (s) : Cr	ebydeb [kao to	: : N/A	:	N/A
		3-73-9	N/A	:	N/A
	3. CONC. (IF MIX) N		N/A		N/A
	4. CHEMICAL SOURCE : AT		N/A	-:	N/A
		ade	: N/A		N/A
	1. DATE TESTED: July 2. NUMBER OF SAMPLES T 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMI 5. STEADY STATE PERMEA 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN	ESTED: Three No breakthrough w T 0.62 ppm. TION RATE <u>N/A</u> 18-19 mil	vas observed after 3	.1 hou	urs.
	TIME : 1. :	CONCENTRATION	: CONCENTRATION	l :	CONCENTRATION
	2	ι,	•		
	3:			:	
	4:		•		
	F				·
	5:			<u> </u>	
	6:		•		
	6: 7:				
	6: 7: 8:				
	6: 7:				
1	6: 7: 8: 9: 10:				
ł	6: 7: 8: 9:				

(-90)

# Chemical Restance Testing of USCG Material with Crotonaldehyde



C-97

### 1. DESCRIPTION OF PRODUCT EVALUATED

	1:	TYPE: Teflon 1	aminated Nomex					
	2:	PROTECTIVE MAT	ERIAL CODE: 068			_		
	3: CONDITION BEFORE TEST: Unused, no visible imperfections							
		MANUFACTURER: PRODUCT IDENT]	Chemfab Corp. FICATION: Challenge 5	100		-		
			TURER DATE: N/A	100		-		
			ESS: 15-20 mil			-		
				lored on one side	and buff colored on the	-		
		other side.				_		
2.	TEST	METHOD						
	1.	TESTING LABOR	TORY: Texas Research I	nstitute, 9063 Bee	Caves Road, Austin, TX	_		
	2.	ANALTIICAL MEI TEMPERATURE: 2	HUD: Continuous photo	1001 Zation detecti	on with a 11.70 eV lamp.	-		
		COLLECTION ME				-		
		COLLECTION SYS				-		
			NS: 1 inch cells wer	e used. /Detector	Temperature = 60C.	-		
	7.	DEVIATIONS FRO	M ASTM F739 METHOD: FI	OW rate to cells w	as 100 cc/min.	-		
3.	THAL	LENGE CHEMICAL	. 1	: COMPONENT 2	: 3	-		
	1.		<u>.Cumene Hydroperoxide</u>	: 	: 			
	2	CAS NUMBER(s):	80-15-9	: <u> </u>	<u>N/A</u>	-		
		CONC. (IF MIX)		N/A	N/A	-		
	4.	CHEMICAL SOUR	E:Aldrich reagent	N/A		-		
		RESULTS	grade	: N/A				
	2. N 3. B 4. M 5. S 6. S	REAKTHROUGH TI	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT <u>1.20 ppm</u> RMEATION RATE <u>N/A</u> SS: <u>18-19 mil</u>	as observed after	3.5 hours.			
	1. 3		······································		······································			
	1	TIME .	CONCENTRATION	: CONCENTRATIO	N : CONCENTRATION			
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	J	•				-		
	5	•						
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	9	o				_		
	1	0	•	•	:	_		
	8.0	THER OBSERVAT	IONS :					
		·						
5.	SOUR	CE OF DATA						
			re run by Sylvia Cooper	- on July 14. 1986.				

Chemical Resistance Testing of USCG Materlal with Cumene Hydroperoxide

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Flow rate to celle: 100cc/min Flow rate to Detector: 100cc/min Input attn: 1 Recorder attn: 4 Chart speed: 6.0cm/80min 1 cm		droperoxide charged into
		≣, ₽
		Alilluttil operox
	· · · · · · · · · · · · · · · · · · ·	ž

Cumene Hydroperoxide charged into cells

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### DESCRIPTION OF PRODUCT EVALUATED 1.

1:	TYPE:	Teflon	laminated	Nomex
----	-------	--------	-----------	-------

- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 15-20 mit 7:
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

### 2. TEST METHOD

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3.

- 1. TESTING LABORATORY: <u>Texas Research Institute</u>, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: <u>Continuous photoionization detection with a 11.7 eV Tamp</u>.
- 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2
- 6. OTHER CONDITIONS: OTHER CONDITIONS: <u>1 inch cells were used./ Detector Temperature = 60C.</u> DEVIATIONS FROM ASTM F739 METHOD: <u>Flow rate to cells was 100 cc/min.</u>

CHALLENGE CHEMICAL	1	•	COMPONENT	2	:	3
1. CHEM MAME(s) :		:			:	
2. CAS NUMBER(s):						فتقوي والمتكاري والتواري والمراجع
3. CONC. (IF MIX)		-:-				
1. CHEMICAL SOURCE:						
CECT DECULTE	grade	_:_				

EST RESULTS

- 1. DATE TESTED: July 3, 1986
- 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 3.4 hours.

- 4. MIN DETECTABLE LIMIT .25 ppm 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A

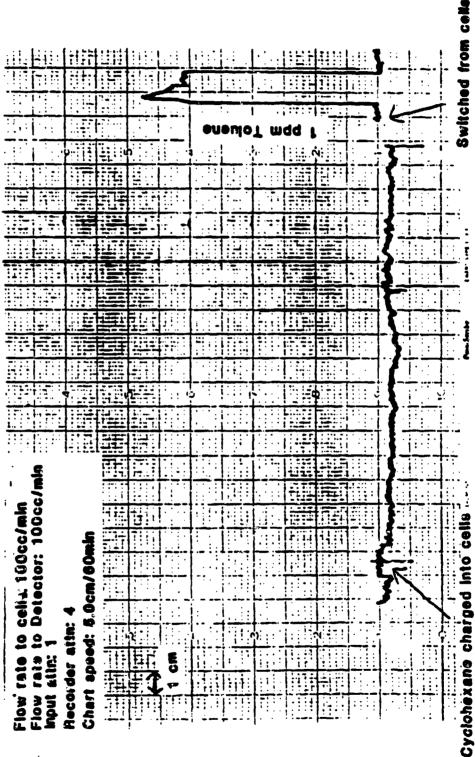
TIME CONCENTRATION CONCENTRATION : CONCENTRATION : : 1. 2. : • 3. : : • : : : 5. : : : 6. 7. : 8. . : 9. : : : 10. :

8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia Cooper on July 3, 1986

Chemical Resistance Testing of USCG Material with Cyclohexane



Switched from cells to standard gas

### 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- PROTECTIVE MATERIAL CODE: 068 2:
- CONDITION BEFORE TEST: Unused, no visible imperfections MANUFACTURER: Chemiab Corp. PRODUCT IDENTIFICATION: Challenge 5100 LOT OR MANUFACTURER DATE: N/A 3:
- 4:
- 5:
- 6: NOMINAL THICKNESS: 15-20 mil
- 7:
- 8: DESCRIPTION: Material was buff colored.

### 2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.
- 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2

- 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100cc/min.

3 3. CHALLENGE CHEMICAL 1 COMPONENT 2 : 1. CHEM NAME(s): 1.2 Dibromoethane : N/A **X**/X 106-93-4 2. CAS NUMBER(s): N7A N/A CONC. (IF MIX) N/A 57A 3. CHEMICAL SOURCE: Aldrich reagent 4 N/A N7A N/A grade

### 4. TEST RESULTS

- 1. DATE TESTED: May 12, 1986 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 5 hours.

- 4. MIN DETECTABLE LIMIT .10 ppm 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 17-19 mil
- 7. SELECTED DATA POINTS N/A

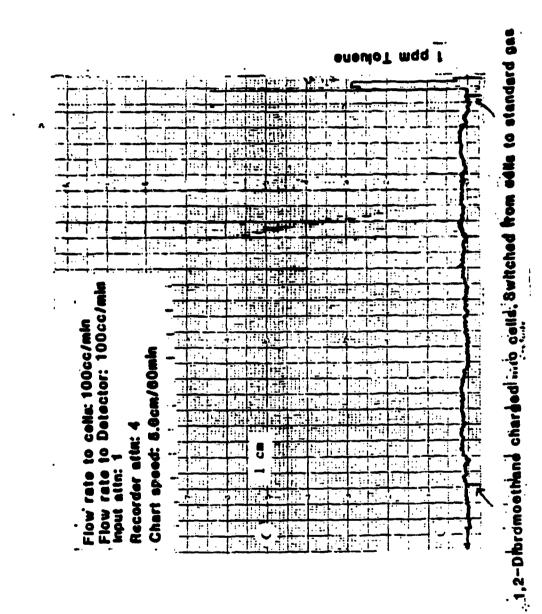
	TIME	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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4		:	:		:	
5. –		•	:		:	
6		•	:		:	
7. –		· · · · · · · · · · · · · · · · · · ·	:		:	
8. –		•	:		:_	
9. –		•	:		:	
10.		•	:		;	
8. – 9. – 10. –						

8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Karen Verschoor on May 12, 1986.

Chemical Resistance Testing of USCG Material with 1,2-Dibromoethane



# 1. DESCRIPTION OF PRODUCT EVALUATED

	TYPE: Teflon laminated Nomex
	PROTECTIVE MATERIAL CODE: 068
3:	CONDITION BEFORE TEST: Unused, no visible imperfections
	MANUFACTURER: Chemfab Corp.
5:	PRODUCT IDENTIFICATION: Challenge 5100
6:	LOT OR MANUFACTURER DATE: N/A
	NOMINAL THICKNESS: 15-20 mil
8:	DESCRIPTION: Material was buff colored.
	•

#### 2. TEST METHOD

1.	TESTING LABORATORY	<u>Texas Research Institute, 9063 Bee Caves Road, Austin, TX</u>	
•			-

- 2. ANALYTICAL METHOD: Continuous photoionization detection 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: No
- 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: 2 inch cells were used
- 7. DEVIATIONS FROM ASIM \$739 METHOD: Flow Fate to cells was 90cc/min.

#### 3. CHALLENGE CHEMICAL : COMPONENT 2 1 : CHEM NAME(s): <u>1,2-Dichloroethane</u>: N/A : •

<b>*</b> •		1,2-DICHIOLOGCHARE	<u> </u>	i <u> </u>
2.	CAS NUMBER(s):	107-06-2	N/A	:N/A
3.	CONC. (IF MIX)	N/A	N/A	: N/A
4.	CHEMICAL SOURCE:	Aldrich reagent -	N/A	: N/A
		grade	N/A	: <u>N/A</u>

EST RESULTS

1. DATE TESTED: May 1, 1986

2. NUMBER OF SAMPLES TISTED: Three 3. BRIAKTHROUGH TIME: No breakthrough was observed after 5.7 hours 4. MIN DETECTABLE LIMIT

- 5. STEADY STATE PERMEATION RATE N/A

6. SAMPLE TEICRNESS: 17-19 mil

7. SELECTED DATA POINTS N/A

TIME :	CONCENTRATION :	CONCENTRATION :	CONCENTRATION
	•	<u> </u>	·
		· · · · · · · · · · · · · · · · · · ·	
		:	
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## 8. OTHER OBSERVATIONS: \_\_\_

5. SOURCE OF DATA

Samples were run by Karen Verschoor on May 1, 1986.

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Chemical Resistance Testing of USCG Material with 1,2-Dichloroethane

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Celte: 100cc/ Detector: 10 6.0cm/80min 6.0cm/80min	inije terestra and his cel
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Flow rate to C Flow rate to D flow rate to D flow rate to D Chart speed: 6 Lamp: 11.7eV	
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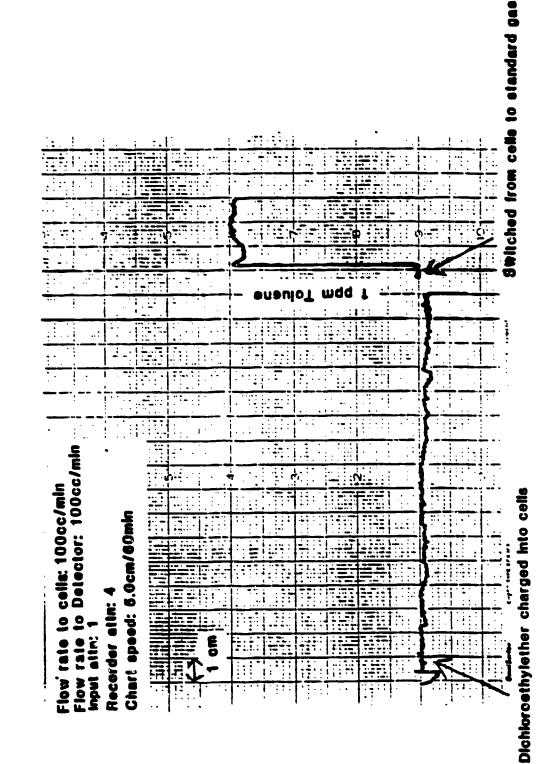
C-103

# 1. DESCRIPTION OF PRODUCT EVALUATED

1: TYPE: Teflon lamina 2: PROTECTIVE MATERIAL				
3: CONDITION BEFORE TE	ST: Unused, no vi	sible imperfection	8	
4: MANUFACTURER: Chem				
5: PRODUCT IDENTIFICAT		00		
6: LOT OR MANUFACTURER	· · · · · · · · · · · · · · · · · · ·			
7: NOMINAL THICKNESS:				
8: DESCRIPTION: Mater	ial was orange col	ored on one side a	nd buff	colored on the
other side.				
TEST METHOD				
1. TESTING LABORATORY:				
2. ANALYTICAL METHOD: 3. TEMPERATURE: 22-25*		ONIZATION detectio	n with	a 11.70 ev lam
4. COLLECTION MEDIUM:				
5. COLLECTION SYSTEM:				
6. OTHER CONDITIONS:		wood (Dependen To		
7. DEVIATIONS FROM AST	T INCH CEILS WERE	used./Detector le	n 100	
			<u>s 100 (</u>	
CHALLENGE CHEMICAL	1 :	COMPORENT 2	1	3
1. CHEM NAME (s): 1,3	7-Dichloroethyl :	N/A	•	N/A
	her :	N/A	-	<u> </u>
2. CAS NUMBER(s): 62		N/A		<u> </u>
3. CONC. (IF MIX) N/		N/A	<b></b> !	<u>N/A</u>
4. CHEMICAL SOURCE: Ko		N/A	:	N/A N/A
1. DATE TESTED: July 10 2. NUMBER OF SAMPLES TES 3. BREAKTHROUGH TIME: 1 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT	STED: Three No breakthrough wa N/A	s observed after 3	hours.	
	-17 211			
6. SAMPLE THICKNESS: 18 7. SELECTED DATA POINTS				
6. SAMPLE THICKNESS: 18		: CONCENTRATION	: (	ONCENTRATION
6. SAMPLE THICKNESS: 18- 7. SELECTED DATA POINTS TIME : 1:	N/A	: CONCENTRATION	: (	ONCENTRATION
6. SAMPLE THICKNESS: 18- 7. SELECTED DATA POINTS TIME : 1: 2:	N/A	: CONCENTRATION :	: (	ONCENTRATION
6. SAMPLE THICKNESS: 18- 7. SELECTED DATA POINTS TIME : 1:	N/A	: CONCENTRATION : :	: (	CONCENTRATION
6. SAMPLE THICKNESS: 18- 7. SELECTED DATA POINTS TIME : 1. : 2. : 3. : 4. :	N/A	: CONCENTRATION : : :	: (	ONCENTRATION
6. SAMPLE THICKNESS: 18- 7. SELECTED DATA POINTS TIME : 1	N/A	: CONCENTRATION : : : :	: ( : : : : :	ONCENTRATION
6. SAMPLE THICKNESS: 18. 7. SELECTED DATA POINTS TIME : 1	N/A	: CONCENTRATION : : : : : :	: (	ONCENTRATION
6. SAMPLE THICKNESS: 18. 7. SELECTED DATA POINTS TIME : 1	N/A	: CONCENTRATION : : : : : : :	: ( : : : : : :	ONCENTRATION
6. SAMPLE THICKNESS: 18. 7. SELECTED DATA POINTS TIME : 1	N/A	: CONCENTRATION : : : : : : : : :		ONCENTRATION
6. SAMPLE THICKNESS: 18- 7. SELECTED DATA POINTS TIME : 1 2 3 4 5 6 7 8 9	N/A	: CONCENTRATION : : : : : : : : : : :	: ( : : : : : : :	ONCENTRATION
6. SAMPLE THICKNESS: 18. 7. SELECTED DATA POINTS TIME : 1	N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :		ONCENTRATION
6. SAMPLE THICKNESS: 18. 7. SELECTED DATA POINTS TIME : 1	N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :		ONCENTRATION
6. SAMPLE THICKNESS: 18- 7. SELECTED DATA POINTS TIME : 1 2 3 4 5 6 7 8 9	N/A	: CONCENTRATION : : : : : : : : : : : : : : :		ONCENTRATION

Samples were run by Sylvia Cooper on July 16, 1986.

C-106

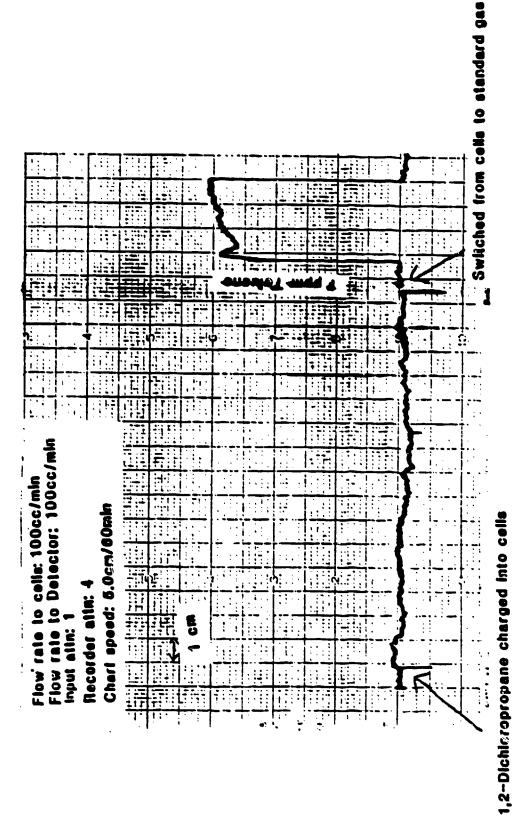


Chemical Restance Testing of USCG Material with Dichloroethylether

C-107

		RIFTION OF PRUDU			
		TYPE: <u>Teflon lam</u> PROTECTIVE MATER			
			TEST: Unused, no vis	ible imperfections	
		MANUFACTURER: C	CATION: Challenge 510	n	والموالية والمراجع والموالية والمراجع
	6:	LOT OR MANUFACTU	RER DATE: N/A		
	7: 1	NOMINAL THICKNES	S: 15-20 mil		
	8: 1	other side.	terial was orange colo	ored on one side and c	outt colored on the
2.	TEST	METHOD			
	1.	TESTING LABORATO	RY: <u>Texas Research Ins</u>	titute, 9063 Bee Cave	s Road, Austin, TX
		ANALYTICAL METHO TEMPERATURE: 22-	D: Continuous photoio	nization detection wi	th a 11.7 eV lamp.
		COLLECTION MEDIU			
	5.	COLLECTION SYSTE	M: N2		
	6. ( 7. )	OTHER CONDITIONS	: I inch cells were ASTM F739 METHOD: Flo	used./ Detector Tempe	erature = 60C.
-		LENGE CHEMICAL		COMPONENT 2 :	
3.				:	3
		CAS NUMBER(s):	<u>1,2-Dichloropropane</u> :	<u>N/A</u>	N/A
	3.	CONC. (IF MIX)	N/A :	N/A ::	N/A
	4.	CHEMICAL SOURCE:	Kodak reagent grade :	N/A :	N/A
	2. N 3. B	UMBER OF SAMPLES REAKTHROUGH TIME	: No breakthrough was	observed after 3.1 h	iours
	4. M	IN DETECTABLE LI	MIT 31 ppm		
	6. S	AMPLE THICKNESS:	EATION RATE N/A 18-19 mil		
	7. S	ELECTED DATA POI	NTS N/A		
	1	TIME	CONCENTRATION	: CONCENTRATION :	CONCENTRATION
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	7 8 9 1	•	ıS :		
5.	7 8 9 1 8. 0	CE OF DATA	S:	: : : : : on July 1, 1986	

Permeation Testing of USCG Material with 1,2-Dichloropropane



C-104

CHEMICAL	PROTECTIVE	CLOTHING	PRODUCT	EVALUATION	RECORD	

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	CHEMICAL PROTECTIVE CLUB	HING PRODUCT EVALUATION	RECORD
1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex 2: PRUTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange other side.	<u>= 5100</u>	buff colored on the
2.	TEST METHOD		
	<ol> <li>TESTING LABORATORY: Texas Research</li> <li>ANALYTICAL METHOD: Continuous pho</li> <li>TEMPERATURE: 22-25 °C</li> <li>COLLECTION MEDIUM: N2</li> <li>COLLECTION SYSTEM: N2</li> <li>OTHER CONDITIONS: 1 inch cells</li> <li>DEVIATIONS FROM ASTM F739 METHOD:</li> </ol>	were used./ Detector Te	mperature = 60C.
3.	CHALLENGE CHEMICAL	= COMPUTENT ?	: 3
4.	1. CHEM NAME(s): 1,3-Dichloroproper 2. CAS NUMBER(s): 542-75-6 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Aldrich reagent grade TEST RESULTS 1. DATE TESTED: July 10, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .17 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A	ne : N/A : N/A : N/A : N/A : N/A	:N/A :N/A :N/A :N/A
	TIME     CONCENTRATIO       1.	DN : CONCENTRATION	CONCENTRATION
	8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA		

Samples were run by Sylvia Cooper on July 10, 1986.

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USCG Material through							
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	Flow, Input Reco	Chart .					

Switched from cells to standard gas

1,3-Dichiororbropene charged into cells

# 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- PROTECTIVE MATERIAL CODE: 068 2:
- CONDITION BEFORE TEST: Unused, no visible imperfections 3:

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- 4:
- MANUFACTURER: <u>Chemfab Corp.</u> PRODUCT IDENTIFICATION: <u>Challenge 5100</u> LOT OR MANUFACTURER DATE: N/A 5:
- 6:
- NOMINAL THICKNESS: 15-20 mil 7:
- DESCRIPTION: Material was orange colored on one side and buff colored on the 8: other side.

# 2. TEST METHOD

- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1.
- ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp. 2.
- TEMPERATURE: 22-25°C 3.
- COLLECTION MEDIUM: N2 4.
- 5.
- COLLECTION SYSTEM: N2 OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min. 6. 7.

### 3. CHALLENGE CHEMICAL

		:			•	
13.	CHEM NAME(s) : Di	i <u>ethanol<b>a</b>mine</u> :	<u> </u>	/A	: <u> </u>	/A
	CAS NUMBER(s): TI		N	7A	: <u>N</u>	/A
	CONC. (IF MIX) N7		N	/n	: <u>N</u>	/A
4.	CHEMICAL SOURCE: AT	drich reagent :	1N	/#	: N	/A
	gr	rade :	N	/A	: N	/A

:

**LUMPONENT 2** 

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#### TEST RESULTS 4.

- 1. DATE TESTED: June 25, 1986 2. NUMBER OF SAMPLES TESTED: Three
- 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours.
- 4. MIN DETECTABLE LIMIT N/A
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 18-19 mil
- 7. SELECTED DATA POINTS N/A

TIME	:	CONCENTRATION :	CONCENTRATION :	CONCENTRATION
	<u> </u>			
	<u>`</u>			
	<u> </u>			

# 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia Cooper on June 25, 1986.

Chemical Resistance Testing of USCG Material with Diethanolamine

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celle: 100cc/mln Detector: 100cc	4 D.	Ŧ	副	ir. : i	<u>.</u>	1 :: 1			þ. i				Ż
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rate attr:	Recorder attn: 4 Chart apeed: 6.0cm/60mln		53	-		1.					11		
	Recorder Chart ape				Ţ	T							
Flow Flow Input	2 1			. <u></u> .	• • • • •	•	<b>†</b>	·	1	1	1		1

Switched from cells to standard gas

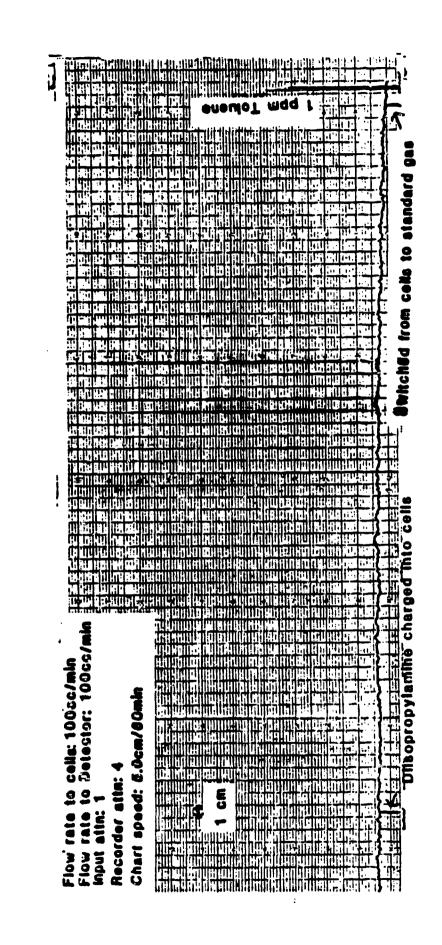
Diethanolamine charged into cells

# 1. DESCRIPTION OF PRODUCT EVALUATED

	<pre>1: TYPE: Teflon lawinated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CUNDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemifab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mill 8: DESCRIPTION: Material was orange colored on one side and buff colored on the</pre>
2.	TEST METHOD
	<ol> <li>TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX</li> <li>ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.</li> <li>TEMPERATURE: 22-25°C</li> <li>COLLECTION MEDIUM: N2</li> <li>COLLECTION SYSTEM: N2</li> <li>OTHER CONDITIONS: 2 inch: cells were used. /Detector Temperature = 60C.</li> <li>DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min</li> </ol>
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s):       Diisopropylamine       N/A         2. CAS NUMBER(s):       108-18-9       N/A         3. CONC. (IF MIX)       N/A       N/A         4. CHEMICAL SOURCE:       Aldrich reagent       N/A         grade       N/A       N/A
	<ol> <li>DATE TESTED: <u>Nay 20, 1986</u></li> <li>NUMBER OF SAMPLES TESTED: <u>Three</u></li> <li>BREAKTHROUGH TIME: <u>No breakthrough was observed after 15 hours</u></li> <li>MIN DETECTABLE LIMIT <u>.39 ppm</u></li> <li>STEADY STATE PERMEATION RATE <u>N/A</u></li> <li>SAMPLE THICKNESS: <u>17-19 mil</u></li> <li>SELECTED DATA POINTS <u>N/A</u></li> </ol>
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	1.       .       .       .         2.       .       .       .         3.       .       .       .         4.       .       .       .         5.       .       .       .         6.       .       .       .         7.       .       .       .         8.       .       .       .         9.       .       .       .         10.       .       .       .         8.       OT HER OBSERVATIONS:       .       .
5.	SOURCE OF DATA Samples were run by Sylvia Cooper on May 20, 1986



hemical Resistance Testing of USCG Material with Diisopropylamine



# 1. DESCRIPTION OF PRODUCT EVALUATED

	1:	TYPE: Teflor	laminato	ed Nomey				
	2:	PROTECTIVE M						
	3:	CONDITION BE			isible	imperfection	15	
	4:	MANUFACTURER		ab Corp.				
	5:	PRODUCT IDEN			5100			
	6:							
	7:	NOMINAL THIC		5-20 mil				
	8:	other side.		al was orange co	olored o	n one side a	ING DUT	f colored on the
2.	TES	T METHOD						
	1. 2.	TESTING LABO ANALYTICAL M	RATORY: 1	exas Research I	nstitut	e, 9063 Bee	Caves R	load, Austin, TX
		TEMPERATURE:		Continuous photo	DIONIZAL	ion detectio	n with	<u>a 10.2 Tamp.</u>
		COLLECTION M	100 M 100 M	12				
		COLLECTION S		12				
	6.	OTHER CONDIT	IONS: T	inch cells were	used./	Detector Te	mperatu	re = 100C.
	7.	DEVIATIONS F	ROM ASTM	F739 METHOD: F	low rate	e to cells w	as 100	cc/min.
3.	CHAL	LENGE CHEMIC	AL	1	: COM	PONENT 2	•	3
	1.	CHEM NAME (s)	: Dimet	thyl Sulfate	•	N/A	•	N/A
	2.	CAS NUMBER (S	): 77-78	-01		N/A		N/A
		CONC. (IF MI			-	N/A		N/A
	4.	CHEMICAL SOU				N/A		N/A
4.		RESULTS			:		_:	
	2. N 3. I 4. N 5. S	JATE TESTED: NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA	PLES TEST TIME: N/ E LIMIT I PERMEATIC ESS: 19-	/A .52 ppm DN RATE <u>N/A</u> 20 mil				
	1	TIME L.	•	CONCENTRATION	: 00	NCENTRATION	: 0	ONCENTRATION
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5.		CE OF DATA						
5.		CE OF DATA			ald on S	eptember 21	, 1986.	
5.		CE OF DATA		by Denise McDon	ald on S	eptember 21	, 1986.	

Chemical Resistance Testing of USCG Material with Dimethyl Sulfate

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etector: 100cc/min	3-	
etector: 100cc/min		
etector: 100cc/min	15	
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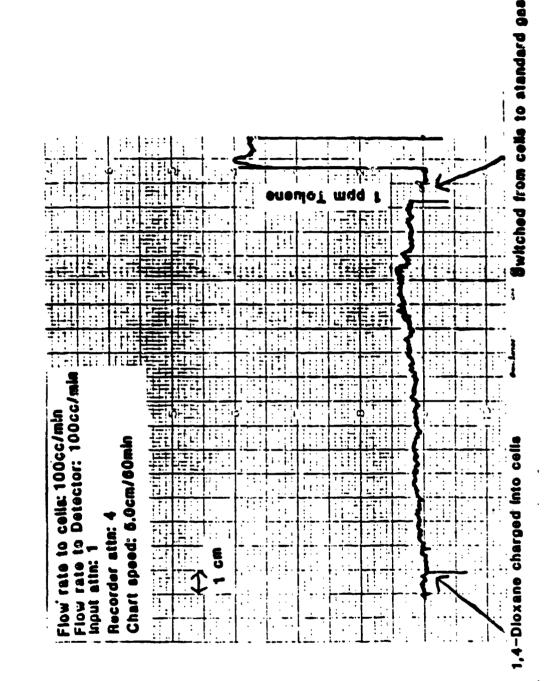
Dimethyl Sulfate cherned into c

hed from cells to standard gas

1. DESCRIPTION OF PRODU	UCT EVALUATED
-------------------------	---------------

	1: TYPE: Teflon laminated Nomex		
	2: PROTECTIVE MATERIAL CODE: 068		
	3: CONDITION BEFORE TEST: Unused, no v 4: MANUFACTURER: Chemfab Corp.	isible impertections	
	5: PRODUCT IDENTIFICATION: Challenge 5	100	
	6: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was grange co		
	8: DESCRIPTION: <u>Material was orange co</u> other side.	olored on one side and	buff colored on the
2.	TEST METHOD		
	1. TESTIG LABORATORY: Texas Research I 2. ANALYTICAL METHOD: Continuous photo	nstitute, 9063 Bee Cav	ves Road, Austin, TX
	3. TEMPERATURE: 22-25 °C	TOTTZELION DELECTION	with a 11./ ev lamp.
	4. COLLECTION MEDIUM: N2		
	5. COLLECTION SYSTEM: N2		
	6. OTHER CONDITIONS: 1 inch cells wer 7. DEVIATIONS FROM ASTM F739 METHOD: F	e used./ Detector Temp	perature = 60C.
		TOW TALE LU CETTS WAS	100_00/min.
3.	CHALLENGE CHEMICAL	: COMPONENT 2	2
	1. CHEM NAME(s) : <u>1</u> ,4-Dioxane	. <b>N/A</b>	N/A
	2. CAS NUMBER(s): 123-91-1	: <u>N/A</u> :	N/A
	3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: J.T. Baker reagent	: <u>N/A</u> :	<u> </u>
	4. CHEMICAL SOURCE: J.T. Baker reagent grade	:N/A: N/A	<u> </u>
4.	TEST RESULTS	•,•	N/K
	1. DATE TESTED: June 26, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough wa 4. MIN DETECTABLE LIMIT 1.04 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A	is observed after 3 hou	irs
	TIME : CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	2. :		
	3.		
	4 5		
	6.		·····
	7		
	8		
	9	:	
	10:		
	8. OTHER OBSERVATIONS:		
r.			
5.	SOURCE OF DATA	1 0C 100C	
	Samples were run by Sylvia Coope	er on June 20, 1980	
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		CHEMICAL PROTECTIVE CL	OTHING PRODUCT EVALUATIO	DN RECORD
1.	DES	CRIPTION OF PRODUCT EVALUATED		
	1:	TYPE: Teflon laminated Nomex		
	2:			
	3:		no visible imperfection	<u> </u>
	4:			
	5: 6:		ge 5100	
	7:			
	8:		e colored on one side at	nd buff colored on the
	•••	other side.		
2.	TES	T METHOD		
	1.	TESTING LABORATORY: Texas Resear	ch Institute, 9063 Bee (	Caves Road, Austin, TX
	2.			
		TEMPERATURE: 22-25°C		
	4.			
		COLLECTION SYSTEM: N2		
		OTHER CONDITIONS: 1 inch cells		
	7.	DEVIATIONS FROM ASTM F739 METHOD	: Flow rate to cells w	as 100 cc/min.
3.	CHA	ILLENGE CHEMICAL 1	: COMPONENT 2	: 3
	1.	CHEM NAME(s) : Dipropylamine	: 17/4.	: N/A
	2.	CAS NUMBER(s): 107-10-8	: N/A	: N/A
	3.	CONC. (IF MIX) N/A	:N/A	: N/A
	4.		:N/A	:N/A
,	***	grade	:N/A	
4.	153	T RESULTS		•,
	1.	DATE TESTED: July 18, 1986		
		NUMBER OF SAMPLES TESTED: Three		
	3.	BREAKTHROUGH TIME: No breakthrou	gh was observed after	3.4 hours.
		MIN DETECTABLE LIMIT .22 ppm		
		STEADY STATE PERMEATION RATE N/A		
		SAMPLE THICKNESS: 18-19 mil		
	/•	SELECTED DATA POINTS N/A		
		TIME : CONCENTRAT 1. :	ION : CONCENTRATION	: CONCENTRATION
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		7:		
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	8.	OTHER OBSERVATIONS:		

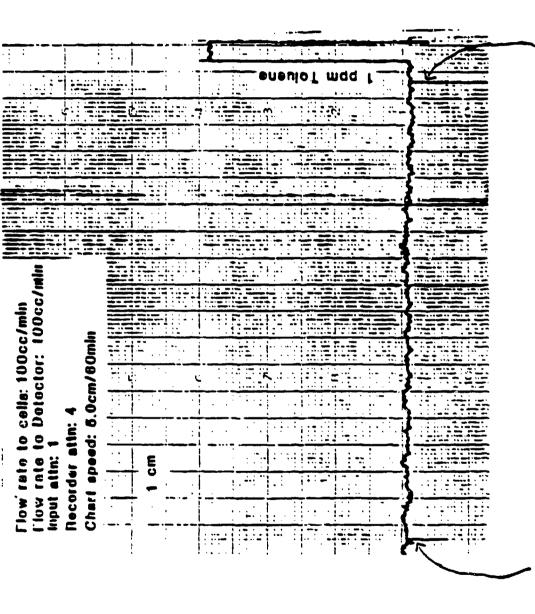
5. SOURCE OF DATA

Samples were run by Sylvia Cooper on July 18, 1986.

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Chemical Resistance Testing of USCG Material with Dipropylamine

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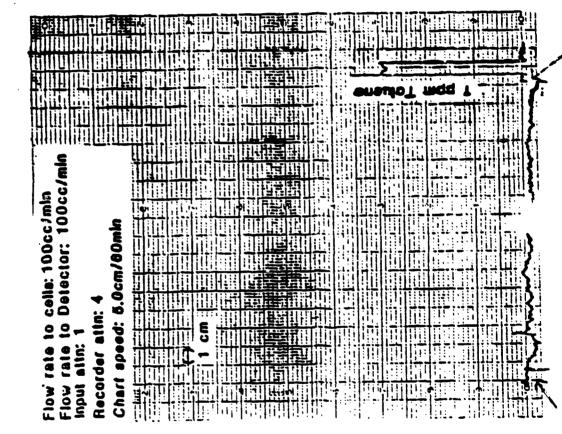
Switched from cells to standard gas

D-N-Propylamine charged into celis

# 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Terlon laminated Nome 2: PROTECTIVE MATERIAL CODE: 0 3: CONDITION BEFORE TEST: Unit 4: MANUFACTURER: Chemfab Corr 5: PRODUCT IDENTIFICATION: CF 6: LOT OR MANUFACTURER DATE: N 7: NOMINAL THICKNESS: 15-20 m 8: DESCRIPTION: Material was other side.	68 sed, no visib allenge 5100 /A iil		buff colored on the
2.	TEST METHOD 1. TESTING LABORATORY: Texas R 2. ANALYTICAL METHOD: Continu 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: N2 7. DEVIATIONS FROM ASTM F739 N	ious photoioni:	Ation detection y	with a 11.70 eV lamp.
3.	CHALLENGE CHEMICAL	: 1	OMPONENT 2	3
	<ol> <li>CHEM NAME(s): Epichlorohy</li> <li>CAS NUMBER(s): 106-89-8</li> <li>CONC. (IF MIX) N/A</li> <li>CHEMICAL SOURCE: Fisher Reagent Grage</li> </ol>		N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
4.	TEST RESULTS 1. DATE TESTED: June 4, 1986 2. NUMBER OF SAMPLES TESTED: TH 3. BREAKTHROUGH TIME: No breakt 4. MIN DETECTABLE LIMIT 0.75 pr 5. STEADY STATE PERMEATION RATE 6. SAMPLE THICKNESS: <u>18-20 mil</u> 7. SELECTED DATA POINTS <u>N/A</u>	hrough was ob m	served after three	e hours.
	TIME       :       CONCE         1.       :       :         2.       :       :         3.       :       :         3.       :       :         4.       :       :         5.       :       :         6.       :       :         7.       :       :         8.       :       :         9.       :       :         10.       :       :         8.       :       :         9.       :       :         10.       :       :	:	CONCENTRATION	CONCENTRATION
5.	SOURCE OF DATA Samples were run by S	ylvia R. Coope	r on June 4, 1986	

Chemical Resistance Testing of USCG Material with Epichlorohydrin



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# 1. DESCRIPTION OF PRODUCT EVALUATED

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3: 4: 5:	MANUFACTURER: Chemfab Co	prp.			
6;	LOT OR MANUFACTURER DATE	N/A			
7:	NOMINAL THICKNESS: 15-20	) mil			
8:	DESCRIPTION: <u>Material</u> wi other side.	is orange colore	a on one side	and Du	ITT COLORED ON L
TE	ST METHOD				
1.		Research Inst	tute, 9063 Bee	Caves	Road, Austin, 1
2.		nuous prototon	Zation detection	DI WIT	n a LU.ZU ev la
	COLLECTION MEDIUM: N2				
	COLLECTION SYSTEM: N2				
6.	OTHER CONDITIONS: 2 ind	ch cells were us	ed./ Detector	emper	ature = 100C.
7.	DEVIATIONS FROM ASTN F73	TETHOD: FIM	TELE TO CELLS	<b>AS</b> 10	O Ec/min.
. Ch	ALLENGE CHEMICAL	1 :	COMPONENT 2	:	3
1.			N/A		N/A
		•	N/A		N/A
	CAS NUMBER (s): N/A				
3. 4.	CONC. (IF MIX) N/A		N/A N/A		N/A N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION R SAMPLE THICKNESS: 19-20	1986 Three eakthrough was o ppm ATE N/A nil	N/A		<u>N/A</u>
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION R SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CO	1986 Three eakthrough was o ppm ATE N/A nil	N/A		<u>N/A</u>
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION R SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CON 1	1986 Three eakthrough was oppom ATE N/A mil	N/A observed after		N/A nours.
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION R SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CON 1	1986 Three eakthrough was oppom ATE N/A mil	N/A observed after		N/A nours.
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION R SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CON 1	1986 Three eakthrough was oppom ATE N/A mil	N/A observed after		N/A nours.
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION RA SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CON 1	1986 Three eakthrough was oppom ATE N/A mil	N/A observed after		N/A nours.
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION R. SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CON 1	1986 Three eakthrough was oppom ATE N/A mil	N/A observed after		N/A nours.
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION RA SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CON 1	1986 Three eakthrough was oppom ATE N/A mil	N/A observed after		N/A nours.
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION R SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CON 1	1986 Three eakthrough was oppom ATE N/A mil	N/A observed after		N/A nours.
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION R SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CON 1	1986 Three eakthrough was oppom ATE N/A mil	N/A observed after		N/A nours.
3. 4. TE 1. 2. 3. 4. 5. 6. 7.	CONC. (IF MIX) N/A CHEMICAL SOURCE: FMC Corp ST RESULTS DATE TESTED: October 12, NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT .03 STEADY STATE PERMEATION R SAMPLE THICKNESS: 19-20 ( SELECTED DATA POINTS N/A TIME : CON 1	1986 Three eakthrough was oppom ATE N/A mil	N/A observed after		N/A nours.

Chemical Rr sistance Testing of USCG Material with Ethion

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Switched from cells to standard gas

Ethion charged into cella

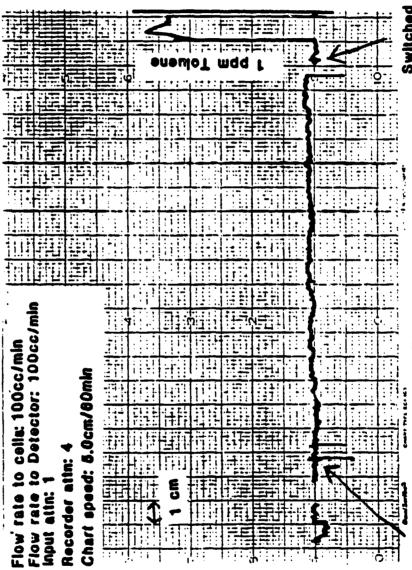
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# 1. DESCRIPTION OF PRODUCT EVALUATED

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	1: TYPE: Teflon laminat 2: PROTECTIVE MATERIAL			
	3: CONDITION BEFORE TES	T: Unused, no vi	sible imperfections	
	4: MANUFACTURER: Chemf 5: PRODUCT IDENTIFICATI	ab Corp.	00	
	6: LOT OR MANUFACTURER			
	7: NOMINAL THICKNESS:	15-20 mil		
	8: DESCRIPTION: <u>Materi</u> other side.	al was orange col	ored on one side and	buff colored on the
2.	TEST METHOD			
, <b>•</b>				
	1. TESTING LABORATORY: 2. ANALYTICAL METHOD:			
	3. TEMPERATURE: 22-25°C			
	4. COLLECTION MEDIUM:			
	5. COLLECTION SYSTEM: 6. OTHER CONDITIONS:		used./ Detector Ten	perature = 60C.
	7. DEVIATIONS FROM ASTM			
3.	CHALLENGE CHEMICAL	1 -	COMPONENT 2	: 3
	1. CHEM NAME(s) : Ethy	'l Ac∈∴ate :	N/A	: : N/A
	2. CAS NUMBER(s): 141-		N/A	:N/A
	3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE:Fish	in mongant and	<u> </u>	: N/A : N/A
	4. GRENIENE BURGET			* <u>#//h</u>
1.	TEST RESULTS			
	1. DATE TESTED: June 30,	1986		s t
	2. NUMBER OF SAMPLES TES	TED: Three		
	3. BREAKTHROUGH TIME: <u>N</u> 4. MIN DETECTABLE LIMIT	o Breakthrough wa	as observed after 3.1	hours
	5. STEADY STATE PERMEATI	ON RATE N/A		
	6. SAMPLE THICKNESS: 18	-19 mil		
		AL ZA		
	7. SELECTED DATA POINTS	<u>N/A</u>		
	TIME . :	CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	TIME : :		: CONCENTRATION	: CONCENTRATION
	-		CONCENTRATION	: CONCENTRATION : :
	TIME : 1: 2: 3: 4:		CONCENTRATION	: CONCENTRATION : :
	TIME : : 1: 2: 3: 4: 5:		CONCENTRATION	CONCENTRATION
	TIME : 1: 2: 3: 4:		CONCENTRATION	CONCENTRATION
	TIME       :         1.       .         2.       .         3.       .         4.       .         5.       .         6.       .         7.       .         8.       .		CONCENTRATION	CONCENTRATION
	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :		CONCENTRATION	CONCENTRATION
	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :	CONCENTRATION		CONCENTRATION
	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :	CONCENTRATION		: CONCENTRATION : : : : : :
	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :         8.       :         9.       :         10.       :	CONCENTRATION		CONCENTRATION
5.	TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.         8.         9.         10.         8.         9.         10.         8.         9.         10.         5.         5.         6.         10.         10.         10.         10.         5.			: CONCENTRATION : : : : : :

Permeation Testing of USCG Material with Ethyl Acetate

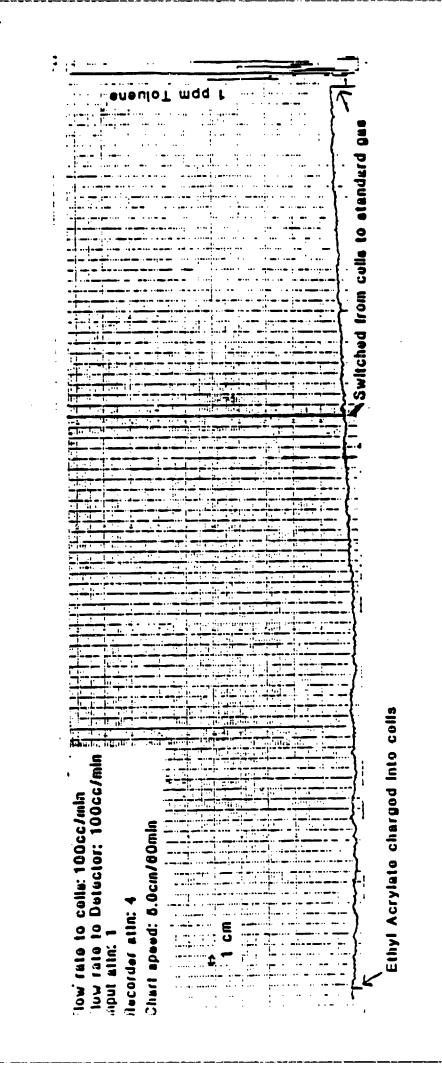


Switched from cells to standard gas

Ethyl Acetate charged into cells

1.	DESCRIPTION OF PRODU			
	4: MANUFACTURER: C 5: PRODUCT IDENTIFI 6: LOT OR MANUFACTU 7: NOMINAL THICKNES	IAL CODE: 068 TEST: <u>Unused, no v</u> Chemfab Corp. CATION: <u>Challenge 5</u> RER DATE: <u>N/A</u> S: 15-20 mil		buff colored on the
2.	TEST METHOD			
	<ol> <li>ANALYTICAL METHO</li> <li>TEMPERATURE: 22-</li> <li>COLLECTION MEDIL</li> <li>COLLECTION SYSTE</li> <li>OTHER CONDITIONS</li> </ol>	D: <u>Continuous photo</u> 25°C JM: N <sub>2</sub> M: N <sub>2</sub> S: 2 inch cells were i	nstitute, 9063 Bee Cav ionization detection w used. /Detector Temper ow rate to cells was 1	ature = 60C.
3.	CHALLENGE CHEMICAL	1 :	COMPONENT 2	3
4.	<ol> <li>CHEM NAME(s):</li> <li>CAS NUMBER(s):</li> <li>CONC. (IF MIX)<sup>-</sup></li> <li>CHEMICAL SOURCE:</li> <li>TEST RESULTS</li> </ol>	Ethyl Acrylate 140-88-5 N/A Aldrich reagent grade	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
	2. NUMBER OF SAMPLES	: No breakthrough w IMIT 1.72 ppm MEATION RATE N/A 18-20 mil.	as observed after 17 H	iours.
	TIME :	CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	3		•	
	3 4 5 6			
	4 5 6 7			
	4 5 6 7 8 9			
	4 5 6 7 8 9 10			
	4 5 6 7 8 9	NS :		

Chemical Resistance Testing of USCG Material with Ethyl Acrylate



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# 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- PROTECTIVE MATERIAL CODE: 068 2:
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A
- NOMINAL THICKNESS: 15-20 mil 7:
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

# 2. TEST METHOD

- TESTING LABURATORY: <u>Texas Research Institute</u>, 9063 Bee Caves Road, Austin, TX
   ANALYTICAL METHOD: <u>Continuous photoionization detection with a 11.70 eV Tamp.</u>
- 3. TEMPERATURE: 22-25℃

4. COLLECTION MEDIUM: N2
5. COLLECTION SYSTEM: N2
6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min.

3 3. CHALLENGE CHEMICAL : COMPONENT 2 1

	CHEM NAME(s) : Ethyl Alcohol	: N/A	. N/A
2.	CAS NUMBER(s): 64-17-5	: N/A	: N/A
3.	CONC. (IF MIX) N/A	: N/A	: N/A
4.	CHEMICAL SOURCE: Aldrich reagent	: N/A	: N/A
	grade	: N/A	:N/A

## 4. TEST RESULTS

- 1. DATE TESTED: June 20, 1986
- 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrous was observed after three nours.

- 4. MIN DETECTABLE LIMIT 2.86 ppm 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 18-19 mil
- 7. SELECTED DATA POINTS N/A

1	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
2	·	:	· · · · · · · · · · · · · · · · · · ·	:		:	
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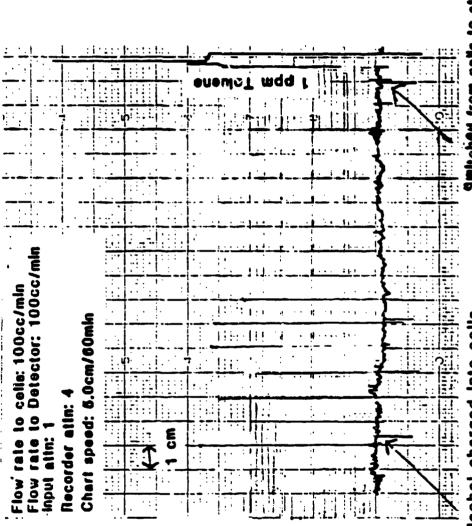
8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia R. Cooper on June 20, 1986.

Chemical Resistance Testing of USCG Material with Ethyl Alcohol

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Switched from cells to standard gas

Ethyl Alcohoi charged into cells

# 1. DESCRIPTION OF PRODUCT EVALUATED

MASSIN EXPLANATION

	4: MANUFACTURER: 5: PRODUCT IDENTIF 6: LOT OR MANUFACT 7: NOMINAL THICKNE	RIAL CODE: 068 E TEST: <u>Unused, n</u> Chemfab Corp. ICATION: <u>Challeng</u> URER DATE: N/A	e 5100	fections		
2.	TEST METHOD					
	<ol> <li>TESTING LABORAT</li> <li>ANAL YTICAL METHO</li> <li>TEMPERATURE: 22:</li> <li>COLLECTION MEDION</li> <li>COLLECTION SYST</li> <li>OTHER CONDITION</li> <li>DEVIATIONS FROM</li> </ol>	-25°C UM: <u>N2</u> EM: <u>N2</u> S: 2 inch cells w	ere used./ Dete	etection wit	ture = 60C.	P•
3.	CHALLENGE CHEMICAL	1	= COMPONEN	T2 :	3	
	1. CHEM NAME(s) :	Ethylamine	. N/A	:	N/A	
	2. CAS NUMBER (s):	75-04-7	: N/A		N/A	
	3. CONC. (IF MIX)	70% in water	. <u>N/A</u>	;	<u>N/A</u>	
	4. CHEMICAL SOURCE	<u>grade</u>	:N/A		<u>N/A</u>	-
	1. DATE TESTED: M 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 6. SAMPLE THICKNESS 7. SELECTED DATA PO	STESTED: <u>Three</u> : <u>No breakthroug</u> IMIT <u>0.74 ppm.</u> MEATION RATE <u>N/A</u> : <u>17-19 mil</u>	n was observed	after 3 hour	°, S.	
	TIME	CONCENTRATIO	DN : CONCEN	TRATION :	CONCENTRATION	
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	10.		··			_
	8. OTHER OBSERVATION	· · · · · · · · · · · · · · · · · · ·				
5.		run by Sylvia Coo		1696		

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Chernical Resistance Testing of USCG Material with Ethylamine

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Ethylamine charged into celle

Switched from cells to standard gas

### 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Tefion laminated Nomex
- PROTECTIVE MATERIAL CODE: 068 2:
- CONDITION BEFORE TEST: Unused, no visible imperfections 3:
- 4:
- MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Challenge 5100 5:
- LOT OR MANUFACTURER DATE: N/A 6:
- NOMINAL THICKNESS: 15-20 mil 7:
- DESCRIPTION: Material was orange colored on one side and buff colored on the 8: other side.

# 2. TEST METHOD

- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
   ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp.
   TEMPERATURE: 22-25°C

- COLLECTION MEDIUM: N2 4.
- 5. COLLECTION SYSTEM: No
- OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C.
   DEVIATIONS FROM ASIM \$239 METHOD: Flow rate to cells was 100cc/min.
- 3. CHALLENGE CHEMICAL COMPONENT 2 3 1 : : 1. CHEM NAME(s) : Ethyl Benzene 2. CAS NUMBER(s): 100-41-4 **#**/A N/A N/A N/A 3. CONC. (IF MIX) N/A N/A N/A CHEMICAL SOURCE: Aldrich reagent N7A N7A 4. grade N/A N/A

# 4. TEST RESULTS

- 1. DATE TESTED: June 16, 1986
- 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No preakthrough was observed after 3 hours.

- 4. MIN DETECTABLE LIMIT.14 ppm
- 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19 mil
- 7. SELECTED DATA POINTS
  - TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. 2. 3. 4. 3 5. : 6. : . 7. : : 8. : : : 9. : : 10. : :

# 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Karen Verschoor on June 16, 1986

Chemical Resistance Testing of USCG Material with Ethyl Benzene

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#### DESCRIPTION OF PRODUCT EVALUATED 1.

- TYPE: Teflon laminated Nomex 1:
- PRUTECTIVE MATERIAL CODE: 068 2:
- CONDITION BEFORE TEST: <u>Unused</u>, no visible imperfections MANUFACTURER: <u>Chemfab Corp</u>. PRODUCT IDENTIFICATION: <u>Challenge 5100</u> 3:
- 4:

5: 6: LOT OR MANUFACTURER DATE: N/A

- NOMINAL THICKNESS: 15-20 mil 7:
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

#### TEST METHOD 2.

- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1.
- ANALYTICAL METHOD: Gas Chromatography 2.
- 3. TEMPERATURE: Ambient
- 4. COLLECTION MEDIUM: Charcoal 5. COLLECTION SYSTEM: Charcoal 6. OTHER CONDITIONS: One inch cells were used.
- 7. DEVIATIONS FROM ASTM F739 METHOD:

3.	CHALLENGE CHEMICAL	1 :	COMPONENT 2	: 3
	1. CHEM NAME(s) :	: Ethylene Cyanohdrin :	N/A	N/A
	2. CAS NUMBER(s):	109-78-4 :	N/A	: N/A
	3. CONC. (IF MIX)	N/A :	N/A	: N/A
	4. CHEMICAL SOURCE	:Aldrich reagent :	N/A	: <u>N/A</u>
		grade :	N/A	:N/A

## JT RESULTS

- 1. DATE TESTED: October 9,1986
- 2. NUMBER OF SAMPLES TESTED: \_\_\_\_\_\_
- 3. BREAKTHROUGH TIME: N/A
- 4. MIN DETECTABLE LIMIT 0.4 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mils
- 7. SELECTED DATA POINTS Cells 1,2, and 3 at end of three hour test.

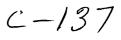
1.	TIME 3 hours	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION	
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10.		:		:		:		

# 8. OTHER OBSERVATIONS: 3 hour samples were collected for 50 minutes for a total volume of 10 liters.

5. SOURCE OF DATA

Samples were run by Denise McDonald on October 9, 1986.

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# 1. DESCRIPTION OF PRODUCT SVALUATED

- TYPE: Teflon laminated Nomex 1:
- PROTECTIVE MATERIAL CODE: 068 2:

CONDITION BEFORE TEST: Unused, no visible imperfections 3:

- 4:
- MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Challenge 5100 LOT OR MANUFACTURER DATE: N/A 5:
- 6:
- NOMINAL THICKNESS: 15-20 mil 7:
- DESCRIPTION: Material was orange colored on one side and buff colored on the 8: other side.

### TEST METHOD 2.

- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1.
- ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp. 2.
- TEMPERATURE: 22-25 °C 3. COLLECTION MEDIUM: N2
- 4.
- 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASIM F739 METHOD: Flow rate to cells was 100cc/min.

1

3. CHALLENGE CHEMICAL

1. CHEM NAME (s) : Ethylenediamine	: N/A	: N/A
2. CAS NUMBER(s): 107-15-3	: N/A	: N/A
3. CONC. (IF MIX) N/A	: N/A	: N/A
4. CHEMICAL SOURCE: Aldrich reagent	: N/A	:N/A
grade	: <u>N/A</u>	: <u>N/A</u>

: COMPONENT 2 :

3

# TEST RESULTS

- 1. DATE TESTED: June 24, 1986
- 2. NUMBER OF SAMPLES TESTED: Three

BREAKTHROUGH TIME: No breakthrough was observed after 3.2 hours.
 MIN DETECTABLE LIMIT 2.78 ppm
 STEADY STATE PERMEATION RATE N/A

- 6. SAMPLE THICKNESS: 13-19 mil 7. SELECTED DATA POINTS N/A

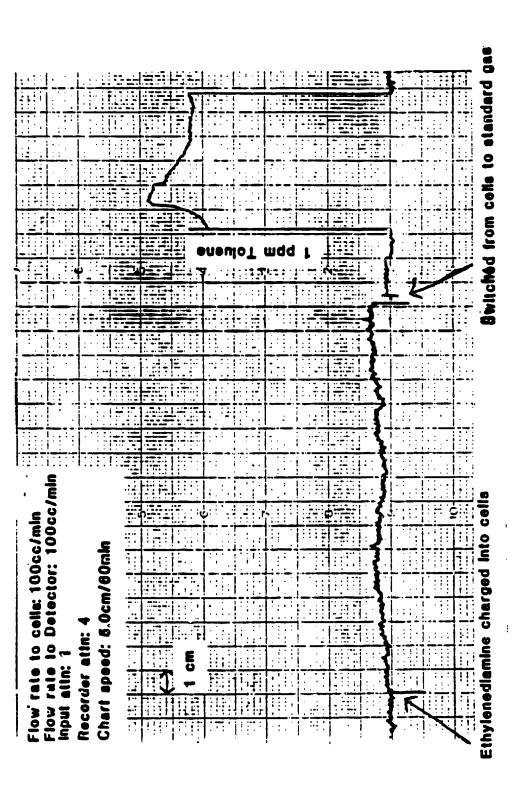
1.	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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### 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia Cooper on June 24, 1986.

Chemical Resistance Testing of USCG Material with Ethylenediamine

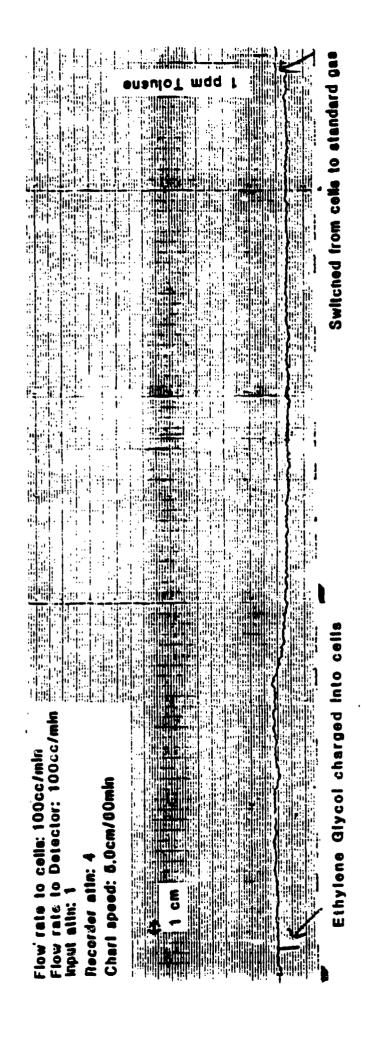


C-140

- 1. DESCRIPTION OF PRODUCT EVALUATED TYPE: Teflon laminated Nomex 1: PROTECTIVE MATERIAL CODE: 068 2: CONDITION BEFORE TEST: Unused, no visible imperfections 3: MANUFACTURER: Chemfab Corp. 4: PRODUCT IDENTIFICATION: Challenge 5100 LOT OR MANUFACTURER DATE: N/A 5: б: NOMINAL THICKNESS: 15-20 mil DESCRIPTION: Material was orange colored on one side and buff colored on the 7: 8: other side. 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp. TEMPERATURE: 22-25 °C 3. 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C. 6... 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min. 3. CHALLENGE CHEMICAL COMPONENT 2 3 1 1. CHEM NAME(s) : Ethylene Blycol 2. CAS NUMBER(s): 107-21-1 N/A N/A N/A N/A 3. CONC. (IF MIX) N/A N/A N/A CHEMICAL SOURCE: Baker reagent grade : 4. N7A N/A 4. TEST RESULTS 1. DATE TESTED: June 17-18, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 16.8 hours 4. MIN DETECTABLE LIMIT 2.63 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19 mil 7. SELECTED DATA POINTS CONCENTRATION TIME CONCENTRATION : CONCENTRATION : : 1. 2. 3. : : 4. : ; : 5, : • 6. : : 7. : : 8. : : : 9. : : 10. : 8. OTHER OBSERVATIONS:
- 5. SOURCE OF DATA

, , , , Samples were run by Sylvia Cooper on June 17-18, 1986.

# Chemical Resistance Testing of USCG Material with Ethylene Glycol



# 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITICN BEFORE TEST: Unused, no 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil	
	8: DESCRIPTION: Material was orange of other side.	colored on one side and buff colored on the
2.	TEST METHOD	
	2. ANALYTICAL METHOD: Continuous phot 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub>	Institute, 9063 Bee Caves Road, Austin, TX coionization detection with a 10.20 eV lamp. ere used./Detector Temperature = 100C.
	7. DEVIATIONS FROM ASTM F739 METHOD:	Flow rate to cells was 100 cc/min.
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2 : 3
	1. CHEM NAME(s) : Ethyl Ether	: : : N/A : N/A
	2. CAS NUMBER(s): 60-29-7	N/A : N/A
	3. CONC. (IF MIX) N/A	: <u>N/A</u> : <u>N/A</u>
	4. CHEMICAL SOURCE: Aldrich reagent	_:N/A:N/A
4.	grade	_:N/A:N/A
	<ol> <li>NUMBER OF SAMPLES TESTED: Three</li> <li>BREAKTHPOUGH TIME: No breakthrough v</li> <li>MIN LÉTECTABLE LIMIT .13 ppm</li> <li>STEADY STATE PERMEATION RATE N/A</li> <li>SAMPLE THICKNESS: 18-19 mil</li> <li>SELECTED DATA POINTS N/A</li> </ol>	vas observed after 3.0 hours.
	TIME : CONCENTRATION 1. :	CONCENTRATION : CONCENTRATION
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	8. OTHER OBSERVATIONS:	
5.	SOURCE OF DATA Samples were run by Sylvia Coope	er on July 23, 1986.

C-143

Chemical Resistance Testing of USCG Material with Ethyl Ether

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Switched from cells to standard gas

Ethyl Ether charged in

### DESCRIPTION OF PRODUCT EVALUATED 1.

1:	TYPE: Teflon laminated Nomex
	PROTECTIVE MATERIAL CODE: 068
3:	CONDITION BEFORE TEST: Unused, no visible imperfections
	MANUFACTURER: Chemfab Corp.
5:	PRODUCT IDENTIFICATION: Challenge 5100
	LOT OR MANUFACTURER DATE: N/A
	NOMINAL THICKNESS: 15-20 mil
8:	DESCRIPTION: Material was buff colored.

### 2. TEST METHOD

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1.	TESTING_LABORATORY:	Texas Research	Institute, 9063	Bee Caves Roa	d, Austin, TX
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- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C COLLECTION MEDIUM: N2 4. 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 60C.
- DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min. 7.

3.	CHALLENCE CHEMICAL	1 .	COMPONENT 2	: 3
	1. CHEM NAME (s) : 2. CAS NUMBER (s):	Formal dehyde	N/A	N/A
	2. LAS NUMBER(S):	50-00-0	N/A	
	3. CONC. (IF MIX)		N/A	: N/A
		10-15% CH3CH	N/A	: <u>N/A</u>
	4. CHEMICAL SOURCE	:Fisher ACS reagent	N/A	: N/A
		grade	N/A	: N/A
	TECT DECINTE			

### TEST RESULTS

1. DATE TESTED: May 13, 1986

2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT N/A

- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A

TIME :	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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8. OTHER OBSERVATIONS:

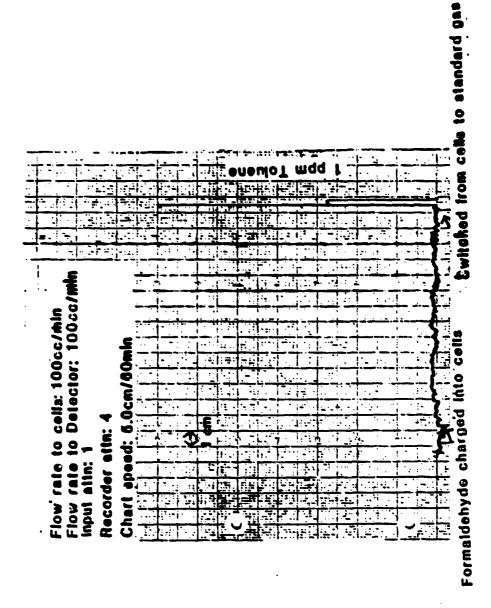
5. SOURCE OF DATA

Samples were run by Karen Verschoor on May 13, 1986

(-145

Chemical Resistance Testing of USCG Material with Formaldehyde

.

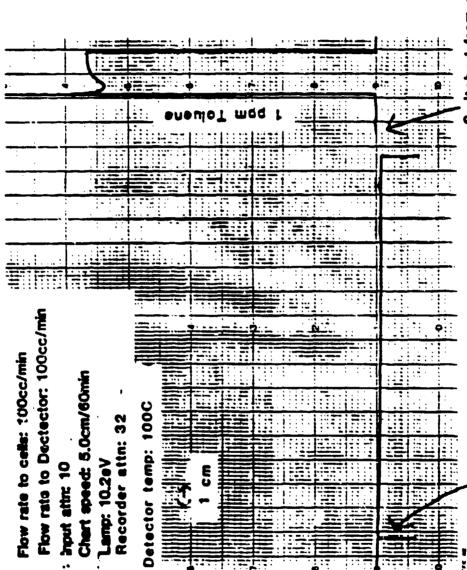


C-146

### 1. DESCRIPTION OF PRODUCT EVALUATED 1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 1 inch cells were used./Detector Temperature =100C. 6. OTHER CONDITIONS: 7. DEVIATIONS FROM ASTA F739 METHOD: Flow rate cells was 100 cc/min. 3 3. CHALLENGE CHEMICAL COMPONENT 2 1 : : • : 1. CHEM NAME(s): Furfural 2. CAS NUMBER(s): 98-01-1 N/A 3/2 N/A N/A : 3. CONC. (IF MIX) N/A N/A N/A N/A 4. CHEMICAL SOURCE: Aldrich reagent N/A N/A N/A grade 4. TEST RESULTS 1. DATE TESTED: August 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3.1 hours. 4. MIN DETECTABLE LIMIT.08 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A TIME CONCENTRATION : CONCENTRATION : CONCENTRATION : 1. : 2 1 2. : : 1 3. : : : 4. : : : 5. : . : 6. : : 2 7. : : : 8. : : ; 9. : : : 10. : : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Samples were run by Sylvia R. Cooper on August 12, 1986.

C-14

Chemical Resistance Testing of USCG Material with Furfural



AND A REAL PROPERTY AND A REAL

Switched from cells to standard gas

Furtural charged into cella

# 1. DESCRIPTION OF PRODUCT EVALUATED

2:		NDITION BEF		ST: Unused, no v	isible impe	rfection	5		
4:	: MA	NUFACTURER:	Chem	fab Corp.					
5		ODUCT IDENT		ION: Challenge 5	100				
7		MINAL THICK							
8	: DE	SCRIPTION:	Mater	al was orange co	lored on or	ne side a	nd bu	iff colored o	n the
		other side.							
T	EST M	ETHOD							
1		STING LABOR	RATORY:	Texas Research 1	nstitute, S	003 Bee	Caves	Road, Austi	n, T)
23		MALTIICAL ME		Continuous photo	1001201100	Getect10	n wit	n a 10.2. ev	<u>a</u> m
- 4	. CO	LLECTION ME	DIUM:	N <sub>2</sub>					
5	. CO	DLLECTION SY	STEM:	N2					
				1 inch cells wer M F739 METHOD: N		etector T	emper	ature = 100C	•
۵	HALLE		L	1	: COMPONE	INT 2	:	3	
1.	. CH	IEM NAME (s)	: Gas	oline	: .: N/	/A	:	N/A	
2.	. CI	LS NUMBER (S)	): N7A			/A		N/A	
3	<b>C</b> 0	DNC. (IF MIX	() N/A		:N	/A		N/A	
4 Tl 1 2	. CH EST R . DAT . NUM	HEMICAL SOUR RESULTS TE TESTED: HBER OF SAMP	Septem LES TE	<u>aco</u>	: N		: .9 hc	N/A	
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM	EMICAL SOUR ESULTS MBER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P MPLE THICKNE	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil			:		
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM	EMICAL SOUR ESULTS BER OF SAMP EAKTHROUGH T DETECTABLE EADY STATE P	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil			_:		
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL	EMICAL SOUR ESULTS MBER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P MPLE THICKNE	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil	s observed				
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1.	EMICAL SOUR ESULTS BER OF SAMP EAKTHROUGH T DETECTABLE EADY STATE P APLE THICKNE LECTED DATA	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	0N
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL	EMICAL SOUR RESULTS MER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P MPLE THICKNE LECTED DATA	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	0N
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4.	EMICAL SOUR RESULTS MER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P MPLE THICKNE LECTED DATA	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	0N
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5.	EMICAL SOUR RESULTS MER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P MPLE THICKNE LECTED DATA	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	ON
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4.	EMICAL SOUR RESULTS MER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P MPLE THICKNE LECTED DATA	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	ON
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8.	EMICAL SOUR RESULTS MER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P MPLE THICKNE LECTED DATA	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	ON
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8. 9.	IEMICAL SOUR RESULTS IE TESTED: ABER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P APLE THICKNE LECTED DATA TIME	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	ON
4 TI 1 2 3 4 5 6	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8.	IEMICAL SOUR RESULTS IE TESTED: ABER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P APLE THICKNE LECTED DATA TIME	Septem PLES TE TIME: N E LIMIT PERMEAT ESS: <u>18</u>	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	ON
4 TI 1 2 3 4 5 6 7	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	IEMICAL SOUR RESULTS IE TESTED: ABER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P APLE THICKNE LECTED DATA TIME	Septem PLES TE TIME: N LIMIT PERMEAT SS: 18 POINTS	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	ON
4 TI 1 2 3 4 5 6 7	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	RESULTS RESULTS TE TESTED: ABER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P APLE THICKNE LECTED DATA TIME	Septem PLES TE TIME: N LIMIT PERMEAT SS: 18 POINTS	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	ON
4 TI 1 2 3 4 5 6 7 7 8	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	IEMICAL SOUR RESULTS TE TESTED: MBER OF SAMP EAKTHROUGH T N DETECTABLE EADY STATE P MPLE THICKNE LECTED DATA TIME	Septem PLES TE TIME: N LIMIT PERMEAT SS: 18 POINTS	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	s observed	after 14		ours.	ON
4 TI 1 2 3 4 5 6 7 7 8	. CH EST R . DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	EMICAL SOUR RESULTS TE TESTED: ABER OF SAMP EAKTHROUGH T ODETECTABLE ADY STATE P APLE THICKNE LECTED DATA TIME	Septem PLES TE TIME: N E LIMIT PERMEAT SS: 18 POINTS : : : : : : : : : : : : : : : : : : :	aco ber 9, 1986 STED: Three o breakthrough wa 1.65 ppm ION RATE N/A -19 mil N/A	is observed : CONCI : : : : : : : : : : : : :	after 14		CONCENTRAT I	ON

amical Resistance Testin, of USCG with Gasoline

Marie Marine Marine Marine State

c : . : ie ۱ ÷ Toluen b b 3 1 : •. : ٠. Ξ. :: 23 ÷ ÷ : ..... :. i ÷ •; +: . . <u>.</u> : : -. ..... ÷  $\frac{1}{1}$ -= ٠. . \* Ŕ •••• ŕ ÷ . : -: -. ÷. : : 111 :\_ 1 Flow rate to Detector: 100cc/min : ÷. 1 Flow rate to cells: 100cc/min ? 7 ÷ ç ÷. :7 ř Ξ Chart speed: 5.0cm/60min ÷ : . -. Detector temp: 100C **Gesoline charged into cel** , Recorder attn: 32 ••• • : Input attn: 10 Lamp: 10.2 eV ---. . : ..... ÷ :• -:Ξ Ξ \_\_\_\_ Ŀ ł -. 5 1-Ň ..... •

C-150

Switched from cells to standard gas

- 1. DESCRIPTION OF PRODUCT EVALUATED
  - TYPE: Teflon laminated Nomex 1:
  - 2: PROTECTIVE MATERIAL CODE: 068
  - CONDITION BEFORE TEST: Unused, no visible imperfections 3:
  - MANUFACTURER: Chemfab Corp. 4:
  - PRODUCT IDENTIFICATION: Challenge 5100 5:
  - LOT OR MANUFACTURER DATE: N/A 6:
  - 7:
  - NOMINAL THICKNESS: 15-20 mil DESCRIPTION: Materia was orange colored on one side and buff colored on the 8: other side.

TEST METHOD 2.

- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1.
- ANALYTICAL METHOD: Continuous photoionization detection with a 10.2 eV Tamp. TEMPERATURE: 22-25 C 2.
- 3.
- COLLECTION MEDIUM: N2 4.
- N2 COLLECTION SYSTEM: 5\_
- UTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 100C. 5. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min. 7.

).	CHALLENEE CHEMICAL	1	COMPONENT 2	3
	1. CHEM NAME(s): 2. CAS NUMBER(s):		• • • • • • • • • • • • • • • • • • •	N/A
	3. CONC. (IF MIX) 4. CHEMICAL SOURCE	N/A	N/A N/A	N/A N/A

### TEST RESULTS

- 1. DATE TESTED: September 19, 1986 2. NUMBER OF SAMPLES TESTED: Three

- 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT\_ 43 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS N/A

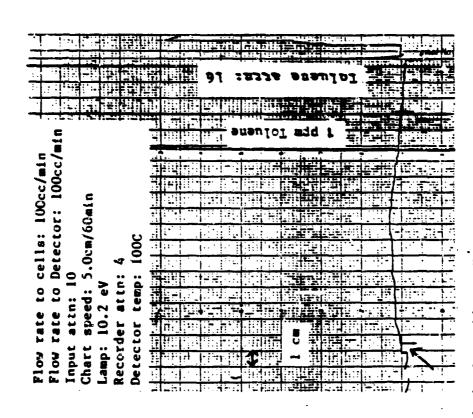
1.	TIME	:	CONCENTRATION	CONCENTRAL 20N :	CONCENTRATION
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# 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Denise McDonald on September 19, 1986.

Chemical Resistance Testing of USCG Material with Glutaraldehyde



Switched from cells to standard gas

Glutaraldehyde charged into cella

С-

# 1. DESCRIPTION OF PRODUCT EVALUATED

1	:	TYP	Έ:	Tefl	on	laminated	I Nomex

2: PROTECTIVE MATERIAL CODE: 058

3: CONDITION BEFORE TEST: Unused, no visible imperfections

- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A
- 7: NOMINAL THICKNESS: 15-20 mil
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

# 2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp.
- 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2
- 6. OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min.

3. CHALLENGE CHEMICAL 1 COMPONENT 2 3 • • 1. CHEM NAME(s) : Hexane N/A N/A 110-54-3 N/A N/A 2. CAS NUMBER (s): 3. CONC. (IF MIX) N/A N/A N/A 4. CHEMICAL SOURCE: Aldrich reagent N/A N/A N/A N/A grade

### 4. TEST RESULTS

1. DATE TESTED: June 16-17, 1986 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 11 hours. 4. MIN DETECTABLE LIMIT .25 ppm

- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19 mil
- 7. SELECTED DATA POINTS

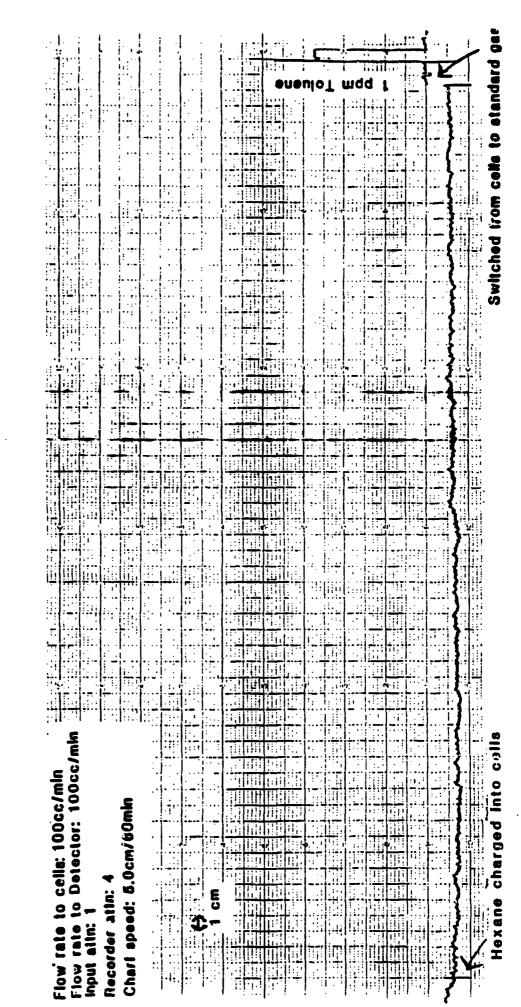
TIME	:	CONCENTRATION	CONCENTRATION	:	CONCENTRATION
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8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia Cooper on June 16-17, 1986.

Chemical Resistance Testing of USCG Material with Hexane



C-150

### 1.

1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange cother side.	5100	
2.	TEST METHOD		
	<ol> <li>TESTING LABORATORY: <u>Texas Research</u></li> <li>ANALYTICAL METHOD: <u>Continuous phot</u></li> <li>TEMPERATURE: 22-25°C</li> <li>COLLECTION MEDIUM: <u>N2</u></li> <li>COLLECTION SYSTEM: <u>N2</u></li> <li>OTHER CONDITIONS: <u>1 inch cells wer</u></li> <li>DEVIATIONS FROM ASIN F739 METHOD:</li> </ol>	e used./ Detector Te	emperature = 100C.
. 3.	CHALLENGE CHEMICAL 1	: COMPONENT 2	: 3
	<ol> <li>CHEM NAME(s): Hydrazine Hydrate</li> <li>CAS NUMBER(s): 10217-52-4</li> <li>CONC. (IF MIX) N/A</li> <li>CHEMICAL SOURCE: Aldrich</li> </ol>	N/A N/A N/A N/A	N/A N/A N/A N/A
4.	TEST RESULTS		
	1. DATE TESTED: <u>September 17, 1986</u> 2. NUMBER OF SAMPLES TESTED: <u>Three</u> 3. BREAKTHROUGH TIME: N/A		

- 4. MIN DETECTABLE LIMIT 0.9 ppm. 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A

TIME CONCENTRATION . : CONCENTRATION CONCENTRATION : : 1. : 2. : : : 3. : 4 . : : : 5. ; : : 6. : : : 7. : ; 8. : : 9. : : 1 10. : : :

# 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Denise McDonald on September 17, 1986

Chemical Resistance Testing of USCG Material with Hydrazine

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Flow Flow Input Chart Lamp: Recor	Det det			

Switched ft - ils to standard gas

Hydrazine charged into cella

# 1. DESCRIPTION OF PRODUCT EVALUATED

- TYPE: Teflon laminated Nomex 1:
- PROTECTIVE MATERIAL CODE: 068 2:
- CONDITION BEFORE TEST: Unused, no visible imperfections 3:
- 4:
- MANUFACTUPER: Chemfab Corp. PRODUCT IDENTIFICATION: Challenge 5100 5:
- LOT OR MANUFACTURER DATE: N/A 6:
- 7: NOMINAL THICKNESS: 15-20 mil 8:
- DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

2. TEST METHOD-

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Colorimetric; Ferrithiocyanate method
- 3. TEMPERATURE: Ambient

- 4. COLLECTION MEDIUM: <u>Aqueous</u> 5. COLLECTION SYSTEM: <u>Aqueous</u> 6. OTHER CONDITIONS: <u>2 Inch cells were used</u>. 7. DEVIATIONS FROM ASTM F739 METHOD:

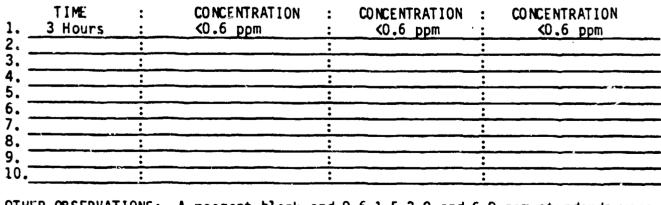
3.	DHALLENGE CHEMICAL	I	: COMPONENT 2	: 3
	1. CHEM NAME(s): 2. CAS NUMBER(s):	Hydrogen Peroxide	<u> </u>	
	3. CONC. (IF MIX)	30%	<u>N/A</u>	: <u> </u>
	4, CHEMICAL SOURCE	:Centex	:N/A	:N/A

# TEST RESULTS

- 1. DATE TESTED: October 10, 1986 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours.

- 4. MIN DETECTABLE LIMIT 0.6 DDM
- 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 13-20 mil
- 7. SELECTED DATA POINTS N/A



- 8. OTHER OBSERVATIONS: A reagent blank and 0.6,1.5,3.0 and 6.0 ppm standards were also run.
- 5. SOURCE OF DATA

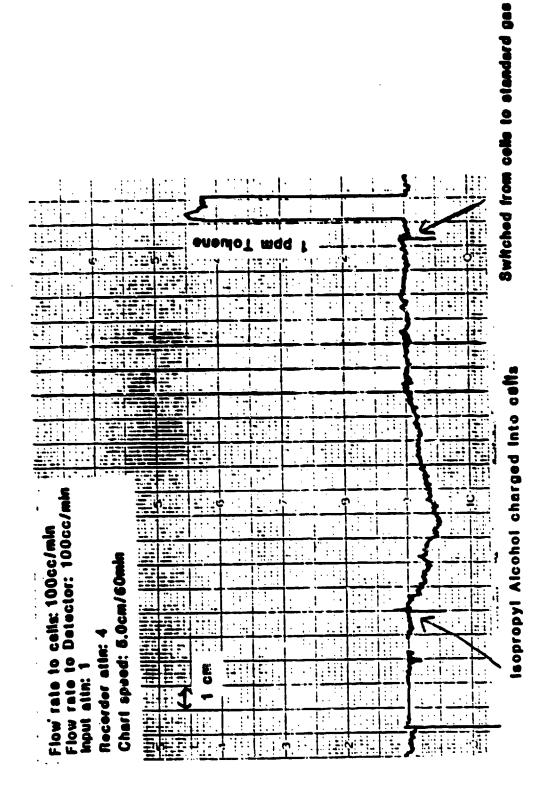
Samples were run by Denise McDonald on October 10, 1986.

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### DESCRIPTION OF PRODUCT EVALUATED 1. 1: TYPE: Teflon laminated Nomex PROTECTIVE MATERIAL CODE: 068 2: CONDITION BEFORE TEST: Unused, no visible imperfections 3: MANUFACTURER: Chemfab Corp. 4: PRODUCT IDENTIFICATION: Challenge 5100 5: LOT OR MANUFACTURER DATE: N/A 6: NOMINAL THICKNESS: 15-20 mil DESCRIPTION: Material was orange colored on one side and buff colored on the 7: 8: other side. 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV Tamp. TEMPERATURE: 22-25 °C 3. 4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: N2 OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C. 6. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min. 3 COMPONENT 2 3. CHALLENGE CHEMICAL 1 : 1. CHEM NAME (s) : Isopropy] Alcohol N/A N/A 2. CAS NUMBER(s): 67-63-0 3. CONC. (IF MIX) N/A N/A N/A N/A N/A 4. CHEMICAL SOURCE: Mallinckrodt N7A N/A N/A Regeant Grade N/A 4. TEST RESULTS 1. DATE TESTED: June 23,1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 1.16ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19mil. 7. SELECTED DATA POINTS N/A CONCENTRATION CONCENTRATION : CONCENTRATION TIME : : 1. 2. : 3. 4. : : 5. : : 6. : : : 7. : • : 8. 9. 10. 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Samples were run by Sylvia R. Cooper on June 23, 1986. C - 159

Chemical Resistance Testing of USCG Material with isopropyl Alcohol



1. DESCRIPTION	OF	PRODUCT	EVALUATED
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- 1: TYPE: Teflon laminated Nomex
- 2: PRCTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUF/CTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A
- 7: NOMINAL THICKNESS: 15-20 mil
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

TEST METHOD 2.

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3

- TESTING LABORATORY: <u>lexas Research Institute</u>, <u>9063 Bee Caves Road</u>, <u>Austin</u>, <u>TX</u>
   ANALTTICAL METHOD: <u>Continuous photoionisation detection with <u>r 11,70 eV lamp</u>.
  </u>
- 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: N2
- 5. COLLECTION SYSTEM: No
- 6. OTHER CONDITIONS: 2 inch cells were used/Detector Temperature =60C. 7. DEVIATIONS FROM AS M \$739 HETHOD: Flow rate to cells was 100cc/min

<b>B.</b>	CALLENCE CREMICAL	1	1	COMPOSENT 2	:	3	
	1. CHEM MARE(B) :	Isopropy lesine	:	₩/▲	1 2	¥/A	
	2. CAS NUMBER(:):	75-31-0	_:_	N/A	;	N/A	
	3. CONC. (IF MIX)	N/A	:	N/A	1	N/A	
	4. CREMICAL SOURCE	Aldrich reagent	_:_	N/A	:	N/A _	
		grade	_:_	N/A		N/A	
4							

TEST RESULTS

1. DATE TESTED: May 20, 1986 NUMBER OF SAMPLES TESTED: Three

BREAKTHROUGE TIME: No breakthrough was observed after 3 hours 4. MIN DETECTABLE LIMET 1.57 ppm

- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 17-19 mil
- 7. SELECTED DATA POINTS N/A

TIME	:	CONCENTRATION	: CONCE	NTRATION :	CONCENTRATION
	:		:		
			:		
	:	المكروبية الكمر ويعربون إبرار المراجع والمراجع والمراجع			يبالا واستدرين الملالين الالماء بيستدي
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	VATIONS:				
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5. SOURCE OF DATA

8.

Samples were run by Sylvia Cooper on May 20, 1986

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a Toluene

Swhished from celle to Standard Di

# 1. DESCRIPTION OF PRODUCT EVALUATED

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1:	TYPE:	Tefion	laminated	Nomex

- 2: PRUTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections

1

- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A
- 7:
- NOMINAL THICKNESS: 15-20 mil DESCRIPTION: Material was orange colored on one side and buff colored on the 8: other side.

### 2. TEST METHOD

- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 3.
- ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp.
- 3. TEMPERATURE: 22-25 °C
- 4. COLLECTION MEDIUM: N2

5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells re used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F739 METHOD: N/A

### 3. CHALLENGE CHEMICAL

	THEM NAME (s) :	Malathion	N/A	:N/A
2.	CAS NUMBER (s):	N/A	N/A	: N/A
3.	CONC. (IF MIX)	50%	: <u>N/A</u>	:N/A
4.	CHEMICAL SOURCE	Black leaf products	N/A	N/A

: COMPONENT 2 :

### TEST RESULTS

- 1. DATE TESTED: <u>September 5, 1986</u> 2. NUMBER OF SAMPLES TESTED: <u>Three</u>

3. BREAKTHROUGH TIME: No breakthrough was observed after 2.10 hours.

- 4. MIN DETECTABLE LIMIT 1.03 DDm
- 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS N/A

1.	TIME	CONCENTRA	TION : C	ONCENTRATION	: 001	CENTRATION
2		:				
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8. <u>-</u> 9					:	
10.		•			•	

# 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Karen Verschoor on September 5, 1986.

Chemical Resistance Testing of USCG Material with Malathion

	I ppe Tolueze	
100cc/min r: 100cc/min Omin		
C \$ 10		
e to c e to D th: 10 eed: 5 attn: attn: temp:		
Flow rat Flow rat Input at Chart sp Lamp: 10 Recorder Detector		

Switched from cells to standard gas

i

# 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon lami 2: PROTECTIVE MATERI	AL CODE: 068		
	3: CONDITION BEFORE		visible imperfections	
	4: MANUFACTURER: CH	emfab Corp.		
		ATION: Challenge 5	100	· · · · · · · · · · · · · · · · · · ·
	6: LOT OR MANUFACTUR			
	7: NOMINAL THICKNESS			
	8: DESCRIPTION: <u>Mat</u> other side.	erial was orange co	olored on one side and t	ouff colored on the
•	TEST METHOD			
		Y: <u>Texas Research I</u>	nstitute, 9063 Bee Cave	s Road, Austin, TX
	2. ANAL YT ICAL METHOD		pionization detection with	th a 10.20 eV lamp.
	3. TEMPERATURE: 22-2			
	4. COLLECTION MEDIUM			
	5. COLLECTION SYSTEM			1000
	6. OTHER CONDITIONS:		e used. /Detector Tempe	rature = 100C.
	7. DEVIATIONS FROM A	STM F739 METHOD: N	<u> </u>	
•	CHALLENGE CHEMICAL	1	: COMPONENT 2 :	З
	.1. CHEM NAME(s) : M	ethyl Acrylate	N/A	N/A
	2. LAS NUMBER (s): 3	6-33-3	. N/A .	N/A
		7A	: N/A :	N/A
	4. CHEMICAL SOURCE:7	drich reagent	: N/A :	N/A
		rade	. N/A	N/A
	4. MIN DETECTABLE LIN 5. STEADY STATE PERME	TESTED: Three (co No breakthrough w NIT 0.48 ppm ATION RATE N/A 18-19 mil	emposite) was observed after 3.7 h	nours.
	TIME :	CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	2			
	3		:	
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	3; 4; 5;	······································		
	5:	······		
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	5:			
	5: 6: 7: 8:			
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•	5: 6: 7: 8: 9: 10: 8. OTHER OBSERVATIONS SOURCE OF DATA		c on August 14, 1986.	
•	5: 6: 7: 8: 9: 10: 8. OTHER OBSERVATIONS SOURCE OF DATA		r on August 14, 1986.	

L CH
· · · · · · · · · · · · · · · · · · ·
Recorder attn: 32 Detector temp: 100C
eed: 5. .2 eV
rate to Detecto sttn: 10

C-165A

1. DESCRIPTION	0F	PRODUCT	EVAL UATED
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- 1: TYPE: Teflon laminated Nomex
- PROTECTIVE MATERIAL CODE: 068 2:
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections

1

- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A

- 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

2. TEST METHOD

- 1. TESTING LABORATORY: Texas Pesearch Institute, 9003 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp. 3. TEMPERATURE: 22-25℃
- 4. COLLECTION MEDIUM: N2
- N2 5. COLLECTION SYSTEM:
- 6.
- OTHER CONDITIONS: I inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTH 7.39 HETHOD: Flow rate to the cells was LODcc/min

CHALLENGE CHEMICAL

1. THEM WATE (s) : Methyl Alcohol	: N/A	• • • • • • • • • • • • • • • • • • • •
2. CAS NUMBER(s): 67-56-1	: N/A	: N/A
3. CONC. (IF MIX) N/A	: N/A	: N/A
4. CHEMICAL SOURCE: Mallinckrodt	:N/A	:N/A
Reagent Grade	: N/A	:N/A

COMPONENT 2

3

### TEST RESULTS

- 1. DATE TESTED: June 19-20, 1986 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 14.2 hours.

- 4. MIN DETECTABLE LIMIT 4.07 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 18-19 mil.
- 7. SELECTED DATA POINTS N/A

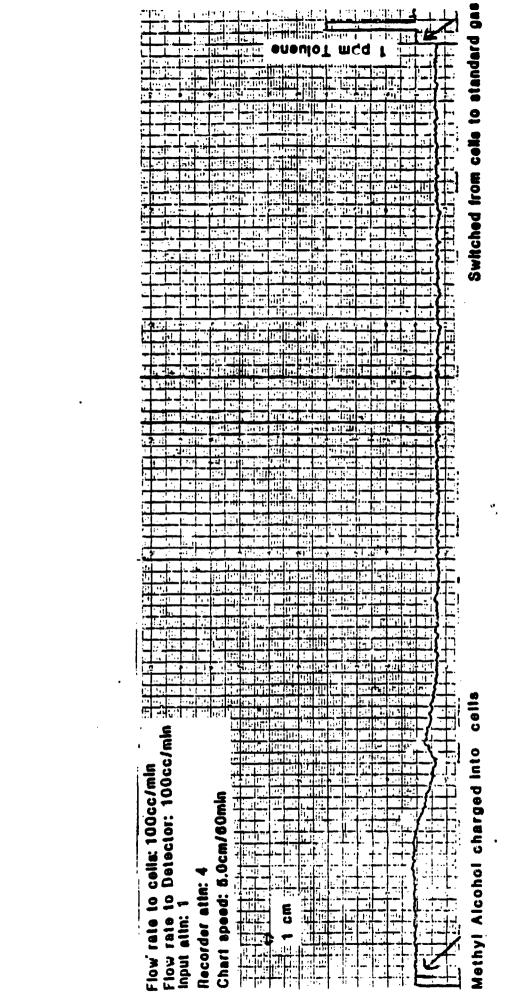
1	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
2				:		:	
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10.				<u>.</u>		:	

### 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Karen Verschoor on June 19-20, 1986.

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Chemical Resistance Testing of USCG Material with Methyl Alcohol

GARANGARA MENDENDENDEN KARANGA

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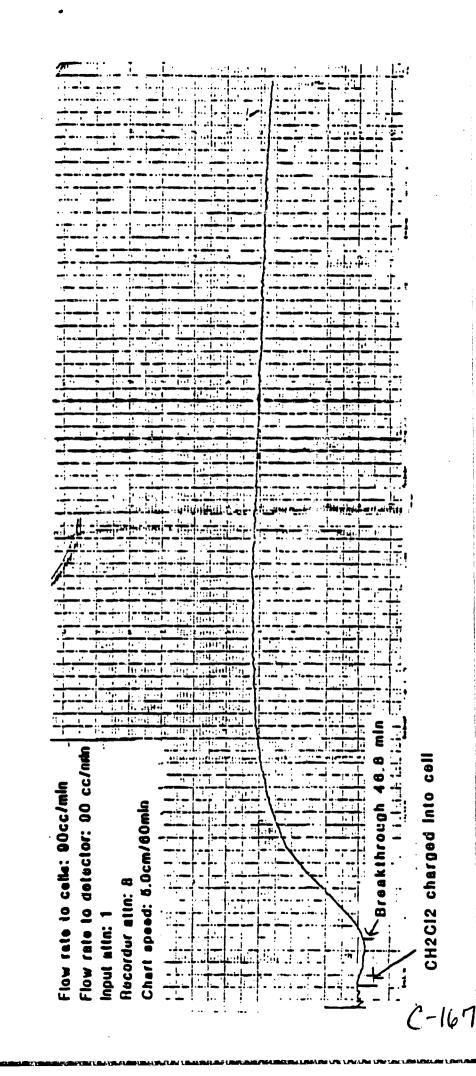
# 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no v 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5 5: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was buff co		
	TEST METHOD 1. TESTING LABORATORY: <u>Texas Research 1</u> 2. ANALYTICAL METHOD: <u>Continuous photo</u> 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: <u>N2</u> 5. COLLECTION SYSTEM: <u>N2</u> 5. OTHER CONDITIONS: <u>2 inch cell was</u> 7. DEVIATIONS FROM ASTH F739 METHOD: <u>F</u>	used./ Detector Temper	with a 11.7 eV Tamp.
4	CHALLENGE CHEMICAL 1	: COMPONENT 2	3
	<pre>I CHEM NAME(s): Methylene Chloride CAS NUMBER(s): 75-09-2 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Fisher Pesticide Grade</pre>	N/A N/A N/A N/A N/A	N/A           N/A           N/A           N/A           N/A
	1. DATE TESTED: <u>April 21-22, 1986</u> 2. NUMBER OF SAMPLES TESTED: <u>One (Run 1</u> 3. BREAKTHROUGH TIME: <u>46.8 min</u> 4. MIN DETECTABLE LIMIT <u>0.27 ppm</u> 5. STEADY STATE PERMEATION RATE <u>1.37uc</u> 5. SAMPLE THICKNESS: <u>17-19 mil</u> 7. SELECTED DATA POINTS		
	TIME : CONCENTRATION 1 2 3	: CONCENTRATION	CONCENTRATION
	4		
	6. <u>:</u> 7. :		
	8. 9		
	10:	:	
c	B. OTHER OBSERVATIONS:		

C-166

Permeation of Methylene Chloride through USCG Material

Run I



# 1. DESCRIPTION OF PRODUCT EVALUATED

- TYPE: Teflon laminated Nomex 1:
- PROTECTIVE MATERIAL CODE: 068 2:
- CONDITION BEFORE TEST: Unused, no visible imperfections 3:
- MANUFACTURER: Chemfab Corp. 4:
- PRODUCT IDENTIFICATION: Challenge 5100 5:
- LOT OR MANUFACTURER DATE: N/A 6:
- 7: NOMINAL THICKNESS: 15-20 mil
- DESCRIPTION: Material was buff colored. 8:

### TEST METHOD 2.

0 . E C

- 1.
- TESTING LABORATORY: <u>Texas Research Institute</u>, 9063 Bee Caves Road, Austin, TX ANALYTICAL METHOD: <u>Continuous photoionization detection with a 11.7 eV Tamp.</u> TEMPERATURE: 22-25 C 2.
- 3.
- COLLECTION MEDIUM: N2 4.
- 5. COLLECTION SYSTEM: No
- OTHER CONDITIONS: 2 inch cell was used./ Detector Temperature = 60C. 6. DEVIATIONS FROM ASTN F739 NETHOD: Flow rate to cell was 90cc/min. 7\_

### CHALLENGE CHEMICAL 1 **COMPONENT 2** 3 3. : : CHEM NAME(s) : Methylene Chloride N/A NA 1. CAS NUMBER(s): 2. 75-09-2 N/A N/A CONC. (IF MIX) N/A N/A 3. N/A

CHEMICAL SOURCE: Fisher Pesticide 4. N/A N/A Grade N/A N/A

# 4. TEST RESULTS

- 1. DATE TESTED: April 22, 1986
- 2. NUMBER OF SAMPLES TESTED: One (Run II )
- 3. BREAKTHROUGH TIME: 50.4 min.
- 4. MIN DETECTABLE LIMIT 0.13 ppm.
- 5. STEADY STATE PERMEATION RATE .964 ug/cm- hour
- 6. SAMPLE THICKNESS: 17-19 mil
- 7. SELECTED DATA POINTS

:	CONCENTRATION	CCICENTRATION	:	CONCENTRATION
			<u>.</u>	
			:	
			:	
:			:	
		CONCENTRATION	CONCENTRATION CONCENTRATION	CONCENTRATION CONCENTRATION

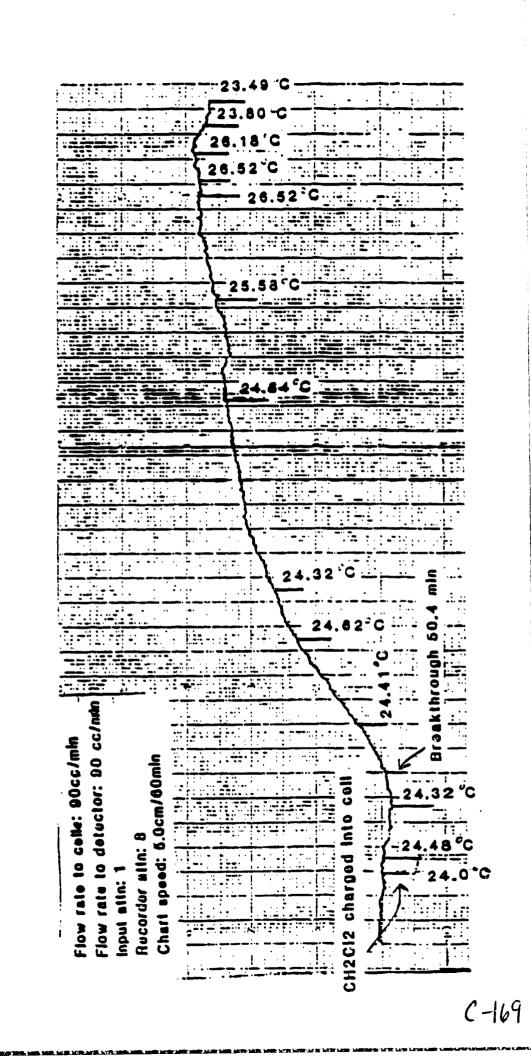
# 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Sample was run by Karen Verschoor on April 22, 1986.

Permeation of Methylene Chloride through USCG Material

Run II



CHEMICAL	PROTECTIVE	CLOTHING	PRODUCT	EVALUATION	RECURD

# 1. DESCRIPTION OF PRODUCT EVALUATED

	1:	TYPE: Teflon la					_			
	2;	PROTECTIVE MATE	RIAL CODE:	068						
		CONDITION BEFOR	E TEST: U	nused, no	visi	ble imperfe	ction	5		
		MANUFACTURER:	Chemfab Co	ro.						
		PROMUCT IDENTIF			5:00		•			
		LOT OR MANUFACT			0100					
										_
		NOMINAL THICKNE								_
	8:	DESCRIPTION:	laterial wa	S DUTT COL	orea				بمالك معين معينا فعر	
	_					•				
2.	TEST	r method								
	1.	TESTING LABORAT	ORY: Texas	Research	Inst	itute, 9063	Bee (	laves Ro	oad, Austin,	TX _
		ANALYTICAL METH								
		TEMPERATURE: 22								
		COLLECTION MEDI								
		COLLECTION SYST				بمحمد بالمتات معيد في موات				
	<b>D</b> .	OTHER CONDITION	15: <u>2 1 n c</u>	n cell was	<u>use</u>	a./ Detecto	riem	perature		
	. ].	DEVIATIONS FROM	ASTM F739	METHOD: F		<u>rate to cel</u>	l was	90cc/mi	<u>n.</u>	
				_			_		•	
3.	CHAL	LENGE CHEMICAL		1	:	COMPONENT	2	:	3	
					:			:		
	1.	CHEM NAME (s) :	Methylene	Chloride	:	· • • • • • • • • • • • • • • • • • • •		:	<b>N/A</b>	

	CHER MALE (3) . Rechyrene ontoride	<u> </u>	· · · · · · · · · · · · · · · · · · ·
2.	CAS NUMBER(s): 75-09-2	N/A	:N/A
3.	CONC. (IF MIX) N/A	. N/A	: N/A
4.	CHEMICAL SOURCE: Fisher Pesticide	: N/A	: <u>N/A</u>
	grade	N/A	N/A

### 4. TEST RESULTS

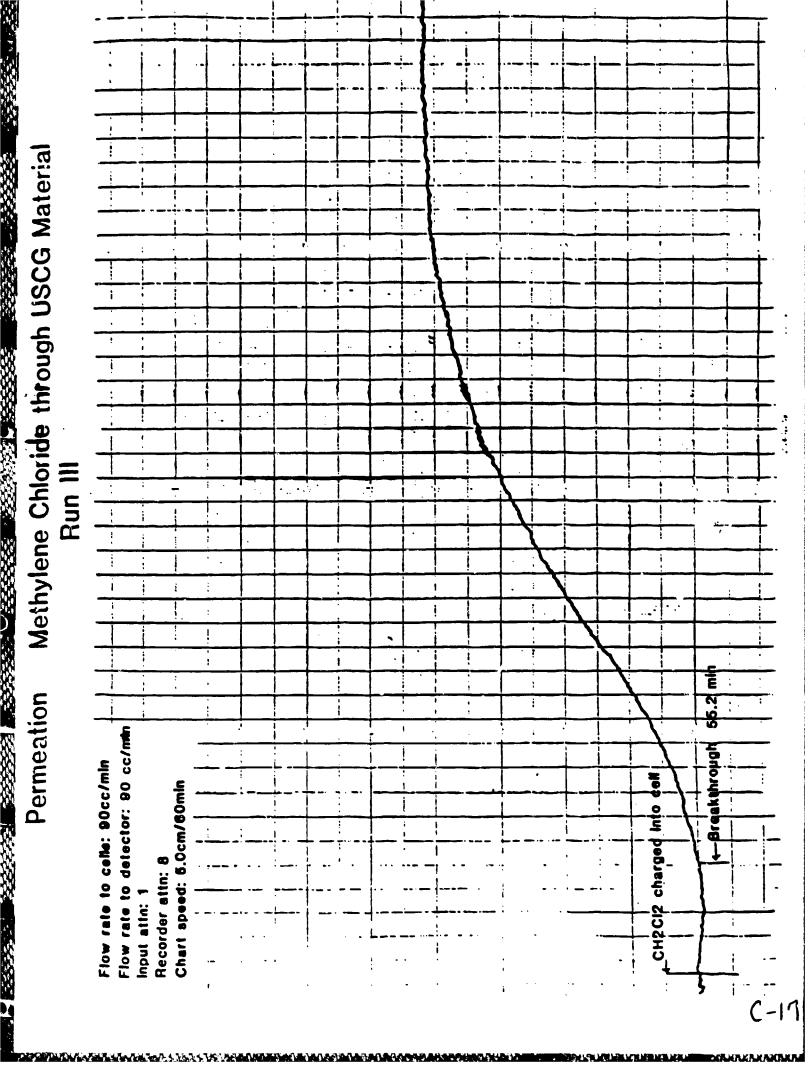
- 1. DATE TESTED: April 22-23, 1985 2. NUMBER OF SAMPLES TESTED: One (Run III) 3. BREAKTHROUGH TIME: 55.2 min 4. MIN DETECTABLE LIMIT 0.17 ppm. 5. STEADY STATE PERMEATION RATE 1.27 ug/cm<sup>2</sup> hour 6. SAMPLE THICKNESS: 17-19 mil
- 7. SELECTED DATA POINTS

1	TIME	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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4		:	:			
6. – 7. –		:	:		:	
8 9		<u>.</u>	:			
10.		•	:		:	

3. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Sample was run by Karen Verschoor on April 22-23, 1986.



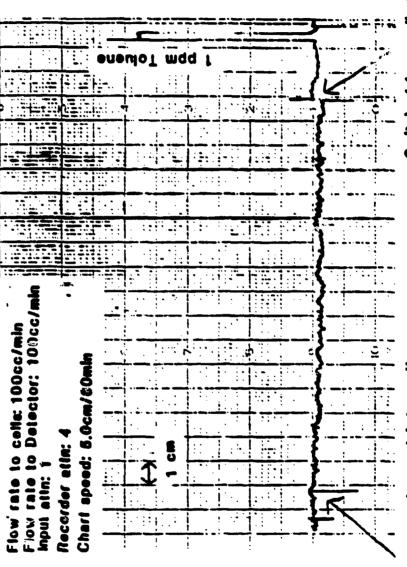
### 1. DESCRIPTION OF PRODUCT EVALUATED

, , ,

ICAL METHOD: ATURE: 22-25	Continuous photoio	titute, 9063 Bee Ca	ves Road, Austin, TX
ICAL METHOD: ATURE: 22-25	Continuous photoio	TITULE, YUDJ BEE CA	ves Road, Austin, 1X
		MIZALION DECECTION	with a 11.7 eV Tamp.
	N <sub>2</sub>		
TION SYSTEM:	inch cells were	sed./ Detector Temp	erature = 60C.
LONS FROM ASTM	F739 METHOD: FION	rate to cells was .	LOOcc/min.
CHEMICAL	1 :	COMPONENT 2	: 3
WE(s): Meth	IVI Ettyl Ketone	N/A	N/A
(IF MIX) N/A		N/A N/A	N/A N/A
AL SOURCE: Bake	r reagent grade :	N/A	:N/A
ROUGH TIME: No ECTABLE LIMIT STATE PERMEATI HICKNESS: <u>17-</u>	o breakthrough was 0.65ppm ION RATE <u>N/A</u> 19 mil.	Observed after 3 hou	urs.
IME :	CONCENTRATION	: CONCENTRATION	CONCENTRATION
			•
The second second second second second second second second second second second second second second second s		1	•
			• •
:			
	CONDITIONS: T IONS FROM AST CHEMICAL ME(s): Meth MBER(s): 78-9 (IF MIX) N/A AL SOURCE: Bake S STED: DF SAMPLES TES ROUGH TIME: NO CTABLE LIMIT TATE PERMEATI HICKNESS: 17- D DATA POINTS	CONDITIONS: I inch cells were IONS FROM ASTM F739 METHOD: Flow CHEMICAL 1 WE(s): Methyl Ethyl Ketone: MBER(s): 78-93-3 (IF MIX) N/A AL SOURCE: Baker reagent grade: S STED: June 18, 1986 OF SAMPLES TESTED: Three ROUGH TIME: No breakthrough was CTABLE LIMIT 0.65ppm TATE PERMEATION RATE N/A HICKNESS: 17-19 mil. DATA POINTS N/A	CONDITIONS:       1 inch cells were used./ Detector Tempolons FROM ASTM F739 METHOD:       Flow rate to cells was         CHEMICAL       1       : COMPONENT 2         CHEMICAL       1       : COMPONENT 2         WE(s):       Methyl Ethyl Ketome:       N/A         MBER(s):       78-93-3       : N/A         (IF MIX)       N/A       : N/A         AL SOURCE:       Baker reagent grade:       N/A         S       :       N/A         S       :       N/A         CTABLE       LIMIT       0.65ppm         TATE       PERMEATION RATE       N/A         HICKNESS:       17-19 mil.         DATA POINTS       N/A

**Chemical Resistance Testing of USCG Material** 

with Methyl Ethyl Ketone



Switched from cells to standard gae

Methyl Ethyl Ketone charged into cells

1.	DESC	CRI PT I		IEMICAL PI		OTHING.	PRODUCT EVALUAT	ION R	ecord	
	1:	TYPE	Teflor	n laminat:	ed Nomex					
	2:				CODE: 068		والبريداني بيراك المالي البريدانيات			
	3:					no visi	ble imperfectio	ns .		
	4:			l: Chemf						
	5:	PRODU	JCT IDEN	IT IF ICAT I	ON: Challer	19e 5100				
	6:	LOT	JR MANUF	ACTURER	DATE: N/A			_		
	7:				15-20 mil					
	8:		RIPTION: er side.		al was orang	e color	ed on one side	and D	utt colored (	<u>)n th</u>
2.	TES	T METH	HOD							
	1.	TEST	ING LABO	RATORY:_'	lexas Resear	rch Inst	itute, 9063 Bee	_Cave	s Road, Austi	in, Ti
	2.				Continuous r	photoion	ization detecti	on wi	th a 11.7 eV	Tamp
				22-25 °C						
	4.		ECTION M							
	5.	COLLE	CTION S	YSTEM:	N2					
	6.	OTHER	CONDIT	IONS: I	Inch cells v	vere use	d./ Detector Te	mpera	ture = $60C$ .	-
	7.	DEVI	ATIONS F	ROM ASTM	F739 METHOD	): <u>Flow</u>	rate to cells w	<u>as 10</u>	Occ/min	
۵.	CHAL	LENG	E CHEMIC	AL.	1	•	COMPONENT 2	:	3	
	1.	CHEM	NAME (s)	:Methyl	Isobutyl Ke	tone:	<u>N/A</u>		<u>N/A</u>	
•	2.	CAS I	UMBER ( 5	;): <u>108-</u> ; X) <u>N/A</u>	10-1		N/A		N/A	
	3.	CONC .	. (IF MI	X) <u>N/A</u>		;	N/A		N/A	
	4.	CHEMI	ical sou	RCE:Aldr	ich	······	N/A		N/A	
		RESU		Reag	ent Grade		N/A		N/A	
	3. 1 4. 1 5. 9 6. 9	BREAKT MIN DE STEAD SAMPLE	THROUGH TECTABL Y STATE THICKN	TIME: No	3.98ppm ON RATE <u>N/A</u> 19 mil	ih was o	bserved after 3	hour	S	
	•	۱.	TIME	:	CONCENTRAT	ION :	CONCENTRATIO	)N :	CO NCENTRAT I	ION
		<u>;                                    </u>			المنور بالمريد والمتحكمة والمريد	<u> </u>				
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5.	SOIP		DATA							
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C-174

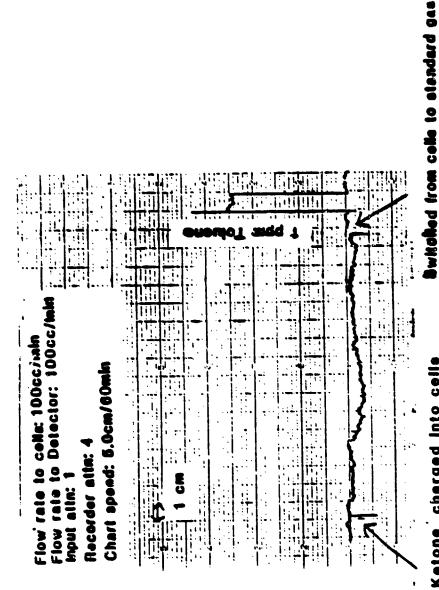
Chemical Resistance Testing of USCG Material

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### with Methyl Isobutyl Ketone



Methyl Isobutyl Ketone charged into cells

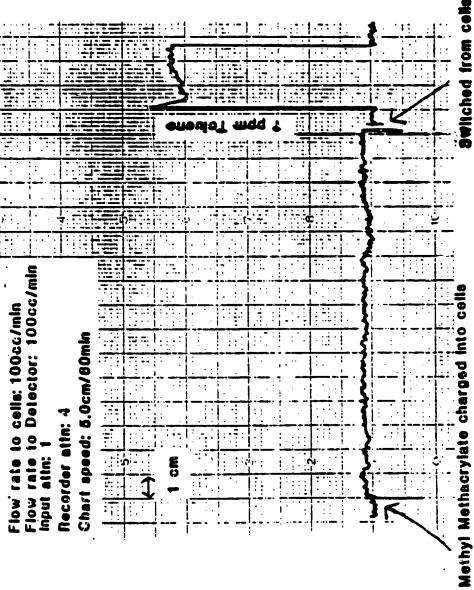
### 1. DESCRIPTION OF PRODUCT EVALUATED

2: 3:		ERIAL CODE: 068 DRE TEST: Unused, no	visible imperfections	
4:	MANUFACTURER:	Chemfab Corp.		
5: 6:		IFICATION: Challenge CTURER DATE: N/A	5100	
7:		VESS: 15-20 mil		
8:	DESCRIPTION: other_side.	Material was orange of	colored on one side and b	uff colored on th
TES	ST METHOD			
1. 2.			Institute, 9063 Bee Cave coionization detection wi	
3.	TEMPERATURE:	22-25 °C		
	COLLECTION ME			
			re used./ Detector i empe	rature = 60C
			Flow rate to cells was 1	
CH/	ALLENGE CHEMICA	. 1	: COMPONENT 2 :	3
1.	CHEM NAME (s)	: Methyl Methacrylate	e : ` N/A :	N/A
2.	CAS NUMBER(s)	: 80-62-6	: N/A :	N/A
	CONC. (IF MIX	) <u>N/A</u>	_:N/A:_	N/A
4.	CHEMICAL SUUR	CE:Aldrich reagent grade	N/A	<u> </u>
TES	ST RESULTS	<u></u>		
1	DATE TESTED. 1	-		
	DATE TESTED: J	LES TESTED: Three		
3.	BREAKTHROUGH T	IME: No breakthrough	was observed after 3.1 h	ours.
	MIN DETECTABLE			
	STEADY STATE P	RMEATION RATE N/A		
	SELECTED DATA			· · · · · · · · · · · · · · · · · · ·
	TIME	: CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	1.	:	:	
	2			
	3			
	5.			
	6.	•		
	7			
	9.	•		
	10	•	:	
8.	OTHER OBSERVAT	IONS :		
	URCE OF DATA			
SOI				
<b>S</b> 01	<u>Samples</u>	ere run by Sylvia Coor	per on June 25, 1986	

Chemical Resistance Testing of USCG Material with Methyl Methacrylate

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K STANKS



Swhched from cells to standard gas

### DESCRIPTION OF PRODUCT EVALUATED 1.

1:	TYPE: Teflon laminated Nomex
2:	PROTECTIVE MATERIAL CODE: C68
3:	CONDITION BEFORE TEST: Unused, no visible imperfections
4:	MANUFACTURER: Chemfab Corp.
5:	PRODUCT IDENTIFICATION: Challenge 5100
6:	LOT OR MANUFACTURER DATE: N/A
7:	NOMINAL THICKNESS: 15-20 mil
8:	DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.

2. TEST METHOD

> TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1.

> Continuous photoionization detection with a 10.2 eV lamp. ANAL YTICAL METHOD: 2.

TEMPERATURE: 22-25°C 3.

COLLECTION MEDIUM: N2 4.

5.

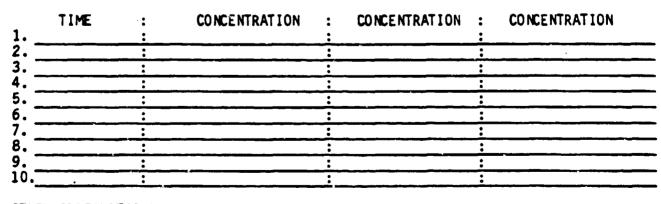
COLLECTION SYSTEM: N2 OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C. б. DEVIATIONS FROM ASTM F739 METHOD: Flow Tate to cells was 100cc/min. 7.

CHALLENCE CHENTCAL 1 3

CHALLENGE CHEMICAL	1	COMPONENT 2	:	3	
1. CHEM NAME(s): 2. CAS NUMBER(s):	Methyl Parathion	N/A		N/A	<b></b>
3. CONC. (IF MIX)	44.0%	<u>N/A</u>		<u>N/A</u>	
4. CHEMICAL SOURCE	Agricultural Supply	: <u> </u>	:	N/A	

### 4. TEST RESULTS

- 1. DATE TESTED: September 18, 1986
- 2. NUMBER OF SAMPLES TESTED: Three
- 3. BREAKTHROUGH TIME: N/A
- 4. MIN DETECTABLE LIMIT .15 DDm 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS N/A

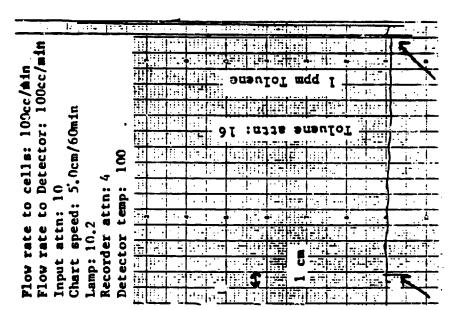


8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Denise McDonald on September 18, 1986.

# Chemical Resistance Testing of USCG Material with Methyl Parathion



Switched from cells to standard gas

Methyl Parathion charged into cells

i

### 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- PROTECTIVE MATERIAL CODE: 068 2:

CONDITION BEFORE TEST: Unused, no visible imperfections 3:

4: MANUFACTURER: Chemfab Corp. 5:

PRODUCT IDENTIFICATION: Challenge 5100 LOT OR MANUFACTURER DATE: N/A 6:

- NOMINAL THICKNESS: 15-20 mil 7:
- DESCRIPTION: Material was orange colored on one side and buff colored on the 8: other side.

### 2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV Tamp

3. TEMPERATURE: 22-23 C
4. COLLECTION MEDIUM: N2
5. COLLECTION SYSTEM: N2
6 OTHER CONDITIONS: 1 inch cells were used./Detector Temperature = 100C.
6 OTHER CONDITIONS: 1 inch cells were used./Detector Temperature = 100C.

COMPONENT 2 3. CHALLENGE CHEMICAL 1 3 : 1. CHEM NAME(s): Naled 2. CAS NUMBER(s): N/A 3. CONC. (IF NIX) N/A 1/A **X/A** N/A N/A N/A N/A 4. CHEMICAL SOURCE: Ortho N/A N/A

### 4. TEST RESULTS

- 1. DATE TESTED: October 10, 1986 2. NUMBER OF SAMPLES TESTED: \_\_\_\_\_\_
- Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 3.46 hours.

- 4. MIN DETECTABLE LIMIT N/A
- 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS N/A

1.	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
2. – 3. –		:		<u> </u>		÷	
4		:		:		:	
6. – 7. –		:		:		:	
8		:		:		:	
10		:		:		:	

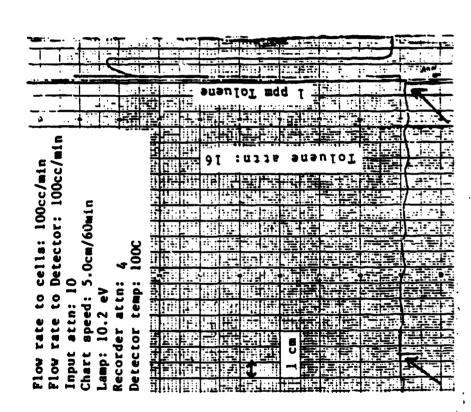
8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Denise McDonald on October 10, 1986.

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Chemical Resistance Testing of USCG Material with Naled

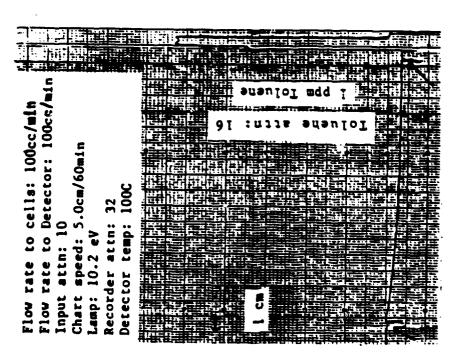


Switched from cells to standard gas

Naled charged into cella

	CHEMICAL PROTECTIVE CLOTHING	PRODUCT EVALUATION R	ECORD
1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visi 4: MANUFACTURER: Chemiab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange color other side.		ouff colored on the
2.	. TEST METHOD		
	<ol> <li>TESTING LABORATORY: <u>Texas Research Inst</u></li> <li>ANAL YTICAL METHOD: <u>Continuous photoion</u></li> <li>TEMPERATURE: 22-25 °C</li> <li>COLLECTION MEDIUM: <u>N2</u></li> <li>COLLECTION SYSTEM: <u>N2</u></li> <li>OTHER CONDITIONS: <u>2 inch cells were u</u></li> <li>DEVIATIONS FROM ASTM F739 METHOD: <u>Flow</u></li> </ol>	ization detection wi	erature = 100C.
з.	CHALLENGE CHEMICAL 1 :	COMPONENT 2 :	3
	<pre>1. CHEM NAME(s) : Naphtha 2. CAS NUMBER(s): 8032-32-4 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Aldrich reagent grade</pre>	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
4.	. TEST RESULTS	<u> </u>	
	1. DATE TESTED: <u>September 24, 1986</u> 2. NUMBER OF SAMPLES TESTED: <u>Three</u> 3. BREAKTHROUGH TIME: <u>No breakthrough was</u> 4. MIN DETECTABLE LIMIT <u>4.55 ppm</u> 5. STEADY STATE PERMEATION RATE <u>N/A</u> 6. SAMPLE THICKNESS: <u>19-20 mil</u> 7. SELECTED DATA POINTS <u>N/A</u>	observed after 3.46	hours.
	TIME : CONCENTRATION :	CONCENTRATION :	CONCENTRATION
	1.       :       :       :         2.       :       :       :         3.       :       :       :         3.       :       :       :         3.       :       :       :         3.       :       :       :         3.       :       :       :         3.       :       :       :         4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         9.       :       :       :         9.       :       :       :         10.       :       :       :         8.       OTHER OBSERVATIONS:      :		
5.	SOURCE OF DATA Samples were run by Denise McDonald	on September 24, 198	36

Chemical Resistance Testing of USCG Material with Naphtha



### Naphtha charged into cells

Switched from cells to standard gas

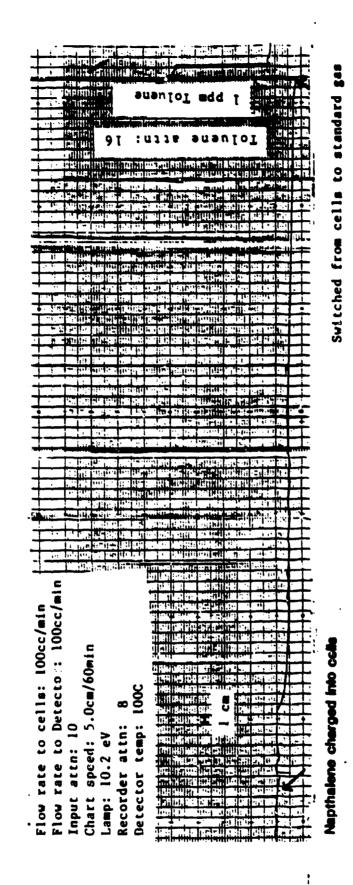
C-183

CHEMICAL PROTECTIVE CLOBHING PRODUCT EVALUATION	EMICAL PROTECTIV	CLORMING PRODUCT EVALUA	TION RECORD
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### DESCRIPTION OF PRUDUCT EVALUATED

1.		CRIPTION OF PF		_			
	2: 3: 4: 5: 6:	PRUTECTIVE MU CONDITION BEI MANUFACTURER	TERIAL CO FORE TEST: Chemfab IFICATION ACTURER DA	DE: 068 Unused, no vi Corp. : Challenge 51 TE: N/A	sible imperfections		
	8:				ored on one side an	d buff colored on	the
2.	_	T METHOD					
	2. 3.	ANALYTICAL ME TEMPERATURE:	THOD: <u>Co</u> 22-25 <b>°</b> C	ntinuous photoi	onization detection	aves Road, Austin, with a 10.20 eV 1	TX amp.
		COLLECTION MI COLLECTION S			<del></del>		
		OTHER CONDIT:	IONS : 1	inch cells were	winds water to cells	mperature = 100C. s 100 cc/min.	
3.	CHA	LLENGE CHEMIC	NL.	1 :	COMPONENT 2	: 3	
		CHEM NAME (s)			<u>N/A</u>	<u>N/A</u>	
	2. 3.	CAS NUMBER(s CONC. (IF MI)	$\frac{91-20-}{N/A}$	3	<u> </u>	N/A	
	4.	CHEMICAL SOUR	CE: Aldric	h reagen:	N/A	N/A	
4.	TEST	T RESULTS	grade		N/A	:N/A	
	2.   3.   4.   5.   6.	DATE TESTED: NUMBER OF SAM BREAKTHROUGH MIN DETECTABLI STEADY STATE I SAMPLE THICKNI SELECTED DATA	PLES TESTE TIME: No b LIMIT .0 PERMEATION SS. 19-20	D: <u>Three</u> reakthrough was 1 ppm as Benzer RATE <u>N/A</u> mil	observed after 13.	2 hours.	
		TIME	:	CONCENTRATION	: CONCENTRATION	: CONCENTRATION	
		2					
		3. 4.			<u>.</u>		
	:	5.					
	1	6					
	ł	8				<u>.</u>	
	1	9	:		•	:	
		10		<u></u>		······································	_
	8. (	OTHER OBSERVA	TIONS:	······			
5.	SOU	RCE OF DATA Samples w	ere run by	Denise McDona	d on September 8, 1	986	

Chemical Resistance Testing of USCG Material with Napthalene



C-185

### DESCRIPTION OF PRODUCT EVALUATED 1.

- 1: TYPE: Teflon laminated Nomex
- 2: PROTECTIVE MATERIAL CODE: 068
- CONDITION BEFORE TEST: <u>Unused</u>, no visible imperfections MANUFACTURER: <u>Chemfab Corp.</u> PRODUCT IDENTIFICATION: <u>Challenge 5100</u> 3:
- 4:
- 5:
- 6: LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 15-20 mil
- 7:
- DESCRIPTION: Material was orange colored on one side and buff colored on the 8: other side.

### 2. TEST METHOD

- TESTING LABORATORY: <u>Texas Research Institute</u>, 9063 Bee Caves Road, Austin, TX
   ANALYTICAL METHOD: <u>Ion Chromatography on Dionex 2000</u>.
- TEMPERATURE: Ambient 3.
- COLLECTION MEDIUM: Aqueous 4.
- COLLECTION SYSTEM: Aqueous 5.
- OTHER CONDITIONS: 2 inch cells were used. б.
- DEVIATIONS FROM ASTM F739 HETHOD: 7.

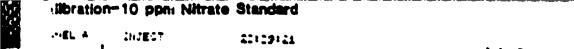
CHALLENGE CHEMICAL **COMPONENT** 2 3 3 1 : CHEM NAME(s) : Nitric Acid N/A N/A 1. N/A 2. CAS NUMBER(s): 7697-37-2 N/A N/A CONC. (IF MIX) 70% N/A 3. CHEMICAL SOURCE: Mallinckrodt N/A N/A 4.

### TEST RESULTS

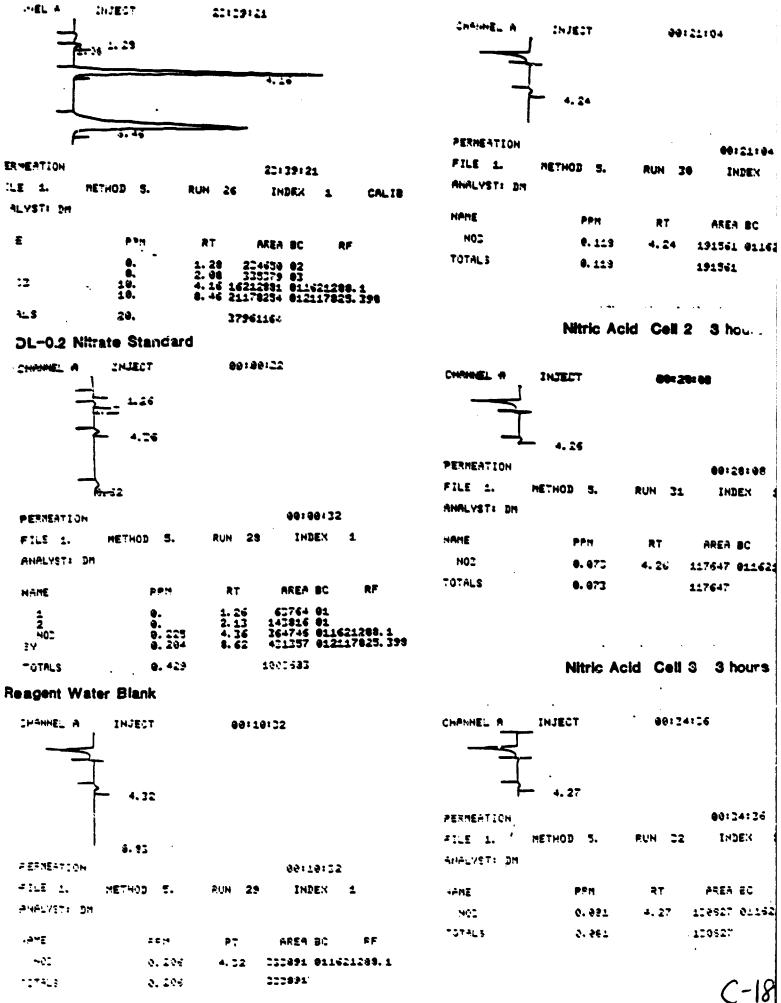
- 1. DATE TESTED: September 11, 1986.
- 2. NUMBER OF SAMPLES TESTED: Three
- 3. BREAKTHROUGH TIME: N/A
- 4. MIN DETECTABLE LIMIT 0.2 DDM
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS cell 1,2, and 3 at end of 3 hour test

1	TIME 3 hours	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
2						
4			÷		:	
<u>6</u>					:	
8		·	:			
9 10.				,		

- 8. OTHER OBSERVATIONS: Retention time for 10ppm Nitrate calibration standard was 4.16 minutes
- 5. SOURCE OF DATA Samples wera run by Denise McDonald on September 11, 1986.







### 1. DESCRIPTION OF PRODUCT EVALUATED

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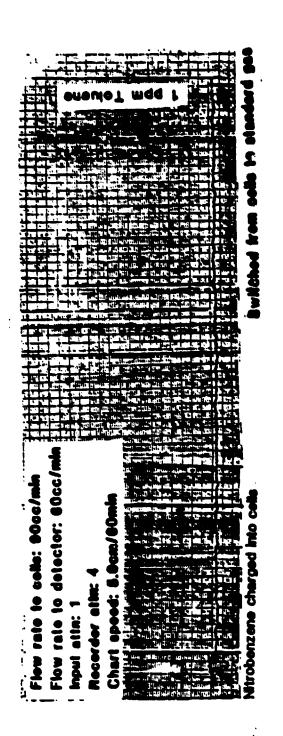
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į,

	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: <u>Material was buff colored</u>
2.	TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV Tamp.
	3. TEMPERATURE: 22-25 C
	4. COLLECTION MEDIUM: N2
	5. COLLECTION SYSTEM: No
	6. OTHER CONDITIONS: 2 inch cells were used./ Detector Temperature = 60C.
	7. DEVIATIONS FROM ASTN F739 NETHED: Flew rate to cells was 90 cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME (s) : Nitrobenzene : N/A : N/A
	2. CAS NUMBER(s): 98-95-3 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A : N/A
4.	TEST RESULTS
	<ol> <li>DATE TESTED: <u>April 9, 1986</u></li> <li>NUMBER OF SAMPLES TESTED: <u>Three</u></li> <li>BREAKTHROUGH TIME: <u>No breakthrough was observed after 3 hours.</u></li> <li>MIN DETECTABLE LIMIT</li> <li>STEADY STATE PERMEATION RATE <u>N/A</u></li> <li>SAMPLE THICKNESS: <u>17-19 mil</u></li> <li>SELECTED DATA POINTS <u>N/A</u></li> </ol>
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION : 1.
	2
	3
	\$i
	6.
	7.
	8.
	9.
	10.
	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA Samples were run by Karen Verschoor on April 9, 1986.

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Chemical Resistance Testing of USCG Material with Nitrobenzene

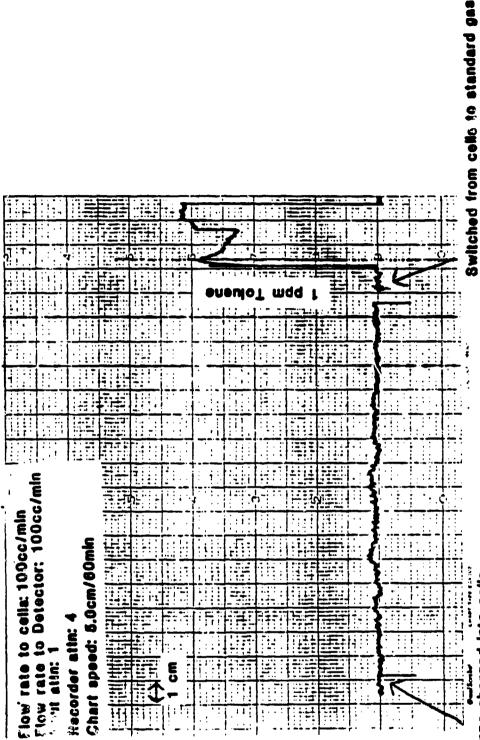


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7. DEVIATIONS FROM ASTM F739         8. CHALLENGE CHEMICAL       1         1. CHEM NAME (s):       2-Nitropro         2. CAS NUMBER(s):       79-46-9         3. CONC. (IF MIX)       N/A         4. CHEMICAL SOURCE:       Kodak reag         4. CHEMICAL SOURCE:       Kodak reag         4. CHEMICAL SOURCE:       NUMBER OF SAMPLES TESTED:         1. DATE TESTED:       July 8, 1986         2. NUMBER OF SAMPLES TESTED:       1         3. BREAKTHROUGH TIME:       N/A         4. MIN DETECTABLE LIMIT       .59 p         5. STEADY STATE PERMEATION RAT       6. SAMPLE THICKNESS:         6. SAMPLE THICKNESS:       18-19 mil         7. SELECTED DATA POINTS N/A       1         4	TAP OF OUT UT	PRODUCT EVALUAT	I I UN RECOR	RD
2: PROTECTIVE MATERIAL CODE: 3: CONDITION BEFORE TEST: UT 4: MANUFACTURER: Chemfab Cor 5: PRODUCT IDENTIFICATION: C 6: LOT OR MANUFACTURER DATE: 7: NOMINAL THICKNESS: 15-20 8: DESCRIPTION: Material was other side. 7: TEST METHOD 1. TESTING LABORATORY: Texas other side. 7: TEST METHOD 1. TESTING LABORATORY: Texas 2. ANALYTICAL METHOD: Contin 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: I Inch 7. DEVIATIONS FROM ASTH F739 4. CHEMICAL SOLRCE: NA 4. CHEMICAL SOLRCE: Kodak reag 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 4. TIME : CONC 1. CILL SOLRCE: SIB-19 mil 7. SELECTED DATA POINTS N/A 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 5	ED			
3: CONDITION BEFORE TEST: Un 4: MANUFACTURER: Chemfab Cor 5: PRODUCT IDENTIFICATION: C 6: LOT OR MANUFACTURER DATE: 7: NOMINAL THICKNESS: 15-20 8: DESCRIPTION: Material was other side. TEST METHOD 1. TESTING LABORATORY: Texas 2. ANAL YTICAL METHOD: CONTIN 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 Inch 7. DEVIATIONS FROM ASTM F739 CHALLENCE CHEMICAL 1 1. CHEM NAME(s): 2-Nitropro 2. CAS MUMBER(s): 79-46-9 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Kodak reag 5. TEST RESULTS 1. DATE TESTED: JULY 8, 1986 2. NUMBER OF SAMPLES TESTED: T 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .59 p 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A TIME : CONC 1 3 4 5 6 7 8. OTHER OBSERVATIONS: 8. OTHER OBSERVATIONS:				
4: MANUFACT URER: <u>Chemfab Cor</u> 5: PRODUCT IDENTIFICATION: <u>C</u> 6: LOT OR MANUFACTURER DATE: 7: NOMINAL THICKNESS: <u>15-20</u> 8: DESCRIPTION: <u>Material was</u> <u>other side</u> . 7. TEST METHOD 1. TESTING LABORATORY: <u>Texas</u> 2. ANALYTICAL METHOD: <u>Contin</u> 3. TEMPERATURE: <u>22-25</u> 4. COLLECTION MEDIUM: <u>N2</u> 5. COLLECTION MEDIUM: <u>N2</u> 5. COLLECTION SYSTEM: <u>N2</u> 6. OTHER CONDITIONS: <u>1 Inch</u> 7. DEVIATIONS FROM ASTM F739 <b>CHALLENGE CHEMICAL</b> 1 1. CHEM NAME(s): <u>2-Nitropro</u> 2. CAS MUMBER(s): <u>79-46-9</u> 3. CONC. (IF MIX) <u>N/A</u> 4. CHEMICAL SOURCE: <u>Kodak reag</u> 7. TEST RESULTS 1. DATE TESTED: <u>July 8, 1986</u> 2. NUMBER OF SAMPLES TESTED: <u>T</u> 3. BREAKTHROUGH TIME: <u>N/A</u> 4. MIN DETECTABLE LIMIT <u>.59 p</u> 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: <u>18-19 mil</u> 7. SELECTED DATA POINTS <u>N/A</u> TIME : CONC 1		the imperfectio	205	
5: PRODUCT IDENTIFICATION: C 6: LOT OR MANUFACTURER DATE: 7: NOMINAL THICKNESS: 15-20 8: DESCRIPTION: Material was other side. TEST METHOD 1. TESTING LABORATORY: Texas 2. ANALYTICAL METHOD: Contin 3. TEMPERATURE: 22-25 C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 Inch 7. DEVIATIONS FROM ASTM F739 CHALLENGE CHEMICAL 1 1. CHEM NAME(s): 2-Nitropro 2. CAS MUMBER(s): 79-46-9 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Kodak reag 7. TEST RESULTS 1. DATE TESTED: July 8, 1986 2. NUMBER OF SAMPLES TESTED: T 3. BREAKTHROUGH TIME: N/A 4. CHEMICAL SOURCE: Kodak reag 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 4	D.		JII3	
7: NOMINAL THICKNESS: 15-20 8: DESCRIPTION: Material was other side. TEST METHOD 1. TESTING LABORATORY: Texas 2. ANALYTICAL METHOD: Contin 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 6. OTHER CONDITIONS: I Inch 7. DEVIATIONS FROM ASTM F739 CHALLENGE CHEMICAL 1 1. CHEM NAME(s): 2-Nitropro 2. CAS NUMBER(s): 79-46-9 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Kodak reag 7. TEST RESULTS 1. DATE TESTED: July 8, 1986 2. NUMBER OF SAMPLES TESTED: T 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .59 p 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 m11 7. SELEC: ED DATA POINTS N/A TIME : CONC 1 3 4 5 5 6 7 8. OTHER OBSERVATIONS: 8. OTHER OBSERVATIONS:	hallenge 510	0		
8: DESCRIPTION: <u>Material was</u> other side. TEST METHOD 1. TESTING LABORATORY: <u>Texas</u> 2. ANAL YTICAL METHOD: <u>Contin</u> 3. TEMPERATURE: 22-25 C 4. COLLECTION MEDIUM: <u>N2</u> 5. COLLECTION MEDIUM: <u>N2</u> 6. OTHER CONDITIONS: <u>1</u> Inch 7. DEVIATIONS FROM ASTM F739 CHALLENGE CHEMICAL 2 1. CHEM NAME(s): <u>2-Nitropro</u> 2. CAS MUMBER(s): <u>79-46-9</u> 3. CONC. (IF MIX) <u>N/A</u> 4. CHEMICAL SOURCE: <u>Kodak reag</u> 7. TEST RESULTS 1. DATE TESTED: <u>July 8, 1986</u> 2. NUMBER OF SAMPLES TESTED: <u>T</u> 3. BREAKTHROUGH TIME: <u>N/A</u> 4. MIN DETECTABLE LIMIT <u>.59 p</u> 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: <u>18-19 mil</u> 7. SELEC: ED DATA POINTS <u>N/A</u> TIME : CONC 1 3 5 3 4 5 3 5 6 8 9 8. OTHER OBSERVATIONS:				
other side.         . TEST METHOD         1. TESTING LABORATORY: Texas         2. ANAL YTICAL METHOD: Contin         3. TEMPERATURE: 22-25°C         4. COLLECTION MEDIUM: N2         5. COLLECTION SYSTEM: N2         6. OTHER CONDITIONS: I Inch         7. DEVIATIONS FROM ASTM F739         6. OTHER CONDITIONS: I Inch         7. DEVIATIONS FROM ASTM F739         6. OTHER CONDITIONS: I Inch         7. DEVIATIONS FROM ASTM F739         6. OTHER CONDITIONS: I Inch         7. DEVIATIONS FROM ASTM F739         6. OTHER CONDITIONS: I Inch         7. DEVIATIONS FROM ASTM F739         6. OTHER CONDITIONS: I Inch         7. CHALLENGE CHEMICAL         1. CHEM NAME (s): 2-Nitropro         2. CAS MUMBER(s): 79-46-9         3. CONC. (IF MIX) M/A         4. CHEMICAL SOURCE: Kodak reag         7. TEST RESULTS         1. DATE TESTED: July 8, 1986         2. NUMBER OF SAMPLES TESTED: T         3. BREAKTHROUGH TIME: N/A         4. MIN DETECTABLE LIMIT .59 p         5. STEADY STATE PERMEATION RAT         6		red on one side	and buff	colored on the
1. TESTING LABORATORY: Texas         2. ANALYTICAL METHOD: Contin         3. TEMPERATURE: 22-25 °C         4. COLLECTION MEDIUM: N2         5. COLLECTION SYSTEM: N2         6. OTHER CONDITIONS: I Inch         7. DEVIATIONS FROM ASTM F739         CHALLENGE CHEMICAL       1         1. CHEM NAME (s): 2-Nitropro         2. CAS NUMBER(s): 79-46-9         3. CONC. (IF MIX) N/A         4. CHEMICAL SOURCE: Kodak reag         7. DEVIATIONS FROM ASTM F739         3. CONC. (IF MIX) N/A         4. CHEMICAL SOURCE: Kodak reag         7. TEST RESULTS         1. DATE TESTED: July 8, 1986         2. NUMBER OF SAMPLES TESTED: T         3. BREAKTHROUGH TIME: N/A         4. MIN DETECTABLE LIMIT .59 p         5. STEADY STATE PERMEATION RAT         6				
2. ANAL YT ICAL METHOD: Contin 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 Inch 7. DEVIATIONS FROM ASTM F739 CHALLENCE CHEMICAL 1 1. CHEM NAME (s): 2-Nitropro 2. CAS NUMBER(s): 79-46-9 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Kodak rgag 7. TEST RESULTS 1. DATE TESTED: July 8, 1986 2. NUMBER OF SAMPLES TESTED: T 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .59 p 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A TIME : CONC 1 5 6 7 8 8. OTHER OBSERVATIONS: 8. OTHER OBSERVATIONS:				
3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: I Inch 7. DEVIATIONS FROM ASTM F739 7. CHEMICAL SOLT CAL 1 1. CHEM NAME (s): 2-Nitropro 2. CAS NUMBER(s): 79-46-9 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Kodak reag 7. TEST RESULTS 1. DATE TESTED: July 8, 1986 2. NUMBER OF SAMPLES TESTED: T 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .59 p 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A TIME : CONC 1	Research Ins	titute, 9063 Ber	e Caves Ro	ad, Austin, T)
4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: I Inch 7. DEVIATIONS FROM ASTM F739 CHALLENGE CHEMICAL 1 1. CHEM NAME (s) : 2-Nitropro 2. CAS NUMBER(s): 79-46-9 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Kodak reag 5. TEST RESULTS 1. DATE TESTED: July 8, 1986 2. NUMBER OF SAMPLES TESTED: T 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .59 p 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A 1. TIME : CONC 1	uous photoic	nization detect	ion with a	11.70 eV lam
5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: I Inch 7. DEVIATIONS FROM ASTM F739 CHALLENGE CHEMICAL 1 1. CHEM NAME (s) : 2-Nitropro 2. CAS NUMBER(s): 79-46-9 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Kodak reag 5. TEST RESULTS 1. DATE TESTED: July 8, 1986 2. NUMBER OF SAMPLES TESTED: T 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .59 p 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A TIME : CONC 1 3 5 6 9 8. OTHER OBSERVATIONS:	<u> </u>			
0. OTHER CONDITIONS:       1 fnch         7. DEVIATIONS FROM ASTM F739         7. DEVIATIONS FROM ASTM F739         1. CHEM NAME (s):       2-Nitropro         2. CAS NUMBER(s):       79-46-9         3. CONC. (IF MIX)       N/A         4. CHEMICAL SOURCE:       Kodak rgag         5. TEST RESULTS       1. DATE TESTED:       July 8, 1986         2. NUMBER OF SAMPLES TESTED:       T         3. BREAKTHROUGH TIME:       N/A         4. MIN DETECTABLE LIMIT       .59 p         5. STEADY STATE PERMEATION RAT         6. SAMPLE THICKNESS:       18-19 mi1         7. SELECTED DATA POINTS N/A         1				
CHALLENGE CHEMICAL         1           1. CHEM NAME (s) :         2-Nitropro           2. CAS NUMBER(s):         79-46-9           3. CONC. (IF MIX)         N/A           4. CHEMICAL SOURCE: Kodak reag           5. TEST RESULTS           1. DATE TESTED:         July 8, 1986           2. NUMBER OF SAMPLES TESTED:           3. BREAKTHROUGH TIME:           4. MIN DETECTABLE LIMIT           5. STEADY STATE PERMEATION RAT           6. SAMPLE THICKNESS:           1. SELECTED DATA POINTS N/A           TIME           2	cells were	used./Detector 1	emperatur	e = 60C.
1. CHEM NAME (s) : 2-Nitropro         2. CAS NUMBER(s): 79-46-9         3. CONC. (IF MIX) N/A         4. CHEMICAL SOURCE: Kodak reag         7. TEST RESULTS         1. DATE TESTED: July 8, 1986         2. NUMBER OF SAMPLES TESTED: T         3. BREAKTHROUGH TIME: N/A         4. MIN DETECTABLE LIMIT .59 p         5. STEADY STATE PERMEATION RAT         6. SAMPLE THICKNESS: 18-19 mil         7. SELECTED DATA POINTS N/A         1	TETHOD: FIC	w rate to cells	was 100 c	c/min.
2. CAS NUMBER(s): 79-46-9         3. CONC. (IF MIX) N/A         4. CHEMICAL SOURCE: Kodak reag         7. TEST RESULTS         1. DATE TESTED: July 8, 1986         2. NUMBER OF SAMPLES TESTED: T         3. BREAKTHROUGH TIME: N/A         4. MIN DETECTABLE LIMIT .59 p         5. STEADY STATE PERMEATION RAT         6. SAMPLE THICKNESS: 18-19 mil         7. SELECTED DATA POINTS N/A         1	:	COMPONENT 2	:	3
3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Kodak reag TEST RESULTS 1. DATE TESTED: July 8, 1986 2. NUMBER OF SAMPLES TESTED: T 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .59 p 5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A TIME : CONC 1 3 4 5 6 7 8 9 8. OTHER OBSERVATIONS:	pane :	<u>N/A</u>		<u>N/A</u>
<ul> <li>4. CHEMICAL SOURCE: Kodak reag</li> <li>TEST RESULTS <ol> <li>DATE TESTED: July 8, 1986</li> <li>NUMBER OF SAMPLES TESTED: T</li> <li>BREAKTHROUGH TIME: N/A</li> <li>MIN DETECTABLE LIMIT .59 p</li> <li>STEADY STATE PERMEATION RAT</li> <li>SAMPLE THICKNESS: 18-19 mil</li> <li>SELECTED DATA POINTS N/A</li> </ol> </li> <li>TIME : CONC <ol> <li></li></ol></li></ul>	;	N/A		NZA
. TEST RESULTS         1. DATE TESTED: July 8, 1986         2. NUMBER OF SAMPLES TESTED: T         3. BREAKTHROUGH TIME: N/A         4. MIN DETECTABLE LIMIT .59 p         5. STEADY STATE PERMEATION RAT         6. SAMPLE THICKNESS: 18-19 mil         7. SELECTED DATA POINTS N/A         1	ent orade	N/A N/A		N/A N/A
TIME       CONC         1.	pm			
1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :         8. OTHER OBSERVATIONS:				
3: 4: 5: 6: 7: 8: 9: 10: 8. OTHER OBSERVATIONS:	ENTRATION	: CONCENTRATIO	)N : CC	NCENTRATION
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6: 7: 8: 9: 10: 8. OTHER OBSERVATIONS:		•		
6: 7: 8: 9: 10: 8. OTHER OBSERVATIONS:		<u>:</u>		
7 8 9 10 8. OTHER OBSERVATIONS:		<u>;</u>		
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10:				
8. OTHER OBSERVATIONS:		•		
. SOURCE OF DATA	uis Connar	on July 9 1094		
Samples were run by Syl	via Looper	UII UUIY 0, 1900.		

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Chemical Resistance Testing of USCG Materlal with 2-Nitropropane



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2-Nitropropane charged into cells

### DESCRIPTION OF PRODUCT EVALUATED 1.

- TYPE: Teflon laminated Nomex 1:
- PROTECTIVE MATERIAL CODE: 068 2:
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil

- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

### 2. TEST METHOD

1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX

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- 2. ANALYTICAL METHOD: Ion Chromatography on Dionex 2000.
- 3. TEMPERATURE: Ambient
- 4. COLLECTION MEDIUM: Aqueous
- 5. COLLECTION SYSTEM: Aqueous
- 5. COLLECTION SYSTEM: Aqueous 6. OTHER CONDITIONS: Z inch cells were used. 7. DEVIATIONS FROM ASTM F739 METHOD:

•	CHALLENGE CHEMICAL	1	: COMPONENT 2	3
	1. CHEM NAME(s):		<u>N/A</u>	<b>N</b> /A
	<ol> <li>CAS NUMBER(s):</li> <li>CONC. (IF MIX)</li> </ol>	20% S03	:N/A	<u> </u>
	4. CHEMICAL SOURCE	: Fisher	: <u>N/A</u>	N/A

### TEST RESULTS

3.

- 1. DATE TESTED: <u>September 22, 1986.</u> 2. NUMBER OF SAMPLES TESTED: <u>Three</u>

3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours

- 4. MIN DETECTABLE LIMIT 0.2 DDm
- 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil

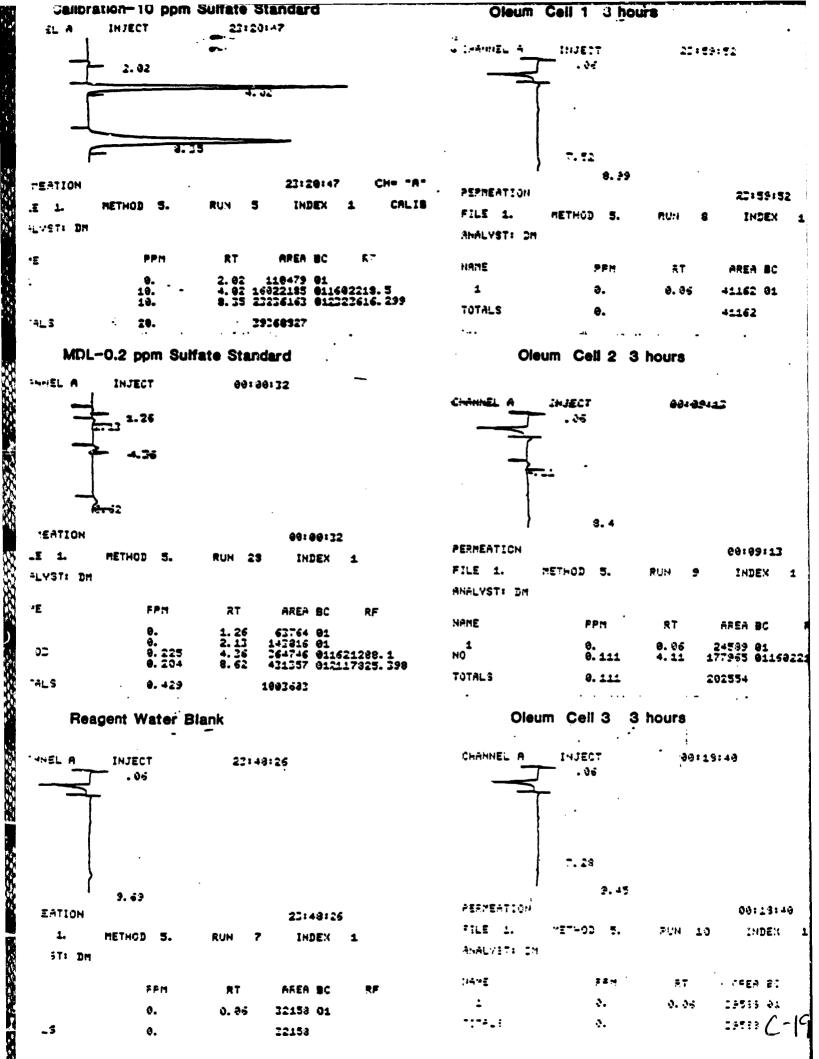
7. SELECTED DATA POINTS cell 1,2, and 3 at end of 3 hour test

1.	TIME 3 hours	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION <0.2ppm
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8.				<u> </u>			
<b>9</b> . 10.				:	·	:	

- 8. OTHER OBSERVATIONS: Retention time for 10ppm sulfate calibration standard was 8.35 minutes.
- 5. SOURCE OF DATA

Samples were run by Denise McDonald on September 22, 1986.

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### 1. DESCRIPTION OF PRODUCT EVALUATED

1:	TYPE: Teflon laminated Nomex
2:	PROTECTIVE MATERIAL CODE: 068
3:	CONDITION BEFORE TEST: Unused, no visible imperfections
4:	MANUFACTURER: Chemfab Corp.
5:	PRODUCT IDENTIFICATION: Challenge 5100
6:	LOT OR MANUFACTURER DATE: N/A
7:	NOMINAL THICKNESS: 15-20 mil
8:	DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.
1.	ST METHOD TESTING LABORATORY: <u>Texas Research Institute, 9063 Bee Caves</u> Road, Austin, TX
2.	ANALYTICAL METHOD: Continuous photoionization detection with a 10.2 eV lamp.
3.	TEMPERATURE: 22-25°C
4.	COLLECTION MEDIUM: N2
5.	COLLECTION SYSTEM: N2
6.	OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 100C.
7.	DEVIATIONS FROM ASTM F739 NETHOD: Flow rate to cells was 100cc/min.
cu e	

1. CHEM NAME(s): Parathion 2. CAS NUMBER(s): N/A N/A N/7 N/A N/A CONC. (IF MIX) 45.07% 3. N/A N/A CHEMICAL SOURCE: Agricultural Supply : 4. N/A N/A

### 4. TEST RESULTS

2.

3.

- 1. DATE TESTED: September 18, 1986
- 2. NUMBER OF SAMPLES TESTED: Three

- 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .09 ppm 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A

1.	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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<u>6</u>		•					
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### 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Denise McDonald on September 18, 1986

Chemical Resistance Testing of USCG Material with Parathion

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Switched from cells to standard gas

Paratition charged into cells

### CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD DESCRIPTION OF PRODUCT EVALUATED 1. TYPE: Teflon laminated Nomex 1: PROTECTIVE MATERIAL CODE: 068 2: 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil DESCRIPTION: Material was orange colored on one side and buff colored on the ۶. other side. 2. TEST METHOD 1. TESTING LABCRATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 2 inch cells were used./Detector Temperature = 100C. 7. DEVIATIONS FROM ASTN F739 HETHOD: Flow rate to cells were 100 cc/min. COMPONENT 2 3. CHALLENGE CHEMICAL 1 : 4 : 1. CHEM NAME (s) : PCBs 2. CAS NUMBER(s): N/A 11/X N/A N/A 3. CONC. (IF MIX) N/A : 4. CHEMICAL SOURCE: Laboratory N/A 4. TEST RESULTS 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT .02 as Benzene 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A CONCENTRATION : TIME CONCENTRATION : : 1. 2. :

CONCENTRATION

3

**N/A** 

N/A

N/A

N/A

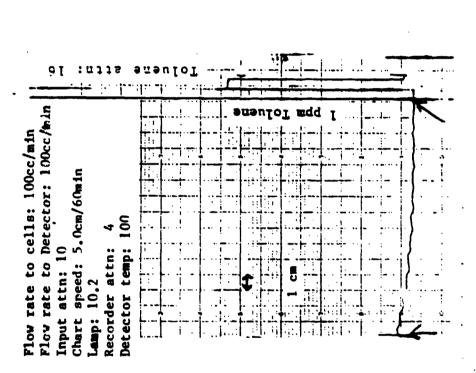
: 3. : : : • 5. 6. : 7. : : 8. : : : ••• 9. : 10. 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

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Samples were run by Denise McDonald on September 25, 1986.

Chemical Resistance Testing of USCG Material with PCBs



Switched from cells to standard gas

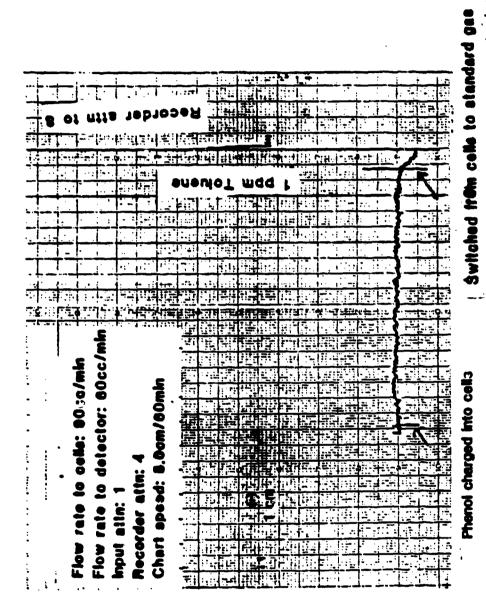
PCEs charged into cells

	CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD	
1.	DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex	
	2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections	
	4: MANUFACTURER: Chemfab Corp.	_
	5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A	
	7: NOMINAL THICKNESS: 15-20 mil	
	8: DESCRIPTION: <u>Material was buff colored</u>	
2.	TEST METHOD-	
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin	n.
	2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV	
	3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2	-
	5. COLLECTION SYSTEM: N2	
	6. OTHER CONDITIONS: 2 inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 90 cc/min	_
3.	CHALLENGE CHEMICAL 1 : CHIPPONENT 2 : 3	
	1. CHEM NAME(s) : Phenol : N/A : N/A	
	2. CAS NUMBER(s): 108-95-2 : N/A : N/A	_
	3. CONC. (IF MIX) 89% (11% H20) : N/A : N/A	
	4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A reagent grade : N/A : N/A	
4.	îEST RESULTS	•
	1. DATE TESTED: April 8, 1986	
	2. NUMBER OF SAMPLES TESTED: Three	
	3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm	
	5. STEADY STATE PERMEATION RATE N/A	
	6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A	
-	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATIO	ON
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	9: 10:	_
	8. OTHER OBSERVATIONS:	
5.	SOURCE OF DATA Samples were run by Karen Verschoor on April 8, 1986	•
<b>d:</b> :	14	

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## Chemical Resistance Testing of USCG Material with Phenol



### 1. DESCRIPTION OF PRODUCT EVALUATED

1: TYPE: Teflon laminated Nomex PROTECTIVE MATERIAL CODE: 068 2: 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Ion Chromatography on Dionex 2000.
- 3. TEMPERATURE: Ambient
- 4. COLLEC ON MEDIUM: Aqueous
- 5. COLLECTION SYSTEM: Aqueous 6. OTHER CONDITIONS: 2 inch cells were used.
- 7. DEVIATIONS FROM ASTM F739 METHOD:

3.	CHALLENGE CHEMICAL	1	: COMPONENT 2	: 3
	1. CHEM NAME(s) :	Phosphoric Acid	N/A	N/A
	2. CAS NUMBER(s):	7664-38-2	: N/A	. N/A
		85%	-: N/A	-: N/A
	4. CHEMICÁL SOURCE	: Allied Chemical		_:N/A

### TEST RESULTS 4.

- 1. DATE TESTED: September 29, 1986
- 2. NUMBER OF SAMPLES TESTED: Three
- 3. BREAKTHROUGH TIME: N/A
- 4. MIN DETECTABLE LIMIT 0.5 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil.
- 7. SELECTED DATA POINTS Cell 1,2, and 3 at end of three hour test

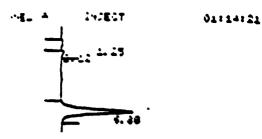
1.	TIME 3 hours	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION	
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### 8. OTHER OBSERVATIONS: Retention time for 10ppm phosphate calibration standard was 6.88 minutes.

5. SOURCE OF DATA

Samples were run by Denise McDonald September 29, 1986.

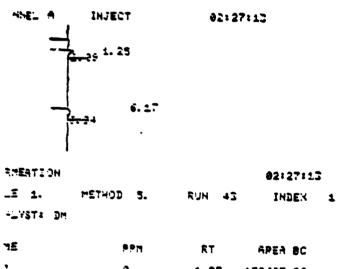
### Calibration-10 ppm Phosphate Standard



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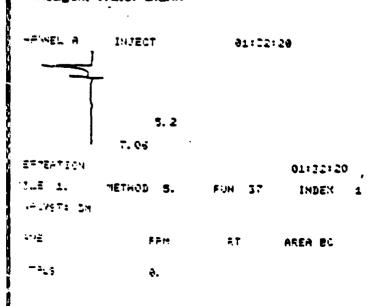
### IDL-0.5 ppm Phosphate Standard



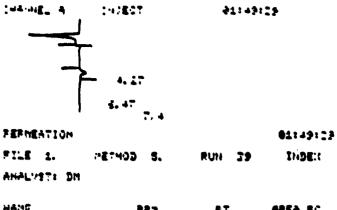
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RF

Reagent Water Blank



### Phosphoric Acid Cell 1 3 hours -

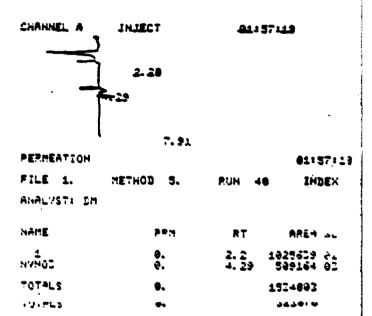


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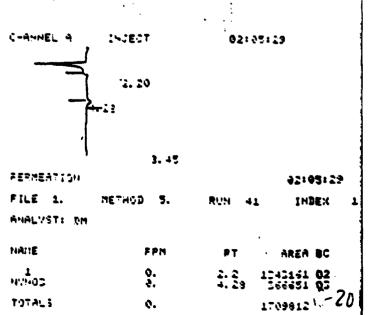
**.**.

Phosphoric Acid Cell 2 3 hours

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Phosphoric Acid Cell 3 3 hours



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### 1. DESCRIPTION OF PRODUCT EVALUATED

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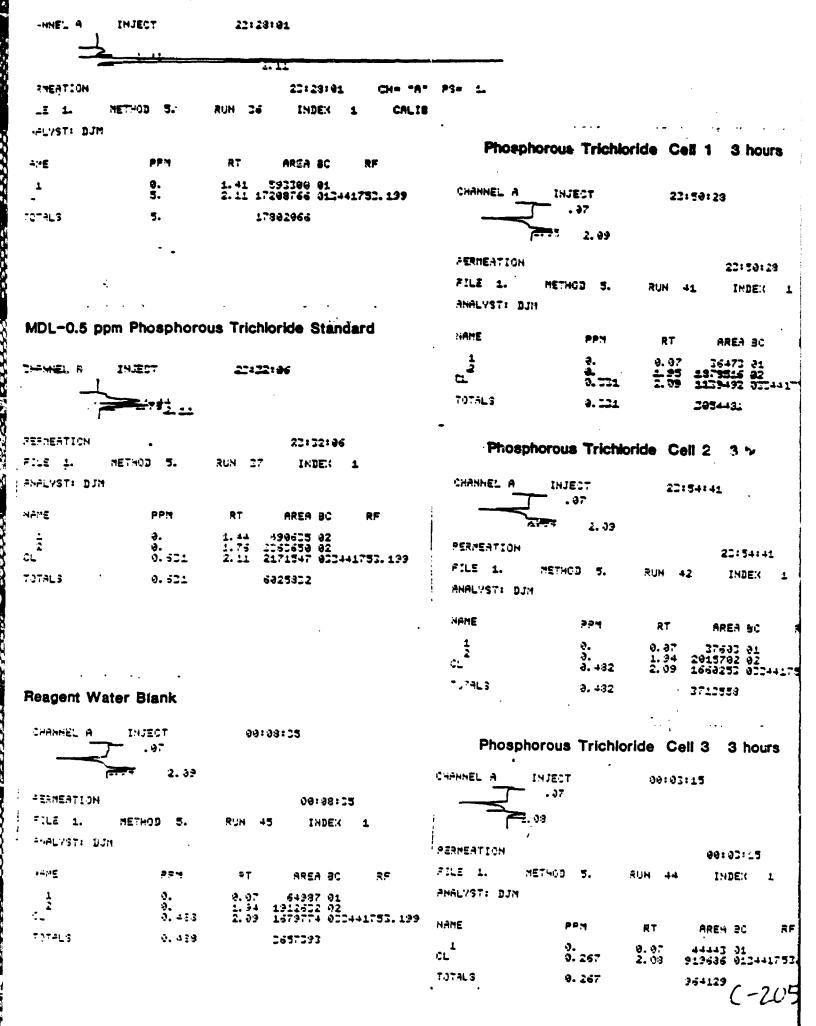
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was grange colored on one side and buff colored on the
	8: DESCRIPTION: <u>Material was orange colored on one side and buff colored on the</u> other side.
•	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Ion Chromatography on Dionex 2000. 3. TEMPERATURE: Ambient
	4. COLLECTION MEDIUM: Aqueous
	5. COLLECTION SYSTEM: Aqueous
	6. OTHER CONDITIONS: 2 inch cells were used.
	7. DEVIATIONS FROM ASTN F739 NETHOD:
•	CHALLENGE CHEMICAL 1° : COMPONENT 2 : 3
	1. CHEM NAME (s) : Phosphorous Dxychits: N/A : N/A
	ride : N/A : N/A
	2. CAS NUMBER(s): 10025-87-3 : N/A : N/A 3. CONC. (IF MIX) 99% : N/A : A/A
	3. CONC. (IF MIX) 99% : N/A : A/A 4. CHEMICAL SOURCE: Alrich : N/A : N/A
	<ol> <li>DATE TESTED: October 7, 1986</li> <li>NUMBER OF SAMPLES TESTED: Three</li> <li>BREAKTHROUGH TIME: No breakthrough observed after 3 hours.</li> <li>MIN DETECTABLE LIMIT 0.5 ppm</li> <li>STEADY STATE PERMEATION RATE N/A</li> <li>SAMPLE THICKNESS: 19-20 mils</li> </ol>
	7. SELECTED DATA POINTS <u>Cells 1,2</u> , and 3 after 15 minutes and at end of 3 hour test.
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	1.       15 minutes :       <0.5 ppm (.204) :
	3:
	4: : :
	5
	7
	9.
	10.
	8. OTHER OBSERVATIONS: Retention time for Phophorous Oxychloride standard was 2.03
	minutes. Fifteen minute samples were run to establish chloride background levels within each cell.
	SOURCE OF DATA
	Samples were ran by Denise McDonald on October 7, 1986.
	/ -

	1.0.							
F	4+ Va		22: 59: 39	CHe 144	250 1.			
IATION	ETHOD 5.	RUN 55	INDEX 1	CALIS-				
, 24 III ,VSTA DJH					Phoenh	orous Oxychia	, side Cal	
•				_				
1	PPH		REA BC RI		CHANNEL A	INJECT	2]:(	<b>16</b> 137
	9. 3.	2.03 13759	1332 02 1026 03235181	9. 139		2. 34		
· 4L3	5.	13913	1739		PERMEATION			
					FILE 1.	NETHOD S.	RUN 34	23:06:37
	••		•		ANALYST: 33		RUN 33	r (h***
-	•				NAME		•	
	· •		· ·		• <b>1</b>	PP14 0.	RT	AREA BC
MDL-0.5 pi	om Phosphor	ous Oxychk	oride Standa	rđ	2 CL	8. 8. 278	0.06 1.91 2.34	191735 01 1935338 02
					TUTALS	4.273	<b>6</b> 4 <b>4</b> 4	1097903 0325: 1097903 0325:
	INJECT	2:1381	יז			· ·		
	- 2.82				Phosphore	xus <sup>°</sup> Oxychlorid	e Cell 2	3 tours
REATION			22158157			• `	_	
	NETHOD S.	<del>R</del> UN 57	INDEX 1			INJECT	يداجع	:12
HALYST: DJM						• . 97		
9ME	PPA	RT	AREA BC	RF				
•••	0. 423		10513 0139518 HMEN 00		PERMEATION			23:11:12
TALS	0. 429		99513		FILE 1. Amalysti DJN	METHOD 5.	run 67	INDEX :
					2MAins	FP4	RT	AREA BC
						9. 0. 0. 424	0.37 1.9 1 2.94 1	69653 01 974102 02 977099 05295
					11 7)74L3	0. 424 2. 424		611351 611351
Reage	nt Water Bla	Ink				44 - <b>6</b> 4	•	
•= •				•	Phoenhor	ous Oxychlori		3 3 hours
THANNEL A	INJECT	22192	: 42					
	. 97				CHANNEL A	INJECT	22+19	5+15
<del>ہے</del> ۔	2.75					96		
PERMERTION	<b>-</b>		23:02:42		<del>مر _</del>	£. 94		
	METHOD 5.	RUN 53	INDEX	1	Hoitebred	;		23+15+15
+#LYST: DJ:	1				FILE 1.	NETHOD 5.	RUN SI	INDEX
4IFE	PPn	RT	AREA SC	RF	ANALVSTI DUN			
1	٥.	9. 07	74430 01		54 SMP			ADEX AF
TAL S	٦.		74430		name 1	PPN 4.	RT 0.06	AREA 80 141439 01
					ÇL	0.177	0.05 2.04	-98330 01399
				•	TOTALS	9. 177		929978
								C-2.

### 1. DESCRIPTION OF PRODUCT EVALUATED

	1: 2: 3: 4: 5: 6: 7: 8:	LOT OR MANL NOMINAL THI	MATERIA BEFORE T IR: Che INTIFICA IFACTURE ICKNESS: I: Mate	L CUDE: 068 EST: Unused, no v mfab Corp. TION: Challenge 5 R DATE: N/A 15-20 mil		and buff colored on the
2.	1. 2. 3. 4. 5.	ANAL YT ICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	METHOD: : Ambie MEDIUM: SYSTEM: TIONS:	Ion Chromatograp nt Aqueous	hy on Dionex 2000	e Caves Road, Austin, X
3.	CHAL	LLENGE CHEMI	CAL	1	COMPONENT 2	: 3
	1.	CHEM NAME ( s	;): Ph	osphorous Trichler	N/A	: N/A
		•	ri	de	N/A	: N/A
		CAS NUMBER (		19-12-2	N/A	
		CONC. (IF N			: <u>N/A</u>	
	4.	CHEMICAL SC	JURCE: AT	aricn	<u> </u>	<u> </u>
	2. 1 3. 1 4. 1 5. 9	NUMBER OF SA BREAKTHROUGH MIN DETECTAB STEADY STATE SAMPLE THICK	MPLES TI I TIME: BLE LIMI I PERMEAT INESS:	No breakthrough w 0.5 ppm TION RATE N/A		
	١	TIME 1. 3 hour	:	CONCENTRATION	: CONCENTRATION: CO.2 ppm	DN : CONCENTRATION : <0.2 ppm
		2.	<u> </u>			. w.e hhii
		3	:			•
		•				
		5			:	
		5				
		3			•	•
		5			······································	<del></del>
					· · · · · · · · · · · · · · · · · · ·	••••••••••••••••••••••••••••••••••••••
	8. (			Retention time f		ous Trichloride
5.	sour	RCE OF DATA	es were	run by Denise McD	onald on Septembe	r 30, 1986.

### libration-5 ppm Phosphorous Trichloride

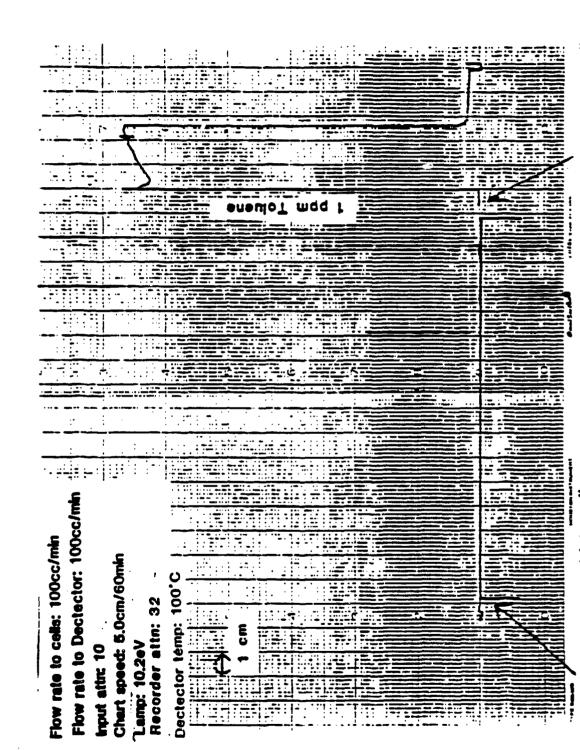


### 1. DESCRIPTION OF PRODUCT EVALUATED

3:	PROTECTIVE MATERIAL CODE CONDITION BEFORE TEST.		le imperfectio	ns	
4:	MANUFACTURER: Chemfab C	orp.			
5:					
6:	LOT OR MANUFACTURER DATE	: N/A			
7:					
8:		as orange colore	d on one side	and bu	ff colored on the
	other side.				
TE	ST METHOD		•		
1.					
2.		inuous photoioni	zation detecti	on wit	h a 10.20 eV lamp
3.					
4.					
5.		ab ealle	ad /Desater m		August = 1000
6.					
7.			FALE TO CELLS	WES IU	
CH	ALLENGE CHEMICAL	1 :	COMPOMENT 2	:	3
1.	CHEM NAME(s) : Propioni	c Acid :	N/A	:	N/A
2.	CAS NUMBER(s): 79-09-4	:	N/A		N/A
	CONC. (IF MIX) N/A		N/A		N/A
4.		reagent :	N/A		N/A
	grade	······································	N/A		N/A
1. 2. 3.	ST RESULTS DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br	Three	bserved after	3 hour	S
1. 2. 3. 4. 5.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R	Three eakthrough was c ATE N/A	bserved after	3 hour	3.
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A	Three eakthrough was c ATE N/A mil	bserved after	3 hour	3.
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO	Three eakthrough was c ATE N/A mil	Observed after		CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1	Three eakthrough was c ATE <u>N/A</u> mil			
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1. : 2. :	Three eakthrough was c ATE N/A mil NCENTRATION : :			
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1. : 2. : 3. :	Three eakthrough was c ATE N/A mil NCENTRATION : : :			
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1	Three eakthrough was c ATE N/A mil NCENTRATION : :			
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1	Three eakthrough was c ATE N/A mil NCENTRATION : : : : : :			
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1	Three eakthrough was c ATE N/A mil NCENTRATION : : :			
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1	Three eakthrough was c ATE N/A mil NCENTRATION : : : : : : : : : : : : : : : : : : :			
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1	Three eakthrough was c ATE N/A mil NCENTRATION : : : : : :			
1. 2. 3. 4. 5. 6.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	Three eakthrough was c ATE N/A mil NCENTRATION : : : : : : : : : : : : : : : : : : :			
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNZSS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : 7. : 10. :	Three eakthrough was c ATE N/A mil NCENTRATION : : : : : : : : : : : : : : : : : : :			
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	Three eakthrough was c ATE N/A mil NCENTRATION : : : : : : : : : : : : : : : : : : :			
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1	Three eakthrough was c ATE N/A mil NCENTRATION : : : : : : : : : : : : : : : : : : :			
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1	Three eakthrough was c ATE N/A mil NCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATIO		
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: July 25, 19 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: No br MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION R SAMPLE THICKNESS: 18-19 SELECTED DATA POINTS N/A TIME : CO 1	Three eakthrough was c ATE N/A mil NCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATIO		

C-206

Chemical Resistance Testing of USCG Material with Propionic Acid



Switched from cells to standard gas

Propionic Acid charyed into cells

# 1. DESCRIPTION OF PRODUCT EVALUATED

		£1 1			
1			ninated Nomex	· · · · · · · · · · · · · · · · · · ·	
2	• • • • • • • •		AIAL CODE: 068		
-			TEST: Unused, no vi	isible imperfections	
•	•		Chemfab Corp.		
5			CATION: Challenge 51	100	
6			JRER DATE: N/A		
			S: 15-20 mil		
8	: DESCRIPT other s		terial was orange col	lored on one side an	d buff colored on the
T	EST METHOD			· ·	
			DRY: Texas Research Li		
-			D: Continuous photo:	ionization detection	with a 10.20 eV lam
	. TEMPERAT				
	. COLLECTI				
	. COLLECTI				
			S: 1 inch cells were		
7	. DEVIATIO	NS FROM	ASTM F739 METHUD: F	low rate to cells wa	s 100 cc/min.
	HALIENCE CH	EMICAL	1 :	COMPONENT 2	: 3
1.	- CHEM NAM	E(s):	n-Propyl Alcohol	: : N/A	: : N/A
2	. CAS NUMB		71-23-8	: N/A	: N/A
	. CONC. (I		N/A	: N/A	: N/A
4		-	Aldrich reagent	: N/A	: N/A
1	EST RESULTS . DATE TEST	ED: Ju	grade ly 28, 1986	:N/A	: N/A
1 2 3 4 5	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER	grade ly 28, 1986 S TESTED: Three E: No breakthrough wi IMIT .76 ppm MEATION RATE N/A	: <u>N/A</u>	:N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS	grade ly 28, 1986 5 TESTED: Three E: No breakthrough wi IMIT .76 ppm MEATION RATE N/A : 18-19 mil	: <u>N/A</u>	:N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS	grade ly 28, 1986 5 TESTED: Three E: No breakthrough wi IMIT .76 ppm MEATION RATE N/A : 18-19 mil	: <u>N/A</u>	:N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM	ED: Ju SAMPLES DUGH TIM TABLE LI ATE PERI ICKNESS DATA POI	grade ly 28, 1986 5 TESTED: Three E: No breakthrough wi IMIT .76 ppm MEATION RATE N/A : 18-19 mil	: <u>N/A</u>	:N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1.	ED: Ju SAMPLES DUGH TIM TABLE LI ATE PERI ICKNESS DATA POI	grade ly 28, 1986 S TESTED: <u>Three</u> E: No breakthrough wi IMIT .76 ppm MEATION RATE <u>N/A</u> : 18-19 mil INTS <u>N/A</u>	: N/A as observed after 3	: N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1. 2.	ED: Ju SAMPLES DUGH TIM TABLE LI ATE PERI ICKNESS DATA POI	grade ly 28, 1986 S TESTED: <u>Three</u> E: No breakthrough wi IMIT .76 ppm MEATION RATE <u>N/A</u> : 18-19 mil INTS <u>N/A</u>	: N/A as observed after 3	: N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1. 2. 3.	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: Three E: No breakthrough wa IMIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION	: N/A as observed after 3	: N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1. 2. 3. 4.	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: <u>Three</u> E: No breakthrough we IMIT .76 ppm MEATION RATE <u>N/A</u> : 18-19 mil INTS <u>N/A</u> : CONCENTRATION	: N/A as observed after 3	: N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1. 2. 3. 4. 5.	ED: Ju SAMPLES DUGH TIM TABLE L TATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: Three E: No breakthrough with MIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION	: N/A as observed after 3	: N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1. 2. 3. 4. 5. 6.	ED: Ju SAMPLES DUGH TIM TABLE L TATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: <u>Three</u> E: No breakthrough wa IMIT .76 ppm MEATION RATE <u>N/A</u> : 18-19 mil INTS <u>N/A</u> : CONCENTRATION	: N/A as observed after 3	: N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1. 2. 3. 4. 5. 6. 7.	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: Three E: No breakthrough with MIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION : :	: N/A as observed after 3	: N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1 3 4 5 6 8	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: Three E: No breakthrough with MIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION	: N/A as observed after 3	: N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1 3 4 5 6 9	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: Three E: No breakthrough with MIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION : :	: N/A as observed after 3	: N/A
1 2 3 4 5 6	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1 3 4 5 6 8	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: Three E: No breakthrough with MIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION : :	: N/A as observed after 3	: N/A
1 2 3 4 5 6 7	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1 3 4 5 6 9	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: Three E: No breakthrough wait IMIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION : : : : : : : : : : : : :	: N/A as observed after 3	: N/A
1 2 3 4 5 6 7	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS DATA PO E	grade ly 28, 1986 S TESTED: Three E: No breakthrough wait IMIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION : : : : : : : : : : : : :	: N/A as observed after 3	: N/A
1 2 3 4 5 6 7	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	ED: Ju SAMPLES DUGH TIM TABLE LI ATE PERI ICKNESS DATA POI E	grade ly 28, 1986 S TESTED: Three E: No breakthrough wait IMIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION : : : : : : : : : : : : :	: N/A as observed after 3	: N/A
1 2 3 4 5 6 7	EST RESULTS DATE TEST NUMBER OF BREAKTHRO MIN DETEC STEADY ST SAMPLE TH SELECTED TIM 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBS OURCE OF DA	ED: Ju SAMPLES DUGH TIM TABLE L ATE PER ICKNESS DATA PO E E E E E E E E E E E E E E E E E E E	grade ly 28, 1986 S TESTED: Three E: No breakthrough wait IMIT .76 ppm MEATION RATE N/A : 18-19 mil INTS N/A : CONCENTRATION : : : : : : : : : : : : :	: N/A as observed after 3 : CONCENTRATION : : : : : : : : : : : :	: N/A

C-208

Chemical Resistance Testing of USCG Material with n-Propyl Alcohol Chemical Bonint--

	bbw Lowene		
<u></u>			
·			
- <u>-</u>			
cc/n			
180 c	' U		
Flow rate to cella: 100cc/min Flow sate to Dectector: 100cc/mi Imput attn: 10 Chart speed: 6.0cm/80min Lamp: 10.2eV	Dectector temp: 100°C	R	¢. 0
Flow rate to c Flow rate to 1 Input attn: 10 Chart speed: 1 Lamp: 10.2eV			

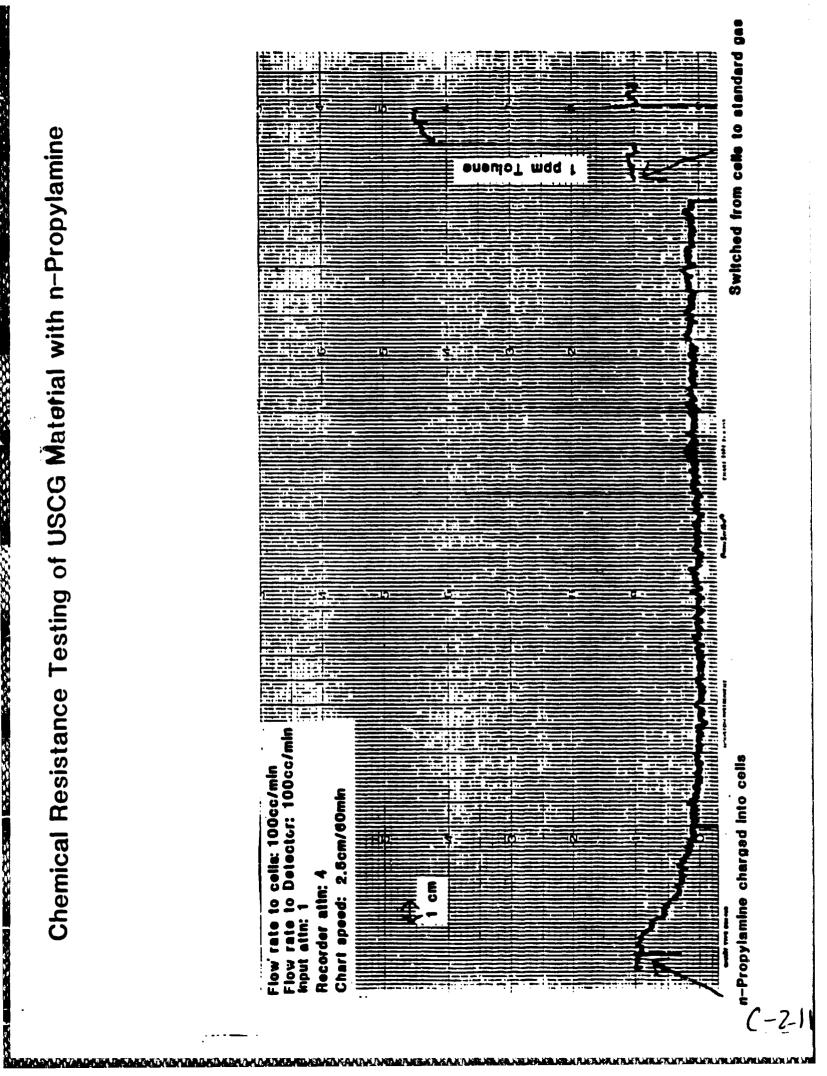
(-209

ard gee

# 1. DESCRIPTION OF PRODUCT EVALUATED

	TEST METHOD			
			nstitute, 9063 Bee Cave	
	2. ANALYTICAL METHO 3. TEMPERATURE: 22-		ionization detection wi	th a 11.70 eV lamp.
	4. COLLECTION MEDIU			
	5. COLLECTION SYSTE			
			e used. /Detector Temp	
	7. DEVIATIONS FROM	ASTM F739 METHOD: F:	low rate to cells was l	.00 cc/min.
ł	CHALLENGE CHEMICAL	1 :	COMPONENT 2 :	3
			1 I N / A	N7 / A
	1. CHEM NAME(s): 2. CAS NUMBER(s):		<u>N/A</u> :	<u> </u>
	3. CONC. (IF MIX)		N/A :	<u> </u>
	4. CHEMICAL SOURCE:		N/A :	N/A
		grade	: <u>N/A</u> :	N/A
	3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI	: No breakthrough was MIT .74 ppm	s observed after 10.2 h	10015.
	5. STEADY STATE PERM 6. SAMPLE THICKNESS:	EATION RATE N/A 18-19 mil		
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI	EATION RATE N/A 18-19 mil NTS N/A	: CONCENTRATION :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS:	EATION RATE N/A 18-19 mil	: CONCENTRATION : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1; 2;	EATION RATE N/A 18-19 mil NTS N/A	: CONCENTRATION : : : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1	EATION RATE N/A 18-19 mil NTS N/A	: CONCENTRATION : : : : : : : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME 1. 2. 3. 4.	EATION RATE N/A 18-19 mil NTS N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME 1. 2. 3. 4. 5.	EATION RATE N/A 18-19 mil NTS N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME 1. 2. 3. 4.	EATION RATE N/A 18-19 mil NTS N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1 2 3 4 5 6	EATION RATE N/A 18-19 mil NTS N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME 1. 2. 3. 4. 5. 5. 6. 7. 8. 9.	EATION RATE N/A 18-19 mil NTS N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1	EATION RATE N/A 18-19 mil NTS N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME 1. 2. 3. 4. 5. 5. 6. 7. 8. 9.	EATION RATE N/A 18-19 mil NTS N/A CONCENTRATION	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	EATION RATE N/A 18-19 mil NTS N/A CONCENTRATION	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION

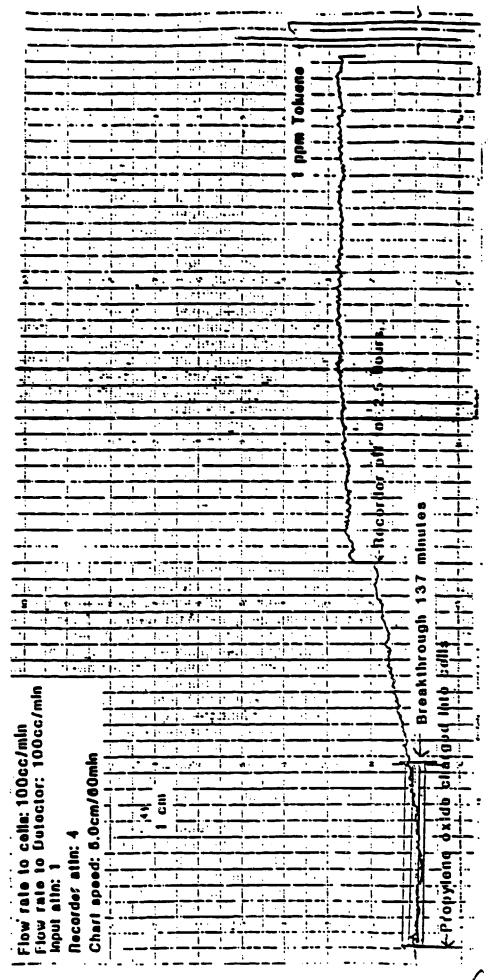




# 1. DESCRIPTION OF PRODUCT EVALUATED

2.	1. 2. 3.	METHOD TESTING LABORATO ANALYTICAL METHO TEMPERATURE: 22-	RY: Texas Research In		
	2. 3.	ANALYTICAL METHO	RY: Texas Research In		
	3.	TEMPERATURE . 22-	D: Continuous photoj	stitute, 9063 Bee Car onization detection	ves Road, Austin, TX
	4.		25 °C		
	2	COLLECTION MEDIU			
	5. 6.	COLLECTION SYSTE	: <u>2 inch cells were u</u>	sed. / Detector Temper	
	7.	DEVIATIONS FROM	ASTM F739 METHOD: F	low rate to cells was	s 100 cc/min
3.		LENGE CHEMICAL	1 :	COMPONENT 2	: 3
5.					
			Propylene Dxide :	<u>N/A</u>	<u>N/A</u>
	3.	CAS NUMBER(s): CONC. (IF N'X)	16088-62-3 N/A	<u>N/A</u>	N/A N/A
	4.	CHEMICAL SOURCE:		N/A	N/A
4.		RESULTS	reagent grade :	N/A	N/A
	5.S	IN DETECTABLE LI TEADY STATE PERM	EATION RATE 1.43 ug/	cm <sup>2</sup> x hour.	
	5.S 6.S	IN DETECTABLE LI	MIT 0.68 ppm. EATION RATE 1.43 ug/ 18-20 mil	cm <sup>2</sup> x hour.	
	5.S 6.S	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS:	MIT 0.68 ppm. EATION RATE 1.43 ug/ 18-20 mil	cm <sup>2</sup> x hour. : CONCENTRATION :	CONCENTRATION
	5.S 6.S	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI	MIT 0.68 ppm. EATION RATE <u>1.43 ug/</u> <u>18-20 mil</u> NTS <u>N/A</u>		CONCENTRATION
	5.S 6.S	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI	MIT 0.68 ppm. EATION RATE <u>1.43 ug/</u> <u>18-20 mil</u> NTS <u>N/A</u>		CONCENTRATION
	5.S 6.S	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI	MIT 0.68 ppm. EATION RATE <u>1.43 ug/</u> <u>18-20 mil</u> NTS <u>N/A</u>		CONCENTRATION
	5.S 6.S	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI	MIT 0.68 ppm. EATION RATE <u>1.43 ug/</u> <u>18-20 mil</u> NTS <u>N/A</u>		CONCENTRATION
	5.S 6.S	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI	MIT 0.68 ppm. EATION RATE <u>1.43 ug/</u> <u>18-20 mil</u> NTS <u>N/A</u>		CONCENTRATION
	5.S 6.S	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI	MIT 0.68 ppm. EATION RATE <u>1.43 ug/</u> <u>18-20 mil</u> NTS <u>N/A</u>		CONCENTRATION
	5. S 6. S 7. S 1 2 3 4 5 6 7 8 9	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI TIME :	MIT 0.68 ppm. EATION RATE <u>1.43 ug/</u> <u>18-20 mil</u> NTS <u>N/A</u>		CONCENTRATION
	5. S 6. S 7. S 1 2 3 4 5 6 7 8 9 1	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI TIME 	MIT 0.68 ppm. EATION RATE 1.43 ug/ 18-20 mil NTS N/A CONCENTRATION		CONCENTRATION
	5. S 6. S 7. S 1 2 3 4 5 6 7 8 9 1	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI TIME :	MIT 0.68 ppm. EATION RATE 1.43 ug/ 18-20 mil NTS N/A CONCENTRATION		CONCENTRATION
-	5. S 6. S 7. S 1 2 3 4 5 6 7 8 9 1 8. 0	IN DETECTABLE LI TEADY STATE PERM AMPLE THICKNESS: ELECTED DATA POI TIME 	MIT 0.68 ppm. EATION RATE 1.43 ug/ 18-20 mil NTS N/A CONCENTRATION		CONCENTRATION

Permeation of Propylene Oxide through USCG Material Composite Run



(-213

# 1.

		UNC	SATCAR PROTECTIVE C	COTHING PRODUCT ETALUATI	UN RECURD
1.	DES	CRIPTION OF PR	RODUCT EVALUATED		
	3: 4: 5: 6:	PROTECTIVE MA CONDITION BEF MANUFACTURER: PRODUCT IDENT LOT OR MANUFA NOMINAL THICK	Chemfab Corp. IFICATION: Challe ACTURER DATE: N/A (NESS: 15-20 mil Material was oran	no visible imperfection enge 5100 nge colored on one side a	
2.	TES	T METHOD			
	2. 3. 4. 5. 6.	ANALYTICAL ME TEMPERATURE: COLLECTION ME COLLECTION SY OTHER CONDITI	THOD: <u>Continuous</u> 22-25°C DIUM: N <sub>2</sub> /STEM: N <sub>2</sub> IONS: 2 inch cell	was used./ Detector Tem D: Flow rate to cell wa	n with a 11.7 eV lamp.
3.		LLENGE CHEMICA	L 1	: CONPONENT 2	: 3
	2.	CAS NUMBER(s) CONC. (IF MIX	: Propylene Oxide : 75-56-9 () N/A :CE:Aldrich reagent grade	:N/A	: N/A : N/A : N/A : N/A : N/A
4.	1. 1 2. 1 3. 1 4. 1 5. 2	BREAKTHROUGH T MIN DETECTABLE STEADY STATE P	LES TESTED: One ( IME: 170 min. LIMIT 1.01 ppm. PERMEATION RATE 1. SS: 19 mil.		
		TIME 1	: CONCENTRA	TION : CONCENTRATION	: CONCENTRATION
		2.	÷		:
		3	• •		
	4				
		·			
		· ·	•	•	· · · · · · · · · · · · · · · · · · ·
	S	7	•	• •	•
		8	•		•
	j	io	•	·	:
				· · · · · · · · · · · · · · · · · · ·	
	8. (	OTHER OBSERVAT	'IONS:		

5. SOURCE OF DATA

Sample was run by Sylvia Cooper on June 10, 1986.

Permeation of Propylene Oxide through USCG Material

Run I

Switched from cells to standard gas 66 Breakthrough 170 mint Propylene Oxide charged into cells Flow rate to cslis: 100cc/min Ficw rate to Detector: 100cc/min Input sin: 1 Chart speed: 5.0cm/80min Recorder attn: 4 Lamp: 11.7eV 

C-215

# 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A
- 7: NOMINAL THICKNESS: 19-20 mil
- 8: DESCRIPTION: <u>Material was orange colored on one side and buff colored on the</u> other side.

2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.
  - 3. TEMPERATURE: 22-25°C
  - 4. COLLECTION MEDIUM: N2
  - 5. COLLECTION SYSTEM: N2
  - 6. OTHER CONDITIONS: 1 inch cell was used. /Detector Te perature = 60C.
- 7. DEVIATIONS FROM ASTM F739 METHOD: Ficw rate to cell was 100 cc/min.

3.	CHALLENCE CHEMICAL	1	:	COMPORENT 2	:	3	
	1. CHEM NAME(s) :	Propylene Oxide	:	N/A	:	N/A	
	2. CAS NUMBER(s):	75-56-9		N/A		N/A	
	3. CONC. (IF MIX)	N/A -		N/A	· · · · · · · · · · · · · · · · · · ·	N/A	
	4. CHEMICAL SOURCE	Aldrich		N/A	;	N/A	

4. TEST RESULTS

- 1. DATE TESTED: 1-30-87
- 2. NUMBER OF SAMPLES TESTED: One (Run II)
- 3. BREAKTHROUGH TIME: 195 minutes
- 4. MIN DETECTABLE LIMIT .13 ppm
- 5. STEADY STATE PERMEATION RATE 1.10 (ug/cm2\*hr)
- 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS N/A

TIME :	CONCENTRATION	: CONCENTRATION	:	CONCENTRATION
		:	:	
		:	:	
:		:	:	
		:	;	
		:	:	
		:	;	
		:	:	
:		:	:	
:		:	:	
:		:	;	

# 8. OTHER OBSERVATIONS:

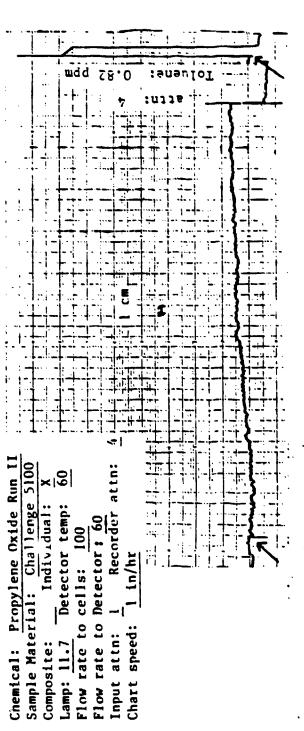
5. SOURCE OF DATA

Sample was run by Denise McDonald on January 30, 1987.

[-2]

Chemical Resistance Testing of Challenge 5100

# Propylene Oxide Run II



Switthed from cells to standard gas

Propylene Oxide charged into cella

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# 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A
- 7: NOMINAL THICKNESS: 19-20 mil
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

# 2. TEST METHOD

# 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX

2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.

- 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: N2
- 5. COLLECTION SYSTEM: N2

6. OTHER CONDITIONS: 1 inch cell was used. /Detector Temperature = 60C.

7. DEVIATIONS FROM ASTM F739 METHOD: Flew rate to cell was 100 cc/min-

: CHA	LLENGE CHEMICAL	L	:	COMPONENT 2	:	3	
1.	CHEM NAME(s) :	Propylene Oxide	•	N/A	<b>:</b>	N/A	_
	CAS NUMBER(s):		-:-	N/A	:	N/A	
з.	CONC. (IF MIX)	N/A	-:-	N/A		N/A	
4.	CHEMICAL SOURCE		_:_	N/A		N/A	

# 4. TEST RESULIS

J.

- 1. DATE TESTED: 2-09-87
- 2. NUMBER OF SAMPLES TESTED: One (Run III)
- 3. BREAKTHROUGH TIME: 169 minutes
- 4. MIN DETECTABLE LIMIT .13 ppm
- 5. STEADY STATE PERMEATION RATE \_\_\_\_\_\_. 67 (ug/cm2\*hr)
- 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A
  - TIME CONCENTRATION CONCENTRATION : CONCENTRATION : 2 1. : : : 2. : : : 3. : : : : : 4. : 5. : : : : 6. : : 7. : : : 8. : : : 9. : : : 10. . : :

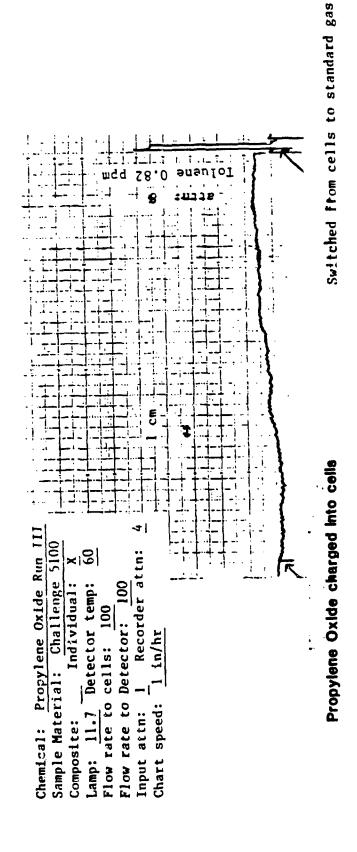
# 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Sample was run by Denise McDonald on February 9, 1987.

Chemical Resistance Testin of Challenge 5100

# Propylene Oxide Run III



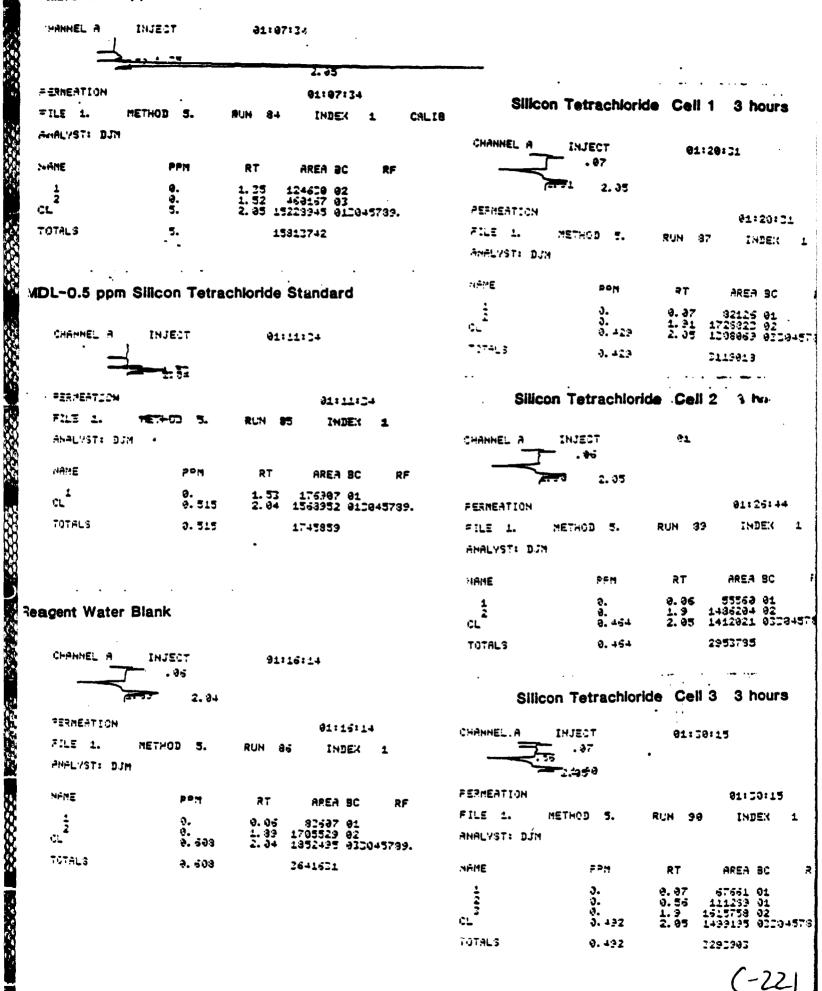
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# 1. DESCRIPTION OF PRODUCT EVALUATED

A CLARKER CLAUDER CORPORATION CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONT

5 6 7 8	: LOT OR MAN	NUFACTURER HICKNESS: ON: <u>Mater</u>		ored on one side and l	buff colored on the
T	EST METHOD				
	ANALYTICA TEMPERATU	L METHOD: RE: <u>Ambier</u> N MEDIUM:	Ion Chromatograph it Aqueous	stitute, 9063 Bee Cave y on Dionex 2000.	es Road, Austin, TX
	. COLLECTIO	N SYSTEM:	Aqueous 2 inch cells were		
	DEVIATION	IS FROM AST	M F739 METHOD:		·····
. C	HALLENGE CHE	MICAL	1 :	COMPONENT 2 :	3
1	- CHEM NAME		icon Tetrachlo-	N/A	N/A
~		ric		N/A :	N/A
2	. CAS NUMBER	- (S): 100 M'X) 997		<u>N/A</u> :	N/A N/A
4	CHEMICAL :	SOURCE : AT C	irich :	<u>N/A</u> :	N/A
		SAMPLES TE IGH TIME: ABLE LIMIT	STED: <u>Three</u> No breakthrough wa 0.5 ppm ION RATE N/A	s observed after 3 ho	urs.
3 4 5 6	. MIN DETECTA . STEADY STA . SAMPLE THI	CKNESS: 1	9-20 mil Cells 1,2, and 3	at end of three hour	test
3 4 5 6	MIN DETECTA STEADY STA SAMPLE THIG SELECTED DA TIME	CKNESS: 1 ATA POINTS	Cells 1,2, and 3 CONCENTRATION	: CONCENTRATION :	CONCENTRATION
3 4 5 6	. MIN DETECTA . STEADY STA . SAMPLE THI . SELECTED DA TIME 1. 3 ho	CKNESS: 1 ATA POINTS	Cells 1,2, and 3		
3 4 5 6	MIN DETECTA STEADY STA SAMPLE THIG SELECTED DA TIME	CKNESS: 1 ATA POINTS	Cells 1,2, and 3 CONCENTRATION	: CONCENTRATION :	CONCENTRATION
3 4 5 6	MIN DETECT. STEADY STA SAMPLE THI SELECTED D TIME 1 3 4	CKNESS: 1 ATA POINTS	Cells 1,2, and 3 CONCENTRATION	: CONCENTRATION :	CONCENTRATION
3 4 5 6	MIN DETECT. STEADY STA SAMPLE THI SELECTED D TIME 1. 3 ho 2 3 4	CKNESS: 1 ATA POINTS	Cells 1,2, and 3 CONCENTRATION	: CONCENTRATION :	CONCENTRATION
3 4 5 6	MIN DETECT. STEADY STA SAMPLE THI SELECTED D TIME 1 3 4	CKNESS: 1 ATA POINTS	Cells 1,2, and 3 CONCENTRATION	: CONCENTRATION :	CONCENTRATION
3 4 5 6	MIN DETECT. STEADY STAT SAMPLE THIC SELECTED D TIME 1. 3 ho 2. 3. 4. 5. 6. 7. 8.	CKNESS: 1 ATA POINTS	Cells 1,2, and 3 CONCENTRATION	: CONCENTRATION :	CONCENTRATION
3 4 5 6	MIN DETECT. STEADY STAT SAMPLE THI SELECTED D TIME 1 3 3 4 5 6 8 9	CKNESS: 1 ATA POINTS	Cells 1,2, and 3 CONCENTRATION	: CONCENTRATION :	CONCENTRATION
34567	. MIN DETECT. . STEADY STAT . SAMPLE THIO . SELECTED DO TIME 1. 3 ho 2 3 4 5 6 7 8 9 10	CKNESS: 1 ATA POINTS	Cells 1,2, and 3 CONCENTRATION CO.2 ppm	: CONCENTRATION : : <0.2 ppm : : : : : : : : : : : : : : : : : : :	CONCENTRATION

slibration-5 ppm Silicon Tetrachloride Standard



1. DESCRIPTION OF PRODUCT EVALUATED TYPE: Teflon laminated Nomex 1: PROTECTIVE MATERIAL CODE: 068 2: CONDITION BEFORE TEST: Unused, no visible imperfections 3: MANUFACTURER: Chemfab Corp. 4: 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. 2. TEST METHOD TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1. 2. ANALYTICAL METHOD: Atomic Absorption Spectrophotometry TEMPERATURE: Ambient 4. COLLECTION MEDIUM: <u>Aqueous</u>
5. COLLECTION SYSTEM: <u>Aqueous</u>
6. OTHER CONDITIONS: <u>1 inch cells were used</u>. 7. DEVIATIONS FROM ASTM F739 METHOD: 3. CHALLENGE CHEMICAL COMPONENT 2 3 1 1. CHEM NAME(s) : Sodium Hydroxide N/A N/A 2. CAS NUMBER(s): 1310-73-2 N/A N/A 3. CONC. (IF MIX) 50% N/A N/A CHEMICAL SOURCE: Fisher N/A N/A 4 TEST RESULTS 4 1. DATE TESTED: October 13, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT 0.5 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS Cells 1,2, and 3 at end of three hour test. TIME CONCENTRATION CONCENTRATION CONCENTRATION : : : 3 hours **<0.5** ppm 1. <0.5 ppm KU.5 DDM 2. : : : 3. : 3 : 4. : : 5. : : 6. : : : 7. : : : 8. : • 9. 10. : : : 8. OTHER OBSERVATIONS: Samples and blanks were analyzed with 0.5, 1.0, and 4.0 ppm sodium standards. 5. SOURCE OF DATA

Samples were run by Denise McDonald on 10-13-86.

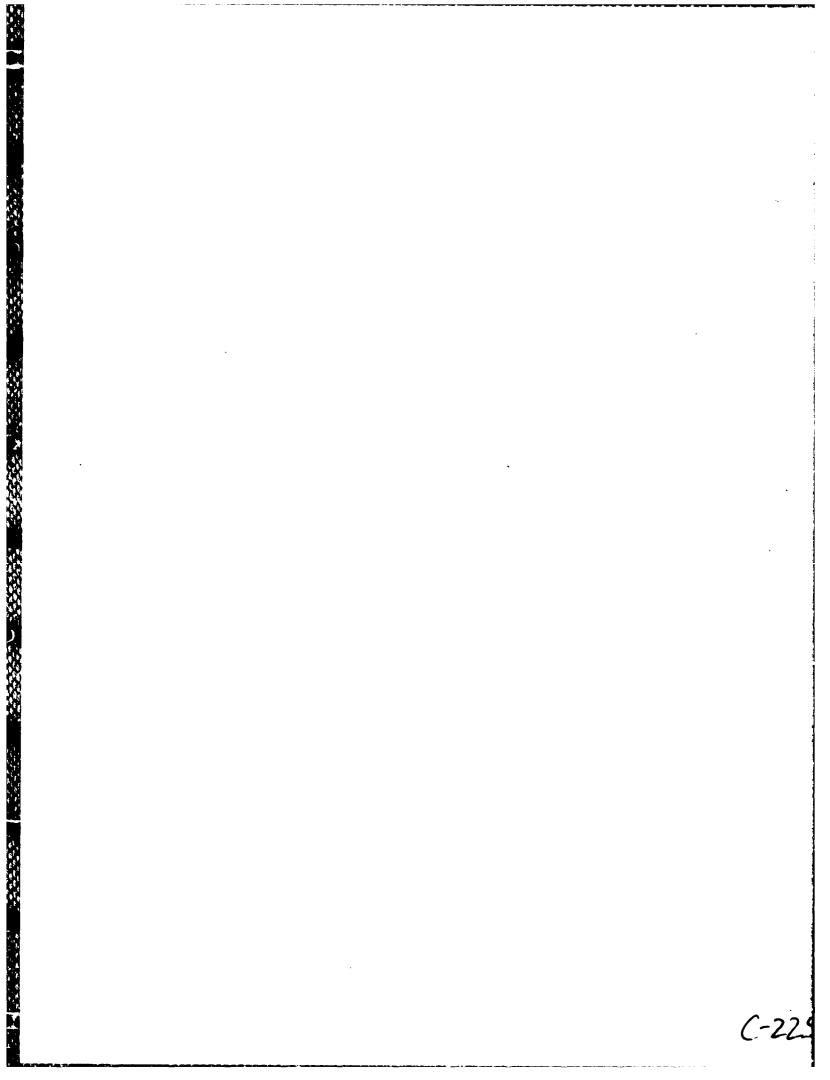
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# 1. DESCRIPTION OF PRODUCT EVALUATED

5.

TYPE: Teflon laminated Nomex 1: PROTECTIVE MATERIAL CODE: 068 2: CONDITION BEFORE TEST: Unused, no visible imperfections 3: MANUFACTURER: Chemfab Corp. 4: PRODUCT IDENTIFICATION: Challenge 5100 LOT OR MANUFACTURER DATE: N/A 5: 6: NOMINAL THICKNESS: 15-20 mit 7: DESCRIPTION: Material was orange colored on one side and buff colored on the 8: \_other side. TEST METHOD 2. 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX ANALYTICAL METHOD: Atomic Absorption Spectrophotometry 2. 3. TEMPERATURE: Ambient COLLECTION MEDIUM: Aqueous 4. COLLECTION SYSTEM: Aqueous OTHER CUNDITIONS: 1 inch cells were used. DEVIATIONS FROM ASTM F739 METHOD: 5. 6. 7\_ CHALLENGE CHEMICAL **COMPONENT** 2 3 1 1. CHEM NAME(s) : <u>Sodium Hydrosulfide</u> : 2. CAS NUMBER(s): <u>16721-80-5</u> : N/A N/A N/A N/A CONC. (IF MIX) 10% CHEMICAL SOURCE: Fisher 3. N/A NZA N/A N/A 4 4. TEST RESULTS 1. DATE TESTED: October 14, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT 0.5 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS Cells 1,2 and 3 at end of three hour test. CONCENTRATION CONCENTRATION TIME : CONCENTRATION : : <0.5 ppm\_ <0.5 ppm <0.5 ppm 1. 3 hours : : : 2. : : 3. : : 4. : : : 5. : : : : : 6. 7. : : 8. : : : 9. : : : 10. ; : 8. OTHER OBSERVATIONS: Samples and blanks were analyzed with 0.5, 1.0 and 4.0 ppm Sodium standards. SOURCE OF DATA Samples were run by Denise McDonald on October 14, 1986.



### 1

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1.	DESCRIPTION OF PRODUCT EVALUATED								
	1: TYPE: Teflon laminated Nomex								
	2: PROTECTIVE MATERIAL CODE: 068								
	3: CONDITION BEFORE TEST: Unused,	no visible imperfection	<u>s</u>						
	4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A								
	7: NOMINAL THICKNESS: 15-20 mil								
	8: DESCRIPTION: Material was buff (	colored							
			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~						
2.	TEST METHOD								
	1. TESTING LABORATORY: Texas Research	ch Institute, 9063 Bee	Caves Road Austin, TX						
	2. ANALYTICAL METHOD: Continuous pl	hotoionization detectio	n with a 11.7 eV lamp.						
	3. TEMPERATURE: 22-25°C								
	4. COLLECTION MEDIUM: N2		*						
	5. COLLECTION SYSTEM . No								
	6. OTHER CUNDITIONS: 2 inch cells	were used. / Detector Te	mperature = 60C.						
	7. DEVIATIONS FROM ASTH F739 METHODS	Fisw rate to cells w	as 90cc/min						
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2	: 3						
	1. CHEM NAME(s) : Styrene	: N/A	: N/A						
	2. CAS NUMBER(s): 100-42-5	: N/A							
	3. CONC. (IF MIX) 99%		<u>N/A</u>						
	4. CHEMILAL SOURCE: Aldrich Co. inhib	ited: N/A							
	with 10-15ppm 4-								
4.	TEST RESULTS								
	1. DATE TESTED: April 13, 1986								
	2. NUMBER OF SAMPLES TESTED: Three		A						
	3. BREAKTHROUGH TIME: No break throu 4. MIN DETECTABLE LIMIT	ugn was observed after	4 nours						
	5. STEADY STATE PERMEATION RATE N/A	·······							
	6. SAMPLE THICKNESS: 17-19 mil								
	7. SELECTED DATA POINTS N/A								
	TIME : CONCENTRAT:	ION : CONCENTRATION	CONCENTRATION						
	2		······································						
	3								
	4:								
	5; 6;	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·						
	7	•	•						
	8		•						
	9		·····						
	10. :	······································							
•	8. OTHER OBSERVATIONS:								
			-						
E									
5.	SOURCE OF DATA Samples were run by Karen Ve	rschoor on April 3 198	6						
	Jampies weie full by hareli te								
			· · · · · · · · · · · · · · · · · · ·						

Chemical Resistance Testing of USCG Material with Styrene

Swhiched from cells to standard gas :1 i. Toluene bbw Flow rate to detector: 00cc/min Input attn: 1 Flow rate to celle: 90cc/min Chart epeed: 6.0cm/80min -Styrene charged into cell -1-11 Recorder attn: 1.

(-22'

# 1. DESCRIPTION OF PRODUCT EVALUATED

- TYPE: Teflon laminated Nomex 1:
- PROTECTIVE MATERIAL CODE: 008 2:
- CONDITION BEFORE TEST: Unused, no visible imperfections 3:
- 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A
- 7: NOMINAL THICKNESS: 15-20 mil
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

# 2. TEST METHOD

- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
   ANALYTICAL METHOD: Ion Chromatogra ny on Dionex 2000.
- 3. TEMPERATURE: Ambient

- 4. COLLECTION MEDIUM: <u>Aqueous</u>
  5. COLLECTION SYSTEM: <u>Aqueous</u>
  6. OTHER CONDITIONS: <u>2 inch cells were used</u>.
- 7. DEVIATIONS FROM ASTN F739 METHOD:

3.	CHALLENGE CHEMICAL	1	: COMPONENT 2	: 3
	1. CHEM NAME(s): 2. CAS NUMBER(s):	Sulfuric Acid	N/A N/A	N/A
	3. CONC. (IF MIX)	95%	: N/A	N/A
	4. CHEMICAL SOURC	E:Mallinckroot	_:N/A	<u>N/A</u>

# TEST RESULTS

- 1. DATE TESTED: <u>September 12, 1986.</u> 2. NUMBER OF SAMPLES TESTED: Three
- 3. BREAKTHROUGH TIME: No breakthrough observed after 3 hours.
- 4. MIN DETECTABLE LIMIT 0.2 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS Cells 1,2, and 3 at end of three hour test

TRATION : CONCENTRATION

# 8. OTHER OBSERVATIONS: Retention time for 10 ppm Sulfate calibration standard was 8.59 minutes.

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# 5. SOURCE OF DATA

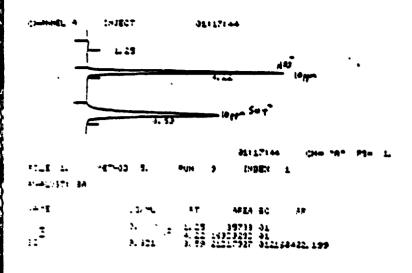
Samples were run by Denise McDonald on September 12, 1986.

# slibration-10 ppm Sulfate Standard

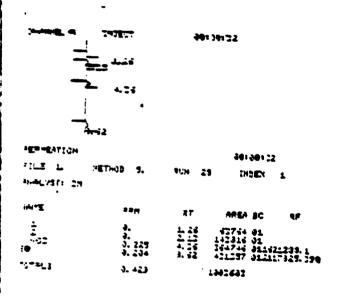
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# Sulfuric Acid Cell 1 3 hours



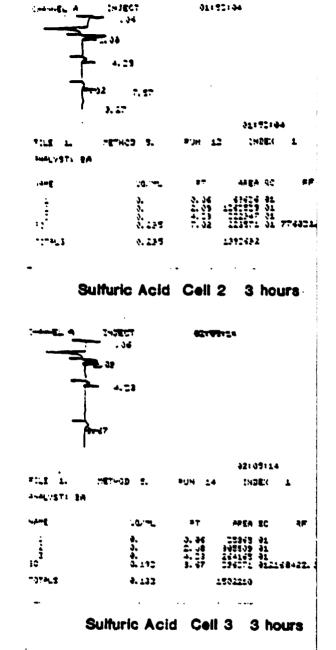


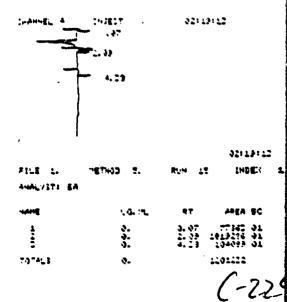




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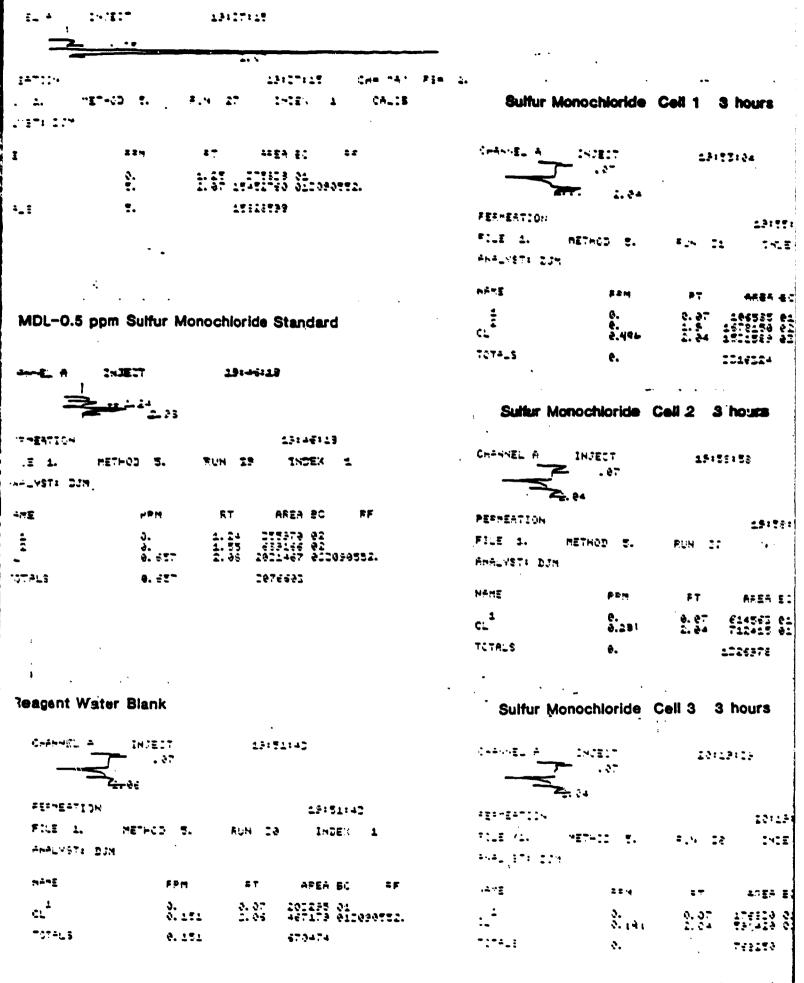
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1.		
	DESCRIPTION OF PRODUCT EVALUATED	1. L. A. 2
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068	
	3: CONDITION BEFORE TEST: Unuse	d, no visible imperfections
	4: MANUFACTURER: Chemtao Corp.	
	5: PRODUCT IDENTIFICATION: Chat 6: LOT OR MANUFACTURER DATE: N/A	lenge 5100
	7: NOMINAL THICKNESS: 15-20 mil	
	8: DESCRIPTION: <u>Material was or</u> other side.	ange colored on one side and buff colored on the
2.	TEST METHOD-	
	1. TESTING LABORATORY: Texas Res	earch Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Ion Chrom	atography on Dionex 2000.
	3. TEMPERATURE: Ambient	
	4. COLLECTION MEDIUM: Aqueous 5. COLLECTION SYSTEM: Aqueous	
	6. OTHER CONDITIONS: 2 inch cei	S MORE USAR
	7. DEVIATIONS FROM ASTM F739 MET	HOD:
<b>.</b>	CHALLENGE CHEMICAL 1	: COMPONENT_2 : 3
	1. CHEM NAME(s) : Sulfur Monoch	loride: N/A : N/A
	2. CAS NUMBER(s): 10025-67-9 3. CONC. (IF MIX) 97%	: <u>N/A</u> : <u>N/A</u>
	3. CONC. (IF MIX) 97% 4. CHEMICAL SOURCE: Aldrich	: <u>N/A</u> : <u>N/A</u>
		:N/A:N/A
Ι.	TEST RESULTS	
	1. DATE TESTED: October 6, 1986	
	1. DATE TESTED: <u>October 6, 1986</u> 2. NUMBER OF SAMPLES TESTED: Thr	20
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A	20
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: <u>N/A</u> 4. MIN DETECTABLE LIMIT 0.5 ppm.	
	<ol> <li>NUMBER OF SAMPLES TESTED: <u>Thr</u></li> <li>BREAKTHROUGH TIME: <u>N/A</u></li> <li>MIN DETECTABLE LIMIT <u>0.5 ppm.</u></li> <li>STEADY STATE PERMEATION RATE IN</li> </ol>	
	<ol> <li>NUMBER OF SAMPLES TESTED: <u>Thr</u></li> <li>BREAKTHROUGH TIME: N/A</li> <li>MIN DETECTABLE LIMIT <u>0.5 ppm</u>.</li> <li>STEADY STATE PERMEATION RATE <u>1</u></li> <li>SAMPLE THICKNESS: 19-20 mils</li> </ol>	N/A
	<ol> <li>NUMBER OF SAMPLES TESTED: <u>Thr</u></li> <li>BREAKTHROUGH TIME: N/A</li> <li>MIN DETECTABLE LIMIT 0.5 ppm.</li> <li>STEADY STATE PERMEATION RATE I</li> <li>SAMPLE THICKNESS: <u>19-20 mils</u></li> <li>SELECTED DATA POINTS <u>Cells 1</u>,</li> </ol>	N/A 2, and 3 at the end of 3 hour test.
	<ol> <li>NUMBER OF SAMPLES TESTED: <u>Thr</u></li> <li>BREAKTHROUGH TIME: <u>N/A</u></li> <li>MIN DETECTABLE LIMIT <u>0.5 ppm</u>.</li> <li>STEADY STATE PERMEATION RATE I</li> <li>SAMPLE THICKNESS: <u>19-20 mils</u></li> <li>SELECTED DATA POINTS <u>Cells 1.7</u></li> <li>TIME : CONCENTION</li> </ol>	N/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE <u>1</u> 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , TIME : <u>CONCENTE</u> 1. <u>3 hours</u> : <u>&lt;0.5</u>	A/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION opm : <0.5 ppm : <0.5 ppm
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE I 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , TIME : <u>CONCENTE</u> 1. <u>3 hours</u> : <u>Consent</u>	N/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE <u>1</u> 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , TIME : <u>CONCENTE</u> 1. <u>3 hours</u> : <u>&lt;0.5</u>	A/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION opm : <0.5 ppm : <0.5 ppm
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT 0.5 ppm. 5. STEADY STATE PERMEATION RATE I 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , TIME : <u>CONCENTR</u> 1. <u>3 hours</u> : <u>CO.5</u> 2. <u>.</u> 3. <u>.</u> 4. <u>.</u> 5. <u>.</u>	A/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION opm : <0.5 ppm : <0.5 ppm
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE <u>1</u> 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , TIME : <u>CONCENTR</u> 1. <u>3 hours</u> : <u>Concentr</u> 3. <u>.</u> 4. <u>.</u> 5. <u>.</u> 6. <u>.</u>	A/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION opm : <0.5 ppm : <0.5 ppm
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE <u>1</u> 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. SELECTED DATA POINTS <u>Cells 1</u> , 1. <u>3 hours</u> : <u>Concentre</u> 1. <u>3 hours</u> : <u>Concentre</u> 3. <u>.</u> 4. <u>.</u> 5. <u>.</u> 6. <u>.</u> 7. <u>.</u>	A/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION opm : <0.5 ppm : <0.5 ppm
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE <u>1</u> 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. <u>Concentration</u> 1. <u>3 hours</u> : <u>Concentration</u> 2. <u>.</u> 3. <u>.</u> 4. <u>.</u> 5. <u>.</u> 6. <u>.</u> 8. <u>.</u>	AV/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION opm : <0.5 ppm : <0.5 ppm
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE <u>1</u> 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. SELECTED DATA POINTS <u>Cells 1</u> , 1. <u>3 hours</u> : <u>Concentre</u> 1. <u>3 hours</u> : <u>Concentre</u> 3. <u>.</u> 4. <u>.</u> 5. <u>.</u> 6. <u>.</u> 7. <u>.</u>	AV/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION opm : <0.5 ppm : <0.5 ppm
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE <u>1</u> 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. <u>Concentre</u> 1. <u>3 hours</u> : <u>Concentre</u> 3. <u>.</u> 4. <u>.</u> 5. <u>.</u> 6. <u>.</u> 7. <u>.</u> 8. <u>.</u> 9. <u>.</u> 10. <u>.</u>	AVA 2. and 3 at the end of 3 hour test. AATION : CONCENTRATION : CONCENTRATION ppm : CO.5 ppm : CO.5 ppm : : : : : : : : : : : : :
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE <u>1</u> 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. <u>Concentre</u> 1. <u>3 hours</u> : <u>Concentre</u> 3. <u>.</u> 4. <u>.</u> 5. <u>.</u> 6. <u>.</u> 7. <u>.</u> 8. <u>.</u> 9. <u>.</u> 10. <u>.</u>	AV/A 2, and 3 at the end of 3 hour test. RATION : CONCENTRATION : CONCENTRATION Oppm : CO.5 ppm : CO.5 ppm
-	<pre>2. NUMBER OF SAMPLES TESTED:</pre>	AVA 2. and 3 at the end of 3 hour test. AATION : CONCENTRATION : CONCENTRATION ppm : <0.5 ppm : <0.5 ppm : : : : : : : : : : : : : : : : : : :
	2. NUMBER OF SAMPLES TESTED: <u>Thr</u> 3. BREAKTHROUGH TIME: <u>N/A</u> 4. MIN DETECTABLE LIMIT <u>0.5 ppm</u> . 5. STEADY STATE PERMEATION RATE <u>1</u> 6. SAMPLE THICKNESS: <u>19-20 mils</u> 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. SELECTED DATA POINTS <u>Cells 1</u> , 7. <u>Concentre</u> 1. <u>3 hours</u> : <u>CONCENTRE</u> 3. <u>Concentre</u> 5. <u>Concentre</u> 6. <u>Concentre</u> 7. <u>Concentre</u> 8. <u>Concentre</u> 8. <u>Concentre</u> 9. <u>Concentre</u> 8. <u>Concen</u>	AVA 2. and 3 at the end of 3 hour test. AATION : CONCENTRATION : CONCENTRATION ppm : <0.5 ppm : <0.5 ppm : : : : : : : : : : : : : : : : : : :

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# Salibration-5 ppm Sulfur Monochloride Standard

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1.	DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on other side.	the
2.	TEST METHOD	
	<ol> <li>TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV 1</li> <li>TEMPERATURE: 22-25 C</li> <li>COLLECTION MEDIUM: N2</li> <li>COLLECTION SYSTEM: N2</li> <li>COLLECTION SYSTEM: N2</li> <li>OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 60C.</li> <li>DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min.</li> </ol>	TX amp.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3	
	1. CHEM NAME (s) : 1,1,2,2,-Tetre- : N/A : N/A	-
	chloroethane : N/A : N/A	
	2. CAS NUMBER(s): 79-34-5 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A	
	4. CHEMICAL SOURCE: Aldrich reagent : N/A : N/A	
	grade : N/A : N/A	-
4.	TEST RESULTS	
	1. DATE TESTED: May 19,1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 15.2 hours 4. MIN DETECTABLE LIMIT C.23 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil. 7. SELECTED DATA POINTS N/A	
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : :	N
	2	
	3.	
	4::: 5:	
	8	
	9.	
	10. : : :	
	8. OTHER OBSERVATIONS:	

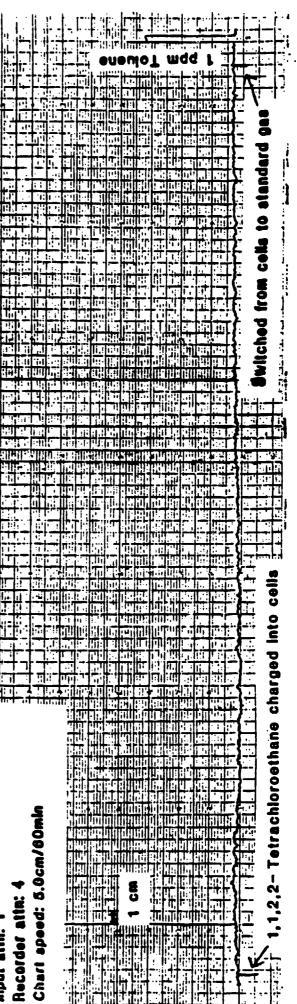
5.

SOURCE OF DATA Samples were run by Sylvia Cooper on May 19, 1986

Chemical Resistance Testing of USCG Material with

1,1,2,2-Tetrachloroethane

Flow' rate to cells: 100cc/mln Flow rate to Detector: 100cc/mln Input attn: 1 Chart apeed: 5.0cm/00mh Recorder atta: 



(-233)

# 1. DESCRIPTION OF PRODUCT EVALUATED

1:	TYPE:	Teflon	laminated	Nomex
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- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A
- 7: NOMINAL THICKNESS: 15-20 mil
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

# 2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.
- 3. TEMPERATURE: <u>22-25°C</u>
- 4. COLLECTION MEDIUM: N2
- 5. COLLECTION SYSTEM: N2
- 6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 60C.
  7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.

3. CHALLENGE CHEMICAL COMPONENT 2 3 1 : : 1. CHEM NAME(s) : Tetrachloroethylene : N/A N/A 2. CAS NUMBER(s): 127-18-4 N/A N/A N/A 3. CONC. (IF MIX)  $\overline{N/A}$ N/A 4. CHEMICAL SOURCE: Aldrich reagent N/A N/A N/A N/A grade

# 4. TEST RESULTS

- 1. DATE TESTED: July 15, 1986
- 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 10.4 hours.

- 4. MIN DETECTABLE LIMIT N/A
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 18-19 mil
- 7. SELECTED DATA POINTS N/A

	TIME	:	CONCENTRATION :	CONCENTRATION	:	CONCENTRATION
1.		:	:		:	
2		:			:	
3		:			:	
4		:			:	
5. 🗌		:			:	
6		:			:	
7. –		:			:	
8. –		:			:	
9. –		;	:		:	
10.		:			:	

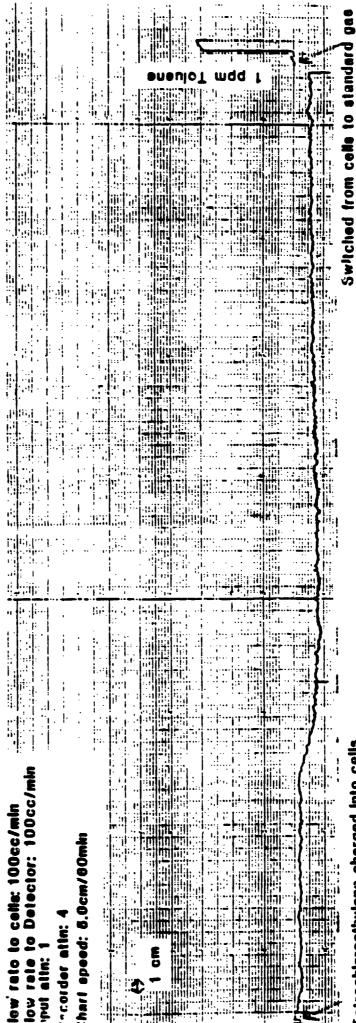
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8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Sylvia Cooper on July 15, 1986.

Chemical Resistance Testing of USCG Material with Tetrachloroethylene



etrachloroethylene charged into cells

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# 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- PROTECTIVE MATERIAL CODE: 068 2:
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: <u>Chemfab Corp.</u> 5: PRODUCT IDENTIFICATION: <u>Challenge 5100</u> 6: LOT OR MANUFACTURER DATE: N/A
- NOMINAL THICKNESS: 15-20 mil
- 7:
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

# 2. TEST METHOD

- TESTING LABORATORY: <u>Texas Research Institutes</u>, 9063 Bee Caves Road, Austin, TX
   ANALYTICAL METHOD: <u>Continuous photoionization detection with a 11.7 eV lamp</u>.
- 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: N2
- COLLECTION SYSTEM: N2
   OTHER CONDITIONS: 2 inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTN F739 HETHOD: Flow rate to cells was BOCC/min.

CHALLENGE CHEMICAL	1	: COMPONENT 2	: 3
<ol> <li>CHEM NAME(s):</li> <li>CAS NUMBER(s):</li> <li>CONC. (IF MIX)</li> <li>CHEMIC/L SOURCE</li> </ol>	108-88-3 N/A	<b>N/A</b> N/A N/A N/A	N/A N/A N/A N/A

# 4. TEST RESULTS

3.

- 1. DATE TESTED: April 2, 1986

2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours 4. MIN DETECTABLE LIMIT 0.06 ppm

- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A

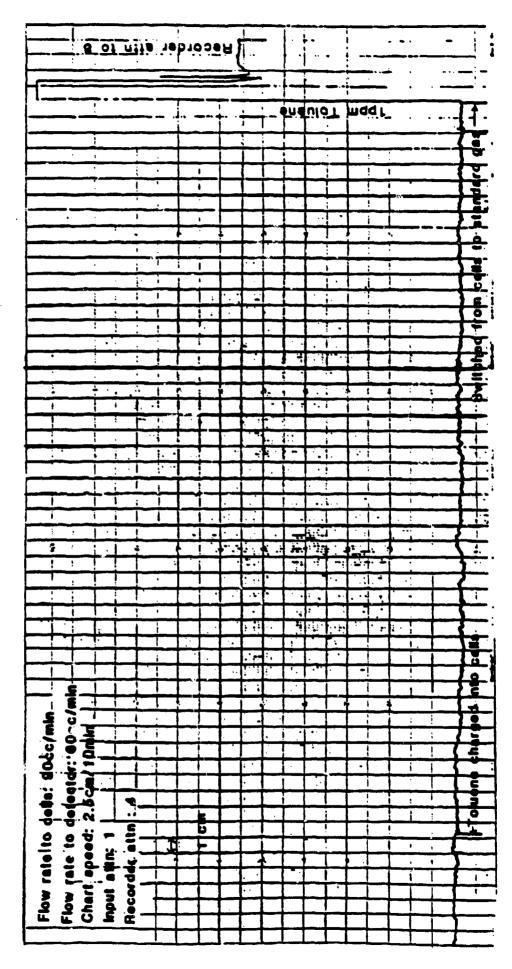
1	TIME	CONCENTRATION	CONCENTRATION :	CONCENTRATION
2.		·		······
4.				
6.				
8.				
10.				

8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Karen Verschoor on April 2, 1986

Chemical Resistance Testing of USCG Material with Toluene



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# 1. DESCRIPTION OF PRODUCT EVALUATED

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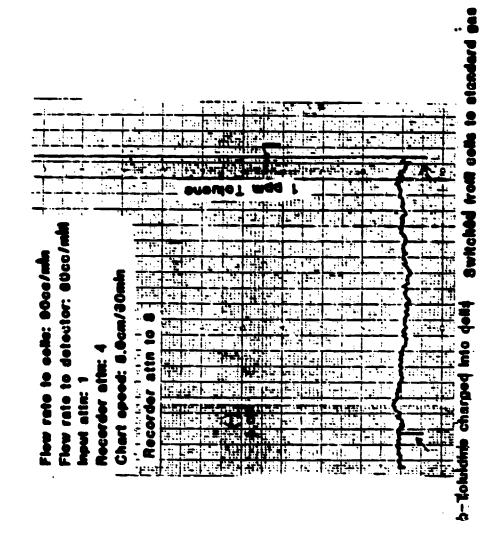
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5 6 7	A: MANUFACTURER: 5: PRODUCT IDENTIF 5: LOT OR MANUFACT 7: NOMINAL THICKNE	Chemfab Corp. ICATION: Challenge URER DATE: N/A		
T	TEST METHOD			
2 3 4 5 6	2. ANALYTICAL METH 3. TEMPERATURE: 22 4. COLLECTION MEDI 5. COLLECTION SYST 5. OTHER CONDITION	OD: <u>Continuous phot</u> -25°C UM: <u>N2</u> EM: <u>N2</u> S: Z inch cells wer	Institute, 9063 Bee Cav colonization detection w e used./ Detector Tempe low rate to cells was 9	ith a 11.7 eV lamp. rature = 60C.
C	CHALLENGE CHEMICAL	1	: COMPONENT 2 :	3
1	L. CHEM NAME (s) :	o-Toluidine	- N/A	N/A
2	2. CAS NUMBER(s):	95-53-4		N/A
3	B. CONC. (IF MIX)	N/A	: N/A ::	N/A
_				
4 T	I. CHEMICÀL SOURČE TEST RESULTS L. DATE TESTED: A	pril 11, 1986	N/A	N/A
4 T 1 2 3 4 5 6	4. CHEMICAL SOURCE TEST RESULTS 1. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT 0.43 ppm. MEATION RATE N/A : 17-19 mil		
4 T 1 2 3 4 5 6	I. CHEMICAL SOURCE TEST RESULTS I. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT 0.43 ppm. MEATION RATE N/A : 17-19 mil	• <u>N/A</u> ••••••••••••••••••••••••••••••••••••	
4 T 1 2 3 4 5 6	A. CHEMICAL SOURCE TEST RESULTS 1. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1.	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT 0.43 ppm. MEATION RATE N/A : 17-19 mil	N/A as observed after 3.25	hours
4 T 12 34 56	A. CHEMICAL SOURCE TEST RESULTS L. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS 7. SELECTED DATA PO TIME	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT U.43 ppm. MEATION RATE N/A : 17-19 mil INTS N/A	N/A as observed after 3.25	hours
4 T 12 34 56	A. CHEMICAL SOURCE TEST RESULTS L. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1. 2. 3. 4.	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT U.43 ppm. MEATION RATE N/A : 17-19 mil INTS N/A	N/A as observed after 3.25	hours
4 T 12 34 56	A. CHEMICAL SOURCE TEST RESULTS 1. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1 3 4 5	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT U.43 ppm. MEATION RATE N/A : 17-19 mil INTS N/A	N/A as observed after 3.25	hours
4 T 12 34 56	A. CHEMICAL SOURCE TEST RESULTS 1. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1 3 4 5 6	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT U.43 ppm. MEATION RATE N/A : 17-19 mil INTS N/A	N/A as observed after 3.25	hours
4 T 12 34 56	A. CHEMICAL SOURCE TEST RESULTS 1. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1 3 4 5 6 7	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT U.43 ppm. MEATION RATE N/A : 17-19 mil INTS N/A	N/A as observed after 3.25	hours
4 T 12 34 56	A. CHEMICAL SOURCE TEST RESULTS 1. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1 3 4 5 6 9	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT U.43 ppm. MEATION RATE N/A : 17-19 mil INTS N/A	N/A as observed after 3.25	hours
4 T 1 2 3 4 5 6	A. CHEMICAL SOURCE TEST RESULTS 1. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1 3 4 5 6 8	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT U.43 ppm. MEATION RATE N/A : 17-19 mil INTS N/A	N/A as observed after 3.25	hours
4 T 12 34 5 67	A. CHEMICAL SOURCE TEST RESULTS 1. DATE TESTED: A 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 5. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1 3 4 5 6 9	:J.T.BAKER practical grade pril 11, 1986 S TESTED: Three E: No breakthrough w IMIT U.43 ppm. MEATION RATE N/A : 17-19 mil INTS N/A : CONCENTRATION : : : : : : : : : : : : :	N/A N/A N/A N/A N/A N/A N/A N/A	hours

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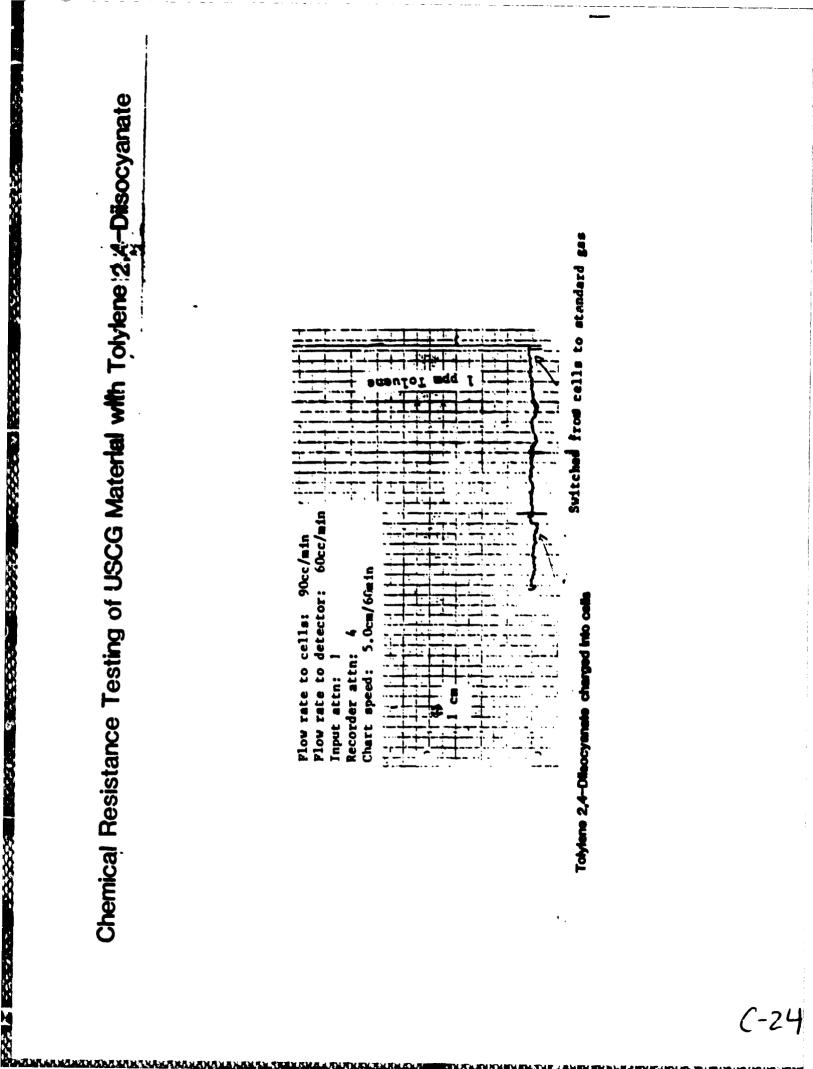
Chemical Resistance Testing of USCG Material with o-Toluidine

語言でして記述が



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	3:		RE TEST: Unused, no	visible imperfections	
		MANUFACTURER:	Chemfab Corp. FICATION: Challenge	\$100	<b>b</b>
		LOT OR MANUTAC			
		NOMINAL THICKN			
		DESCRIPTION:	Material was buff col	OTEC	
2.	TES	t method			
				Institute, 9063 Bee Cav Diobization detection w	
		TENPERATURE: 2		OTONI SECTOR REFECTION A	the 11.70 ev lamb.
	٨.	COLIFICATION NOT	IUM: N2	مین با <sup>میر</sup> ان می باشد. این از مان می از این این این این این این این این این این	
		COLLECTION STS			
	7.	DEVIATIONS FRO	M ASTM \$739 METEOD: F	re used /Delector Temper low fate to cells was 90	Occ/sia
• •	CKA	LLENGE CHEMICAL	. 1	: COMPONENT 2 :	3
	1.	THEM MANE (s) :	Tolylene 2.4-	: \$/A :	<u>N/A</u>
	,	CAS NUMBER(s):	diisocvanate	: <u> </u>	<u>N/X</u> N/A
		CONC. (IF MIX)		-:: N/A	<u> </u>
	4.		Z:Aldrich Technical	: <u>K/A</u> :	<u>.</u>
	-	T RESULTS	Irade	:N/A:	N/A
	2.		LS TESTED: Three		
	2. 3. 4. 5.	NUMBER OF SAMPL BREAKTBROUGE TI MIN DETECTABLE	LS TESTED: <u>Three</u> ME: <u>No breakthrough</u> LIMIT <u>.69 ppm</u> RMEATION RATE N/A	was observed after 3.25	hours
	2. 3. 4. 5. 6.	NUMBER OF SAMPL Breakterouge ti Min Detectable Steady State Pe	LS TESTED: Three ME: No breakthrough LIMIT .69 ppm RMEATION RATE N/A S: 17-19 mil	was observed after 3.25	hours
-	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETICTABLE STEADT STATE PE SAMPLE THICRNES SELECTED DATA P TIME 1.	LS TESTED: Three ME: No breakthrough LIMIT .69 ppm RMEATION RATE N/A S: 17-19 mil		CONCENTRATION
-	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETECTABLE STEADT STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A		
-	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETICTABLE STEADT STATE PE SAMPLE THICRNES SELECTED DATA P TIME 1.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A	CONCENTRATION :	
-	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETECTABLE STEADT STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A	: CONCENTRATION : :	CONCENTRATION
-	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETECTABLE STEADT STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A	CONCENTRATION :	CONCENTRATION
-	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETECTABLE STEADT STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A	: CONCENTRATION : :	CONCENTRATION
-	2. 3. 4. 5. 6. 7. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETECTABLE STEADT STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A	: CONCENTRATION : :	CONCENTRATION
-	2. 3. 4. 5. 6. 7. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETECTABLE STEADT STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 6. 7. 8.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A	: CONCENTRATION : :	CONCENTRATION
-	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETECTABLE STEADT STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A : CONCENTRATION : : : : : :	: CONCENTRATION : :	CONCENTRATION
-	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETICTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A : CONCENTRATION : : : : : :	: CONCENTRATION : :	CONCENTRATION
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTHROUGE TI MIN DETICTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A : CONCENTRATION : : : : : :	: CONCENTRATION : :	CONCENTRATION
5.	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL BREAKTBROUGE TI MIN DETECTABLE STEADY STATE PE SAMPLE THICRNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 	LS TESTED: Three ME: No breakthrough LIMIT .65 ppm RMEATION BATE N/A S: 17-19 mil OINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: CONCENTRATION : :	



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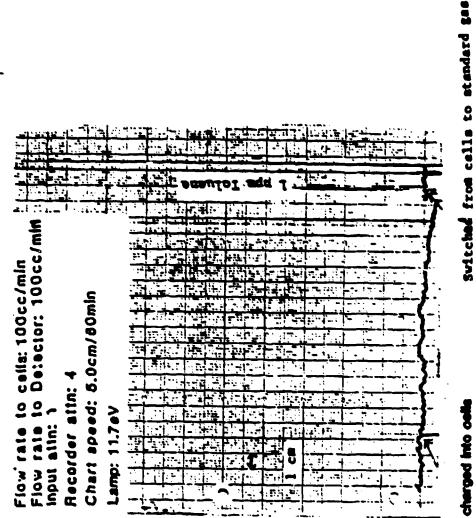
	CHEMICAL PROTECTIVE CLOTHI	NG FRODUCT EVALUATION	RECORD				
1.	DESCRIPTION OF PRODUCT EVALUATED						
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: <u>Unused, no v</u> 4: MANUFACTURER: <u>Chemfab Corp.</u> 5: PRODUCT IDENTIFICATION: <u>Challenge 5</u> 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: <u>15-20 mil</u> 8: DESCRIPTION: <u>Material was orange cc</u> other side.	100	buff colored on the				
2.	TEST METHOD						
	<ol> <li>TESTING LABORATORY: <u>Texas Research II</u></li> <li>ANALYTICAL METHOD: <u>Continuous photo</u></li> <li>TEMPERATURE: <u>22-25 °C</u></li> <li>COLLECTION MEDIUM: <u>N2</u></li> <li>COLLECTION SISTEM: <u>N2</u></li> <li>OTHER CONDITIONS: <u>2 inch cells were</u></li> <li>DEVIATIONS FROM ASTM F739 METHOD: <u>FI</u></li> </ol>	tonization detection w	rature = 60C.				
3.	CHALLENGE CHEMICAL 1	COMPONENT 2 :	3				
4.	<pre>1. CHEM NAME(s) : Trichloroethane 2. CAS NUMBER(s): 71-55-6 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Aldrich reagent 4. CHEMICAL SOURCE: Aldrich reagent 9 TEST RESULTS 1. DATE TESTED: June 6, 1986 2. NUMBER OF SAMPLES TESTED: Three</pre>	N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A				
	3. BREAKTHROUGH TIME: No breakthrough was 4. MIN DETECTABLE LIMIT .60 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-20 mil 7. SELECTED DATA POINTS N/A	s observed after 3 hou	rs				
	TIME : CONCENTRATION 1:	: CONCENTRATION :	CONCENTRATION				
	3.						
	5						
	7						
	9	:i					
	8. OTHER OBSERVATIONS:		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				
5.	SOURCE OF DATA Samples were run by Karen Versch	oor on June 6, 1986.					

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O LEVA

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Chemical Resistance Testing of USCG Material with Trichloroethane



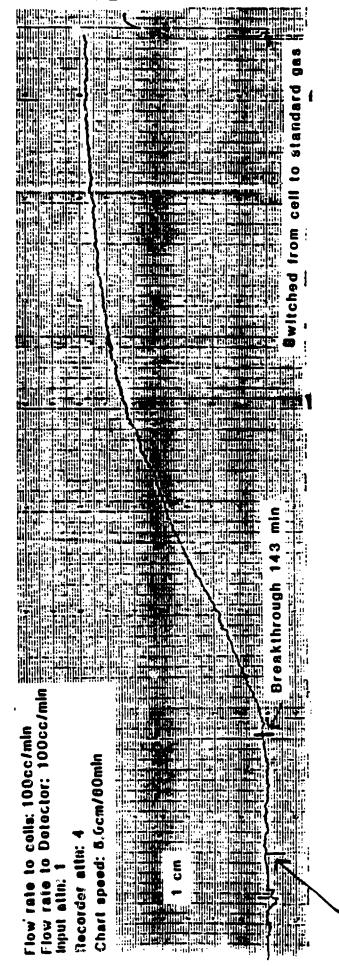
Trichloroethene charged into cell

DESCRIPTION OF PRO			
1: TYPE: Teflon 1 2: PROTECTIVE MAT	ERIAL CODE: 068		
3: CONDITION BEFO	RE TEST: Unused, no v	visible imperfections	
	Chemfab Corp.	100	
	FICATION: <u>Challenge 5</u> TURER DATE: N/A	5100	الموادي المراغبي عروانك والمراجع والمراجع
7: NGMINAL THICKN	ESS: 15-20 mil		
8: DESCRIPTION:	Material was buff cold	bred	
TEST METHOD			
1. TESTING LABORA	TORY: Texas Research I	Institute, 9063 Bee Cav	es Road, Austin, T
2 ANALYTICAL MET	HOD: Continuous photo	pionization detection w	ith a 11.70 eV lam
3. TEMPERATURE: 2			
4. COLLECTION MED 5. COLLECTION SYS		``````````````````````````````````````	
6. OTHER CONDITIO	NS: 2 inch cell was	used /Detector Tempera	ture = $60C$ .
7. DEVIATIONS FRO	M ASTM F739 NETHOD: FI	ow rate to cell was 90	cc/min
CHALLENGE CHEMICAL	1	: COMPONENT 2 :	3
1. CHEM NAME(s) :	Trichloroethylene	· • •	N/A
2. CAS NUMBER(s):	79-01-6	: N/A :	N/A
3. CONC. (IF NIX)	N/A	: <u>N/A</u> :	N/A
4. CHEMICAL SOURC	E:Aldrich reagent grade	N/A	<u> </u>
TEST RESULTS			
I DATE TESTED. A.			
1. DATE TESTED: Ap 2. NUMBER OF SAMPL	ES TESTED: One (Run)		
3. BREAKTHROUGH TI	ME: 143 min.		
4. MIN DETECTABLE	LIMIT 0.07 ppm		
6. SAMPLE THICKNES	RMEATION RATE 2.04 U	g/cmf hour	
7. SELECTED DATA P	POINTS		
TIME		: CONCENTRATION :	CONCENTRATION
2.			
3.			
4.			
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8. OTHER OBSERVATI	UNS:		

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Permeation of Trichloroethylene through USCG Material

Run



Trichloroethane charged into cells

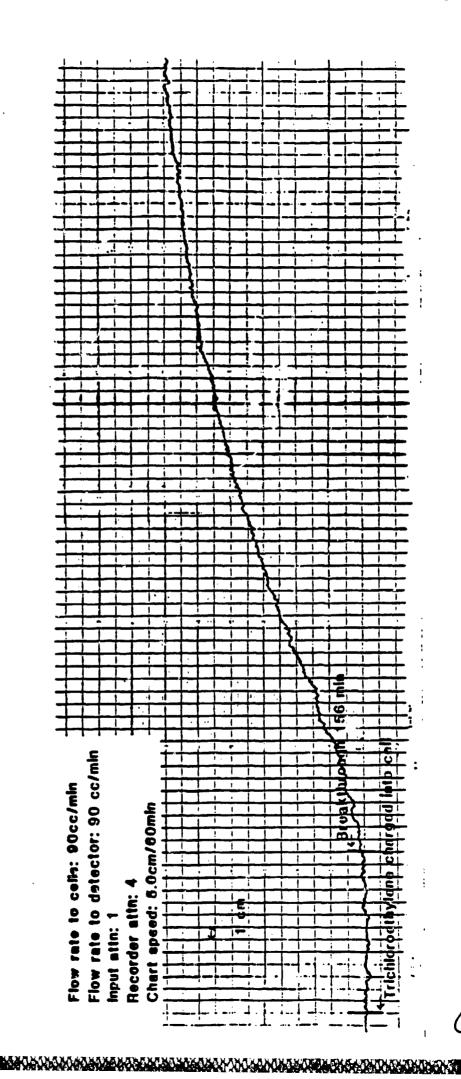
1. DESCRIPTION OF PRODUCT EVALUAT	1.	DESCRIPTION	OF	PROD UCT	EVAL UAT I	ΞD
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	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMIHAL THICKNESS: 15-20 mil
	6: DESCRIPTION: Material was buff colored.
	O. DESCRIPTION. <u>Pacellal</u> Was buil colored.
2.	TEST METHOD
	•
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp.
	3. TEMPERATURE: 22-25°C
	4. COLLECTION MEDIUM: N2
	5. COLLECTION SYSTEM: N2
	6. OTHER CONDITIONS: 2 inch cell was used./ Detector Temperature = 60C.
	7. DEVIATIONS FROM ASTM F739 NETHOD: Flow rate to cell was 90cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
•	
	1. CHEM NAME(s): Trichloroethylene : N/A : N/A
	2. CAS NUMBER (s): 79-01-6 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	4. CHEMICAL SOURCE: Aldrich reagent : N/A : N/A
	grade : N/A : N/A
١.	TEST RESULTS
	1. DATE TESTED: April 29, 1986
	2. NUMBER OF SAMPLES TESTED: One (Run II)
	3. BREAKTHROUGH TIME: 156 min
	4. MIN DETECTABLE LIMIT 0.10 ppm.
	5. STEADY STATE PERMEATION RATE 1.63 ug/cm hour
	6. SAMPLE THICKNESS: 17-19 mil
	7. SELECTED DATA POINTS
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	1;;;
	1.     :     :       2.     :     :
	1;;;
	1.     :     :       2.     :     :
	1.     :     :       2.     :     :
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	1.     :     :       2.     :     :
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	1.       :       :       :         2.       :       :       :         3.       :       :       :         4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         8.       :       :       :         9.       :       :       :         10.       :       :       :
	1.       :       :       :         2.       :       :       :         3.       :       :       :         4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         8.       :       :       :         9.       :       :       :         10.       :       :       :
•	1.       .       .       .         2.       .       .       .         3.       .       .       .         4.       .       .       .         5.       .       .       .         6.       .       .       .         7.       .       .       .         8.       .       .       .         9.       .       .       .         10.       .       .       .         8.       .       .       .         9.       .       .       .         10.       .       .       .         SOURCE OF DATA       .       .
•	1.       :       :       :         2.       :       :       :         3.       :       :       :         3.       :       :       :         3.       :       :       :         3.       :       :       :         3.       :       :       :         3.       :       :       :         4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         8.       :       :       :         9.       :       :       :         10.       :       :       :         8.       OTHER OBSERVATIONS:       :       .

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Permeation of Trichloroethylene through USCG Material Run II



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### DESCRIPTION OF PRODUCT EVALUATED 1.

- TYPE: Teflon laminated Nomex 1:
- PROTECTIVE MATERIAL CODE: 068 2:
- CONDITION BEFORE TEST: Unused, no visible imperfections 3:
- MANUFACTURER: Chemfab Corp. 4:
- PRODUCT IDENTIFICATION: Challenge 5100 LOT OR MANUFACTURER DATE: N/A 5:
- 6:
- NOMINAL THICKNESS: 15-20 mil 7:
- DESCRIPTION: Material was buff colored. 8:

### 2. TEST METHOD

and the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second s

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- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp.
- 2.
- 3. TEMPERATURE: 22-25°C
- 4. 5.
- COLLECTION MEDIUM: N2 COLLECTION SYSTEM: N2 OTHER CONDITIONS: 2 inch cell was used./ Detector Temperature = 60C. 6. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 90cc/min 7.

### **COMPONENT 2** 3. CHALLENGE CHEMICAL 1 • .3 : 1. N/A CHEM NAME(s) : **Trichloroethylene** N/A CAS NUMBER(s): 79-01-6 N/A 2. N/A CONC. (IF MIX) N/A N/A N/A 3. CHEMICAL SOURCE: Aldrich reagent 4. N/A N/A N/A grade N/A

### 4. TEST RESULTS

- 1. DATE TESTED: April 30, 1986
- 2. NUMBER OF SAMPLES TESTED: One (Run III)
- 3. BREAKTHROUGH TIME: 146 min.
- 4. MIN DETECTABLE LIMIT 0.09 ppm
- 5. STEADY STATE PERMEATION RATE 1.91 ug/cm hour 17-19 mil
- 6. SAMPLE THICKNESS: 7. SELECTED DATA POINTS

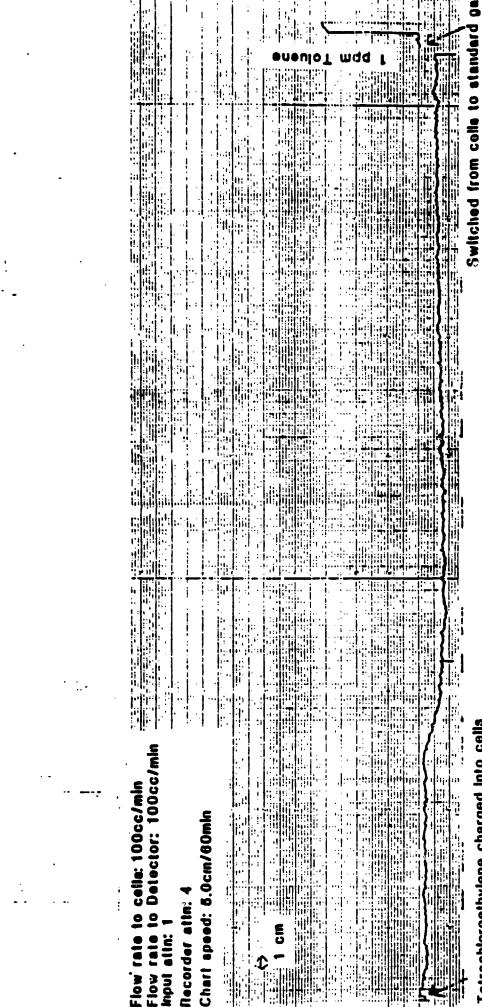
	TIME	:	CONCENTRATION :	CONCENTRATION	CONCENTRATION
		:			
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8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Sample was run by Karen Verschoor on April 30, 1986.

Chemical Resistance Testing of USCG Materlal with Tetrachloroethylene



Tetrachtoroethylene charged into cells

### 1. DESCRIPTION OF PRODUCT EVALUATED

1 2				
	: TYPE: Teflor	n laminated Nomex		
	: PROTECTIVE M	MATERIAL CODE: 068		
3	: CONDITION BE	FORE TEST: Unused, I	no vis(ble imperfections	
4	: MANUFACY URER	R: Chemfab Comp.		
5		WIFICATION: Challen	ae 5100	
6		ACTURER DATE: N/A		
7		KNESS: 15-20 mil		
8			e colored on one side and	buff colored on the
	other side.			
. Tl	EST METHOD			
1	. TESTING LABO	DRATORY: Texas Researc	<u>ch Institute, 9063 Bee Cav</u>	<u>es Road, Austin, TX</u>
-		ETHOD: <u>Continuous pl</u>	notoionization detection w	vith a 10.20 eV lamp
	. TEMPERATURE:			
4.		EDIUM: <u>N2</u>		
5				
	. OTHER CONDIT	IONS: 1 inch cells	were used. /Detector Temp	erature =100C.
7.	. DEVIATIONS F	RON ASTM 1739 NETHOD:	Flow rate to cells was 1	00 cc/min.
<b>C</b> 1	HALLENGE CHEMIC	AL 1	: COMPONENT 2 :	3
ιų.	nallende Gremie			3
٦	. CHEM NAME (s)	: Turpentine	: <b>N/A</b> :	<b>N/A</b>
	. CAS NUMBER(s		<u> </u>	N/A
	. CONC. (IF MI			
4		RCE:Crown reagent gra		N/A
	EST RESULTS	July 24, 1986		
2	. NUMBER OF SAM		was observed after 3 6 t	OUTE
2	. NUMBER OF SAM BREAKTHROUGH	TIME: No breakthrough	n was observed after 3.6 h	iours.
2 3 4	. NUMBER OF SAM BREAKTHROUGH MIN DETECTABL	TIME: No breakthrough E LIMIT_0.03 ppm	n was observed after 3.6 h	ours.
2 3 4 5	<ul> <li>NUMBER OF SAM</li> <li>BREAKTHROUGH</li> <li>MIN DETECTABL</li> <li>STEADY STATE</li> </ul>	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A	n was observed after 3.6 h	lours.
2 3 4 5 6	<ul> <li>NUMBER OF SAM</li> <li>BREAKTHROUGH</li> <li>MIN DETECTABL</li> <li>STEADY STATE</li> <li>SAMPLE THICKN</li> </ul>	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE <u>N/A</u> HESS: <u>18-19 mil</u>	n was observed after 3.6 h	iours.
2 3 4 5 6	<ul> <li>NUMBER OF SAM</li> <li>BREAKTHROUGH</li> <li>MIN DETECTABL</li> <li>STEADY STATE</li> </ul>	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE <u>N/A</u> HESS: <u>18-19 mil</u>	n was observed after 3.6 h	iours.
2 3 4 5 6	<ul> <li>NUMBER OF SAM</li> <li>BREAKTHROUGH</li> <li>MIN DETECTABL</li> <li>STEADY STATE</li> <li>SAMPLE THICKN</li> </ul>	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE <u>N/A</u> HESS: <u>18-19 mil</u>		CONCENTRATION
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5. 5. 6. 7.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5. 5. 6. 7.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A		
2 3 4 5 6 7	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A NESS: 18-19 mil A POINTS N/A : CONCENTRATION : : : : : : : : : : : : :		
2 3 4 5 6 7	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A NESS: 18-19 mil A POINTS N/A : CONCENTRATION : : : : : : : : : : : : :		
2 3 4 5 6 7	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A NESS: 18-19 mil A POINTS N/A : CONCENTRATION : : : : : : : : : : : : :		
2 3 5 6 7 7	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 10.	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A NESS: 18-19 mil A POINTS N/A : CONCENTRATION : : : : : : : : : : : : :		
2 3 5 6 7 7	NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBSERVA	TIME: No breakthrough E LIMIT 0.03 ppm PERMEATION RATE N/A MESS: 18-19 mil A POINTS N/A : CONCENTRATIONS:		

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Chemical Resistance Testing of USCG Material with Turpentine

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	m Toluene	dd 1	
L.			
			 0
10:10 100 32	19. C		
	ä		
1 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			
	ð III E		
Flow rate to cells: 100cc/min Flow rate to Dectector: 100cc/min Input attn: 10 Chart speed: 6.0cm/60min Chart speed: 6.0cm/60min Recorder attn: 32	Dectector temp: 100°C		
		[ [-: <del>-</del> -] [:	

Turpentine charged into cells

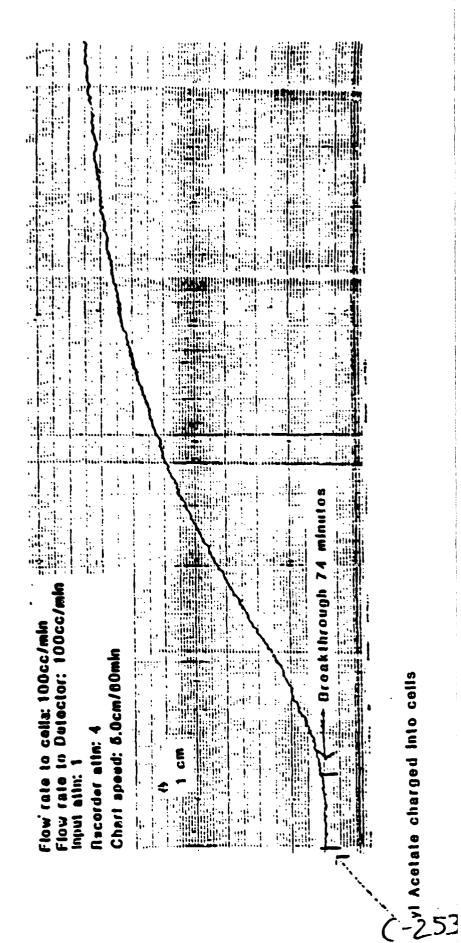
### DESCRIPTION OF PRODUCT EVALUATED

	6: 7: 8:	NOMINAL THICKN DESCRIPTION:	Material was orange co	Diored on one side and	buff colored
2.	TES	<u>on the other</u> T METHOD	<u>side.</u>		
	1.	TESTING LABORA	TORY: Texas Research I	nstitute, 9063 Bee Cav	ves Road, Austin.
	2.	ANALYTICAL MET	HOD: Continuous photo	Dionization detection w	ith a 11.7 eV la
	3.	TEMPERATURE: 2 COLLECTION MED			
	5.	COLLECTION SYS	TEM: N2		
	6. 7.	OTHER CONDITIO	NS: 2 inch cells wer	e used./ Detector Temp	erature = 60C.
	<b>′</b> •	VEVIALIUNS FRU	M ASIM 1739 MEIDUU:	low rate to cells was	
3.	CHA	LLENGE CHEMICAL	1	: COMPONENT 2 :	3
			Vinyl Acetate	:N/A;	N/A
		CAS NUMBER(s):		N/A	<u>N/A</u>
	3.		A/A E:Aldrich reagent	N/A	<u>h/A</u>
	*•		grade	N/A	N/A
	2.   3. 4.	NUMBER OF SAMPE BREAKTHROUGH TI MIN DETECTABLE	ME: 74 min. LIMIT 0.21 ppm.		
	2. 3. 4. 5.	NUMBER OF SAMPE BREAKTHROUGH TI MIN DETECTABLE	ES TESTED: <u>Three</u> ME: <u>74 min.</u> LIMIT <u>0.21 ppm.</u> RMEATION RATE <u>3.30uc</u> S: <u>17-19 mil</u>	l/cn2/hr	
	2. 3. 4. 5.	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES	ES TESTED: <u>Three</u> ME: <u>74 min.</u> LIMIT <u>0.21 ppm.</u> RMEATION RATE <u>3.30uc</u> S: <u>17-19 mil</u>	: CONCENTRATION	CONCENTRATION
	2. 3. 4. 5.	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P	ES TESTED: <u>Three</u> ME: <u>74 min.</u> LIMIT <u>0.21 ppm.</u> RMEATION RATE <u>3.30uc</u> S: <u>17-19 mil</u> OINTS		CONCENTRATION
	2. 3. 4. 5.	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P	ES TESTED: <u>Three</u> ME: <u>74 min.</u> LIMIT <u>0.21 ppm.</u> RMEATION RATE <u>3.30uc</u> S: <u>17-19 mil</u> OINTS		CONCENTRATION
	2. 3. 4. 5.	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P	ES TESTED: <u>Three</u> ME: <u>74 min.</u> LIMIT <u>0.21 ppm.</u> RMEATION RATE <u>3.30uc</u> S: <u>17-19 mil</u> OINTS		CONCENTRATION
	2. 3. 4. 5.	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P	ES TESTED: <u>Three</u> ME: <u>74 min.</u> LIMIT <u>0.21 ppm.</u> RMEATION RATE <u>3.30uc</u> S: <u>17-19 mil</u> OINTS		CONCENTRATION
	2. 3. 4. 5.	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P	ES TESTED: <u>Three</u> ME: <u>74 min.</u> LIMIT <u>0.21 ppm.</u> RMEATION RATE <u>3.30uc</u> S: <u>17-19 mil</u> OINTS		CONCENTRATION
	2.   3. 4.   5. 6. 9	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	ES TESTED: <u>Three</u> ME: <u>74 min.</u> LIMIT <u>0.21 ppm.</u> RMEATION RATE <u>3.30uc</u> S: <u>17-19 mil</u> OINTS		CONCENTRATION
	2.   3. 4.   5. 6. 9	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P	ES TESTED: <u>Three</u> ME: <u>74 min.</u> LIMIT <u>0.21 ppm.</u> RMEATION RATE <u>3.30uc</u> S: <u>17-19 mil</u> OINTS		CONCENTRATION
	2.   3. 4.   5. 6. ! 7.	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	ES TESTED: Three ME: 74 min. LIMIT 0.21 ppm. RMEATION RATE 3.30uc S: 17-19 mil OINTS CONCENTRATION CONCENTRATION		CONCENTRATION
	2.   3. 4.   5. 6. 7.	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES. SELECTED DATA P TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 0THER OBSERVATI	ES TESTED: Three ME: 74 min. LIMIT 0.21 ppm. RMEATION RATE 3.30uc S: 17-19 mil OINTS CONCENTRATION CONCENTRATION		CONCENTRATION
5.	2.   3. 4.   5. 6. 7.	NUMBER OF SAMPT BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES. SELECTED DATA P TIME 	ES TESTED: Three ME: 74 min. LIMIT 0.21 ppm. RMEATION RATE 3.30uc S: 17-19 mil OINTS CONCENTRATION CONCENTRATION		CONCENTRATION

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Permeation of Vinyl Acetate through USCG Material

### **Composite Run**



### 1. DESCRIPTION OF PRODUCT EVALUATED

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1	EST METHOD			
	. TESTING LABORATO			
	ANALYTICAL METHO	D: Continuous photoi	stitute, 9063 Bee Cavorization detection w	es Road, Austin, TX ith a 11.7 eV Tamp.
	TEMPERATURE: 22-			
	COLLECTION MEDIU			
6	. OTHER CONDITIONS	: 2 inch cellis were	used./ Detector Temp	ersture = 60C.
7	. DEVIATIONS FROM	ASTM F739 METHOD: F1	ow rate to cell was li	00 cc/min
C	HALLENGE CHEMICAL	1 :	COMPONENT 2 :	3
1	. CHEM NAME (s) :	Vinvl Acetate :	• • • • • • • • • • • • • • • • • • •	N/A
		108-05-4	N/A :	N/A
		A/:	<u> </u>	N/A
4	. CHEMICAL SOURCE:		<u>N/A</u> :	<u>N/A</u>
Т	EST RESULTS	reagent grade :	<u> </u>	N/A
2	BREAKTHROUGH TIME	TESTED: one (Run I) : 137 min.		
2 3 4 5 6	. NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS:	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EA <sup>T</sup> ION RA <sup>TE</sup> <u>3.73 ug/</u> 18-20 m.i	cm-hour	
2 3 4 5 6	. NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI	TESTED: <u>one (Run I)</u> : <u>137 min.</u> MIT <u>0.21 ppm.</u> EATION RATE <u>3.73 ug/</u> <u>18-20 m.i</u> NTS		
2 3 4 5 6	. NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME :	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS CONCENTRATION	Concentration :	CONCENTRATION
2 3 4 5 6	. NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME 1. 136 min 2. 195.6 min :	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm		CONCENTRATION
2 3 4 5 6	. NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME 1. 136 min	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS CONCENTRATION 0.0 ppm		CONCENTRATION
2 3 4 5 6	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNES: SELECTED DATA POI TIME 1. 136 min 2. 195.6 min 4.	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm		CONCENTRATION
2 3 4 5 6	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNES: SELECTED DATA POI TIME: 1. 136 min 2. 195.6 min 3. 756 min 4	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm		CONCENTRATION
2 3 4 5 6	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNES: SELECTED DATA POI TIME 1. 136 min 2. 195.6 min 4.	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm		CONCENTRATION
2 3 4 5 6	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNES: SELECTED DATA POI TIME 1. 136 min 2. 195.6 min 3. 756 min 4	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm		CONCENTRATION
2 3 4 5 6	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNES: SELECTED DATA POI TIME 1. 136 min 2. 195.6 min 3. 756 min 4	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm		CONCENTRATION
2 3 4 5 6	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNES: SELECTED DATA POI TIME 1. 136 min 2. 195.6 min 3. 756 min 4	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm		CONCENTRATION
234567	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNES: SELECTED DATA POI TIME 1. 136 min 2. 195.6 min 3. 756 min 4	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm 3.55 ppm		CONCENTRATION
2345 67	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNES: SELECTED DATA POI TIME: 1. 136 min 2. 195.6 min 3. 756 min 4	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm 3.55 ppm		
234 567 8	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNES: SELECTED DATA POI TIME: 1. 136 min 2. 195.6 min 3. 756 min 4	TESTED: <u>one (Run I)</u> : 137 min. MIT 0.21 ppm. EATION RATE <u>3.73 ug/</u> 18-20 m.i NTS <u>CONCENTRATION</u> 0.0 ppm 1.57 ppm 3.55 ppm		

Permeation of Vinyl Acetate through USCG Material

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Run I

Vinyl Acotato chargol inilo co Flow rate to cells: 100cc/mln Flow rate to Detector: 100cc/mln input attn: 1 Charl speed: 6.0cm/80mln Recorder attn: 4 •••

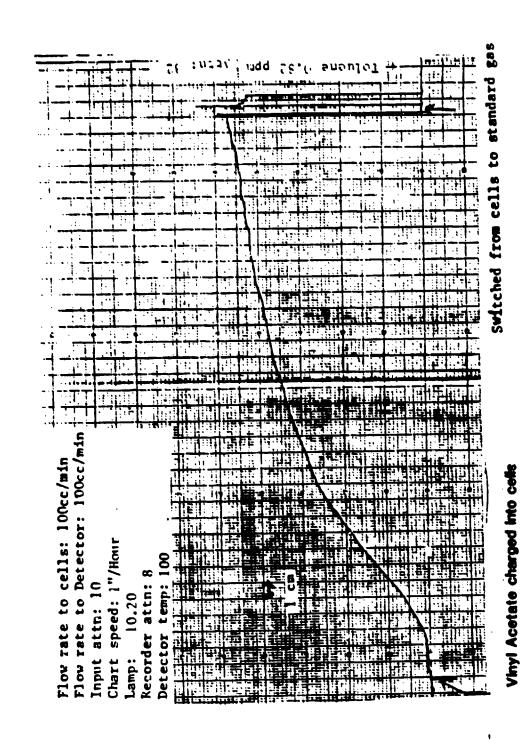
(-25

	TYPE: Teflon lan:	inated Nomex										
2:												
Ĵ:		TEST: Unused, no v	sible imperfection	<b>N</b> 5								
4:	MANUFACTURER: CI	erfab Corp.										
5:	PRODUCT IDENTIFIC	ATION: Challenge 5	100									
6:	LOT OR MANUFACTUR	ER DATE: N/A										
	NOMINAL THICKNESS											
8:	DESCRIPTION: National Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength Strength	erial was orange cu	lored on one side	and buff	colored on the							
TE	TEST METHOD											
1.	TESTING LABORATO	XY: Texas Research I	nstitut∓, ~063 Bee	Caves R	oad, Austin, T)							
	ANALYTICAL METHON		ionizat on detecti									
	TEMPERATURE: 22-2											
	COLLECTION MEDIU											
	COLLECTION SYSTEM											
6.	OTHER CONDITIONS	1 inch cell was	used./Detector Tem	perature	= 100C.							
1.	DEVIATIONS FROM A	ASTN: F739 METHOD: F	low rate to cell w	as 100 c	c/min.							
Сн	ALLENCE CHEMICAL	1.	CONPONENT 2	:	3							
1.	CHEM NAME (s) : M		:N/A		N/A							
			k N/A	;	N/A							
	CONC. (IF MIX)		N/A		N/A							
4.	CHEMICAL SOURCE:	Aldrich	: <u>N/A</u>		<u>N/A</u>							
2. 3. 4.	BREAKTHROUGH TIME: MIN DETECTABLE LIN	TESTED: One (Run 1 53 minutes IIT 0.01 ppm CATION RATE 0.46 ug 19-20 mils										
6.	SELECTED DATA PUT				ONCENTRATION							
6.	TIME :	CONCENTRATION	: CONCENTRATIO	N; C								
6.	TIME : 1:	CONCENTRATION	: CONCENTRATIO	N : C								
6.	TIME :	CONCENTRATION	: CONCENTRATIO : :									
6.	TIME : 1: 2:	CONCENTRATION	: CONCENTRATIO : : : :									
6.	TIME : 1. : 2. : 3. :	CONCENTRATION	: CONCENTRATIO : : : : :									
6.	TIME       :         1.       .         2.       .         3.       .         4.       .         5.       .         6.       .	CONCENTRATION	: CONCENTRATIO : : : : : :									
6.	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :	CONCENTRATION	: : : :									
6.	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :	CONCENTRATION	: : : :									
6.	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :	CONCENTRATION	: : : : : :									
6.	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :	CONCENTRATION	: : : : : : : :									
6.7.	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :		: : : : : : : :									
6.7.	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :		: : : : : : : :									
6.7.	TIME       :         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :		: : : : : : : :									

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Chemical Resistance Testing of Challenge 5100

## Vinyl Acetate Run II



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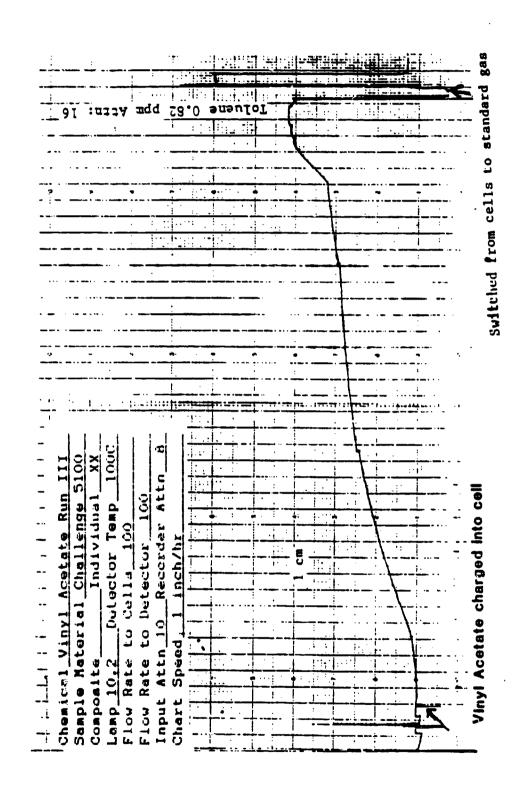
	4: MANUFACTURER: Cha 5: PRODUCT IDENTIFICA 6: LOT OR MANUFACTUR 7: NOMINAL THICKNESS 8: DESCRIPTION: Mate	AL CODE: 068 TEST: Unused, no emfab Corp. ATION: Challenge ER DATE: N/A : 15-20 mil	visible imperfectio 5100 olored on one side		off colored on the
	other side.				·
		-			
			Institute, 9063 Bee		
	2. ANALYTICAL METHOD 3. TEMPERATURE: 22-21	s <sup>a</sup> c	oionization detecti	OL WIL	n a 10.20 ev lamp
	4. COLLECTION MEDIUM				
	5. COLLECTION SYSTEM				ويواوينا المكور المعاور المتكورين
-	6. OTHER CONDITIONS:		sed/Detector Temper	at 11 74	= 100C.
	. DEVIATIONS FROM AN	TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT	ins that th cell wa	= 100-	- 1000.
(	HALLENGE CHEMICAL	1	: COMPONENT 2	:	З
			*	:	
	1. CHEM NAME(s) : V	inyl Acetate	: N/A	:	N/A
	CAS NUMBER(s): TO		: N/A	;	N/A
	3. CONC. (IF MIX) N.		: N/A	;	N/A
4	. CHEMICAL SOURCE: A	ldrich	: N/A	:	N/A
	1. DATE TESTED: 2-24 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN	TESTED: One (Run I 68 minutes IT.02 ppm ATION RATE 2.78 (u 19-20 mils			
	TIME :	CONCENTRATION	: CONCENTRATIO	)N :	CONCENTRATION
	2.		· · · · · · · · · · · · · · · · · · ·		
	3. :		••••••••••••••••••••••••••••••••••••••	:	
	4. :		•	:	
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	7;		•	:	
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8	B. OTHER CBSERVATIONS	·			ويقودا ببنايية بمادياتهما ببسواتين

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Chemical Resistance Testing of Challenge 5100

, Vinyl Acetate Run III



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### 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- PROTECTIVE MATERIAL CODE: 068 2:
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections

1

- 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A
- NOMINAL THICKNESS: 15-20 mil 7:
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

### 2. TEST METHUD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.2 eV lamp.
- TEMPERATURE: 22-25°C 3.
- 4.
- 5. 6.
- COLLECTION MEDIUM: N2 COLLECTION SYSTEM: N2 OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTN F739 METHOD: FINN TALE to cells was 100cc/min.

### 3. CHALLENGE CHEMICAL

		:	<b>:</b> ·	:	1	
1.	CHEM NAME (s) :	Vinylidene Chloride	: <b>x</b>	/¥ :	: N	/A
	CAS NUMBER(s):	75-35-4	: N	/A	N	/A
3.	CONC. (IF MIX)	N/A	: N	/A	N,	/A
4.	CHEMICAL SOURCE	:Aldrich	:N	7A	N.	/A .

.

COMPONENT 2

3

:

### 4. TEST RESULTS

- 1. DATE TESTED: <u>September 23, 1986</u> 2. NUMBER OF SAMPLES TESTED: <u>Three</u>

- 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .49 ppm 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A

### TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. 2. • : 3. : : 4. : 5. 6. : : 7. : 8. : : : 9. : : : 10. :

### 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Denise McDonald on September 23, 1986

1-260

Chemical Resistance Testing of USCG Material with Vinylidene Chloride

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Switched from cells to standard gas

Vinylidene Chloride charged into cella

### 1. DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon laminated Nomex 2: PRUTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no v 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange co other side.			uff colored on the
	TEST METHOD 1. TESTING LABORATORY: <u>Texas Research I</u> 2. ANALYTICAL METHOD: <u>Continuous photo</u> 3. TEMFERATURE: 22-25°C 4. COLLECTION MEDIUM: <u>N2</u> 5. COLLECTION SYSTEM: <u>N2</u> 5. OTHER CONDITIONS: <u>2 inch cells were</u> 7. DEVIATIONS FROM ASTM F739 METHOD: <u>F1</u>	used./ Detector Tem	n wi pera	th a 11.7 eV lamp.
	CHALLENGE CHEMICAL	COMPONENT 2	::	3
	L. CHEM NAME(s): Xylene	N/A		<u>N/A</u>
	2. CAS NUMBER(s): 1330-20-7 3. CONC. (IF MIX) Mixed Isomers	N/A	!	N/A • N/A
	4. CHEMICAL SOURCE: Baker	<u>N/A</u>	<u>*</u>	N/A
•	Reagent Grade	N/A	:	N/A
	2. NUMBER OF SAMPLES TESTED: <u>Three</u> 3. BREAKTHROUGH TIME: <u>No breakthrough wa</u> 4. MIN DETECTABLE LIMIT <u>0.13 ppm.</u> 5. STEADY STATE PERMEATION RATE <u>N/A</u> 5. SAMPLE THICKNESS: <u>18-20 mil</u> 7. SELECTED DATA POINTS <u>N/A</u>	s observed after th	ree	hours.
·	TIME : CONCENTRATION	: CONCENTRATION	:	CONCENTRATION
	1:		<u> </u>	
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	5	•	:	
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	10		:	······································
ε	B. OTHER OBSERVATIONS:			
	SOURCE OF DATA			

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Chemical Resistance Testing of USCG Material with Xylene

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Flow rate to celle: 100cc/ Flow rate to Detector: 10 Input attn: 1 Recorder attn: 4 Chart epeed: 6.0cm/80min			
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			Xylene charged
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### 1. DESCRIPTION OF PRODUCT EVALUATED

- **TYPE: Teflon laminated Nomex** 1:
- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil

- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.

### 2. TEST METHOD

- TESTING LABORATORY: <u>Texas Research Institute</u>, 9063 Bee Caves Road, Austin, TX
   ANALYTICAL METHOD: <u>Continuous photoionization detection with a 10.20 eV lamp</u>.
- 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: N2
- 5. COLLECTION SYSTEM: N2
- OTHER CONDITIONS: 1 inch cells were user. /Detector Temperature = 100C. б.
- 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rute to cells was 100 cc/min.

3.	CHALLENGE CHEMICAL	1	: COMPONENT 2	:	3
	1. CHEM NAME(s): 2. CAS NUMBER(s):	Xylenol 576-26-1	N/A N/A		N/A
	3. CONC. (IF MIX) 4. CHEMICAL SOURCE	N/A	Ν/Α		<u>N/A</u>
			_•	-'	<u> </u>

### 4. TEST RESULTS

- 1. DATE TESTED: September 9, 1986
- 2. NUMBER OF SAMPLES TESTED: Three

BREAKTHROUGH TIME: No breakthrough was observed after 3.26 hours.
 MIN DETECTABLE LIMIT OI ppm as Cresol.
 STEADY STATE PERMEATION RATE N/A

- 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS N/A

: CONCENTRATION :	CONCENTRATION :	CONCENTRATION
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	CONCENTRATION :	CONCENTRATION : CONCENTRATION :

8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Denise McDonald on September 9, 1986

Chemical Resistance Testing of USCG Material with Xylenol

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Switched from cells to standard gas

Xylenol charged into cells

### APPENDIX D

### METHOD FOR CREASING MATERIAL SAMPLES

(Provided by Chemical Fabrics Corporation)

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Rough Draft CHEMFAB Test Procedure 05 September 1986

### Fold Resistance of CHEMFAB Protective Clothing Material

### SCOPE:

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To evaluate the reduction of chemical permeation resistance of chemical protective clothing material due to hard folding or creasing.

### SAMPLE PREPARATION:

Cut a rectangular section of material, 4" x 8", with the long dimension parallel to the warp or machine-direction of the material.

### TEST EQUIPMENT:

- 1.) Steel roller 1.50" diameter x 2.25 " length, 10 lb. "Cal weight (Fig. 1)
- 2.) Permeation test apparatus consistent with ASTM 739-81.

### **PROCEDURE:**

- 1.) Wipe sample with damp cloth to remove any surface dust or abrasive particles which may damage the sample during rolling.
- 2.) Fold sample perpendicular to long dimension.
- 3.) Place the folded sample on a hard surface such as a clean lab bench top, metallic or formica table top.
- 4.) Roll the sample with the ten pound roller so that the direction of the roll is parallel to the sample fold (Fig. 2).
- 5.) Repeat Step 4 nine (9) times for a total of ten (10) rolls.

Page Two Rough Draft CHEMFAB Test Procedure O5 September 1986

### Fold Resistance of CHEMFAB Protective Clothing Material

- 6.) Reverse the fold, taking care to insure that the new fold occurs along the same line as the original fold (Fig. 3).
- 7.) Repeat Steps 4 and 5.
- 8.) Cut permeation test sample so that the fold line bisects the exposed area in the test cell.
- 9.) Perform permeation testing (ASTM 739-81) toward chemical of choice.

### **RESULTS:**

Report breakthrough time and permeation rate of folded samples and pristine control samples. Report all parameters required by ASTM 739-81 including chemical(s) type and concentration.

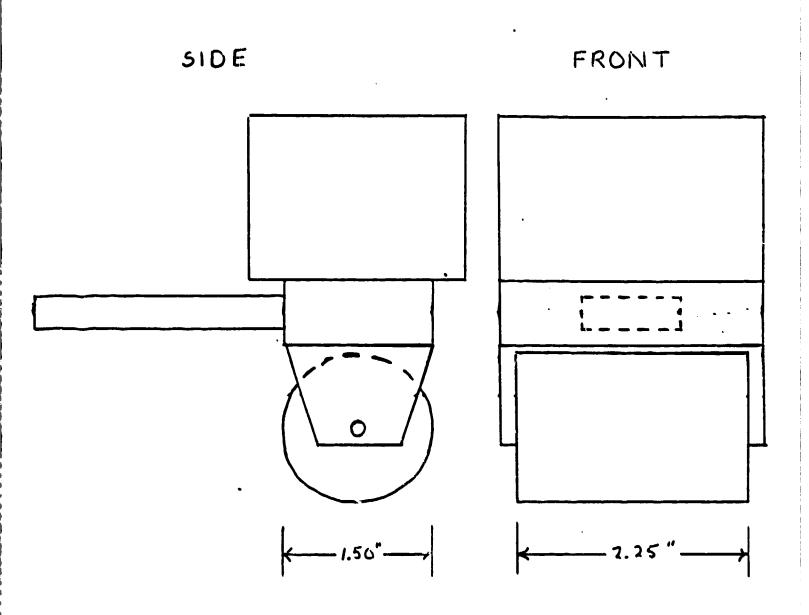
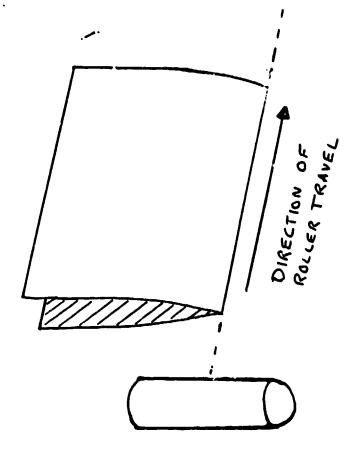


FIG. 1. STEEL ROLLER, TOTAL WEIGHT 10 LB



F16. 2.

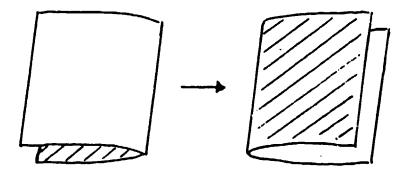


FIG. 3.

### APPENDIX E

### PERMEATION TEST DATA FOR CREASED GARMENT MATERIAL SAMPLES

(Data Provided by Texas Research Institute Under Contract)

### DESCRIPTION OF PROLUCT EVALUATED 1.

1:	TYPE: Teflon lawinated Nomex
2:	PROTECTIVE MATERIAL CODE: 068
3:	CONDITION BEFORE TEST: Unused, no visible imperfections
4:	MANUFACTURER: Chemfab Corp.
5:	PRODUCT IDENTIFICATION: Challenge 5100
6:	LOT OR MANUFACTURER DATE: N/A
7:	NOMINAL THICKNESS: 15-20 mil
8:	DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side. Sample was creased using CHEMFAB Fold Resistance Test procedure
	of 5 September 1986.

2. TEST METHOD

1.	TESTING	LABORATORY:	Texas	Research	Institute,	9063 Bee	Caves Road,	. Austin.	TX

2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp.

3. TEMPERATURE: 22-25°C

4. COLLECTION MEDIUM: No 3. COLLECTION SYSTEM: No

6. OTHER CONDITIONS: 1 inch cells was used. /Detector Temperature = 100 C. 7. DEVIATIONS FROM ASIM F739 METHOD: Flow rate to cells was 100 cc/min.

. Cha	llenge Cremical	1	:	COMPONENT 2	:	3	
1.	CHEM NAME(s) :	Acetone	:	N/A	:	N/A	
	CAS NUMBER(s):			N/A		N/A	
	CONC. (IF MIX)			N/A	:	N/A	
4.	CHEMICAL SOURCE	:Mallinckrodt		N/A		N/A	

TEST RESULTS

3.

- 1. DATE TESTED: 2-23-87
- 2. NUMBER OF SAMPLES TESTED: Three
- 3. BREAKTHROUGH TIME: N/A
- 4. MIN DETECTABLE LIMIT .09 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mils
- 7. SELECTED DATA POINTS N/A

TIME	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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8. OTHER OBSERVATIONS:

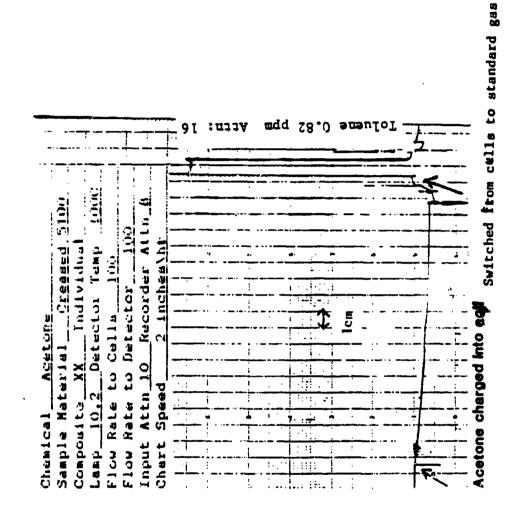
5. SOURCE OF DATA

Samples were run by Denise McDonald on February 23, 1987.

Chemical Resistance Testing of Creased 5100

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	CHEMIC	CAL PROTECTIVE CLOTHI	NG PRODUCT EVALUAT	ION RE	CORD
DE	SCRIPTION OF PRODU	UCT EVALUATED			
1:	TYPE: Teflon lan				
2:	PROTECTIVE MATER	RIAL CODE: 068			
3:		E TEST: Unused, no v	isible imperfection	ດີອໍ	
:	MANUFACTURER: (				·
:		ICATION: Challenge 5	100		
:					
:	NOMINAL THICKNES				
3:		aterial was orange co			
		nple was creased usin	g CHEMFAB Fold Rest	istanc	e Test procedure
	of 5 September	1986.			
1.	ANALYTICAL METHO	DRY: <u>Texas Research I</u> DD: <u>Gas Chromatograp</u>		Caves	Road, Austin, T
3.	TEMPERATURE: Ami				
4. E	COLLECTION MEDIN COLLECTION SYST		<u></u>		
5.		S: 1 inch cells wer			
). /_		ASTM F739 METHOD:			
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H	ALLENGE CHEMICAL	1	: COMPONENT 2	:	3
	CHEM WAME (s) :	Acetonitrile	: N/A	:	N/A
	CAS NUMBER(s):	2206-26-0	: N/A		N/A
ι.	CONC. (IF MIX)	N/A	: N/A		N/A
	CHEMICAL SOURCE	: Fisher-Pesticide	: N/A	:	N/A
		Grade	: N/A	;	N/A
E	ST RESULTS				
	DATE TESTED: 2-0		~~		
	NUMBER OF SAMPLES				
4.	BREAKTHROUGH TIME MIN DETECTABLE L				
•	STEADY STATE PERM				
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	SELECTED DATA DO	INTS Cells 1,2, and	3 at and of three	hour +	· Act
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•	TIME	: CONCENTRATION	: CONCENTRATIO	N :	CUNCENTRATION
•	TIME 1 3 hours	: CONCENTRATION : <0.6 ppm	: CONCENTRATIO	N : :	CUNCENTRATION <0.6 ppm
•	TIME 1. <u>3 hours</u> 2			N : :	
•	TIME 1. <u>3 hours</u> 2 3			N : : : :	
•	TIME 1. <u>3 hours</u> 2 3		: <0.6 ppm : : :	N : : : : :	
•	TIME         1. 3 hours         2.         3.         4.         5.			N : : : : : :	
	TIME         1. 3 hours         2		: <0.6 ppm : : : : :	: 	
/.	TIME         1. 3 hours         2.         3.         4.         5.		: <0.6 ppm : : :	N : 	

8. OTHER OBSERVATIONS:

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5. SOURCE OF DATA

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2.

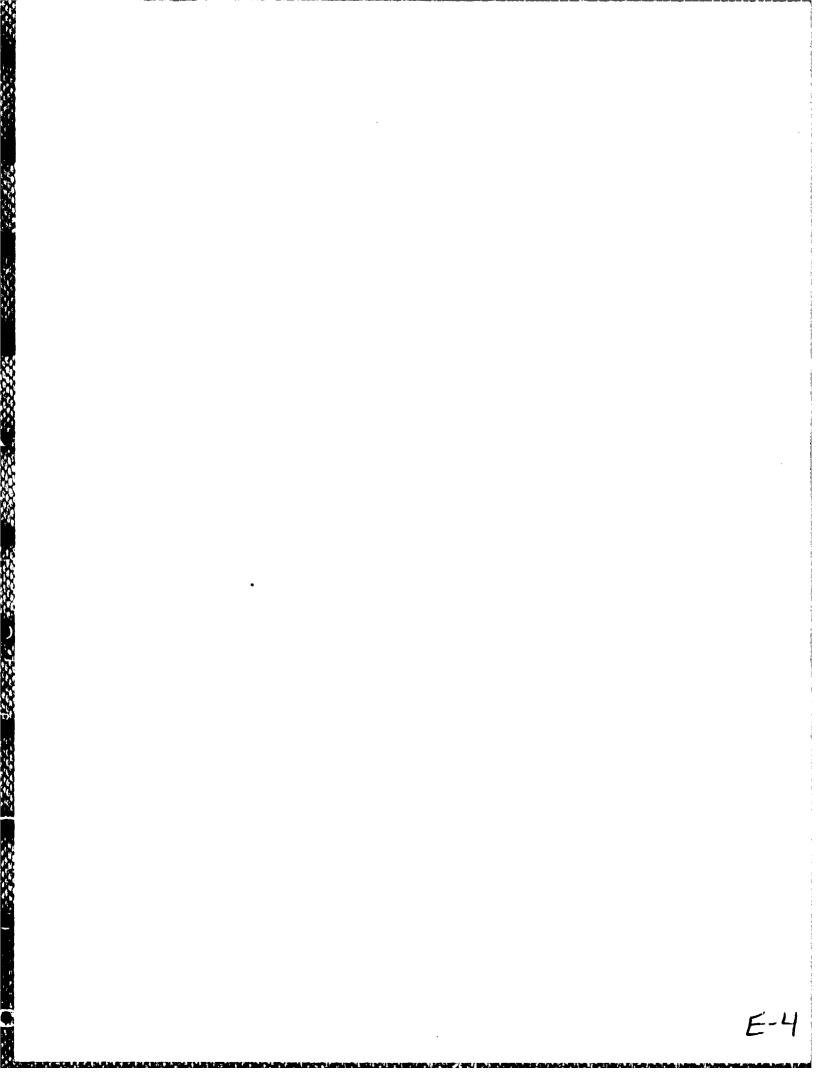
3.

4.

Samples were run by Denise McDonald on February 6, 1987.

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### 1

<pre>1: TYPE: Tefion laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BETORE TEST: Unused, no visible imperfections 4: MANUTACTURRE Chemical Corp. 5: PRODUCT LEWRITEGATION: Challenge SIGO 6: LOT OR MANUTACTURRE NATE: N/A 7: NoMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the     other side. Sample was creased using CHEMPAB Fold Resistance Test procedute     of I September 1986. 7: TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. AVALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lagp. 7: TONE RATURE 2:225°C 4: COLLECTION MEDIUM: N2 5: COLLECTION MEDIUM</pre>	•	DES	CRIPTION OF PROP	DUCT EVALUATED			
<pre>2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION SERVER ESST: Unused, no visible imperfections 4: MANUFACTURERS: Chemical Corp. 5: PRODUCT IDENTIFICATION: Challenge \$100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRITION: Material was orange colored on one side and buff colored on the     other side. Sample was creased using CHEMFAB Fold Resistance Test procedure     of 5 September 1986. 7: TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. AVALTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 7: TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. AVALTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 7: COLLECTION HOTURE: N^ 7: COLLECTION SUSTEM: N^ 7: COLLECTION SUSTEM: N^ 7: COLLECTION MEDIUM: N/A 7: CHEMICAL SOURCE: Fisher :: N/A 7: N/A 7: COLLECTION MEDIUM: N/A 7: CHEMICAL SOURCE: Fisher 7: N/A 7: N/A 7: MOMBER OF SAMPLES ESTED: One (Run I) 7: SELECTED DATA POINTS N/A 7: COLLECTION MEDIUM: CONCENTRATION : CONCENTRATION 7: CONCENTRATION : CONCENTRATION : CONCENTRATION 7: CONCENTRATION : CONCENTRATION : CONCENTRATION 7: CONCENTRATION : CO</pre>		1:	TYPE: Teflon 1	aminated Nomex			
<pre>i MANUFACTURER: Cheatab Corp. i MANUFACTURER DATE: N/A i NOMINAL THICKNESS: 15-20 mil i DECATITION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedute of 5 September 1986. TEST METHOD I. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX aval x1 Coll METHOD: Continuous photoionization detection with a 10.20 eV lamp. C. COLLECTION MEDIA: NA C. COLLECTION SUSTEM: NA C. COMPONENT 2 : 3 C. CHEM NAME(s): Carbon Disulfide : N/A : N/A C. CAS MUMBER(s): 75-15-0 C. M/A C. M/A C. CAS MUMBER(s): 75-15-0 C. M/A C. CAS MUMBER(s): 75-15-0 C. M/A C. M/A C. CAS MUMBER(s): 75-15-0 C. M/A C. M/A C. CAS MUMBER(s): 75-15-0 C. M/A C. M/A C. CAS MUMBER(s): 75-15-0 C. M/A C. M/A C. CAS MUMBER(s): 75-15-0 C. M/A C. M/A C. CAS MUMBER(s): 75-15-0 C. M/A C. M/A C. CAS MUMBER(s): 75-15-0 C. M/A C. M/A C. CAS MUMBER(s): 75-15-0 C. M/A C. M/A C. CAS MUMBER OF SAMPLES TESTED: One (Run I) C. SAMPLES C. SAMPLES IB-20 OH C. M/A C. CONCENTRATION : CONCENTRATION C. CONCENTRATION : CONCENTRATION C. CONCENTRATION : CONCENTRATION C. CONCENTRATION : CONCENTRATION C. CONCENTRATION : CONCENTRATION C. CONCENTRA</pre>							
<pre>5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIFTION: Material was creased using CHEMFAB Fold Resistance Test procedute         of 5 September 1986. 7: TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALTICAL METHOD: Continuous photoionisation detection with a 10.20 eV lamp. 3: TENTPRATURE: 22-25°C 4: COLLECTION MEDIUM: N- 5: CONCENTRATION : CONCENTRATION : N/A 5: CONCENTRATION : CONCENTRATION : CONCENTRATION 1 7: SELECTEL DATA POINTS N/A 7: CONCENTRATION : CONCENTRATION : CONCENTRATION 1 7: CL 1: CL</pre>					o visible i	mperfections	
6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedute of 3 September 1986. 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 See Caves Road, Austin, TX 2. ANALTICAL METHOD: Continuous photoionisation detection with a 10.20 eV lapp. 3. TEMPERATURE: 22-29°C 4. COLLECTION MEDIUM: N: 5. COLLECTION MEDIUM: N: 5. COLLECTION MEDIUM: N: 5. COLLECTION MEDIUM: N: 6. CTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/39 METHOD: Flow rate to cell was 100 cc/min. 4. CAALIENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A : N/A 3. CONC. (IF MIX) N/A 4. CHENICAL SOURCE: Fisher : N/A : N/A 4. CHENICAL SOURCE: Fisher : N/A : N/A 4. CHENICAL SOURCE: Fisher : N/A : N/A 4. CHENICAL SOURCE: Fisher : N/A 5. STERSULTS 1. DATE TESTED: 2-19-87 2. WUMBER OF SAMPLES TESTED: One (Run I) 3. BREAKTHROUGH TIME: 15 minutes 4. MIN DETECTABLE LIMIT.OF pem 5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>4</sup> Mr) 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A 5. CONCENTRATION : CONCENTRATION : CONCENTRATION 1							
<pre>7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was crange colored on one side and buff colored on the         other side. Sample was creased using CHEMFAB Fold Resistance Test procedute         of 5 September 1986. 3. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALTICAL METHOD: Continuous photoionization detection with a 10.20 eV lagp. 3. TENTRATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 5. COLLECTION SUSTEM: N2 5. CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A : N/A 2. CAS NUMBER(s): 75-15-0 2. N/A 2. CAS NUMBER(s): TESTED: One (Run 1) 3. BREAKTHROUGH THME: IS minutes 4. MIN DETECTABLE LIMIT. 07 ppm 5. STEADY STATE PERMEATION RATE 13.33 (ug/cm2*hr) 6. SAMPLE MICKNESS: 19-20 mil 7. SELECTEL DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1</pre>					e 5100		
8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of September 1986. 7. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. AVALT ICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No 5. COLLECTION SUSTEM: No 6. OTHER TONDITIONS: I finch cell was used./Detector Temperature = 100C. 7. DEVIATIONS STEME: No 7. DEVIATIONS FORM ASTMERIES MARKED: Flow rate to cell was 100 cc/min. CRALLENGE EMEMITIAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A : N/A 2. COLS. (IF MIX) N/A : N/A : N/A 3. TEST RESULTS 1. DATE TESTED: 2-19-87 2. WUMBER OF SAMPLES TESTED: One (Run I) 3. REACTHROUGH TIME: 15 minutes 4. MIN DETCATAL POINTS N/A 7. TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. CIME STADE STATE PERMENTION RATE 13.33 (ug/cm <sup>2</sup> 4hr) 6. SAMPLE THICKNESS: 19-20 mil 7. EXAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A 7. I. ONCENTRATION : CONCENTRATION : CONCENTRATION 1							
other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of 5 September 1986.         1. TESTIME LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX         2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp.         3. TEMPEATURE: 22-25°C         4. COLLECTION MEDIUM: No         5. COLLECTION SYSTEM: No         6. OTHER CONDITIONS: 1 inch cell was used./Detector Tomperature = 100C.         7. DEVILTIONS FROM ASEN F739 METHOD: Flow rate to cell was 100 cc/min.         4. CHEMICAL       1         1. CHEMICAL SOURCE: STATE NO         2. CAS NUMBER(s): Carbon Disulfide : N/A       N/A         2. CAS NUMBER(s): Carbon Disulfide : N/A       N/A         3. CONC. (IF MIX) N/A       N/A         4. CHEMICAL SOURCE: Fisher       N/A         5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> /mr.)         6. SAMPLES MICHANCES: 19-20 moil         7. SELCTEL DATA POINTS N/A         1							
of 5 September 1986.         2. TEST METHOD         1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX         2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp.         3. TEMPERATURE: 22-25°C         4. COLLECTION MEDIUM: No         5. COLLECTION SYSTEM: No         6. THE? TONDITIONS: I inch cell was used./Detector Temperature = 100C.         7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min.         9. THE? TONDITIONS: I inch cell was used./Detector Temperature = 100C.         7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min.         9. CHAMINGE IMEMICAL       1         1. CHAMINGE IMEMICAL       1         2. CAS NUMBER(s): Carbon Disulfide: N/A       N/A         3. CONC. (IF MIX) N/A       N/A         4. CHENICAL SOURCE: Fisher       N/A         5. MUMBER OF SAMPLES TESTED: One (Run I)       N/A         5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> hr)         6. SAMPLE THICKESS: 19-20 mil         7. SELECTED DATA POINTS N/A         7. DIME : CONCENTRATION : CONCENTRATION : CONCENTRATION         1. i       i         2. i       i       i         3. ELECTED DATA POINTS N/A       i         3. CONCENTRATION : I       i         3. CONCENTRATION :		8:	DESCRIPTION:	Material was orange	colored or	n one side and	buff colored on the
<pre>. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 See Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 5. TTHER TONDITIONS: 1 inch cell was used./Detector Tomperature = 100C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 7. CAS UMBER(s): T5-50 : N/A : N/A 7. N/A 7. CAS UMBER(s): T5-50 : N/A : N/A 7. N/A 7. TEST RESULTS 7. DATE TESTED: 2-19-87 7. N/A 7. DATE TESTED: 2-19-87 7. DATE TESTED: 10. DATE POINTS N/A 7. TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 7. SELECTED DATA POINTS N/A 7. TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 7. SELECTED DATA POINTS N/A 7. DATE INTERVENTS N/A 7. TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 7. I I I I I 7. I I I I 7. I I I I 7. I I I 7. I I I 7. I I I 7. I I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I I 7. I</pre>					sing CHEMFA	B Fold Resist	ance Test procedure
<pre>1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lapp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N- 5. COLLECTION SUSTEM: N- 5. THER TONDITIONS: 1 inch cell was used./Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 4. CHALINGE THEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A : N/A 2. CAS NUMBER(s): 75-15-0 : N/A : N/A 3. CONC. (IF MIX) N/A 3. CONC. (IF MIX) N/A 4. CHENICAL SOURCE:Fisher : N/A : N/A 4. CHENICAL SOURCE:Fisher : N/A : N/A 5. TEST RESULTS 1. DATE TESTED: 2-19-87 2. WIMBER OF SAMPLES TESTED: One (Run I) 3. BREAKTHROUGH TIME: 15 minutes 4. MIN DETECTABLE LIMIT .07 ppm 5. STEADY STATE PERMEATION RATE 13.33 (ug/cm<sup>2</sup> %hr) 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION 1</pre>			of 5 September	r 1986.			
2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER TONDITIONS: 1 inch cell was used./Detector Temperature = 100C. 7. DEVILTIONS FROM ASIM F739 METHOD: Flow rate to cell was 100 cc/min. 4. CHALINGE CHMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A : N/A 2. CAS NUMBER(s): 75-15-0 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHENICAL SOURCE:Fisher : N/A : N/A 5. TEST RESULTS 1. DATE TESTED: 2-19-87 2. NUMBER OF SAMPLES TESTED: One (Run 1) 3. BREAKTHROUGH TIME: 15 minutes 4. MIN DETECTABLE LIMIT .07 ppm 5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr) 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1	•	TES	T METHOD				
2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER TONDITIONS: 1 inch cell was used./Detector Temperature = 100C. 7. DEVILTIONS FROM ASIM F739 METHOD: Flow rate to cell was 100 cc/min. 4. CHALINGE CHMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Carbon Disulfide : N/A : N/A 2. CAS NUMBER(s): 75-15-0 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHENICAL SOURCE:Fisher : N/A : N/A 5. TEST RESULTS 1. DATE TESTED: 2-19-87 2. NUMBER OF SAMPLES TESTED: One (Run 1) 3. BREAKTHROUGH TIME: 15 minutes 4. MIN DETECTABLE LIMIT .07 ppm 5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr) 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1		1.	TESTING LABORA	TORY: Texas Researc	h Institute	e, 9063 Bee Ca	ves Road, Austin, TX
3. TEMPERATURE: 22-25°C         4. COLLECTION MEDIUM: N2         5. COLLECTION SYSTE: N-         6. OTHER TONDITIONS: 1 inch cell was used./Detector Temperature = 100C.         7. DEVILTIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min.         1. CHALIENGE CHEMICAL       1 :: COMPONENT 2 :: 3         1. CHAMIENCE: 1 Carbon Disulfide :: N/A       N/A         2. CAS MUMBER(s): 75-15-0 :: N/A       N/A         3. CONC. (IF MIX) N/A       :: N/A         4. CHENICAL SOURCE: Fisher       :: N/A         5. TEST RESULTS       :         1. DATE TESTED: 2-19-87         2. NUMBER OF SAMPLES TESTED: One (Run I)         3. BREAKTHROUGH TIME: 15 minutes         4. MIN BETECTABLE LIMIT .07 ppm         5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS: 19-20 mil         7. SELECTED DATA POINTS N/A         7. SELECTED DATA POINTS N/A         1		2.	ANALYTICAL MET	HOD: Continuous ph	otoionizati	on detection	with a 10.20 eV lamp.
5. COLLECTION SYSTEM: No 6. TTHER CONDITIONS: I inch cell was used./Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min. 5. CHALIENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s) : Carbon Disulfide : N/A : N/A 2. CAS NUMBER(s): 75-15-0 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHENICAL SOURCE:Fisher : N/A : N/A 5. TEST RESULTS 1. DATE TESTED: 2-19-87 2. NUMBER OF SAMPLES TESTED: One (Run I) 3. BREACTHROUCH TIME: 15 minutes 4. MIN DETECTABLE LIMIT .07 ppm 5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr) 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1		3.	TEMPERATURE: 2	2-25°C			
5. OTHER CONDITIONS:I inch cell was used./Detector Temperature = 100C.         7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min.         9. CHALLENGE CHEMICAL       1       : COMPONENT 2       :       3         1. CHEM NAME (s): Carbon Disulfide       :       N/A       :       N/A         2. CAS NUMER(s): 75-15-0       :       N/A       :       N/A         3. CONC. (IF MIX)       N/A       :       N/A       :       N/A         4. CHENICAL SOURCE: Fisher       :       N/A       :       N/A         5. DATE TESTED: 2-19-87       :       N/A       :       N/A         6. MIMER OF SAMPLES TESTED: One (Run 1)       :       :       N/A         7. NUMBER OF SAMPLES TESTED: One (Run 1)       :       :       :       N/A         7. NUMBER OF SAMPLES TESTED: One (Run 1)       :       :       :       :       :         8. EAKTHROUGH TIME: 15 minutes       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :		4.	COLLECTION MED	IUM: No			
7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min.         4. CHALLENGE CHEMICAL       1       : COMPONENT 2       : 3         1. CHEM NAME(s): Carbon Disulfide       N/A       N/A       N/A         2. CAS NUMBER(s): 75-15-0       : N/A       : N/A         2. CAS NUMBER(s): 75-15-0       : N/A       : N/A         2. CAS NUMBER(s): 75-15-0       : N/A       : N/A         3. CONC. (IF MX) N/A       : N/A       : N/A         4. CHENICAL SOURCE: Fisher       : N/A       : N/A         5. TEST RESULTS       : N/A       : N/A         1. DATE TESTED: 2-19-87       : N/A       : N/A         2. NUMBER OF SAMPLES TESTED: One (Run I)       : N/A       : N/A         3. BREAKTHROUGH TIME: 15 minutes       : N/A       : N/A         4. MIN DETECTABLE LIMIT _07 ppm       : STEADY STATE PERMEATION RATE _13.33 (ug/cm <sup>2</sup> *hr)       : : : : : : : : : : : : : : : : : : :		5.	COLLECTION SYS:	TEM: No			
7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min.         1. CHALIENCE CHEMICAL       1       : COMPONENT 2       : 3         1. CHEM NAME(s): Carbon Disulfide       N/A       N/A       N/A         2. CAS NUMBER(s): 75-15-0       : N/A       : N/A         3. CONC. (IF MIX) N/A       : N/A       : N/A         4. CHEMICAL SOURCE: Fisher       : N/A       : N/A         5. CONC. (IF MIX) N/A       : N/A       : N/A         6. CONC. (IF MIX) N/A       : N/A       : N/A         7. NUMBER OF SAMPLES TESTED: One (Run I)       : N/A       : N/A         3. BREAKTHROUGH TIME: 15 minutes       : N/A       : N/A         4. MIN DETECTABLE LIMIT .07 ppm       : STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr)       : SAMPLE THICKNESS: 19-20 mil         7. SELECTED DATA POINTS N/A       : : : : : : : : : : : : : : : : : : :		5.	OTHER CONDITION	NS: 1 inch cell w	as used. /De	tector Temper	ature = 100C.
1       :       COMPONENT 2       :       3         1.       CHEM NAME(s):       Carbon Disulfide       N/A       N/A         2.       CAS NUMBER(s):       75-15-0       :       N/A       N/A         3.       CONC. (IF MIX)       N/A       :       N/A       N/A         4.       CHENICAL SOURCE:       Fisher       :       N/A       N/A         4.       CHENICAL SOURCE:       Fisher       :       N/A       N/A         5.       Concentration       :       :       :       :         6.       :       :       :       :       :         7.       :       :       :       :       :         7.       :       :       :       :       :         7.       :       :       :       :       :         7.       :       :       :       :       :       :         7.       :       :       :       :       :       :       :         6.       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       <					Flow rate	to cell was	100 cc/min.
1. CHEM NAME(s): Carbon Disulfide:       N/A       N/A         2. CAS NUMBER(s): 75-15-0       N/A       N/A         3. CONC. (IF MIX) N/A       N/A       N/A         4. CHENICAL SOURCE: Fisher       N/A       N/A         5. TEST RESULTS       N/A       N/A         1. DATE TESTED: 2-19-87       N/A       N/A         2. NUMBER OF SAMPLES TESTED: One (Run I)       N/A       N/A         3. BREAKTHROUGH TIME: 15 minutes       MIN DETECTABLE LIMIT .07 ppm         5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> thr)       6. SAMPLE THICKNESS: 19-20 mil         7. SELECTED DATA POINTS N/A       Image: Concentration : Concentration : Concentration : Concentration :							
2. CAS NUMBER(s): 75-15-0 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE: Fisher : N/A : N/A 5. TEST RESULTS 1. DATE TESTED: 2-19-87 2. NUMBER OF SAMPLES TESTED: One (Run I) 3. BREAKTHROUGH TIME: 15 minutes 4. MIN DETECTABLE LIMIT .07 ppm 5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr) 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1	•	CHA	LLENGE CHEMICAL	1	: Com	ONENT 2	: 3
2. CAS NUMBER(s): 75-15-0 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Fisher 1. DATE TESTED: 2-19-87 2. NUMBER OF SAMPLES TESTED: One (Run I) 3. BREAKTHROUGH TIME: 15 minutes 4. MIN DETECTABLE LIMIT .07 ppm 5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr) 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1		1.	CHEM NAME(s) :	Carbon Disulfide	•	N/A	. N/A
3. CONC. (IF MIX) N/A       :       N/A       :       N/A         4. CHENICAL SOURCE: Fisher       :       N/A       :       N/A         4. CHENICAL SOURCE: Fisher       :       N/A       :       N/A         5. TEST RESULTS       :       N/A       :       N/A         1. DATE TESTED: 2-19-87       :       N/A       :       N/A         2. NUMBER OF SAMPLES TESTED: One (Run I)       :       :       N/A         3. BREAKTHROUGH TIME: 15 minutes       :       :       :       :         4. MIN DETECTABLE LIMIT .07 ppm       :       :       :       :       :         5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr)       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       : <td></td> <td>2.</td> <td>CAS NUMBER(s):</td> <td>75-15-0</td> <td></td> <td></td> <td></td>		2.	CAS NUMBER(s):	75-15-0			
4. CHENICAL SOURCE: Fisher       :       N/A       :       N/A         5. TEST RESULTS       1. DATE TESTED: 2-19-87       2. NUMBER OF SAMPLES TESTED: One (Run I)       3. BREAKTHROUGH TIME: 15 minutes         4. MIN DETECTABLE LIMIT .07 ppm       5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr)       6. SAMPLE THICKNESS: 19-20 mil         7. SELECTED DATA POINTS N/A       :       :       :         1       :       :       :         2       :       :       :         3       :       :       :         3       :       :       :         4       :       :       :         5       :       :       :         6       :       :       :         7       :       :       :         8       :       :       :         9       :       :       :         10       :       :       :       :							
TEST RESULTS         1. DATE TESTED:       2-19-87         2. NUMBER OF SAMPLES TESTED:       One (Run I)         3. BREAKTHROUGH TIME:       15 minutes         4. MIN DETECTABLE LIMIT       .07 ppm         5. STEADY STATE PERMEATION RATE       13.33 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS:       19-20 mil         7. SELECTED DATA POINTS N/A         CONCENTRATION : CONCENTRATION : CONCENTRATION         1.       :         2.       :         3.       :         4.       :         5.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :							
2. NUMBER OF SAMPLES TESTED: One (Run 1) 3. BREAKTHROUGH TIME: 15 minutes 4. MIN DETECTABLE LIMIT .07 ppm 5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr) 6. SAMPLE THICKNESS: 19-20 min 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :	•	TES	T RESULTS				
3. BREAKTHROUGH TIME:       15 minutes         4. MIN DETECTABLE LIMIT       .07 ppm         5. STEADY STATE PERMEATION RATE       13.33 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS:       19-20 mil         7. SELECTED DATA POINTS       N/A         TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION         1.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         1.       :         2.       :         3.       :         3.       :         3.       :         4.       :         5.       :         10.       :       :		1.	DATE TESTED: 2	-19-87			
3. BREAKTHROUGH TIME:       15 minutes         4. MIN DETECTABLE LIMIT       .07 ppm         5. STEADY STATE PERMEATION RATE       13.33 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS:       19-20 mil         7. SELECTED DATA POINTS       N/A         TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION         1.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         1.       :         2.       :         3.       :         3.       :         3.       :         4.       :         5.       :         10.       :       :		2.			n I)		
4. MIN DETECTABLE LIMIT .07 ppm         5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS: 19-20 mil         7. SELECTED DATA POINTS N/A         TIME : CONCENTRATION : CONCENTRATION         1.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         1.       :         2.       :         3.       :         1.       :         2.       :         3.       :         1.       :         2.       :         3.       :         3.       :         1.       :         2.       :         3.       :         3.       :         2.       :         3.       :         2.       :         3.       :         3.       :         1.       :         2.       :         2.       : <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
5. STEADY STATE PERMEATION RATE 13.33 (ug/cm <sup>2</sup> *hr) 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :							······································
6. SAMPLE THICKNESS: 19-20 mil         7. SELECTED_DATA POINTS N/A         TIME : CONCENTRATION : CONCENTRATION         1.       :       :         2.       :       :         3.       :       :         3.       :       :         5.       :       :         6.       :       :         7.       :       :         8.       :       :         9.       :       :         10.       :       :					$3 \left( ug/cm^{2} \star \right)$	η <b>Γ</b> )	
7. SELECTED_DATA POINTS N/A         TIME       :       CONCENTRATION       :       CONCENTRATION         1.       :       :       :       :       :         2.       :       :       :       :       :         3.       :       :       :       :       :         3.       :       :       :       :       :         3.       :       :       :       :       :         3.       :       :       :       :       :         3.       :       :       :       :       :         4.       :       :       :       :       :       :         5.       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :		-					
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2.       :       :       :         3.       :       :       :         4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         8.       :       :       :         9.       :       :       :         10.       :       :       :			TIME	: CONCENTRATI	.ON : CO	NCENTRATION	: CONCENTRATION
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8. OTHER OBSERVATIONS:			10	•	:		•
		8. (	OTHER OBSERVATIO	ONS:			

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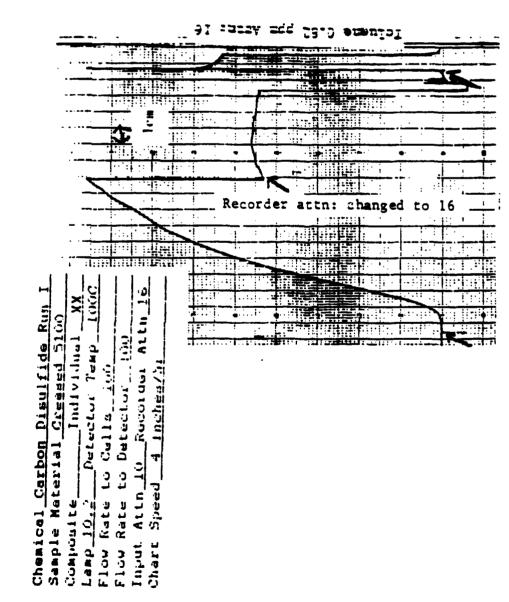
Sample was run by Denise McDonald on February 19, 1987.

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Chemical Resistance Testing of Creased 5100

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Carbon Disulfide Run



Switched from cells to standard gas

**Carbon Disulfide charged into cells** 

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DES	SCRIPTION OF PRO	DUCT EVALUATED			
1:	TYPE: Teflon 1	entreed Nemer			
2:		ERIAL CODE: 068			
3:		RE TEST: Unused, no v:	isible imperfectio	75	
4:	MANUFACTURER:				
5:		FICATION: Challenge 5	100		
6:					
7:	NOMINAL THICKN	ESS: 15-20 mil			
8:		Material was orange co.	lored on one side	and buff colore	d on the
	other side. S	ample was creased using	g CHEMFAB Fold Res	istance Test pr	ocedure
	of 5 Septembe				
TES	ST METHOD				
1.	TESTING LABORA	IORY: Texas Research I:	nstitute, 9063 Bee	Caves Road. Au	stin. TX
2.		HOD: Continuous photo			
3.					
-	COLLECTION MED				
5	COLLECTION SYS	IEM: No			<u>مي الأين من من ما ترب من م</u>
5.	OTHER CONDITIO	NS: 1 inch cell was	used. /Detector Tem	perature = 1000	
7.	DEVIATIONS FRO	M ASIM F739 METHOD: F.	low rate to cell w	as 100 cc/min.	
				•	
CH	ALIENGE CHEMICAL	1	: COMPONENT 2	: 3	
1.	CHEM NAME(s) :	Carbon Disulfide	: N/A	: N,	/A
2.	CAS NUMBER(s):	75-15-0	: N/A	: N/	
3.	CONC. (IF MIX)	N/A	: N/A	: N/	/A
4.	CHEMICAL SOURC	E:Fisher	: N/A	: N	/A
TES	ST RESULTS				
i.	DATE TESTED: 2	-20-87			
		ES TESTED: One (Run I	I)		
	BREAKTHROUGH TI				
	MIN DETECTABLE				
		RMEATION RATE 12.85(u	g/cm <sup>2</sup> *hr)		
	SAMPLE THICKNES				
7.	SELECTED_DATA P	OINTS N/A			
	TIME	: CONCENTRATION	: CONCENTRATIO	N : CONCENTI	RATION
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8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Sample was run by Denise McDonald on February 20, 1987.

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Chemical Resistance Testing of Creased 5100

# Carbon Disulfide Run II

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<u>\_\_\_\_\_</u> Switched from cells to standard gas : 91 :. eventoj ... . ... I Ť. 1 . 34 i **h**... 11 Chemical <u>Carbon Disulfide Run II</u> inc h Recuider Atèn <u>16</u> S) I 2 XX 5100 Carbon Disuffide charged into cell 100 20 Individual Detector Temp <u>Created</u> 100 2 Inches/hr changed Flow Rete to Detector Flow Kate to Cella\_ Bpeed Sample Material Input Attn 10 T :•1 • • • • Chart Speed Chart + -Compouite\_ Lamp 10.2 ₹ ł.

# DES\_RIPTION OF PRODUCT EVALUATED

1:	TYPE: Teflon laminated Nomex
2:	PROTECTIVE MATERIAL CODE: 068
3:	CONDITION BEFORE TEST: Unused, no visible imperfections
4:	MANUFACTURER: Chemfab Corp.
5:	PRODUCT IDENTIFICATION: Challenge 5100
6:	LOT OR MANUFACTURER DATE: N/A
7:	NOMINAL THICKNESS: 15-20 mil
8:	DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side. Sample was creased using CHEMFAB Fold Resistance Test procedure
	of 5 September 1986.

2. TEST METHOD

1.	TESTING	LABORATORY:	Texas	Research	Institute,	9063 Bee	Caves Road	, Austin, T	ζ

2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp.

3. TEMPERATURE: 22-25°C

4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No

5. OTHER CONDITIONS: 1 inch cell was used/Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc. min.

3.	CHALLENGE CHEMICAL	1	: COMPONENT 2	:	3	
	1. CHEM NAME(s) :	Carbon Disulfide	: : N/A	:	N/A	
	2. CAS NUMBER(s):	75-15-0	: N/A		N/A	
	3. CONC. (IF MIX)		: N/A		N/A	وبجرد علاكمي
	4. CHEMICAL SOURCE	E:Fisher	: N/A		N/A	

TEST RESULTS 4.

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1. DATE TESTED: 2-24-87

2. NUMBER OF SAMPLES TESTED: One (Run III)

3. BREAKTHROUGH TIME: 15 minutes

4. MIN DETECTABLE LIMIT .04 ppm

5. STEADY STATE PERMEATION RATE 10.04 (1g/cm-\*hr) 6. SAMPLE THICKNESS: 19-20 mils

7. SELECTED DATA POINTS N/A

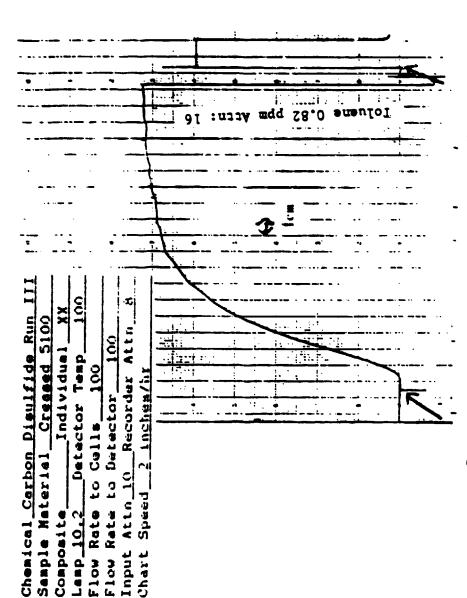
TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Sample was run by Denise McDonald on February 24, 1987.

Carbon Disulfide Run III



Carbon Disuifide charged into cell Switched from cells to standard gas

## DESCRIPTION OF PRODUCT EVALUATED 1.

1:	TYPE:	Teflon	laminated	Nomex

- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A
- 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of 5 September 1986.

2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.
- 3. TEMPERATURE: 22-25°C
- COLLECTION MEDIUM: N2 4.
- 5. COLLECTION SYSTEM: N2

6. OTHER CONDITIONS: 1 inch cell was used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASIM F739 METHOD: Flow rate to cell was 100 cc/min.

CHALLENCE CHEMICAL	1	• •	COMPONENT 2	:	3	
1. CHEM NAME(s) :	Dichloromethane	:	N/A	:	N/A	
2. CAS NUMBER(s):		<u> </u>	N/A		N/A	_
3. CONC. (IF MIX)			N/A	:	N/A	<b></b>
4. CHEMICAL SOURCE	Fisher	;	N/A	;	N/A	

# TEST RESULTS

L

- 1. DATE TESTED: 4-13-87
- 2. NUMBER OF SAMPLES TESTED: One (Run I)
- 3. BREAKTHROUGH TIME: 53 minutes 4. MIN DETECTABLE LIMIT\_.71 ppm
- 5. STEADY STATE PERMEATION RATE 3.79 (ug/cm2\*hr)
- 6. SAMPLE THICKNESS: 19-20 mils
- 7. SELECTED DATA POINTS N/A

_		CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
	<u> </u>	· · · · · · · · · · · · · · · · · · ·	<u>:</u>		:	
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# 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Sample was run by Denise McDonald on April 13, 1987.

# Dichloromethane Run I

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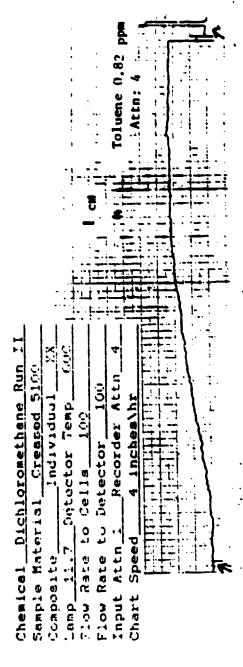
# 1. DESCRIPTION OF PRODUCT EVALUATED

, <sup>6</sup>, 6

	l: TYPE: Teflon					
	2: PROTECTIVE M			محمد بالشي محمد الألام الاشع جيرات	-	
				visible imperfect	ions	والمحالية المراجعة فينوعها ويوجعها
	A: MANUFACTURER					والسري والمراجع والمراجع
	5: PRODUCT IDEN			5100		
	: LOT OR MANUF					
	7: NOMINAL THIC				·	
				colored on one sid		
				ing CHEMFAB Fold B	lesistance 7	fest procedure
	of 5 Septem	Der 1900.				
-	TEST METHOD					
	. TESTING LABO	RATORY: T	exas Research	Institute, 9063 B	ee Caves R	oad, Austin, TX
	2. ANALYTICAL M			toionization detec		
	3. TEMPERATURE:	22-25°C				
	4. COLLECTION M	EDIUM: N	2			
	5. COLLECTION S					
	5. OTHER CONDIT		inch cell wa	s used./Detector I	amperature	= 60C.
7	. DEVIATIONS F	ROM ASIM	F739 METHOD:	Flow rate to cell	was 100 ci	c/min.
. (	CHALLENGE CHEMIC	AT	1	: COMPONENT 2		3
1			4	; COMPONENT 2	2	2
	. CHEM NAME(s)	• Diebl		: N/A	•	N/A
	L. CAS NUMBER(s					N/A
	B. CONC. (IF MI	·				N/A
	CHEMICAL SOU		·····			N/A
_		·	•			
2	TEST RESULTS					
•	. DATE TESTED:	4-13-87				
	2. NUMBER OF SAM		FD: One (Run	TT \		
	3. BREAKTHROUGH			••/		
	4. MIN DETECTABL					
	5. STEADY STATE			(ug/cmp*hr)		
	6. SAMPLE THICKN					
	. SELECTED DATA					
	TIME	:	CONCENTRATIO	N : CONCENTRAT	TION : O	ONCENTRATION
	1	:		:	:	
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4						
I	10 B. OTHER OBSERVA	TIONS:				
ł		TIONS:				
		TIONS:				

E-13

# **Dichloromethane Run II**



Dichloromethane charged into cells

E-14

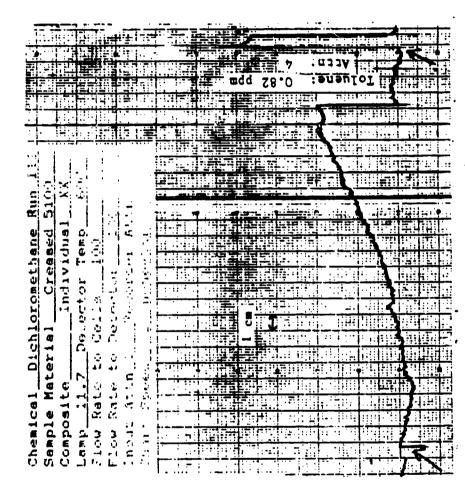
Switched from cells to standard gas

# 

30

	1: TYPE: Teflon laminated Nomex		
	2: PROTECTIVE MATERIAL CODE: 068		
	3: CONDITION BEFORE TEST: Unused, m	o visible imperfection	8
	4: MANUFACTURER: Chemfab Corp.		
	5: PRODUCT IDENTIFICATION: Challeng	te 5100	
	6: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 m11		
	8: DESCRIPTION: Material was orange		
	other side. Sample was creased u of 5 September 1986.	ISING CHEMPAD FOID RESI	stance lest procedure
	OI J September 1900.		
•	TEST METHOD		
	1. TESTING LABORATORY: Texas Researc		
	2. ANALYTICAL METHOD: Continuous ph	otoionization detectio	n with a 11.70 eV lamp.
	3. TEMPERATURE: <u>22-25°C</u>		
	4. COLLECTION MEDIUM: N2		
	5. COLLECTION SYSTEM: N2		
	6. OTHER CONDITIONS: 1 inch cell w	as used. /Detector Temp	erature = 60C.
	7. DEVIATIONS FROM ASTH F739 METHOD:	Flow rate to cell we	is 100 cc/min.
•	CHALLENGE CHEMICAL 1	: COMPONENT 2	: 3
•	CRALLENGE CREMICAL I	: COMPONENT 2	: J
	1. CHEM NAME(s) : Dichloromethane	: \\/A	: N/A
	2. CAS NUMBER(s): 75-09-2		
	3. CONC. (IF MIX) $N/A$	N/A N/A	: N/A
	4. CHEMICAL SOURCE: Fisher	<u> </u>	
	3. BREAKTHROUGH TIME: 53 minutes 4. MIN DETECTABLE LIMIT .79 ppm 5. STEADY STATE PERMEATION RATE 3.24 6. SAMPLE THICKNESS: 19-20 mils	(Run III) (ug/cm2*hr)	
	7. SELECTED DATA POINTS N/A	· · · · · · · · · · · · · · · · · · ·	
	TIME : CONCENTRATI	ION : CONCENTRATION	CONCENTRATION
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	7;	:	:
	8. :		:
	9:	:	8
	10:		:
•	N OTHER DECERVATIONS.		
	SOURCE OF DATA Sample was run by Denise Mcl	Donald on April 14, 19	87.
•	محويف بهويود بهذا وماني فيقت بالمتشافية والمحوالي والهوابي المتعالية	:	:

# Dichloromethane Run III



Switched from cells to standard gas

Dichloromethane charged into cella

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# 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil
- P. DECOTITION. Meterici une erenze el
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of 5 September 1986.

2. TEST METHOD

10.00

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.
   TEMPERATURE: 22-25°C
- 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2
- 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2
- COLLECTION SISTEM.
- OTHER CONDITIONS: 1 inch cells were used. / Detector Temperature = 60C.
   DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.

CHALLENCE CHEMICAL	1	:	COMPONENT 2	:	3	
1. CHEM NAME(s):	Diethylamine	:	N/A	:	N/A	
2. CAS NUMBER(s):	109-89-7		N/A		N/A	
3. CONC. (IF MIX)	N/A		N/A	:	N/A	
4. CHEMICAL SOURCE:	Mallinckrodt		N/A		N/A	
	<ol> <li>CAS NUMBER(s):</li> <li>CONC. (IF MIX)</li> </ol>	1. CHEM NAME(s): Diethylamine 2. CAS NUMBER(s): 109-89-7 3. CONC. (IF MIX) N/A	1. CHEM NAME(s):       Diethylamine       :         2. CAS NUMBER(s):       109-89-7       :         3. CONC. (IF MIX)       N/A       :	1. CHEM NAME(s):       Diethylamine       :       N/A         2. CAS NUMBER(s):       109-89-7       :       N/A         3. CONC. (IF MIX)       N/A       :       N/A	1. CHEM NAME(s):       Diethylamine       :       N/A       :         2. CAS NUMBER(s):       109-89-7       :       N/A       :         3. CONC. (IF MIX)       N/A       :       N/A       :	1. CHEM NAME(s):       Diethylamine       :       N/A         2. CAS NUMBER(s):       109-89-7       :       N/A         3. CONC. (IF MIX)       N/A       :       N/A

4. TEST RESULTS

- 1. DATE TESTED: 2-10-87
- 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 3.0 hours

- 4. MIN DETECTABLE LIMIT .15 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS N/A

TIME :	CONCENTRATION :	CONCENTRATION :	CONCENTRATION
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E-1

8. OTHER OBSERVATIONS:

Samples were run by Denise McDonald on February 10, 1987.

# **Diethylamine**

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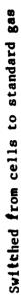
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4
Chemical: Diethylamine Samp'e Material: <u>Creased 5100</u> Composite: <u>X</u> Individual: Lamp: 11.7 Detector temp: 60 Flow rate to Detector: 100 Input attn: <u>1</u> Recorder attn: Chart speed: <u>2 in/hr</u>



Diethylamine charged into cells

-----K

## DESCRIPTION OF PRODUCT EVALUATED 1.

- 1: TYPE: Teflon laminated Nomex
- PROTECTIVE MATERIAL CODE: 068 2:
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- PRODUCT IDENTIFICATION: Challenge 5100 5:
- 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of 5 September 1986.

2. TEST METHOD

3.

1.	TESTING	LABORATORY:	: Texas	Research	Institute,	9063 B	ee Caves B	Road, Austin, T	X

- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.
- 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: N2 DUIECTION SYSTEM: N2
- 5. COLLECTION SYSTEM:
- 6. OTHER CONDITIONS: 1 inch cells were used. / Detector Temperature = 60C. 7. DEVIATIONS FROM ASIM F739 METHOD: Flow rate to cells was 100 cc/min.

CHALLENGE CHEMICAL	1	:	COMPONENT 2	:	3	
1. CHEM NAME(s) :	Dimethylformamide	:	N/A	•	N/A	_
2. CAS NUMBER(s):	68-12-2	-:	N/A		N/A	منط <u>ال</u> ف بندا
3. CONC. (IF MIX)	N/A ·	-:-	N/A	;	N/A	
4. CHEMICAL SOURCE:	Mallinckrodt	-:-	N/A		N/A	

TEST RESULTS 4.

- 1. DATE TESTED: 2-11-87
- 2. NUMBER OF SAMPLES TESTED: Three

3. BREAKTHROUGH TIME: No breakthrough was observed after 4.0 hours

- 4. MIN DETECTABLE LIMIT .40 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A

TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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ER OBSERV	ATIONS:					

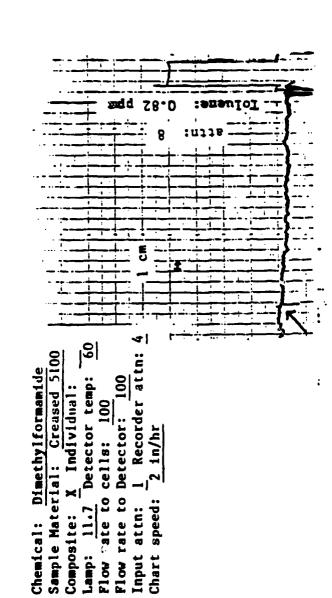
5. SOURCE OF DATA

8.

Samples were run by Denise McDonald on February 11, 1987.

E-19

# **Dimethylformamide**





# 1. DESCRIPTION OF PRODUCT EVALUATED

1: TYPE: Terlon laminated Nome	1:	TYPE:	Teilon	laminated	Nome
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- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100

6: LOT OR MANUFACTURER DATE: N/A

- 7: NOMINAL THICKNESS: 15-20 mil
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of 5 September 1986.

2. TEST METHOD

1.	TESTING LABORATO	RY: Texas Research	Institute,	9063 Bee	Caves R	oad, Austin, TX
2.	ANALYTICAL METHO	D: Continuous pho	toionizatio	on detectio	on with a	a 10.20 eV lamp.
3.	TEMPERATURE: 22-	-25°C				
4.	COLLECTION MEDIL	M: No				
5.	COLLECTION SYSTE	M: No				
6.	OTHER CONDITIONS	: 1 inch cells w	vere used. /	Detector 3	Cemperati	ure = 100C.
7.	DEVIATIONS FROM	ASIN F739 METHOD:	Flow rate	to cells a	as 100	cc/min.
СНА	LLENGE CHEMICAL	ì	: COMPO	NENT 2	•	3
			:		:	
1.	CHEM NAME(s) :	Ethyl Acetate	: 1	N/A	:	N/A
2.	CAS NUMBER(s):	141-78-6		N/A	:	N/A
3.	CONC. (IF MIX)	N/A		N/A		N/A
4.	CHEMICAL SOURCE:	EM Science		N/A	:	N/A
		والمتحدث والأكف المستجرب المتحدين والمتحد والمحاكم	بيسامية فستعفين مسدي			

4. TEST RESULTS

3.

1.	DATE TESTED: 3-4-87
2.	NUMBER OF SAMPLES TESTED: Three
3.	BREAKTHROUGH TIME: N/A
4.	MIN DETECTABLE LIMIT .20 ppm
5.	STEADY STATE PERMEATION RATE N/A
6.	SAMPLE THICKNESS: 19-20 mils
	SELECTED DATA BOINTS N/A

7. SELECTED DATA POINTS <u>N/A</u>

	TIME	:	CONCENTRATION :	CONCENTRATION	:	CONCENTRATION
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9. 🗌		:	:		:	
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F-7

5. SOURCE OF DATA

Samples were run by Denise McDonald on March 4, 1987.

# Ethyl Acetate

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0.82 ppm	
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	5
Cetate Creased 5100 Individual tor Temp 10 ts 100 ts	
위해귀엽의 [월기	
hyl Acetate 141_Creesed 5 X Individual Detector Temp_ Cellu 100 Detector 100 2 inches/hr	
· · · · · · · · · · · · · · · · · · ·	
1 1 1 1 0 mm	
Chemical <u>Ethyl Acetate</u> Sample Material <u>Crease</u> Composite <u>XX</u> Individ Composite <u>XX</u> Individ Lamp <u>10.2</u> Detector Te Flow Rate to Detector Input Attn <u>10</u> Recorder Chart Speed <u>2 inches/h</u>	
ចត្រីដំណូណ្ដឹកបី	

Ethyl Acetate charged into cells Switchoù from cells to standard gas

# 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100

6: LOT OR MANUFACTURER DATE: N/A

- 7: NOMINAL THICKNESS: 15-20 mil
- 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of 5 September 1986.

2. TEST METHOD

1.	TESTING LABORAT	ORY: Texas Research	h Institute, 9063 Bee	Caves R	oad, Austin, 1	<u>[X]</u>
2.	ANALYTICAL METH	OD: Continuous pho	toionization detection	on with a	a 10.20 eV lan	ap.
3.	TEMPERATURE: 22	-25 °C				
4.	COLLECTION MEDI	UM: No				
3.	COLLECTION SYST	EM: N2				
ó.	OTHER CONDITION	S: 1 inch cells w	vere used. /Detector To	emperatu	re = 100C.	
7.	DEVIATIONS FROM	ASIM F739 METHOD:	Flow rate to cells a	as 100	cc/min.	
					_	
CHA	LLENCE CHEMICAL	1	: COMPONENT 2	:	3	
			•	:		
1.	CHEM NAME(s) :	Hexane	:N/A	:	N/A	
2.	CAS NUMBER(s):	110-54-3	:N/A		N/A	
3.	CONC. (IF MIX)	N/A			N/A	

4. CHEMICAL SOURCE: Aldrich : N/A : N/A

4. TEST RESULTS

3.

- 1. DATE TESTED: 3-3-87
- 2. NUMBER OF SAMPLES TESTED: Three

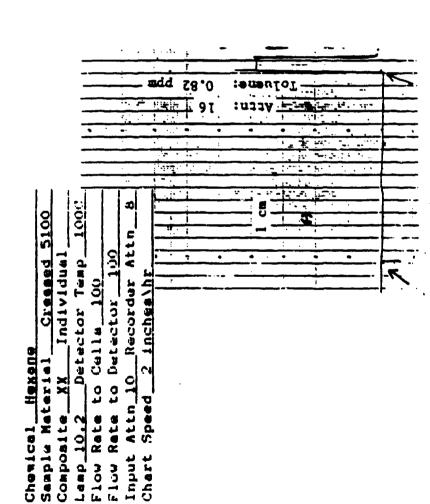
3. BREAKTHROUGH TIME: N/A

- 4. MIN DETECTABLE LIMIT .11 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mils
- 7. SELECTED DATA POINTS N/A

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OTHER OBSI	ERVATIONS:			

Hexane

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Switched from cells to standard gas Hexans charged into cells

# 1. DESCRIPTION OF PRODUCT EVALUATED

- 1: TYPE: Teflon laminated Nomex
- 2: PROTECTIVE MATERIAL CODE: 068
- 3: CONDITION BEFORE TEST: Unused, no visible imperfections
- 4: MANUFACTURER: Chemfab Corp.
- 5: PRODUCT IDENTIFICATION: Challenge 5100
- 6: LOT OR MANUFACTURER DATE: N/A
- 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of 5 September 1986.

2. TEST METHOD

- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp.
- 3. TEMPERATURE: <u>22-25°C</u>
- 4. COLLECTION MEDIUM: No
- 5. COLLECTION SYSTEM: N2
- OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C.
   DEVIATIONS FROM ASTM #739 METHOD: Flow rate to cells was 100 cc/mip.

3.	CHALLENGE CHEMICAL	1	: COMPONENT 2	:	3	
	1. CHEM NAME(s) :	Methanol	n N/A	:	N/A	
	2. CAS NUMBER(s):	811-98-3	: N/A		N/A	
	3. CONC. (IF MIX)	N/A	: N/A	:	N/A	
	4. CHEMICAL SOURCE	Ficher	• N / A		N/A	

. TEST RESULTS

- 1. DATE TESTED: 2-04-87
- 2. NUMBER OF SAMPLES TESTED: Three
- 3. BREAKTHROUGH TIME: No breakthrough was observed after 3.2 hours.
- 4. MIN DETECTABLE LIMIT .10 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 19-20 mil
- 7. SELECTED DATA POINTS N/A

TIME :	<b>CONCENTRATION</b>	CONCENTRATION	: CONCENTRATION
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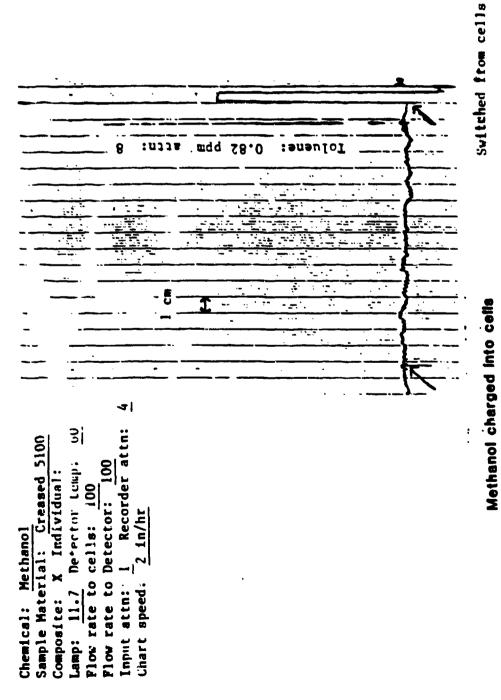
8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Samples were run by Denise McDonald on February 4, 1987.



# Methanol



Switched from cells to standard gas

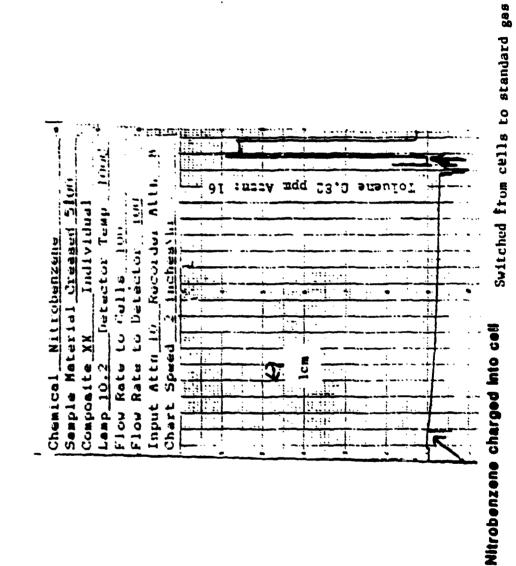
	Under CAL FR	DIECTIVE CLOTHI	NG PRODUCT EVALUATION	RECORD
1.	DESCRIPTION OF PRODUCT EV	ALUATED		
	1: TYPE: Teflon laminate	d Nomex		
	2: PROTECTIVE MATERIAL C	ODE: 068		
	3: CONDITION BEFORE TEST		isible imperfections	
	4: MANUFACTURER: Chemfa			
	5: PRODUCT IDENTIFICATIO		100	
	6: LOT CR MANUFACTURER D 7: NOMINAL THICKNESS: 1			
	8: DESCRIPTION: Materia		lored on one side and	buff colored on the
			g CHEMFAB Fold Resist	
	of 5 September 1986.			
2.	TEST METHOD			
	1. TESTING LABORATORY: T	ever Research T	perituta 9063 Bas Ca	ver Road Averia TY
				with a 10.20 eV lamp.
	3. TEMPERATURE: 22-25°C			
	4. COLLECTION MEDIUM: N			
	5. COLLECTION SYSTEM: N	2		
	6. OTHER CONDITIONS: 1	inch cells wer	e used./Detector Temp	erature = 100C.
	T. DEVIATIONS FROM ASTM	F739 METHOD: F	low rate to cells was	100 cc.min.
3.	CHALLENGE CHEMICAL	1	: COMPONENT 2	: 3
	1. CHEM NAME(s) : Nitro	benzene	: N/A	: N/A
	2. CAS NUMBER(s): 98-95	-3	: <u> </u>	: <u> </u>
	3. CONC. (IF MIX) N/A		: N/A	: N/A
	4. CHEMICAL SOURCE : Malli	nckrodt	: N/A	: N/A
4.	TEST RESULTS			
	1. DATE TESTED: 2-26-87			
	2. NUMBER OF SAMPLES TEST	ED: Three		
	3. BREAKTHROUGH TIME : N/		······································	
	4. MIN DETECTABLE LIMIT .			
	5. STEADY STATE PERMEATIC	N RATE N/A		
	6. SAMPLE THICKNESS: 19-2			
	7. SELECTED DATA POINTS	<u>N/A</u>		
	TIME : 1. :	CONCENTRATION	: CONCENTRATION	: CONCENTRATION
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	<b>9.</b> : 10:		<u>;</u>	
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	8. OTHER OBSERVATIONS:			
5.	SOURCE OF DATA			

Samples were run by Denise McDonald on February 26, 1987.

E-27

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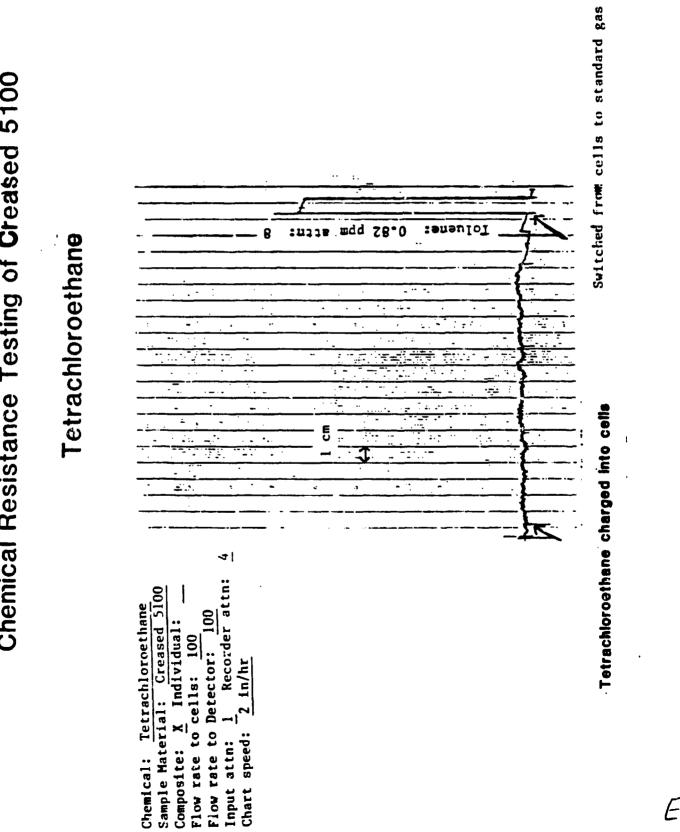
# Nitrobenzene



E-28

# 1. DESCRIPTION OF PRODUCT EVALUATED 1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 CONDITION BEFORE TEST: Unused, no visible imperfections 3: 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of 5 September 1986. TEST METHOD 2. 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were used. / Detector Temperature = 60C. 7. DEVIATIONS FROM ASIM F739 METHOD: Flow rate to cells was 100 cc/min. 3. CHALLENGE CHEMICAL COMPONENT 2 3 1 : : 1. CHEM NAME(s) : Tetrachloroethane : TN/A N/A 2. CAS NUMBER(s): 79-34-5 N/A N/A 3. CONC. (IF MIX) N/A N/A N/A 4. CHEMICAL SOURCE: Aldrich N/A N/A TEST RESULTS 4. 1. DATE TESTED: 2-05-87 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3.2 hours. 4. MIN DETECTABLE LIMIT .07 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION CONCENTRATION : CONCENTRATION : 1. : : 1 2. : : : 3. : : : 4. : : : 5. : : : 6. : : : 7. : : : 8. : : : 9. : : : 10. : : : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Samples were run by Denise McDonald on February 5, 1987.

F-2



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E-3

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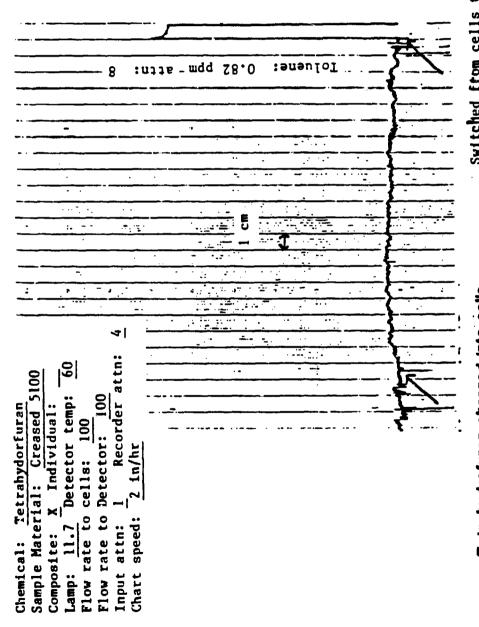
## CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD DESCRIPTION OF PRODUCT EVALUATED 1. 1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure of 5 September 1986. 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: $22-25 \, ^{\circ}C$ 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 б. OTHER CONDITIONS: 1 inch cells were used. / Detector Temperature = 60C. 7. DEVIATIONS FROM ASIM F739 METHOD: Flow rate to cells was 100 cc/min. CHALLENGE CHEMICAL COMPONENT 2 1 3 : 2 : 1. CHEM NAME(s): Tetrahydrofuran N/A N/A 2. CAS NUMBER(s): 109-99-9 N/A N/A N/A CONC. (IF MIX) N/A N/A 3. 4. CHEMICAL SOURCE: Aldrich N/A N/A TEST RESULTS 1. DATE TESTED: 2-05-87 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3.9 hours. 4. MIN DETECTABLE LIMIT .09 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A TIME CONCENTRATION : : CONCENTRATION : CONCENTRATION 1. : : : 2. : : : 3. : : : 4. : : : 5. ; : : 6. : : . 7. : : : 8. : : : 9. : : : 10. : : : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Samples were run by Denise McDonald on February 5, 1987.

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# Chemical Resistance Testing of Creased 5100

# Tetrahydrofuran

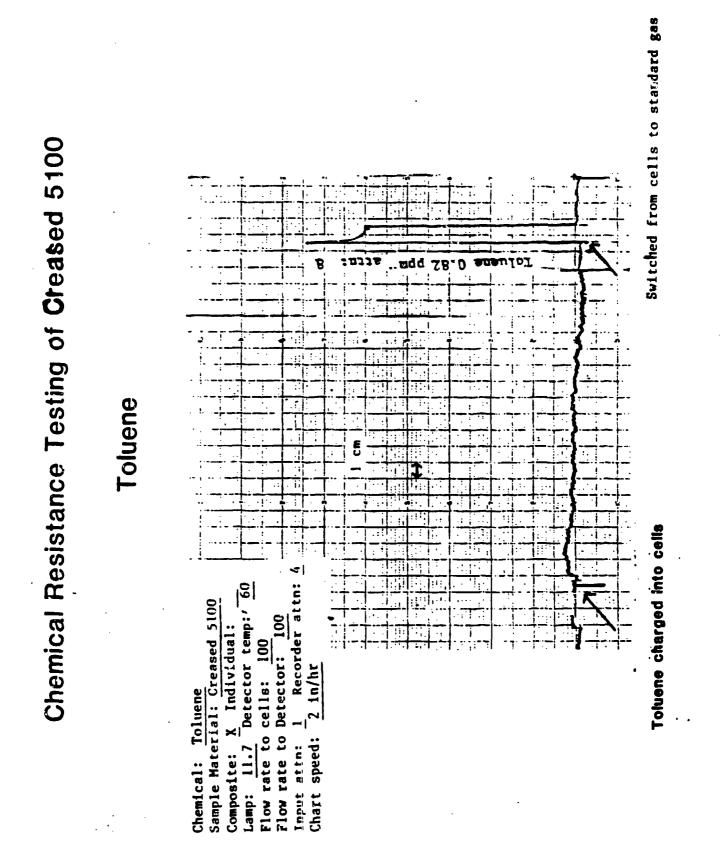


Switched from cells to standard gas

Tetrahydrofuran charged into cells

TYPE: Teflor PROTECTIVE P CONDITION BE MANUFACTURES PRODUCT IDES LOT OR MANUE NOMINAL THIC DESCRIPTION:	PRODUCT EVALUATED A laminated Nomex ATERIAL CODE: 06 EFORE TEST: Unus R: Chemfab Corp. NTIFICATION: Cha ACTURER DATE: N/	8 ed, no visib	le imperfections	•	
PROTECTIVE N CONDITION BE MANUFACTURES PRODUCT IDEN LOT OR MANUE NOMINAL THIC DESCRIPTION:	ATERIAL CODE: 06 FORE TEST: Unus Chemfab Corp. NTIFICATION: Cha FACTURER DATE: N/	ed, no visib	le imperfections		
CONDITION BE MANUFACTURES PRODUCT IDEN LOT OR MANUE NOMINAL THIC DESCRIPTION:	Chemfab Corp. Chemfab Corp. TIFICATION: Cha ACTURER DATE: N/	ed, no visib	le imperfections		
MANUFACTUREN PRODUCT IDEN LOT OR MANUE NOMINAL THIC DESCRIPTION:	R: Chemfab Corp. NTIFICATION: Cha ACTURER DATE: N/				
LOT OR MANUE NOMINAL THIC DESCRIPTION:	ACTURER DATE: N/	llenve 5100			
NOMINAL THIC DESCRIPTION:					
DESCRIPTION:					
			t op ope eide end	buff colored on the	
other side.	Sample was creat	sed using CHI	MFAB Fold Resist	ance Test procedure	
of 5 Septer	ber 1986.				
ST METHOD					
TESTING LABO	PATORY Towas Pa				
ANALYTICAL N	ETHOD: Continuor	search instit	ation detection a	ves Koad, Austin, TX	
TEMPERATURE:	22-25 °C				
DEVIATIONS F	ROM ASTM F739 MET	HOD: Flow	ate to calle war	$\frac{100 \text{ cc/min}}{100 \text{ cc/min}}$	
ALLENGE CHEMIC	AL 1	; (	COMPONENT 2	3	
CHEM NAME (s)	: Toluene	•	N/A	N/A	
		······································	N/A	N/A	
CONC. (IF MI	X) <u>N/A</u>	·	N/A	N/A	
CHEMICAL SUL	RCE: Mallinckrodi	·	N/A	N/A	
ST RESULTS					
DATE TESTED:	2-09-87				
		ree			
BREAKTHROUGH	TIME: No breakth		served after 3.8	hours	
MIN DETECTABL	E LIMIT .02 nnm			· · · · · · · · · · · · · · · · · · ·	
STEADY STATE SAMPLE THICKN	PERMEATION RATE	<u>N/A</u>			
SELECTED DATA	POINTS N/A				
				······································	
•		RATION	CONCENTRATION :	CONCENTRATION	
2.	:		•		
3.		¢ •			
	:	:	3		
		:			
7.		<del>i</del>		· · · · · · · · · · · · · · · · · · ·	
8.					
9.	:				
10	:				
OTHER OBSERVA	TIONS:				
		N-D	<b>.</b>		
	TESTING LABO ANALYTICAL M TEMPERATURE: COLLECTION M COLLECTION S OTHER CONDIT DEVIATIONS F ALLENGE CHEMIC CAS NUMBER (s) CAS NUMBER(s) CAS NUMBER(s) CAS NUMBER(s) CONC. (IF MI CHEMICAL SOU ST RESULTS DATE TESTED: NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 0THER OB SERVA	TESTING LABORATORY: Texas Res         Continuou         Continuou         TEMPERATURE: 22-25°C         COLLECTION MEDIUM: N2         COLLECTION MEDIUM: N2         COLLECTION MEDIUM: N2         COLLECTION SYSTEM: N2         OTHER CONDITIONS: 1 inch ca         DEVIATIONS FROM ASTM F739 MED         ALLENCE CHEMICAL 1         Toluene         CAS NUMBER (s): Toluene         CAS NUMBER(s): Toluene         CAS NUMBER(s): Toluene         CONC. (IF MIX) N/A         CHEMICAL 1         The Samues of Samples Tested: The BREAKTHROUGH TIME: No breakther MIN DETECTABLE LIMIT .02 ppm         STEADY STATE PERMEATION RATE         SAMPLE THICKNESS: 19-20 mil         SELECTED DATA POINTS N/A         TIME : CONCENT         CONCENT         STEADY STATE PERMEATION RATE         SAMPLE THICKNESS: 19-20 mil         SELECTED DATA POINTS N/A         TIME : CONCENT         CONCENT         SAMPLE : SAMPLE : CONCENT <td colspa<="" td=""><td>TESTING LABORATORY: Texas Research Instite         ANALYTICAL METHOD:       Continuous photoioniz         TEMPERATURE:       22-25°C         COLLECTION MEDIUM:       N2         COLLECTION SYSTEM:       N2         COLLECTIONS FROM ASTM F739 METHOD:       Flow 18         ALLENGE CHEMICAL       1       :         CHEMICAL       1       :         CONC.       (IF MIX)       N/A         CONC.       (IF MIX)       N/A         ST RESULTS       DATE TESTED:       Three         BREAKTHROUGH TIME:       No breakthrough was of         MIN DETECTABLE LIMIT       .02 ppm         STEADY STATE PERMEATION RATE       N/A         SAMPLE THICKNESS:       19-20 mil         SELECTED DATA POINTS      </td><td>TESTING LABORATORY:       Texas Research Institute, 9063 Bee Cavanalytical METHOD:       Continuous photoionization detection with the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second</td></td>	<td>TESTING LABORATORY: Texas Research Instite         ANALYTICAL METHOD:       Continuous photoioniz         TEMPERATURE:       22-25°C         COLLECTION MEDIUM:       N2         COLLECTION SYSTEM:       N2         COLLECTIONS FROM ASTM F739 METHOD:       Flow 18         ALLENGE CHEMICAL       1       :         CHEMICAL       1       :         CONC.       (IF MIX)       N/A         CONC.       (IF MIX)       N/A         ST RESULTS       DATE TESTED:       Three         BREAKTHROUGH TIME:       No breakthrough was of         MIN DETECTABLE LIMIT       .02 ppm         STEADY STATE PERMEATION RATE       N/A         SAMPLE THICKNESS:       19-20 mil         SELECTED DATA POINTS      </td> <td>TESTING LABORATORY:       Texas Research Institute, 9063 Bee Cavanalytical METHOD:       Continuous photoionization detection with the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second</td>	TESTING LABORATORY: Texas Research Instite         ANALYTICAL METHOD:       Continuous photoioniz         TEMPERATURE:       22-25°C         COLLECTION MEDIUM:       N2         COLLECTION SYSTEM:       N2         COLLECTIONS FROM ASTM F739 METHOD:       Flow 18         ALLENGE CHEMICAL       1       :         CHEMICAL       1       :         CONC.       (IF MIX)       N/A         CONC.       (IF MIX)       N/A         ST RESULTS       DATE TESTED:       Three         BREAKTHROUGH TIME:       No breakthrough was of         MIN DETECTABLE LIMIT       .02 ppm         STEADY STATE PERMEATION RATE       N/A         SAMPLE THICKNESS:       19-20 mil         SELECTED DATA POINTS	TESTING LABORATORY:       Texas Research Institute, 9063 Bee Cavanalytical METHOD:       Continuous photoionization detection with the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second

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# APPENDIX F

# PERMEATION TEST DATA FOR VISOR MATERIAL SAMPLES

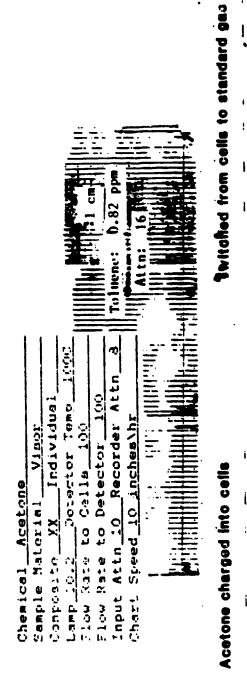
(Data Provided by Texas Research Institute Under Contract)

# 1. DESCRIPTION OF PRODUCT EVALUATED

	1:	TYPE: Teflon				
		PROTECTIVE MAT	TRIAL CODE . 09			
			RE TEST: Unused	no vieth	a imperfactions	
		MANUFACTURER:		, 10 11010	e impersections	
			FICATION: Visor			
			TURER DATE: N/A			
			TESS: 11-13 mils			
	6:		Material was a w	nite trans	arent sneet.	
2.	TES	T METHOD			·	
	1.					aves Road, Austin, TX
				photoionia	ation detection	with a 10.20 eV amp.
	-	TEMPERATURE:	A 1997 MARKET AND A 1997 A 1997 A 1997 A 1997 A 1997 A 1997 A 1997 A 1997 A 1997 A 1997 A 1997 A 1997 A 1997 A			
	4.	COLLECTION MEI				
		COLLECTION SYS				
			DNS: 1 inch cel			
	7.	DEVIATIONS FRO	DM ASTM F739 METH	OD: Flow ra	te to cells wer	e 100 cc/min.
3.	CHA	LLENGE CHEMICAL	1	: (	COMPONENT 2	: 3
	,	CHEM NAME (-)		:	17 / A	: 
		CHEM NAME(s)			<u>. N/A</u>	-:N/A
		CAS NUMBER(s):			N/A	
		CONC. (IF MIX)			<u>N/A</u>	: <u>N/A</u>
	4.	CHEMICAL SOURC	CE:Mallinckrodt		N/A	:N/A
		DATE TESTED:	4-6-87 LES TESTED: Thr			
			IME: No breakthr		berved after 3.	25 hours
		MIN DETECTABLE		008		
			ERMEATION RATE	N/A		
		SAMPLE THICKNES				
		SELECTED DATA I			······································	
	••					
		TIME 1	: CONCENTR	ATION :	CONCENTRATION	: CONCENTRATION :
		2.		:		••••••••••••••••••••••••••••••••••••••
		3.				;
		4.				
		5	:			······································
		6	<u> </u>	:		
		7				
		8				· · · · · · · · · · · · · · · · · · ·
		9.				······································
		10				•
	8.	OTHER OBSERVAT	IONS:		_	
•	•	•	······································			
5.	SOT	TRCE OF DATA				
~.	501		ere run by Denise	McDonald	on April 6. 1983	7.
		ampies_W	ere tun by benise	. ACDUNEIO	UI RPIII U, 190	•

# Chemical Resistance Testing of Visor Material

# Acetone



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DE			ING PRODUCT EVAL		
-	SCRIPTION OF PRODUCT H	EVALUATED			
1:					
2:					
3:			visible imperfect	tions	
4:					
5:	LOT OR MANUFACTURER				
7:					مربور با المرب الكريمي والي مربور الم
8:			ransparent sheet	t.	
TE	ST METHOD				
1.	TESTING LABORATORY:	Texas Research 1	Institute, 9063 1	Bee Caves 1	Road, Austin, TX
2.	ANALYTICAL METHOD:	Continuous photo			
3.				· ·	
4.		Nitrogen			
5.		Nitrogen	10.00		1000
6.		1 inch cells wer			
8.				LE WAS DU	CC/min.
0.	FERMENTION TEST 515	TER. INGIVIQUEI	Cell Monitoring		
	VALLENGE CHEMICAL	1	: COMPONENT 2	:	3
· .1.	CHEM NAME(s) : Acro	olein	: N/A		N/A
	CAS NUMBER(s): 107-		: N/A		N/A
	CONC. (IF MIX) N/A		: N/A		N/A
4.	CHEMICAL SOURCE: Ald	rich	: N/A	:	N/A
1	DATE TESTED: 6-29-4			r 3.0 hours	5.
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES BREAKTHROUGH TIME: NO	.60 ppm ION RATE N/A 2 mils	as observed afte:		
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES BREAKTHROUGH TIME: N MIN DETECTABLE LIMIT STEADY STATE PERMEAT SAMPLE THICKNESS: 12	.60 ppm ION RATE N/A 2 mils	es observed afte: : CONCENTRA		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES BREAKTHROUGH TIME: NO MIN DETECTABLE LIMIT STEADY STATE PERMEAT SAMPLE THICKNESS: 12 SELECTED DATA POINTS TIME :	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES BREAKTHROUGH TIME: NO MIN DETECTABLE LIMIT STEADY STATE PERMEAT SAMPLE THICKNESS: 12 SELECTED DATA POINTS TIME : 1	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: NO         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME :         1. :         2. :         3. :         4. :	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: NO         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME :         1. :         2. :         3. :         4. :         5. :	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: NO         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME :         1.         2.         3.         4.         5.         6.	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: NO         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME         1.         2.         3.         4.         5.         6.         7.	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: NO         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME         1.         2.         3.         4.         5.         1.         2.         3.         4.         5.         1.         2.         3.         2.         3.         2.         3.         2.         3.         2.         3.         2.         3.         3.         5.         1.         2.         3.         2.         3.         2.         3.         2.         3.         2.         3.         3.         3.         3.         3.         3.         3.         3.         3.         3. <td>.60 ppm ION RATE <u>N/A</u> 2 mils N/A</td> <td></td> <td></td> <td>CONCENTRATION</td>	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: NO         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: No         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: NO         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6. 7. 8.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: No         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.	.60 ppm ION RATE <u>N/A</u> 2 mils N/A			CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TES         BREAKTHROUGH TIME: No         MIN DETECTABLE LIMIT         STEADY STATE PERMEAT         SAMPLE THICKNESS: 12         SELECTED DATA POINTS         TIME         1.         2.         3.         5.         6.         7.         8.         9.         10.         :         OTHER OBSERVATIONS:	.60 ppm ION RATE N/A 2 mils N/A CONCENTRATION	: CONCENTRA'	TION : (	

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	1:	TYPE: Teflon				·
	2:	PROTECTIVE MAT				
	3:		RE TEST: Unused, no v	isible	imperfections	
		MANUFACTURE : PRODUCT IDENTI				
		LOT OR MANUFAC				
		NOMINAL THICKN				<u></u>
			Material was a white t	ranspar	ent sheet.	
2.	TËS	T METHOD				
	1.	TESTING LABORA	TORY: Texas Research I	netitut	e. 9063 Bee Ca	ves Road. Austin.
			HOD: Continuous photo			
	3.	TEMPERATURE: 2				
	4.	COLLECTION MED				
	5.					
	<b>b.</b> 7	OTHER CONDITIO	NS: 1 inch cells wer	e used.	/Detector Temp	$\frac{\text{erature} = 100C}{60 \text{ obs}/100}$
			M ASTM F739 METHOD: F T SYSTEM: Individual			ov cc/min.
3.	CHA	LLENGE CHEMICAL	1	: COM :	PONENT 2	: 3
	1-		Allyl Chloride	:	N/A	:N/A
		CAS NUMBER(s):		•	N/A	:N/A
		CONC. (IF MIX)		:	N/A	:N/A
	4.	CHEMICAL SOURC	E: <u>Aldrich</u>	·	<u>N/A</u>	: <u>N/A</u>
		DATE TESTED:	7-01-87			
	2.	NUMBER OF SAMPL	ES TESTED: Three	ac obso	rund after / h	
	2. 3.	NUMBER OF SAMPL BREAKTHROUGH TI	ES TESTED: <u>Three</u> ME: No breakthrough w	as obse		
	2. 3. 4.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE	ES TESTED: <u>Three</u> ME: No breakthrough w	as obse		ours.
	2. 3. 4. 5. 6.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT .50 ppm RMEATION RATE <u>N/A</u> S: <u>12 mils</u>	as obse		
	2. 3. 4. 5. 6.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT .50 ppm RMEATION RATE <u>N/A</u> S: <u>12 mils</u>	as obse		
	2. 3. 4. 5. 6.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT .50 ppm RMEATION RATE <u>N/A</u> S: <u>12 mils</u>			
	2. 3. 4. 5. 6.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1.	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT <u>.50 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>			
	2. 3. 4. 5. 6.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT <u>.50 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>			
	2. 3. 4. 5. 6.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4.	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT <u>.50 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>			
	2. 3. 4. 5. 6.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5.	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT <u>.50 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>			
	2. 3. 4. 5. 6.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 6.	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT <u>.50 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>			
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	2. 3. 4. 5. 6.	NUMBER OF SAMPL         BREAKTHROUGH TI         MIN DETECTABLE         STEADY STATE PE         SAMPLE THICKNES         SELECTED DATA P         TIME         1.         2.         3.         4.         5.         6.         7.         8.	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT <u>.50 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>			
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	2. 3. 4. 5. 6.	NUMBER OF SAMPL         BREAKTHROUGH TI         MIN DETECTABLE         STEADY STATE PE         SAMPLE THICKNES         SELECTED DATA P         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.	ES TESTED: <u>Three</u> ME: <u>No breakthrough w</u> LIMIT <u>.50 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>			
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPL         BREAKTHROUGH TI         MIN DETECTABLE         STEADY STATE PE         SAMPLE THICKNES         SELECTED DATA P         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.	ES TESTED: Three ME: No breakthrough w LIMIT .50 ppm RMEATION RATE N/A S: 12 mils OINTS N/A : CONCENTRATION : : : : : : : : : : : : :			
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# 1. DESCRIPTION OF PRODUCT EVALUATED

1:	TYPE: Teflon
2:	PROTECTIVE MATERIAL CODE: 09
3:	CONDITION BEFORE TEST: Unused, no visible imperfections
4:	MANUFACTURER: Dupont
5:	PRODUCT IDENTIFICATION: Visor
6:	LOT OR MANUFACTURER DATE: N/A
7:	NOMINAL THICKNESS: 11-13 mil
8:	DESCRIPTION: Material was a white transparent sheet.
TES	ST METHOD
1	TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
1.	
2.	ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp

- 3. TEMPERATURE: <u>22-25 °C</u>
- 4. COLLECTION MEDIUM: N2
- 5. COLLECTION SYSTEM: N2

6. OTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 100C.

7. DEVIATIONS FROM ASTM 5739 METHOD: Flow rate to cell was 100 cc/min.

COMPONENT 2 3. CHALLENGE CHEMICAL 1 3 : : 2 1 1. CHEM NAME(s):Carbon Disulfide2. CAS NUMBER(s):75-15-03. CONC. (IF MIX)N/A ¥/A ¥/A N/A N/A 1 N/A N/A 4. CHEMICAL SOURCE: Mallinckrodt N/A N/A

# 4. TEST RESULTS

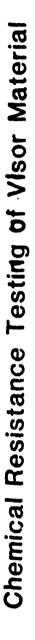
2.

- 1. DATE TESTED: 4-3-87
- 2. NUMBER OF SAMPLES TESTED: One (Run I)
- 3. BREAKTHROUGH TIME: 90 minutes
- 4. MIN DETECTABLE LIMIT .06 ppm
- 5. STEADY STATE PERMEATION RATE 10.61 (ug/cm2\*hr)
- 6. SAMPLE THICKNESS: 12 mils
- 7. SELECTED DATA POINTS N/A

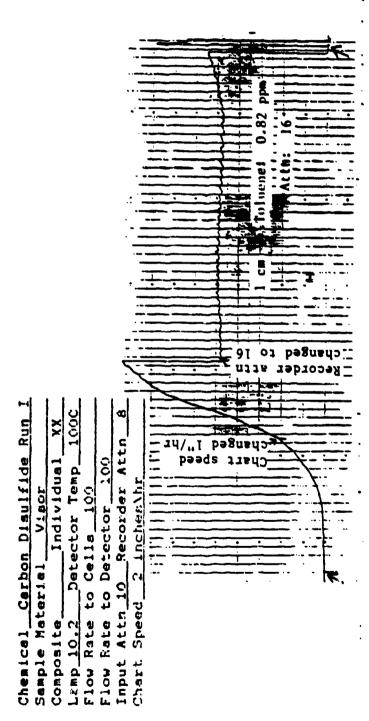
	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
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- 8. OTHER OBSERVATIONS:
- 5. SOURCE OF DATA

Sample was run by Denise McDonald on April 3, 1987.



# **Carbon Disulfide Run**



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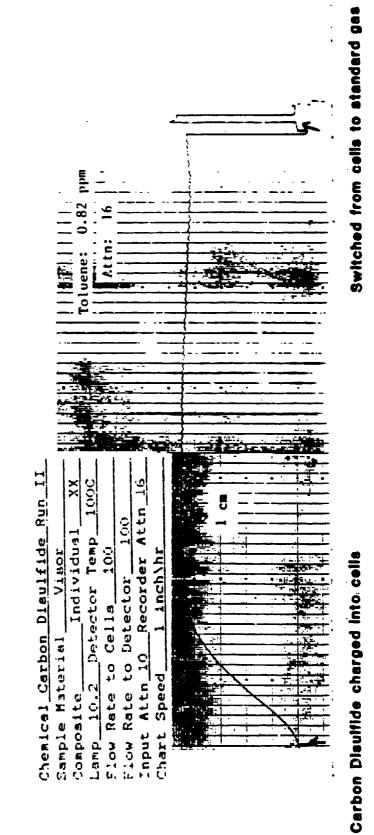
Switched from cells to standard ges

Carbon Disulfide charged into cell

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2: PR 3: CO 4: MA 5: PR 5: LO 7: NO 8: DE TEST M 1. TE 2. AN 3. TE 4. CO 6. OT 7. DE CHALLE 1. CH 2. CA 3. CO CHALLE 1. CH 1. DAT 2. NUM 5. STE 6. SAM 7. SEL	ANUTACTURER: RODUCT IDENTIF DT OR MANUFACT DMINAL THICKNE ESCRIPTION: ME METHOD ESTING LABORAT NALYTICAL METH EMPERATURE: 22 DLLECTION MEDI DLLECTION SYST THER CONDITION ENCE CHEMICAL HEM NAME(s): DNC / F MIX)	E TEST: Unused, no y Dupont ICATION: Visor UKER DATE: N/A SS: 11-13 mi1 aterial was a white f OD: Continuous photo -25°C UM: N <sub>2</sub> EM: N <sub>2</sub> IS: 1 inch cell was ASTM F739 METHOD: F: 1 Carbon Disulfide 75-15-0	Institute, 9063 Bee ( Dionization detection used./Detector Tempo	Caves Roa h with a	10.20 eV 1a
3: CO 4: MA J: PR 5: LO 7: NO 8: DE TEST M 1. TE 2. AN 3. TE 4. CO 5. CO 6. OT 7. DE CHALLE 1, CH 2. CA 3. CO 4. CO 4. CH TEST R 1. DAT 2. NUM J. BRE 4. MIN 5. STE 6. SAM 7. SEL	ANDITION BEFOR ANUIACTURER: RODUCT IDENTIF DT OR MANUFACT DMINAL THICKNE ESCRIPTION: M METHOD ESTING LABORAT NALYTICAL METH EMPERATURE: 22 DILECTION MEDI DILECTION MEDI DILECTION SYST THER CONDITION ENCE CHEMICAL MEM NAME(s): DNC (TF MIX) HEMICAL SOURCE RESULTS	E TEST: Unused, no y Dupont ICATION: Visor URER DATE: N/A SS: 11-13 mil aterial was a white f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was a second f aterial was	Institute, 9063 Bee ( Dionization detection used./Detector Tempo low rate to cell was : COMPONENT 2 : : N/A : N/A : N/A	Caves Roa h with a	10.20 eV 1a 100C. 100C. 1n. 3 N/A N/A N/A
4: MA J: PR 6: 10 7: NO 8: DE TEST M 1. TE 2. AN 3. TE 4. CO 5. CO 6. OT 7. DE CHALLE 1. CH 2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM J. BRE 4. MIN 5. STE 6. SAM 7. SEL	ANUTACTURER: RODUCT IDENTIF DT OR MANUFACT DMINAL THICKNE ESCRIPTION:M METHOD ESTING LABORAT NALYTICAL METH EMPERATURE: 22 DLLECTION MEDI DLLECTION MEDI DLLECTION SYST THER CONDITION ENCE CHEMICAL MEM NAME(s): DNC /~~ MIX) HEMICAL SOURCE RESULTS	Dupont ICATION: Visor UKER DATE: N/A SS: 11-13 mil aterial was a white for CORY: Texas Research 1 OD: Continuous photo -25°C UM: N <sub>2</sub> EM: N <sub>2</sub> IS: 1 inch cell was ASTM F739 METHOD: F. 1 Carbon Disulfide 75-15-0 N/A	Institute, 9063 Bee ( Dionization detection used./Detector Tempo low rate to cell was : COMPONENT 2 : : N/A : N/A : N/A	Caves Roa h with a	10.20 eV 1a 100C. 1n. 3 N/A N/A N/A
J:       PR         0:       1.0         7:       NO         8:       DE         TEST       M         1.       TE         2.       AN         3.       TE         4.       CO         5.       CO         6.       OT         7.       DE         1.       CHALLE         1.       CHALLE         1.       CH         2.       CA         3.       CO         4.       CH         TEST       R         1.       DAT         2.       NUM         .       BRE         4.       MIN         5.       STE         6.       SAM         7.       SEL	ADDUCT IDENTIF DT OR MANUFACT DMINAL THICKNE ESCRIPTION: M METHOD ESTING LABORAT NALYTICAL METH EMPERATURE: 22 DLLECTION MEDI DLLECTION MEDI DLLECTION SYST THER CONDITION ENCE CHEMICAL MEM NAME(s): DNC / F MIX) HEMICAL SOURCE RESULTS	ICATION: Visor UKER DATE: N/A SS: 11-13 mil aterial was a white is CORY: Texas Research 1 OD: Continuous photo -25°C UM: N <sub>2</sub> IS: 1 inch cell was I ASTM F739 METHOD: F. 1 Carbon Disulfide 75-15-0 N/A	Institute, 9063 Bee ( pionization detection used./Detector Tempo low rate to cell was : COMPONENT 2 : N/A : N/A : N/A	rature =	10.20 eV 1a 100C. 100C. 1n. 3 N/A N/A N/A
0:       1.0         7:       NO         8:       DE         TEST       M         1.       TE         2.       AN         3.       TE         4.       CO         5.       CO         6.       OT         7.       DE         CHALLE       1.         1.       CHALLE         1.       DAT         2.       NUM         3.       STE         4.       MIN         5.       STE         6.       SAM         7.       SEL	TOR MANUFACT DMINAL THICKNE ESCRIPTION: M METHOD ESTING LABORAT NALYTICAL METH EMPERATURE: 22 DILECTION MEDI DILECTION MEDI DILECTION SYST THER CONDITION ENCE CHEMICAL MEM NAME(s): DNC (TF MIX) HEMICAL SOURCE RESULTS	UKER DATE: N/A SS: 11-13 mil Jaterial was a white is ORY: Texas Research 1 OD: Continuous photo -25°C UM: N <sub>2</sub> S: 1 inch cell was I ASTM F739 METHOD: F. 1 Carbon Disulfide 75-15-0 N/A	Institute, 9063 Bee ( pionization detection used./Detector Tempo low rate to cell was : COMPONENT 2 : N/A : N/A : N/A	rature =	10.20 eV 1a 100C. 100C. 1n. 3 N/A N/A N/A
7: NO 8: DE TEST M 1. TE 2. AN 3. TE 4. CO 5. CO 6. OI 7. DE CHALLE 1. CH 2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM 4. STE 6. SAM 7. SEL	MINAL THICKNE ESCRIPTION: <u>M</u> METHOD ESTING LABORAT NALYTICAL METH EMPERATURE: <u>22</u> DLLECTION MEDI DLLECTION MEDI DLLECTION SYST THER CONDITION ENCE CHEMICAL MEM NAME(s): DNC (TF MIX) HEMICAL SOURCE RESULTS	SS: <u>11-13 mil</u> <u>aterial was a white f</u> ORY: <u>Texas Research 1</u> OD: <u>Continuous photo</u> -25°C UM: <u>N2</u> S: <u>1 inch cell was</u> I ASTM F739 METHOD: <u>F</u> 1 <u>Carbon Disulfide</u> 75-15-0 <u>N/A</u>	Institute, 9063 Bee ( pionization detection used./Detector Tempo low rate to cell was : COMPONENT 2 : N/A : N/A : N/A	rature =	10.20 eV 1a 100C. 100C. 1n. 3 N/A N/A N/A
8: DE TEST M 1. TE 2. AN 3. TE 4. CO 5. CO 6. OT 7. DE CHALLE 1. CH 2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM 5. STE 6. SAM 7. SEL	ESCRIPTION: <u>M</u> METHOD ESTING LABORAT NALYTICAL METH EMPERATURE: <u>22</u> DLLECTION MEDI DLLECTION SYST THER CONDITION EVIATIONS FROM ENCE CHEMICAL HEM NAME(s): DNC (TF MIX) HEMILAL SOURCE RESULTS	ORY: Texas Research 1 OD: Continuous photo -25°C UM: N <sub>2</sub> TEM: N <sub>2</sub> IS: 1 inch cell was ASTM F739 METHOD: F: 1 Carbon Disulfide 75-15-0 N/A	Institute, 9063 Bee ( pionization detection used./Detector Tempo low rate to cell was : COMPONENT 2 : N/A : N/A : N/A	rature =	10.20 eV 1a 100C. 100C. 1n. 3 N/A N/A N/A
TEST M 1. TE 2. AN 3. TE 4. CO 5. CO 6. OT 7. DE CHALLE 1, CH 2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM 5. STE 6. SAM 7. SEL	METHOD ESTING LABORAT NALYTICAL METH EMPERATURE: 22 DILECTION MEDI DILECTION SYST THER CONDITION EVIATIONS FROM ENCE CHEMICAL HEM NAME(s): DNC ("F MIX) HEMILAL SOURCE RESULTS	CORY: <u>Texas Research</u> OD: <u>Continuous photo</u> -25°C UM: <u>N2</u> EM: <u>N2</u> IS: <u>1 inch cell was</u> I ASTM F739 METHOD: <u>F</u> 1 <u>Carbon Disulfide</u> 75-15-0 <u>N/A</u>	Institute, 9063 Bee ( pionization detection used./Detector Tempo low rate to cell was : COMPONENT 2 : N/A : N/A : N/A	rature =	10.20 eV 1a 100C. 100C. 1n. 3 N/A N/A N/A
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5. CO 6. OT 7. DE CHALLE 1, CH 2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM . BRE 4. MIN 5. STE 6. SAM 7. SEL	DILECTION SYST THER CONDITION EVIATIONS FROM ENCE CHEMICAL HEM NAME(s): AS NUMBER(s): DNC / T MIX) HEMIJAL SOURCE RESULTS	EM: N2 IS: 1 inch cell was ASTM F739 METHOD: F 1 Carbon Disulfide 75-15-0 N/A	low rate to cell was : COMPONENT 2 : : N/A : N/A : N/A	<pre>rature = 100 cc/m : : : : : : : : : : : : : : : : : : :</pre>	1n. 3 <u>N/A</u> <u>N/A</u> N/A
5. CO 6. OT 7. DE CHALLE 1, CH 2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM . BRE 4. MIN 5. STE 6. SAM 7. SEL	DILECTION SYST THER CONDITION EVIATIONS FROM ENCE CHEMICAL HEM NAME(s): AS NUMBER(s): DNC / T MIX) HEMIJAL SOURCE RESULTS	EM: N2 IS: 1 inch cell was ASTM F739 METHOD: F 1 Carbon Disulfide 75-15-0 N/A	low rate to cell was : COMPONENT 2 : : N/A : N/A : N/A	<pre>rature = 100 cc/m : : : : : : : : : : : : : : : : : : :</pre>	1n. 3 <u>N/A</u> <u>N/A</u> N/A
6. OT 7. DE CHALLE 1. CH 2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM . BRE 4. MIN 5. STE 6. SAM 7. SEL	THER CONDITION EVIATIONS FROM ENCE CHEMICAL HEM NAME(s): AS NUMBER(s): DNC / MIX) HEMILAL SOURCE RESULTS	IS: <u>1 inch cell was</u> ASTM F739 METHOD: <u>F</u> 1 <u>Carbon Disulfide</u> 75-15-0 N/A	low rate to cell was : COMPONENT 2 : : N/A : N/A : N/A	i i i i i i i i i i i i i i i i i i i	1n. 3 <u>N/A</u> N/A N/A
7. DE CHALLE 1, CH 2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM . BRE 4. MIN 5. STE 6. SAM 7. SEL	EVIATIONS FROM ENCE CHEMICAL HEM NAME(s): AS NUMBER(s): DNC (TF MIX) HEMILAL SOURCE RESULTS	ASTM F739 METHOD: <u>F</u> 1 <u>Carbon Disulfide</u> 75-15-0 N/A	low rate to cell was : COMPONENT 2 : : N/A : N/A : N/A	100 cc/m	1n. 3 <u>N/A</u> N/A N/A
CHALLE 1, CH 2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM . BRE 4. MIN 5. STE 6. SAM 7. SEL	ENCE CHEMICAL HEM NAME(s) : AS NUMBER(s): DNC (TF MIX) HEMIJAL SOURCE RESULTS	l Carbon Disulfide 75-15-0 N/A	: COMPONENT 2 : : N/A : N/A : N/A		3 N/A N/A N/A
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2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM . BRE 4. MIN 5. STE 6. SAM 7. SEL	AS NUMBER(s): DNC ("F MIX) HEMILAL SOURCE RESULTS	75-15-0 N/A	: N/A : N/A		N/A N/A
2. CA 3. CO 4. CH TEST R 1. DAT 2. NUM . BRE 4. MIN 5. STE 6. SAM 7. SEL	AS NUMBER(s): DNC ("F MIX) HEMILAL SOURCE RESULTS	75-15-0 N/A	: N/A : N/A		N/A N/A
3. CO 4. CH TEST R 1. DAT 2. NUM . BRE 4. MIN 5. STE 6. SAM 7. SEL	DNC ("F MIX) HEMILAL SOURCE RESULTS	N/A	: N/A		N/A
<ul> <li>4. CH</li> <li>TEST R</li> <li>1. DAT</li> <li>2. NUM</li> <li>. BRE</li> <li>4. MIN</li> <li>5. STE</li> <li>6. SAM</li> <li>7. SEL</li> </ul>	HEMILAL SOURCE				
TEST R 1. DAT 2. NUM . BRE 4. MIN 5. STE 6. SAM 7. SEL	RESULTS		-* <u></u> *	<u></u> * <u>_</u>	••• <i>[</i> ]
7. SEL	EAKTHROUGH TIM N DETECTABLE L EAD'S STATE PER	MEATION RATE 13.58	·····		
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Chemical Resistance Testing of Visor Material

## Carbon Disulfide Run li

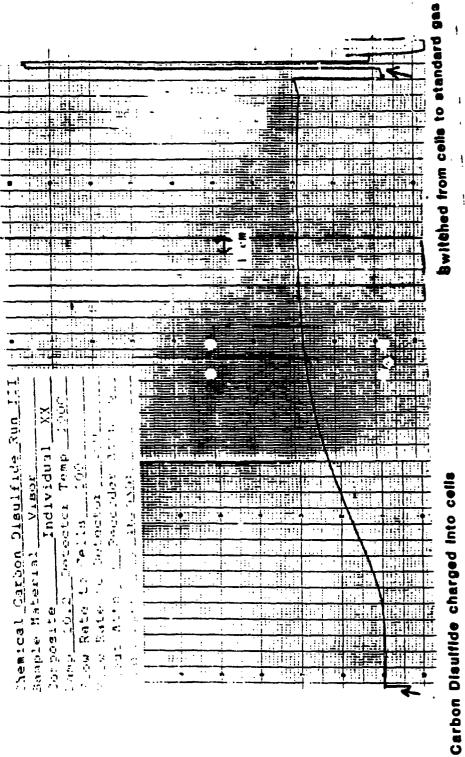
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DES	SCRIPTION OF PRODUCT EVA	LUATED			
1:	TYPE: Teflon				
	والمراجعة والمراجع المراجع والمتعار والفريد والفريد المتحدين والمتحدين والمحدور والمراجع والمراجع والمراجع	DF· 09			
	CONDITION BEFORE TEST:		this imperfection		
	MANUFACTURER: Dupont	Unused, no via	The imperiection		
	PRODUCT IDENTIFICATION	Viene			
	LOT OR MANUFACTURER DA				
	NOMINAL THICKNESS: 11				
	DESCRIPTION: Material				
•••		Wab a white the			······
TE	ST METHOD				
1.	TESTING LABORATORY: TC	xas Research Ins	titute, 9063 Bee	Caves Ro	ad. Austin. TX
	ANALYTICAL METHOD: Co				
	TEMPERATURE: 22-25 °C	· · · · · · · · · · · · · · · · · · ·			
4.	COLLECTION MEDIUM: N2				
5.	COLLECTION SYSTEM: N2				
. 6.	OTHER CONDITIONS: 1.	inch cell was us	ed. /Detector Temp	erature	= 100C.
7.	DEVIATIONS FROM ASTM F	739 METHOD: Flow	Tate to cell was	100 cc/	ain.
CH	ALLENGE CHEMICAL	1 :	COMPONENT 2	:	3
•		:	<b></b> <i>(</i> )	:	<b></b>
	CHEM NAME(s) : Carbon		<u>N/A</u>	<sup>•</sup>	N/A
	CAS NUMBER(6): 75-15-	<u> </u>	N/A		N/A
	CONC. (IF MIX) N/A CHEMICAL SOURCE:Mallin	<u> </u>	<u>N/A</u> N/A		<u>N/A</u>
TE	ST RESULTS				
	DATE TESTED: 4-6-87				
	NUMBER OF SAMPLES TESTE		<u>.)</u>		
	BREAKTHROUGH TIME: 98				
	MIN DETECTABLE LIMIT .1				
	STEADY STATE PERMEATION		g/cm2*hr)		
	SAMPLE THICKNESS: 12 m		·a		
7.	SELECTED DATA POINTS N	/A			
		CONCENTRATION	: CONCENTRATION	: 00	NCENTRATION
	1: 2:		·	:	
	3.	<u> </u>			
	4. :		•		
	5:		•		
	6. <u> </u>		· ·		
	8. :				
	9:		:	:	
	10:		:	:	
8.	OTHER OBSERVATIONS:				
	*				
<b>S</b> 01	URCE OF DATA	Dentes Manasid	An-41 6 1007		
	Sample was run by	venise mcvonald	ON APT11 0, 198/.	•	

Chemical Resistance Testing of Visor Material

## Carbon Disulfide Run III



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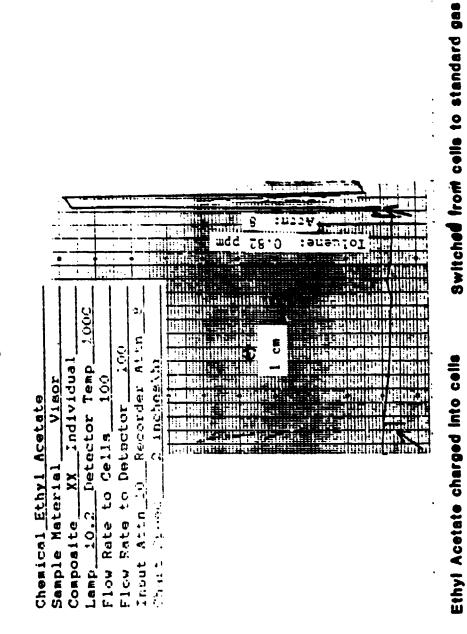
DE	SCRIPTION OF PR				
1:	TYPE: Teflon				
		TERIAL CODE: 09			
_		ORE TEST: Unused, n	o visible imperfe	ctions	
	MANUFACTURER:				
		IFICATION: Visor			
		CTURER DATE: N/A			
		NESS: 11-13 mil			
8:	DESCRIPTION:	Material was a whit	e transparent she	<u>et.</u>	· _ · · · · · · · · · · · · · · · · · ·
TE	ST METHOD				
î.	TESTING LABOR	ATORY: Texas Researc	h Institute, 9063	Bee Caves	Road, Austin,
2.	ANALYTICAL ME	THOD: Continuous ph	otoionization det	ection wit	h a 10.20 eV 1a
3.	TEMPERATURE:	22-25°C			
4.	COLLECTION ME	DIUM: No			
	COLLECTION SY				
		ONS: 1 inch cells	Ware used /Datast	or Tempera	
		COM ASTM F739 METHOD:			
/.	DEVIATIONS FR	ICM ASIM F739 MEIROD:	FLOW FATE to ce	lis were	UU CC/min.
CH	LALLENGE CHEMICA	1 1	: COMPONENT	2 :	3
_1	CHEM NAME (	: Ethyl Acetate	: N/A	- -	N/A
	CAS NUMBER(s)				<u>N/A</u>
				·	
	CONC /TE WIN	/ N / A		•	N / A
3.	CONC. (IF MIX			i	<u>N/A</u>
3. 4. TE 1.	CHEMICAL SOUR	CE: <u>EM Science</u> 4-7-87	: <u>N/A</u> ; <u>N/A</u>		<u>N/A</u> <u>N/A</u>
3. 4. TE 1. 2. 3. 4. 5.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE F	4-7-87 LES TESTED: <u>Three</u> IME: <u>No breakthroug</u> LIMIT <u>.27 ppm</u> PERMEATION RATE <u>N/A</u>	: N/A		N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE	4-7-87 LES TESTED: <u>Three</u> TME: <u>No breakthroug</u> LIMIT_27 ppm PERMEATION RATE <u>N/A</u> SS: 12 mils	: N/A		N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE F	4-7-87 LES TESTED: <u>Three</u> TME: <u>No breakthroug</u> LIMIT_27 ppm PERMEATION RATE <u>N/A</u> SS: 12 mils	: N/A		N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA TIME	4-7-87 LES TESTED: <u>Three</u> IME: <u>No breakthroug</u> LIMIT <u>27 ppm</u> PERMEATION RATE <u>N/A</u> SS: <u>12 mils</u> POINTS <u>N/A</u> : CONCENTRATI	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA TIME 1.	4-7-87 LES TESTED: <u>Three</u> IME: <u>No breakthroug</u> LIMIT <u>27 ppm</u> PERMEATION RATE <u>N/A</u> SS: <u>12 mils</u> POINTS <u>N/A</u> : CONCENTRATI	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2.	4-7-87 PLES TESTED: Three TIME: No breakthroug LIMIT27 ppm PERMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATI :	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3.	4-7-87 PLES TESTED: Three TIME: No breakthroug LIMIT27 ppm PERMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATI :	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4.	4-7-87 PLES TESTED: Three TIME: No breakthroug LIMIT27 ppm PERMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATI :	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5.	4-7-87 PLES TESTED: Three TIME: No breakthroug LIMIT27 ppm PERMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATI :	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6.	4-7-87 PLES TESTED: Three TIME: No breakthroug LIMIT27 ppm PERMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATI :	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7.	4-7-87         PLES TESTED:         Three         TIME:       No breakthroug         LIMIT27 ppm         PERMEATION RATE       N/A         SS:       12 mils         POINTS       N/A         :	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8.	4-7-87         PLES TESTED:         Three         TIME:       No breakthroug         LIMIT27 ppm         PERMEATION RATE       N/A         SS:       12 mils         POINTS       N/A         :	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7.	4-7-87         PLES TESTED:         Three         TIME:       No breakthroug         LIMIT27 ppm         PERMEATION RATE       N/A         SS:       12 mils         POINTS       N/A         :	: N/A h was observed af	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8.	4-7-87         PLES TESTED:         Three         TIME:       No breakthroug         LIMIT27 ppm         PERMEATION RATE       N/A         SS:       12 mils         POINTS       N/A         :	: N/A h was observed af	ter 3 hou	N/A
3. 4. 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 10.	4-7-87         PLES TESTED:         Three         TIME:         No breakthroug         LIMIT         PERMEATION RATE         POINTS	: N/A : N/A : N/A : : : : : : : : : : : : :	ter 3 hou	N/A
3. 4. 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 10.	4-7-87         PLES TESTED:         Three         TIME:       No breakthroug         LIMIT27 ppm         PERMEATION RATE       N/A         SS:       12 mils         POINTS       N/A         :	: N/A : N/A : N/A : : : : : : : : : : : : :	ter 3 hou	N/A
3. 4. 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 10.	4-7-87         PLES TESTED:         Three         TIME:         No breakthroug         LIMIT         PERMEATION RATE         POINTS	: N/A : N/A : N/A : : : : : : : : : : : : :	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBSERVAT	4-7-87         PLES TESTED:         Three         TIME:         No breakthroug         LIMIT         PERMEATION RATE         POINTS	: N/A : N/A : N/A : : : : : : : : : : : : :	ter 3 hou	N/A
3. 4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBSERVAT	4-7-87         PLES TESTED:         Three         CIME:         No breakthroug         LIMIT         POINTS         POINTS         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :         :       :         :       :         :       :         :       :         :       :	: N/A h was observed af 	ATION : : : : : : : : : : : : : :	N/A
3. 4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOUR ST RESULTS DATE TESTED: NUMBER OF SAMF BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBSERVAT	4-7-87         PLES TESTED:         Three         TIME:         No breakthroug         LIMIT         PERMEATION RATE         POINTS	: N/A h was observed af 	ATION : : : : : : : : : : : : : :	N/A

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# Chemical Resistance Testing of Visor Material

## Ethyl Acetate



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## 1.

1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon		
	2: PROTECTIVE MATERIAL CODE: 09		
	3: CONDITION BEFORE TEST: Unused, no	visible imperfections	
	4: MANUFACTURER: Dupont		
	5: PRODUCT IDENTIFICATION: Visor	<u>میں ہے دیکر ہوتی ہے۔ یہ ہے کہ خات کے سینے میں میں معرفی میں میں م</u>	
	6: LOT OR MANUFACTURER DATE: N/A	······································	المواد والمكافحة البعيلي المستخب ومستحد والمحاد
	7: NOMINAL THICKNESS: 11-13 mil	*****	· · · · · · · · · · · · · · · · · · ·
	8: DESCRIPTION: Material was a white	transparent sheet.	
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research	Institute, 9063 Bee Ca	ves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous phot		
	3. TEMPERATURE: 22-25°C		
	4. COLLECTION MEDIUM: N <sub>2</sub>		
	5. COLLECTION SYSTEM: N2		
	6. OTHER CONDITIONS: 1 inch cells we	re used. /Detector Temp	erature = 100C.
	7. DEVIATIONS FROM ASTM F739 METHOD:	Flow rate to cells wer	e 100 cc/min.
	-		
3.	CHALLENGE CHEMICAL	: COMPONENT 2	: 3
	3. CHEM NAME (s) : Bexade	: ¶/A	: ¥/A
	2. CAS NUMBER(s): 110-54-3	: N/A	:N/A
	3. CONC. (IF MIX) N/A	: N/A	: N/A
	4. CHEMICAL SOURCE: Aldrich	_:N/A	:N/A
4.	TEST RESULTS		
	1. DATE TESTED: <u>4-2-87</u>		
	2. NUMBER OF SAMPLES TESTED: Three		
	3. BREAKTHROUGH TIME: No breakthrough	was observed after 3.0	hours.
	4. MIN DETECTABLE LIMIT .31 ppm		
	5. STEADY STATE PERMEATION RATE N/A		
	6. SAMPLE THICKNESS: 12 mils		
	7. SELECTED DATA POINTS N/A		
	TIME : CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	2;	·····	· · · · · · · · · · · · · · · · · · ·
	3. ;	•	•
	4. :	•	•
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	5;		•
	6: 7:	•	• • •
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	8:	· · · · · · · · · · · · · · · · · · ·	•
	9. :		· · · · · · · · · · · · · · · · · · ·
	10:	······································	·

8. OTHER OBSERVATIONS:

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5. SOURCE OF DATA

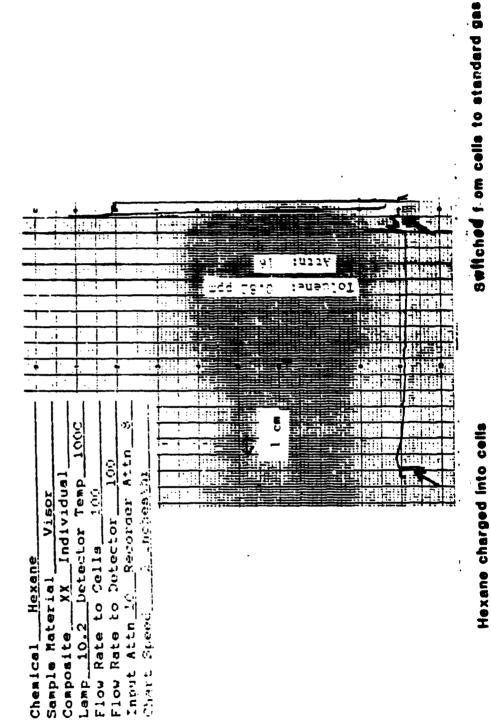
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Samples were run by Denise McDonald on April 2, 1987.

Chemical Resistance Testing of Visor Material

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## Hexane



## 1. DESCRIPTION OF PRODUCT EVALUATED

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1:	TYPE: Teflo	n				
2:			CODE: 09			
				sible imperfection	ns	
4:						
	LOT OR ME					
				ransparent sheet.		
TES	ST METHOD			•		
1.	TESTING LAB	ORATORY:	Texas Research I	nstitute, 9063 Bee	Caves I	load, Austin, TX
2.	ANAL YT ICAL	METHOD: 🗋	Continuous photo:	ionization detects	lon with	a 10.20 eV lamp
3.	TEMPERATURE	: 22-25°C				
4.	COLLECTION	MEDIUM:	N <sub>2</sub>			
5.	COLLECTION	SYSTEM:	N <sub>2</sub>			
				used. /Detector To	mperatu	e = 100C.
				low rate to cells		
CHI	ALLENGE CHEMI	CAL	1 .	COMPONENT 2	:	3
	CHEM NAME (s			. N/A	:	N/A
2.	CAS NUMBER(	s): <u>98-9</u>	5-3	: N/A	:	N/A
3.	CONC. (IF M	IX) $\overline{N/A}$		: N/A	:	N/A
	CHEMICAL SO		inckrodt	: <del>\</del> /A	;	N/A
2. 3. 4.	MIN DETECTAB	MPLES TES TIME: No LE LIMIT	TED: Three breakthrough wa .04 ppm	s observed after	3.8 hour	<b>5.</b>
			ON RATE N/A			
	SAMPLE THICK					
7.	SELECTED DAT	A POINTS	N/A			
	TIME 1.	:	CONCENTRATION	: CONCENTRATIO	ON : :	CONCENTRATION
	2.	:		:	:	
	3.	:		:	:	
	4.			:	:	
	5.			:	:	
	6.			•		
	7.			:		
	8.				<u> </u>	
		<u> </u>		•		
	9	- <u></u>	····	•	<del>;</del>	
	10	<u> </u>		•		
8.	OTHER OBSERV	ATIONS:	· · · · · · · · · · · · · · · · · · ·			
8.	OTHER OBSERV	ATIONS:				
	·	ATIONS:				
	UKCE OF DATA	•••		ald on April 6, 1		

Chemical Resistance Testing of Visor Material

## Nitrobenzehe

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Nitrobenzene erial Visor XX Individua Dotoctor Temp to Cella 100 to Cella 100 to Secoror 10		
Part of I		
Nitrobenz prial V XX Ino Dotected Cella Seco		
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Chemical Nitro Sample Material Composite XX Lame 10.2 Tot Slow Sate to Ce Flow Sate to Ce		
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<b>F B O B</b> - + + + + + + + + + + + + + + + + + +		
ស្តែប៉ុន្តែដល់នេះ		

Nitrobenzene charged into cells

5-18

Builtchid from cells to standard ges

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## 1. DESCRIPTION OF PRODUCT EVALUATED

	B: CONDITION BEFORE TEST: Unused, no : MANUFACTURER: Dupont	visible imperfection	5					
5								
6	: LOT OR MANUFACTURER DATE: N/A							
7:	: NOMINAL THICKNESS: 11-13 mil							
8	B: DESCRIPTION: Material was a white	transparent sheet.						
T	TEST METHOD							
1		Institute, 9063 Bee (	Caves	s Road, Austin, TX				
_	ANALYTICAL METHOD: Continuous phot	oionization detection	<u>n wi</u> t	th a 10.20 eV lamp				
	. TEMPERATURE: 22-25°C							
4. E								
5. 6.		The second second second second second second second second second second second second second second second se		1000				
	<ul> <li>OTHER CONDITIONS: <u>l inch cells we</u></li> <li>DEVIATIONS FROM ASTM F739 METHOD:</li> </ul>							
	B. PERMEATION TEST SYSTEM: Individual			CC/min.				
G	HALLENGE CHEMICAL 1	: COMPONENT ?	:	3				
1.	. CHEM NAME(s) : Trichloroethylene	: N/A	:	N/A				
2.	CAS NUMBER(s): 79-01-6	: N/A		N/A				
3	CONC. (IF MIX) N/A	: N/A	_:_	N/A				
4,	. CHEMICAL SOURCE: Aldrich	: N/A	-:-	N/A				
1 2 3	EST RESULTS DATE TESTED: 6-29-87 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough	was observed after 4	1 h	ours.				
1 2 3 4 5 6	• DATE TESTED: <u>6-29-87</u> • NUMBER OF SAMPLES TESTED: <u>Three</u> • BREAKTHROUGH TIME: <u>No breakthrough</u> • MIN DETECTABLE LIMIT <u>.21 ppm</u> • STEADY STATE PERMEATION RATE <u>N/A</u> • SAMPLE THICKNESS: <u>12 mils</u>	was observed after 4	.1 ha	ours.				
123456	. DATE TESTED: 6-29-87 . NUMBER OF SAMPLES TESTED: Three . BREAKTHROUGH TIME: No breakthrough . MIN DETECTABLE LIMIT .21 ppm . STEADY STATE PERMEATION RATE N/A . SAMPLE THICKNESS: 12 mils . SELECTED DATA POINTS N/A							
1.23.45.6	DATE TESTED: 6-29-87 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .21 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION			CONCENTRATION				
123456	. DATE TESTED: 6-29-87 . NUMBER OF SAMPLES TESTED: Three . BREAKTHROUGH TIME: No breakthrough . MIN DETECTABLE LIMIT .21 ppm . STEADY STATE PERMEATION RATE N/A . SAMPLE THICKNESS: 12 mils . SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. :							
123456	. DATE TESTED: 6-29-87 . NUMBER OF SAMPLES TESTED: Three . BREAKTHROUGH TIME: No breakthrough . MIN DETECTABLE LIMIT .21 ppm . STEADY STATE PERMEATION RATE N/A . STEADY STATE PERMEATION RATE N/A . SAMPLE THICKNESS: 12 mils . SELECTED DATA POINTS N/A TIME : CONCENTRATION 1							
1.23456	. DATE TESTED: <u>6-29-87</u> . NUMBER OF SAMPLES TESTED: <u>Three</u> 3. BREAKTHROUGH TIME: <u>No breakthrough</u> . MIN DETECTABLE LIMIT <u>.21 ppm</u> 5. STEADY STATE PERMEATION RATE <u>N/A</u> . SAMPLE THICKNESS: <u>12 mils</u> . SELECTED DATA POINTS <u>N/A</u> TIME : CONCENTRATION 1. <u>:</u> 2. <u>:</u> 3. <u>:</u>							
1.23456	. DATE TESTED: <u>6-29-87</u> . NUMBER OF SAMPLES TESTED: <u>Three</u> 3. BREAKTHROUGH TIME: <u>No breakthrough</u> . MIN DETECTABLE LIMIT <u>.21 ppm</u> 5. STEADY STATE PERMEATION RATE <u>N/A</u> 5. STEADY STATE PERMEATION RATE <u>N/A</u> 5. SAMPLE THICKNESS: <u>12 mils</u> 7. SELECTED DATA POINTS <u>N/A</u> TIME : CONCENTRATION 1 2 3 4							
1.23456	DATE TESTED: 6-29-87 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .21 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1							
1.23.45.6	. DATE TESTED: <u>6-29-87</u> . NUMBER OF SAMPLES TESTED: <u>Three</u> 3. BREAKTHROUGH TIME: <u>No breakthrough</u> . MIN DETECTABLE LIMIT <u>.21 ppm</u> 5. STEADY STATE PERMEATION RATE <u>N/A</u> 5. STEADY STATE PERMEATION RATE <u>N/A</u> 5. SAMPLE THICKNESS: <u>12 mils</u> 7. SELECTED DATA POINTS <u>N/A</u> TIME : CONCENTRATION 1 2 3 4							
123456	DATE TESTED: 6-29-87 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .21 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1 3 4 5 6							
123456	DATE TESTED: 6-29-87 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .21 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1							
123456	DATE TESTED: 6-29-87 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .21 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1							
1234567	DATE TESTED: 6-29-87 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .21 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1							
1. 2.3.4.5.6.7. 8.	DATE TESTED: 6-29-87 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .21 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1	CONCENTRATION						
1.234567	DATE TESTED: 6-29-87 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .21 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1	: CONCENTRATION : : : : : : : : : : : :						

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	TYPE: Teflon			
	PROTECTIVE MAT			
			visible imperfections	
4:	MANUFACTURER: PRODUCT IDENTI			
	LOT OF MANUFAC			
	NOMINAL THICKN			
		Material was a white	transparent sheet.	
TE	ST METHOD			
			Institute, 9063 Bee Ca	
	TEMPERATURE: 2		coionization detection	with a 10.20 eV lan
	COLLECTION MED			
	COLLECTION MED			
			re used./Detector Temp	erature = 100C.
			Flow rate to cells was	
8.	PERMEATION TES	T SYSTEM: <u>Individual</u>	cell monitoring	
CH	IALLENGE CHEMICAL	1	: COMPONENT 2	: 3
1.	CHEM NAME(s) :	Vinyl Acetate	: N/A	: N/A
	CAS NUMBER(s):		: N/A	: N/A
3.	CONC. (IF MIX)	N/A	: N/A	: N/A
4. Te	CHEMICAL GOURCE	E:Aldrich	:N/A	:N/A
4. TE 1. 2. 3. 4.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIL MIN DETECTABLE	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm	: N/A was observed after 4.5	: <u>N/A</u> ,
4. TE 1. 2. 3. 4. 5.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIL MIN DETECTABLE I STEADY STATE PE	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A	: N/A was observed after 4.5	: N/A
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils	: N/A was observed after 4.5	: N/A
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIL MIN DETECTABLE I STEADY STATE PE	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils	: N/A was observed after 4.5	: N/A
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION	: N/A was observed after 4.5	: N/A
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PER TIME 1. 2.	E:Aldrich 6-30-87 ES TESTED: <u>Three</u> ME: <u>No breakthrough</u> LIMIT <u>.50 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>	: N/A was observed after 4.5	: N/A 
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIL MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION	: N/A was observed after 4.5	: N/A 
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIL MIN DETECTABLE I STEADY STATE PES SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION	: N/A was observed after 4.5	: N/A 
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIL MIN DETECTABLE I STEADY STATE PE SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION	: N/A was observed after 4.5	: N/A 
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION	: N/A was observed after 4.5 : CONCENTRATION : : : : : : : :	: N/A 
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLI BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION	: N/A was observed after 4.5	: N/A 
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 5. 6. 7.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION	: N/A was observed after 4.5 : CONCENTRATION : : : : : : : :	: N/A 
4. TE 1. 2. 3. 4. 5. 6.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIL MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION	: N/A was observed after 4.5 : CONCENTRATION : : : : : : : : : : :	: N/A 
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIL MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: N/A was observed after 4.5 CONCENTRATION : : : : : : : : : : : : :	: N/A hours. CONCENTRATION : : : : : : : : : : : : :
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLI BREAKTHROUGH TIL MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: N/A was observed after 4.5 : CONCENTRATION : : : : : : : : : : :	: N/A hours. CONCENTRATION : : : : : : : : : : : : :
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL GOURCE ST RESULTS DATE TESTED: NUMBER OF SAMPLE BREAKTHROUGH TIL MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: N/A was observed after 4.5 CONCENTRATION : : : : : : : : : : : : :	: N/A hours. CONCENTRATION : : : : : : : : : : : : :
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL GOURCE	E:Aldrich 6-30-87 ES TESTED: Three ME: No breakthrough LIMIT .50 ppm RMEATION RATE N/A S: 12 mils DINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: N/A was observed after 4.5 : CONCENTRATION : : : : : : : : : : : : :	: N/A hours. CONCENTRATION : : : : : : : : : : : : :

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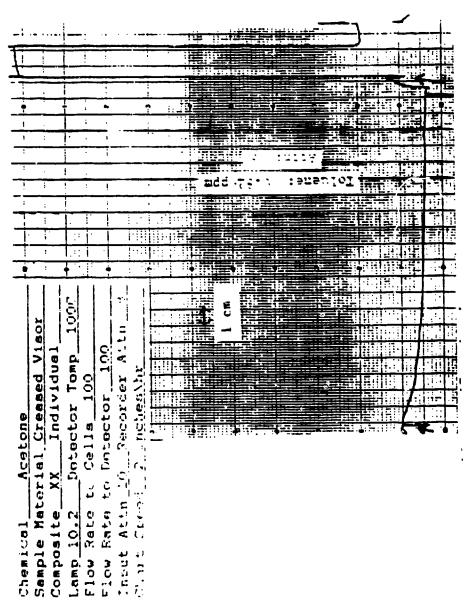
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## 1. DESCRIPTION OF PRODUCT EVALUATED

2:	TYPE: Teflon PROTECTIVE MATERIAL COI	<u>v. 00</u>	·	
2: 3:	CONDITION BEFORE TEST:	Unused no visib	le imperfections	
4:	MANUFACTURER: Dupont	0110366; 10 11910		<u></u>
	PRODUCT IDENTIFICATION:	Vicor		
	LOT OR MANUFACTURER DAT			<u></u>
7:	NOMINAL THICKNESS: 11-1			······································
7: 8:	DESCRIPTION: Material		narant cheat. Samp	le was creased usin
0:	CHEMFAB Fold Resistance	Test procedure o	f 5 September 1986	
TES	ST METHOD			
1.	TESTING LABORATORY: Tes			
	ANALYTICAL METHOD: Con	<u>itinuous photoioni</u>	zation detection w	ith a 10.20 eV lamp
3.	TEMPERATURE: 22-25°C			
	COLLECTION MEDIUM: N2			
	OTHER CONDITIONS: 1			
7.	DEVIATIONS FROM ASTM F	39 METHOD: Flow	rate to cells were	100 cc/min.
CHA	ALLENGE CHEMICAL	1 :	COMPONENT 2 :	3
1.	CHEM NAME(s) : Acetom	• . •	N/A :	N/A
	CAS NUMBER(s): 67-64-		N/A :	N/A
	CONC. (IF MIX) N/A	·	N/A :	N/A
		ckrodt :	N/A :	N/A
TES	ST RESULTS			
		•		
	DATE TESTED: <u>4-7-87</u>			
	NUMBER OF SAMPLES TESTED			المتعادي والمستعدي والمستقدوني
3.	BREAKTHROUGH TIME: No	breakthrough was	observed after 4 h	ours.
	MIN DETECTABLE LIMIT			
	STEADY STATE PERMEATION			
6.	SAMPLE THICKNESS: 12 m	115		
7.	SELECTED DATA POINTS N	/A	•	
		CONCENTRATION :	CONCENTRATION :	CONCENTRATION
	1: 2:		i 	
	3. :	i	• •	= <i></i>
	3: 4:		· · · · · · · · · · · · · · · · · · ·	
	4. <u> </u>	<u>.</u>	·	
	5: 6:		·	<u> </u>
	· · · · · · · · · · · · · · · · · · ·	<u> </u>	······	
	7:			
	8			
	9. :			
	10:	<b>:</b>	······································	
	OTHER OBSERVATIONS:	·····		
8.				
8.				

Chemical Resistance Testing of Creased Visor Material

## Acetohe



Bwitched from cells to standard gas

Acetone charged into cella

	1:	TYPE: Teflon				
	2:	PROTECTIVE MAT	TERIAL CODE: 09			
	3:	CONDITION BEFO	ORE TEST: Unused	, no visible imperf	ections	
4		MANUFACTURER:				
		PRODUCT IDENT				
			CTURER DATE: N/A	······································		
			NESS: 11-13 mil			
	B:	CHEMFAB Fold I	Resistance Test p	hite transparent sh rocedure of 5 Septe	mber 1986.	Was creased usi
	resi	I METHOD				
1	1.			arch Institute, 906	3 Bee Caves	Road, Austin, T
- 2			THOD: Gas Chroma	tography		
		TEMPERATURE:			****	
			DIUM: Charcoal			
-	5.		STEM: Charcoal			
			ONS: 1 inch cel OM ASTM F739 METH			
	7.	DEVIATIONS PRO	UM ASIM 7/39 MEIN	UD:		
(	CHAI	LLENGE CHEMICAL	L 1	: Component	2:	3
1	l.	CHEM NAME (s)	: Acetonitrile	: T/A	:	17/A
		CAS NUMBER(s)				N/A
1	3.	CONC. (IF MIX)	) N/A	: N/A		N/A
4		CHEMICAL SOUR	CE:Fisher	:N/A		N/A
	2. N 3. E 4. M 5. S 5. S	STEADY STATE PE SAMPLE THICKNES	LES TESTED: Three IME: N/A LJMIT 0.5 ppm ERMEATION RATE N SS: 19-20 mils	e /A & 3 at end of thre	a hour tast	
		TIME	: CONCENTR		RATION :	CONCENTRATION
	1	l. 3 hours	: <0.5 pp			<0.5 ppm
	2	2	:	:		
		3	:	*	:	
					:	
			:	:	:	
			:	:	:	
		·	:	:		
		3	:			
		0.				
	•		· · · · · · · · · · · · · · · · · · ·		•	
		THER ORSERVATI	IONS: 3 hour sa	mples were collecte	d for 50 mi	nutes for total
8	3. 0	volume of 11	.5 liters.			

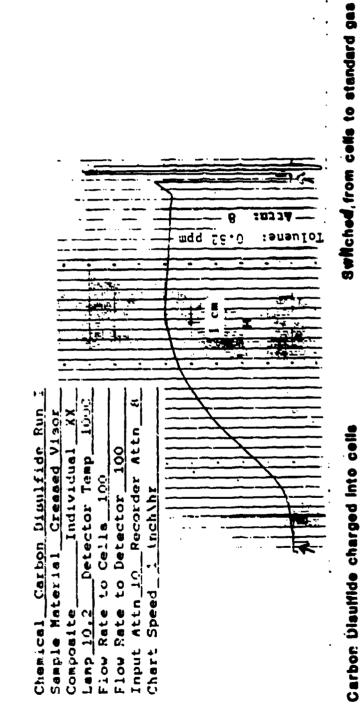
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	YPE: Teflon	TEDTAT	CODE . 00				
	ROTECTIVE MAT		CODE: 09 T: Unused, no v	1 + 1 L 7			
	ANUFACTURER:			V15101	e imperiections		
	RODUCT IDENT						
÷ -	OT OR MANUFA	-					
-	OMINAL THICK					· · · · · · · · · · · · · · · · · · ·	
				transp	arent sheet. Sam	ple was	creased us:
<u>c</u>	HEMFAB Fold	Resista	nce Test procedu	are of	5 September 198	6.	
TEST	METHOD						
					ute, 9063 Bee Ca		
		_		Dioniz	ation detection	with a	10.20 ev 14
	EMPERATURE:						
	OLLECTION ME						
	THER CONDITI			used.	/Detector Temper		1000.
					ate to cell was		
CHALI	ENGE CHEMICA	L	1	: C	OMPONENT 2	:	3
1. 0	HEM NAME (S)	: Carb	on Disulfide	:	N/A	:	¥/A
2. 0	AS NUMBER(s)	: 75-1	5-0	:	N/A	:	N/A
	XONC. (IF MIX			:	N/A	:	N/A
4. (	HEMICAL SOUR	CE:Mall	inckrodt	:	N/A	:	<u>N/A</u>
2. NU 3. BF 4. MI 5. SI 6. SA	EAKTHROUGH T	LES TES IME: 3 LIMIT ERMEATI SS: 1	.09 ppm ON RATE 8.40		2*hr)		
	TIME	:	CONCENTRATION	:	CONCENTRATION	: CON	CENTRATION
2.						:	
3.		:		:		:	
4.		:		:		:	
5.		:		:		:	
6.		:		:		:	
7.	The second second second second second second second second second second second second second second second s	:		:		:	
8.	The second second second second second second second second second second second second second second second se	:		:		:	
9.	The second second second second second second second second second second second second second second second s			:		:	
10	·	:				:	
		TONE					
8, 07	THER OBSERVAT	10N5: _	·				

含义式 法承认者公主法 无法表达 医单方法 血液血液的

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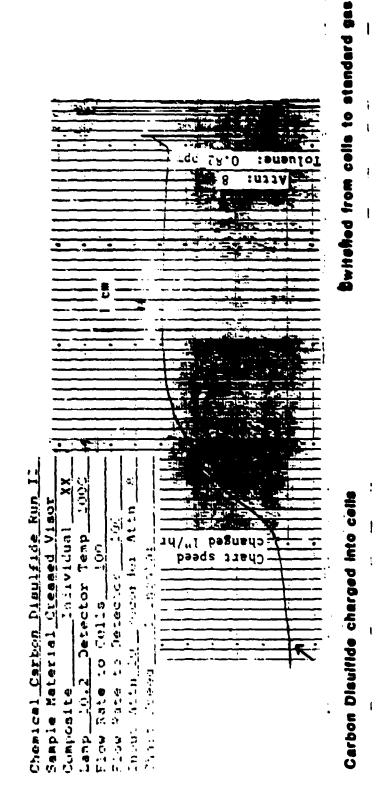
# Chemical Resistance Testing of Creased Visor Material

## Carbon Disulfide Run

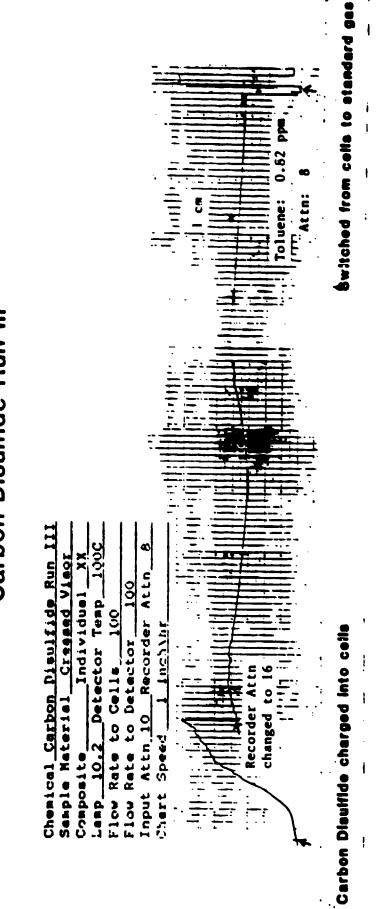
		Tefles TIVE MATE	RIAL CODE: 09		
				visible imperfections	و الله و الم المحمد المحمد المحمد المحمد المحمد المحمد المحمد المحمد المحمد المحمد المحمد المحمد الم
		CTURER:			
			ICATION: Visor		
	-		TURER DATE: N/A		
			SS: 11-13 mil		
8:				transparent sheet. Sa dure of 5 September 19	
TES	T METHO	ממ			
1.	TESTIN	NG LABORAT	CORY: Texas Research	Institute, 9063 Bee C	eves Road, Austin,
				toionization detection	with a 10.20 eV 1a
		ATURE: 22			
		TION MEDI			
		CTION SYST		s used. /Detector Tempe	
				Flow tate to cell was	
••					
Сна	LLENCE	CHEMICAL	1	: COMPONENT 2	: 3
1.	CHEM N	NAME(s):	Carbon Disulfide	: N/A	: N/A
2.	CAS NI	MBER(s):	75-15-0	:N/A	: N/A
		(IF MIX)		:N/A	:N/A
4.	CHEMIC	CAL SOURCE	E:Mallinckrodt	:N/A	:N/A
TES	T RESUL	LTS	•		
1	DATE T	ESTED: 4-9	9-97		
			ES TESTED: One (Ru	n II)	
			AE: 25 minutes		
			LIMIT .10 ppm		ويور المتحوي بني في من ومريد
5.	STEADY	STATE PER	RMEATION RATE 8.60	(ug/cm2*hr)	
			5: 12 mils		
7.	SELECTE	ED DATA PO	DINTS N/A		
	1.	IME	: CONCENTRATIO	N : CONCENTRATION	: CONCENTRATION
	2.		•		:
	3. —		•	•	:
	4.			:	:
	5		:	:	· · · · · · · · · · · · · · · · · · ·
	6		•	:	:
	7,		: 	<u> </u>	:
	8				:
	<b>9.</b> 10.		;		
	10	<u> </u>		•	• 
•	OTHER (	DBSERVATI(	ONS:		

# Chemical Resistance Testing of Creased Visor Material

## Carbon Disulfide Run II



	1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 3: CONDITION BEFCRE TEST: U		ble imperfections	
	4: MANUFACTURER: Dupont 5: PRODUCT IDENTIFICATION:	1		·
	6: LOT OR MANUFACTURER DATE:			
	7: NOMINAL THICKNESS: 11-13			
	8: DESCRIPTION: Material was CHEMFAB Fold Resistance To	s a white tran est procedure	sparent sheet. Sa of 5 September 19	mple was creased us 86.
•	TEST METHOD			
	1. TESTING LABORATORY: Texas			
	2. ANALYTICAL METHOD: Contis 3. TEMPERATURE: 22-25°C	Jous photolon	ization detection	With & 10.20 ev 18
	4. COLLECTION MEDIUM: N <sub>2</sub>			
	5. COLLECTION SYSTEM: N2			
	6. OTHER CONDITIONS: 1 inc			
	7. DEVIATIONS FROM ASIM F739	METHOD: Flow	rate to cell was	100 cc/ain.
•	CHALLENGE CHEMICAL	1 :	COMPONENT 2	: 3
	1. CHEM NAME (s) : Carbon Din	mlfide :	¥/A	5 <b>%</b> /A
	2. CAS NUMBER(s): 75-15-0		N/A	:N/A
	3. CONC. (IF MIX) N/A	······································	N/A	: <u>N/A</u>
	4. CHEMICAL SOURCE: Mallinckr		N/A	:N/A
•	TEST RESULTS			
	1. DATE TESTED: 4-10-87		<u></u>	
	2. NUMBER OF SAMPLES TESTED: 3. BREAKTHROUGH TIME: 34 min		)	
	4. MIN DETECTABLE LIHIT .10 p			
	5. STEADY STATE PERMEATION RATE		mo*br)	
	6. SAMPLE THICKNESS: 12 mil			
	7. SELECTED DATA POINTS N'A		· · · · · · · · · · · · · · · · · · ·	
	TIME : CON	CENTRATION :	CONCENTRATION	: CONCENTRATION
	2.	•		······································
	3. :	:		:
	4:			:
	5:			:
	6:			• •
	7:			
	8: 9:		; 	•
	16.			



# Chemical Resistance Testing of Creased Visor Material

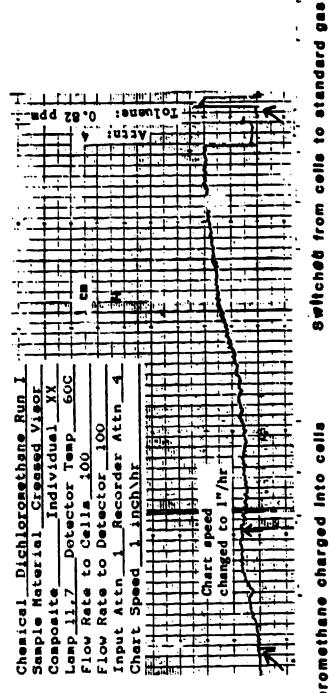
たらうしいた

## Carbon Disulfide Run III

	ESCRI	PTION OF PRO	DUCT EVALUATED				
1		PE: Teflon					
-			ERIAL CODE: 09				
			RE TEST: Unused	, no visib	le imperfection	ons	
		NUFACTURER:					المراجلين وطنياتكورات
-			FICATION: Visor	· 			
			TURER DATE: N/A				
-			ESS: 11-13 11				
G			Material was a w esistance Test p				as creased
2. 1	EST M	ETHOD					
1	. TE	STING LABORA	TORY: Texas Rese	arch Insti	tute, 9063 Be	e Caves R	oad. Austin
	AN	ALYTICAL MET	HOD: Continuous	photoioni	zation detects	lon with	a 11.70 eV
3		MPERATURE: 2					
		LLECTION MED.					
5	. 00	LLECTION SYS	TEM: N2				
6	. OT	HER CONDITIO	NS: 1 inch cel	1 was used	./Detector Ter	perature	= 60C.
7	. DE	VIATIONS FRO	M ASTM F739 METH	OD: Flow	rate to cell a	vas 100 c	c/min.
2 0	HALLE	NGE CHEMICAL	1	<b>4</b> -	Conformit 2	<b>3</b>	3
			Dichloromethan	<u>e;</u>	<u>N/A</u>	;	<u>N/A</u>
_		S NUMBER(s):			N/A		R/A
-		NC. (IF MIX) Emical source			N/A N/A	<sup>2</sup>	<u>N/A</u> N/A
-	• Un	ELICAL SOURCE	<u>c:riiner</u>	:	N/A	:	N/A
4. T	EST R	ESULTS					
1 2 3	. DAT . NUM . BRE	E TESTED: Ber of Sampli Akthrough Ti	4-15-87 ES TESTED: On ME: 38 minutes	e (Run I)			
1 2 3 4	. DAT . NUM . BRE . MIN	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm	e (Run I)			
1 2 3 4	. DAT . NUM . BRE . MIN . STE	E TESTED: BER OF SAMPL AKTHROUGH TIJ Detectable 1 Ady state pei	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE	e (Run I)			
1 2 3 4 5 6	. DAT . NUM . BRE . MIN . STE . SAM	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE I ADY STATE PEI PLE THICKNES:	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils	e (Run I)			
1 2 3 4 5 6	. DAT . NUM . BRE . MIN . STE . SAM	E TESTED: BER OF SAMPL AKTHROUGH TIJ Detectable 1 Ady state pei	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils	e (Run I)			
1 2 3 4 5 6	. DAT NUM BRE MIN STE SAM SEL	E TESTED: BER OF SAMPL AKTHROUGH TIL DETECTABLE I ADY STATE PEI PLE THICKNESS ECTED DATA PO TIME	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils	e (Run I) 5.22 (ug/			DNCENTRATI(
1 2 3 4 5 6	. DAT NUM BRE MIN STE SAM SEL	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE 1 ADY STATE PE PLE THICKNESS ECTED DATA PO TIME	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils DINTS N/A : CONCENTR :	e (Run I) 5.22 (ug/	<b>c</b> ∎ <sup>2</sup> *hr)		
1 2 3 4 5 6	. DAT NUM BRE MIN STE SAM SEL	E TESTED: BER OF SAMPL AKTHROUGH TIN DETECTABLE I ADY STATE PEI PLE THICKNES: ECTED DATA PO TIME	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils DINTS N/A : CONCENTR :	e (Run I) 5.22 (ug/	<b>c</b> ∎ <sup>2</sup> *hr)		
1 2 3 4 5 6	. DAT NUM BRE MIN STE SAM SEL	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE I ADY STATE PEI PLE THICKNES: ECTED DATA PO TIME	4-15-87 ES TESTED:On ME:38 minutes LIMIT14 ppm RMEATION RATE S:12 mils DINTSN/A : CONCENTR : :	e (Run I) 5.22 (ug/	<b>c</b> ∎ <sup>2</sup> *hr)	DN : C	
1 2 3 4 5 6	. DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4.	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE I ADY STATE PEI PLE THICKNESS ECTED DATA PO TIME	4-15-87 ES TESTED:On ME:38 minutes LIMIT14 ppm RMEATION RATES:12 mils OINTSN/A :CONCENTR : : :	e (Run I) 5.22 (ug/	<b>c</b> ∎ <sup>2</sup> *hr)	DN : C	
1 2 3 4 5 6	. DAT. . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 3. 5.	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE I ADY STATE PEI PLE THICKNESS ECTED DATA PO TIME	4-15-87 ES TESTED:On ME:38 minutes LIMIT14 ppm RMEATION RATES:12 mils OINTSN/A : CONCENTR : : : :	e (Run I) 5.22 (ug/	<b>c</b> ∎ <sup>2</sup> *hr)	DN : C : : :	
1 2 3 4 5 6	. DAT. . NUM . BRE . MIN . STE. . SAM . SEL 1. 2. 3. 3. 4. 5. 6. 7.	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE 1 ADY STATE PEI PLE THICKNESS ECTED DATA PO TIME	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils OINTS N/A : CONCENTR : : : : :	e (Run I) 5.22 (ug/	<b>c</b> ∎ <sup>2</sup> *hr)	DN : C : : :	
1 2 3 4 5 6	. DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8.	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE 1 ADY STATE PEI PLE THICKNESS ECTED DATA PO TIME	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils OINTS N/A : CONCENTR : : : : :	e (Run I) 5.22 (ug/ ATION : : : : : : : :	<b>c</b> ∎ <sup>2</sup> *hr)	DN : C : : : : :	
1 2 3 4 5 6	. DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8. 9.	E TESTED: BER OF SAMPL AKTHROUGH TIN DETECTABLE I ADY STATE PEN PLE THICKNES: ECTED DATA PO TIME	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils OINTS N/A : CONCENTR : : : : :	e (Run I) 5.22 (ug/ ATION : : : : : : : :	<b>c</b> ∎ <sup>2</sup> *hr)	DN : C : : : : :	
1 2 3 4 5 6	. DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8. 9.	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE 1 ADY STATE PEI PLE THICKNESS ECTED DATA PO TIME	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils DINTS N/A : CONCENTR : : : : : : :	e (Run I) 5.22 (ug/ ATION : : : : : : : : : : : : : : : : : : :	<b>c</b> ∎ <sup>2</sup> *hr)	DN : C	
1 2 3 4 5 6 7	. DAT . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	E TESTED: BER OF SAMPL AKTHROUGH TIN DETECTABLE I ADY STATE PEN PLE THICKNES: ECTED DATA PO TIME	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils DINTS N/A : CONCENTR : : : : : : :	e (Run I) 5.22 (ug/ ATION : : : : : : : : : : : : : :	cm <sup>2</sup> *hr) CONCENTRATIO	DN : C	
1 2 3 4 5 6 7	. DAT. . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 3. 4. 5. 6. 7. 8. 9. 10. 10.	E TESTED: BER OF SAMPL AKTHROUGH TI DETECTABLE I ADY STATE PEI PLE THICKNESS ECTED DATA PO TIME 	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils DINTS N/A : CONCENTR : : : : : : : : : : : : :	e (Run I) 5.22 (ug/ ATION : : : : : : : : : : : : : :	cm <sup>2</sup> *hr) CONCENTRATIO	DN : C	
1 2 3 4 5 6 7	. DAT. . NUM . BRE . MIN . STE . SAM . SEL 1. 2. 3. 3. 4. 5. 6. 7. 8. 9. 10. 10.	E TESTED: BER OF SAMPLA AKTHROUGH TIL DETECTABLE I ADY STATE PEL PLE THICKNES: ECTED DATA PO TIME ECTED DATA CONSERVATION	4-15-87 ES TESTED: On ME: 38 minutes LIMIT .14 ppm RMEATION RATE S: 12 mils DINTS N/A : CONCENTR : : : : : : : : : : : : :	e (Run I) 5.22 (ug/ ATION : : : : : : : : : : : : : :	cm <sup>2</sup> *hr) CONCENTRATIO		

Chemical Resistance Testing of Creased Visor

## Dichloromethane Run



Dichloromethane charged into cells

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i I

 -		-		-					 		_	-	-			-	-			~ ~		-			-		-	 -	-				-		-	• •			• •	-					-	• •				~		
	C	H	l	2	1	I	C	J	P	R	Q	T	E	C	1		lV	ł	(	3	.(	)'	C	H	I	N	Ģ	P	R	0	D	U	C	T	•	Ē	V	A'	5	U/	Ľ	[]	[(	DI	N	1	R	E	C	)1	RĪ	)

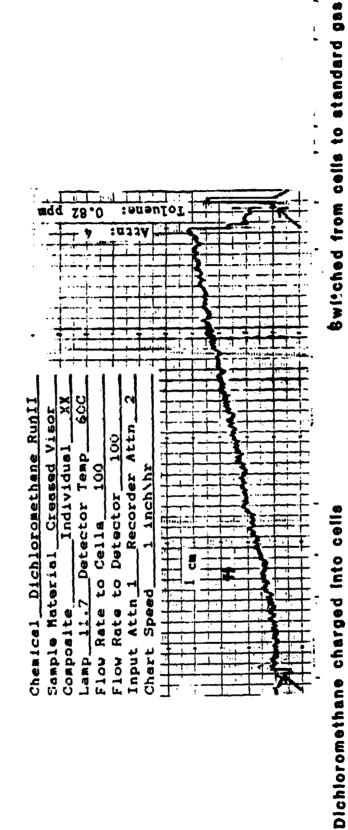
1. DESCRIPTION OF PRODUCT EVALUATED

ba

1: 2:	TYPE: Teflon				
2.					
4.	PROTECTIVE MATER				
3:	CONDITION BEFORE	TEST: Unused, no	visible imperfection	118	
4:	MANUFACTURER: Du				
5:	PRODUCT IDENTIFIC	CATION: Visor			
6:	LOT OR MANUFACTU	RER DATE: N/A			
7:	NOMINAL THICKNESS	5: 11-13 mil			
8:	DESCRIPTION: Mat	erial was a white	transparent sheet.	Sample w	ras creased usi
	CHEMFAB Fold Rest	Istance Test proce	dure of 5 September	1986.	
TE	ST K TYOD				
1.	TESTING LABORATO	RY: Texas Research	Institute, 9063 Bee	Caves I	Road, Austin, T
2.	ANALYTICAL METHON	D: Continuous pho	toionization detecti	on with	a 11.70 eV lam
3.	TEMPERATURE: 22-2	25°C			
4.	COLLECTION MEDIU	1: N <sub>2</sub>			
5.	COLLECTION SYSTEM	1: N <sub>2</sub>			
6.	OTHER CONDITIONS	: l inch cell wa	s used./Delector Ten	perature	= 60C.
7.	DEVIATIONS FROM		Flow rate to cell w		
		•			9
	LLENGE CHEMICAL	1	: COMPONENT 2	•	3
•			7	:	
	CHEM NAME(s) : 1		<u> </u>	i	<u>N/A</u>
2.			: N/A		N/A
	CONC. (IF MIX)		: <u>N/A</u>		N/A
4.	CHEMICAL SOURCE:	Fisher	:N/A	;	<u>N/A</u>
2.	DATE TESTED: 4-22 NUMBER OF SAMPLES	TESTED: One (Ru	n II)		
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERMI SAMPLE THICKNESS:	TESTED:One (Ru:60 minutesflT.06 ppmCATION RATE2.4512 mils			
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERMI	TESTED:One (Ru:60 minutesflT.06 ppmCATION RATE2.4512 mils			
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERMI SAMPLE THICKNESS: SELECTED DATA POIN TIME :	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr)</td> <td>)N : (</td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr)	)N : (	CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERMI SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2.	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr)</td> <td>)N : (</td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr)	)N : (	CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERMI SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2;	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr)</td> <td>)N : (</td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr)	)N : (	CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME : MIN DETECTABLE LIN STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr)</td> <td>)N : (</td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr)	)N : (	CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr) N : CONCENTRATIO</td> <td>)N : (</td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO	)N : (	CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERMI SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr) N : CONCENTRATIO</td> <td></td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERMI SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr) N : CONCENTRATIO</td> <td></td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERMI SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr) N : CONCENTRATIO</td> <td></td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLESBREAKTHROUGH TIME:MIN DETECTABLE LINSTEADY STATE PERMESAMPLE THICKNESS:SELECTED DATA POINTIME :2.3.4.5.5.6.7.8.	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr) N : CONCENTRATIO : : : : : :</td> <td></td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO : : : : : :		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLESBREAKTHROUGH TIME:MIN DETECTABLE LINSTEADY STATE PERMESAMPLE THICKNESS:SELECTED DATA POINTIME :2:3:4:5:6:7:8:9:	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr) N : CONCENTRATIO : : : : : : : : :</td> <td></td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO : : : : : : : : :		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLESBREAKTHROUGH TIME:MIN DETECTABLE LINSTEADY STATE PERMESAMPLE THICKNESS:SELECTED DATA POINTIME :2.3.4.5.5.6.7.8.	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr) N : CONCENTRATIO : : : : : : : : : :</td> <td></td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO : : : : : : : : : :		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLESBREAKTHROUGH TIME:MIN DETECTABLE LINSTEADY STATE PERMESAMPLE THICKNESS:SELECTED DATA POINTIME :2:3:4:5:6:7:8:9:	TESTED:One (Ru:60 minucesfit.06 ppm:.06 ppm </td <td>(ug/cm<sup>2</sup>*hr) N : CONCENTRATIO : : : : : : : : : :</td> <td></td> <td>CONCENTRATION</td>	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO : : : : : : : : : :		CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLESBREAKTHROUGH TIME:MIN DETECTABLE LINSTEADY STATE PERMESAMPLE THICKNESS:SELECTED DATA POINTIME :2:3:4:5:6:7:8:9:	TESTED: <u>One (Ru</u> <u>60 minutes</u> <u>41T .06 ppm</u> EATION RATE <u>2.45</u> <u>12 mils</u> NTS <u>N/A</u> CONCENTRATIO	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO : : : : : : : : : :		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF S         BREAKTHROUG         MIN DETECTA         STEADY STAT         SAMPLE THIC         SELECTED DA         TIME         2.         3.         4.         5.         6.         7.         8.         9.	AMPLES TH TIME: BLE LIN TE PERMI KNESS: TA POIN : : : : : : : : : : : : :	AMPLES TESTED: <u>One (Ru</u> H TIME: <u>60 minutes</u> BLE LIMIT <u>.06 ppm</u> TE PERMEATION RATE <u>2.45</u> KNESS: <u>12 mils</u> TA POINTS <u>N/A</u> : <u>CONCENTRATIO</u> : : : : :	AMPLES TESTED: One (Run II) TH TIME: 60 minutes BLE LIMIT .06 ppm TE PERMEATION RATE 2.45 (ug/cm <sup>2</sup> *hr) TA POINTS N/A : CONCENTRATION : CONCENTRATION : : : : : : : : : : : : : : : : : : :	AMPLES TESTED:       One (Run II)         CH MIME:       60 minutes         BLE LIMIT       .06 ppm         CE PERMEATION RATE       2.45 (ug/cm <sup>2</sup> *hr)         CE PERMEATION RATE       2.45 (ug/cm <sup>2</sup> *hr)         CONCENTRATION       CONCENTRATION :         CONCENTRATION       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :
2. 3. 4. 5. 6. 7. 8.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERMI SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2	TESTED: <u>One (Ru</u> <u>60 minutes</u> <u>41T .06 ppm</u> EATION RATE <u>2.45</u> <u>12 mils</u> NTS <u>N/A</u> CONCENTRATIO	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO : : : : : : : : : :		CONCENTRATION
2. 3. 4. 5. 6. 7. 8.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2	TESTED:       One (Ru         : 60 minuces       60 minuces         flT       .06 ppm         EATION RATE       2.45         12 mils	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO : : : : : : : : : : : : :		CONCENTRATION
2. 3. 4. 5. 6. 7. 8.	NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIN STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 2	TESTED:       One (Ru         : 60 minuces       60 minuces         flT       .06 ppm         EATION RATE       2.45         12 mils	(ug/cm <sup>2</sup> *hr) N : CONCENTRATIO : : : : : : : : : :		CONCENTRATION



## Dichloromethane Run II



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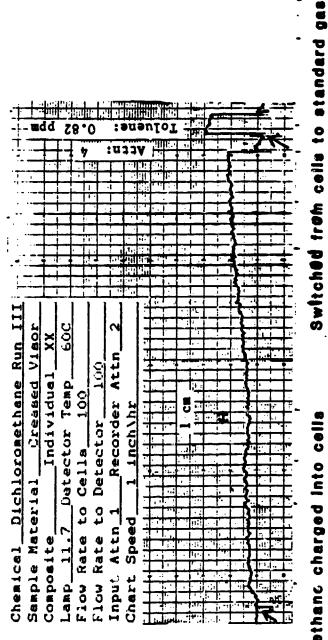
## 1. DESCRIPTION OF PRODUCT EVALUATED

	• .					
	1:	TYPE: Teflon	BILL CODE. AA			
	2:	PROTECTIVE MATE		whethis descriptions		
	3: 4:	MANUFACTURER:	E TEST: Unused, no	Visible imperiecti	ons	
	5:		ICATION: Visor		in a subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the subscription of the s	
	6:	LOT OR MANUFACT				
	7:	NOMINAL THICKNE				
	8:		laterial was a white	trangnarant chao?	Semple 4	as areased water
		CHEMFAB Fold Re	sistance Test proce	dure of 5 September	1986.	ab created using
2.	TES	T METHOD				
	1.	TESTING LABORAT	ORY: Texas Research	Institute, 9063 Be	e Caves R	oad, Austin, TX
	2.		OD: Continuous pho	toionization detect	ion with	a 11.70 eV lamp.
	3.			······································		
	4.					
		COLLECTION SYST				
	ð.	OTHER CONDITION	S: 1 inch cell was	s used. /Detector Te	mperature	= 50C.
	15	DEVIATIONS FROM	ASTM F739 METHOD:	Flow rate to cell	was 100 c	c/min.
3.	CHL	LLENCE CHEMICAL	2	: COMPONENT 2	•	3
	1.	CHEM NAME ( . )	Dichloromethane	: : N/A	:	N/A
		CAS NUMBER(s):				N/A N/A
	3.	CONC. (IF MIX)	N/A	N/A	·····	N/A
		CHEMICAL SOURCE				N/A N/A
						N/A
	3. 4. 5.	BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS	IMIT .08 ppm MEATION RATE 3.55	(ug/cm <sup>2</sup> *hr)		
	7.	SELECTED DATA PO	INTS N/A			
		TIME	: CONCENTRATION	S : CONCENTRATIO	DN : 0	DNCENTRATION
		2.	*****		·····	
		3.	*	:		
		4.	•	:		
		5.	*	:	:	
		6	•	:	:	
		7	:	د	:	
		8.	:	:	:	
		9	:	:	:	
		10	:	:	:	
	8. (	OTHER OBSERVATIO	NS :			
	~• •					
=	<b>6</b>					
5.	2001	RCE OF DATA	• • • • • •			
		Sample was	run by Denise McDons	ild on April 22, 19	87.	

**Chemical Resistance Testing of Creased Visor** 

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# Dichloromethane Run III



Dichloromethanc charged into cells

## 1. DESCRIPTION OF PRODUCT EVALUATED

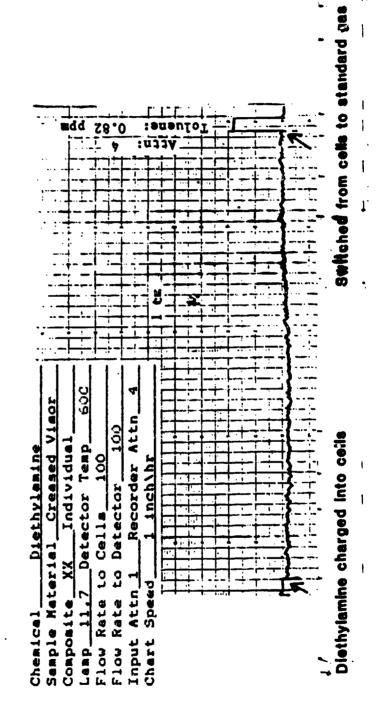
i.

	1: TYPE: Teflon		
	2: PROTECTIVE MATERIAL CODE: 09		
	3: CONDITION BEFORE TEST: Unused, no v	visible imperfection	35
	4: MANUFACTURER: Dupont	· · · · · · · · · · · · · · · · · · ·	
	5: PRODUCT IDENTIFICATION: Visor		
	6: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 11-13 mil		
	8: DESCRIPTION: Material was a white t	ransparent sheet.	sample was creased using
	CHEMFAB Fold Resistance Test procedu	ire of 5 September	986.
2.	TEST METHOD		
			Come Basil Austria TV
	1. TESTING LABORATORY: Texas Research 1	Institute, 9003 Bee	Caves Koad, Austin, IA
	2. ANALYTICAL METHOD: Continuous photo	Dionization detection	M WITH & 11.70 ev lamp.
	3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N <sub>2</sub>		
	4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub>		
		re used./Detector To	emperature = b0C.
	7. DEVIATIONS FROM ASTM F739 METHOD: 1		
L	CHALLENCE CHEMICAL 1	: COMPONENT 2	: 3
		:	:
	1. CHEM NAME(s) : Diethylamine	: <u>N/A</u>	<u>: N/A</u>
	2. CAS NUMBER(s): 109-89-7	: <u>N/A</u>	:N/A
	3. CONC. (IF MIX) N/A	: <u>N/A</u>	::N/A
	4. CHEMICAL SOURCE: EM Science	: N/A	\$N/A
	4. MIN DETECTABLE LIMIT 1.21 ppm	was observed after	17.8 hours.
	5. STEADY STATE PERMEATION RATE N/A		
	6. SAMPLE THICKNESS: 12 mils		
	7. SELECTED DATA POINTS N/A		
	TIME : CONCENTRATION	: CONCENTRATIO	N : CONCENTRATION
	1. : CONSEMENTION	·	·
	2	······································	<u></u>
	3	:	······································
	4. :	:	:
	5. :	:	:
	6. :	•	* *
	7. :	*	*
	8. :	•	
	9:	:	
	10:	:	:
	8. OTHER OBSERVATIONS:		
2			
5.	SOURCE OF DATA		<b>~~</b> 7
	Samples were run by Denise McDon	hald on April 23, 1	98/.



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## Diethylamine



## 1. DESCRIPTION OF PRODUCT EVALUATED

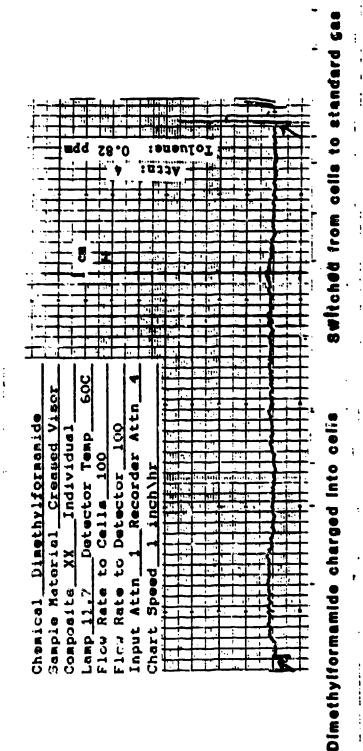
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i

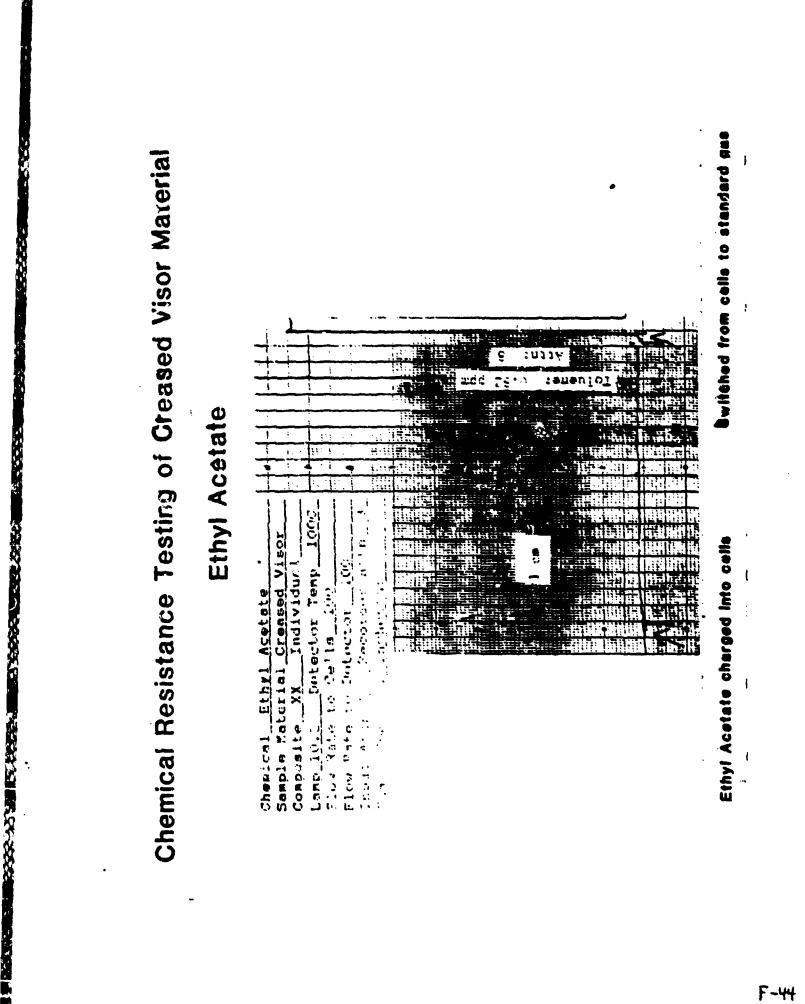
3:	PROTECTIVE MA	TERIAL CODE: 09		
	CONDITION BEF	ORE TEST: Unused, no v:	isible imperfections	
4:	MANUFACTUREP :			والمالي ومعادية والمتقادين ومعادية ومعاديه
:د		IFICATION: Visor		
6:		CTURER DATE: N/A		
7: 8:		NESS: <u>11-13 mil</u> Material was a white th	Contract Contract	- lo use another and used
0;		Resistance Test procedur		
TES	ST METHOD			
1. 2.		ATORY: <u>Texas Research In</u> THOD: Continuous photo:		
3.				
4.	COLLECTION ME			
5.	COLLECTION SY			
6.		ONS: 1 inch cells were		
7.	DEVIATIONS FR	OM ASTM F739 METHOD: F	low rate to cells we	re 100 cc/min.
	ALLENCE CHEMICA	LI	COMPONENT 2	• .3
1.	CHEM NAME(a)	: Dimethylformamide	: N/A	: N/A
2.	CAS NUMBER(s)	: 68-12-2	N/A	: N/A
	CONC. (IF MIX		: N/A	: N/A
4.		A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESC	: N/A	1 N/A
	DATE TESTED:			
2. 3.	NUMBER OF SAMP BREAKTHROUGH T		s observed after 20.3	3 hours.
2. 3. 4. 5.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P	LES TESTED: Three IME: No breakthrough was LIMIT I.16 ppm ERMEATION RATE N/A	s observed after 20.3	3 hours.
2. 3. 4. 5. 6.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNES	LES TESTED: Three IME: No breakthrough was LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils	s observed after 20.	3 hours.
2. 3. 4. 5. 6.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P	LES TESTED: Three IME: No breakthrough was LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils	s observed after 20.	3 hours.
2. 3. 4. 5. 6.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNES	LES TESTED: Three IME: No breakthrough was LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils	s observed after 20.3 : CONCENTRATION	3 hours. 3 hours. CONCENTRATION :
2. 3. 4. 5. 6.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNES SELECTED DATA	LES TESTED: Three IME: No breakthrough war LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A		
2. 3. 4. 5. 6.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNES SELECTED DATA TIME 1.	LES TESTED: Three IME: No breakthrough war LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A		
2. 3. 4. 5. 6.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4.	LES TESTED: Three IME: No breakthrough war LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A		
2. 3. 4. 5. 6.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNES SELECTED DATA TIME 1. 2. 3. 4. 5.	LES TESTED: Three IME: No breakthrough war LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A		
2. 3. 4. 5. 6.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNES SELECTED DATA TIME 1. 2. 3. 4. 5. 6.	LES TESTED: Three IME: No breakthrough war LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A		
2. 3. 4. 5. 6.	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNES SELECTED DATA TIME 1. 2. 3. 4. 5. 5. 6. 7.	LES TESTED: Three IME: No breakthrough war LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A	: CONCENTRATION : : : : : : : :	
2. 3. 4. 5. 6.	NUMBER OF SAMP         BREAKTHROUGH T         MIN DETECTABLE         STEADY STATE P         SAMPLE THICKNES         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.	LES TESTED: Three IME: No breakthrough war LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A		
2. 3. 4. 5. 6. 7.	NUMBER OF SAMP         BREAKTHROUGH T         MIN DETECTABLE         STEADY STATE P         SAMPLE THICKNES         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.	LES TESTED: Three IME: No breakthrough war LIMIT 1.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A	: CONCENTRATION : : : : : : : :	
2. 3. 4. 5. 6. 7.	NUMBER OF SAMP         BREAKTHROUGH T         MIN DETECTABLE         STEADY STATE P         SAMPLE THICKNES         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.	LES TESTED: Three IME: No breakthrough war LIMIT I.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: CONCENTRATION : : : : : : : :	
2. 3. 4. 5. 6. 7.	NUMBER OF SAMP         BREAKTHROUGH T         MIN DETECTABLE         STEADY STATE P         SAMPLE THICKNES         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.	LES TESTED: Three IME: No breakthrough war LIMIT I.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: CONCENTRATION : : : : : : : :	
2. 3. 4. 5. 6. 7.	NUMBER OF SAMP         BREAKTHROUGH T         MIN DETECTABLE         STEADY STATE P         SAMPLE THICKNES         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.	LES TESTED: Three IME: No breakthrough war LIMIT I.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: CONCENTRATION : : : : : : : :	
2. 3. 4. 5. 6. 7. 8.	NUMBER OF SAMP         BREAKTHROUGH T         MIN DETECTABLE         STEADY STATE P         SAMPLE THICKNES         SELECTED DATA         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.	LES TESTED: Three IME: No breakthrough war LIMIT I.16 ppm ERMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: CONCENTRATION : : : : : : : :	

Chemical Resistance Testing of Creased Visor

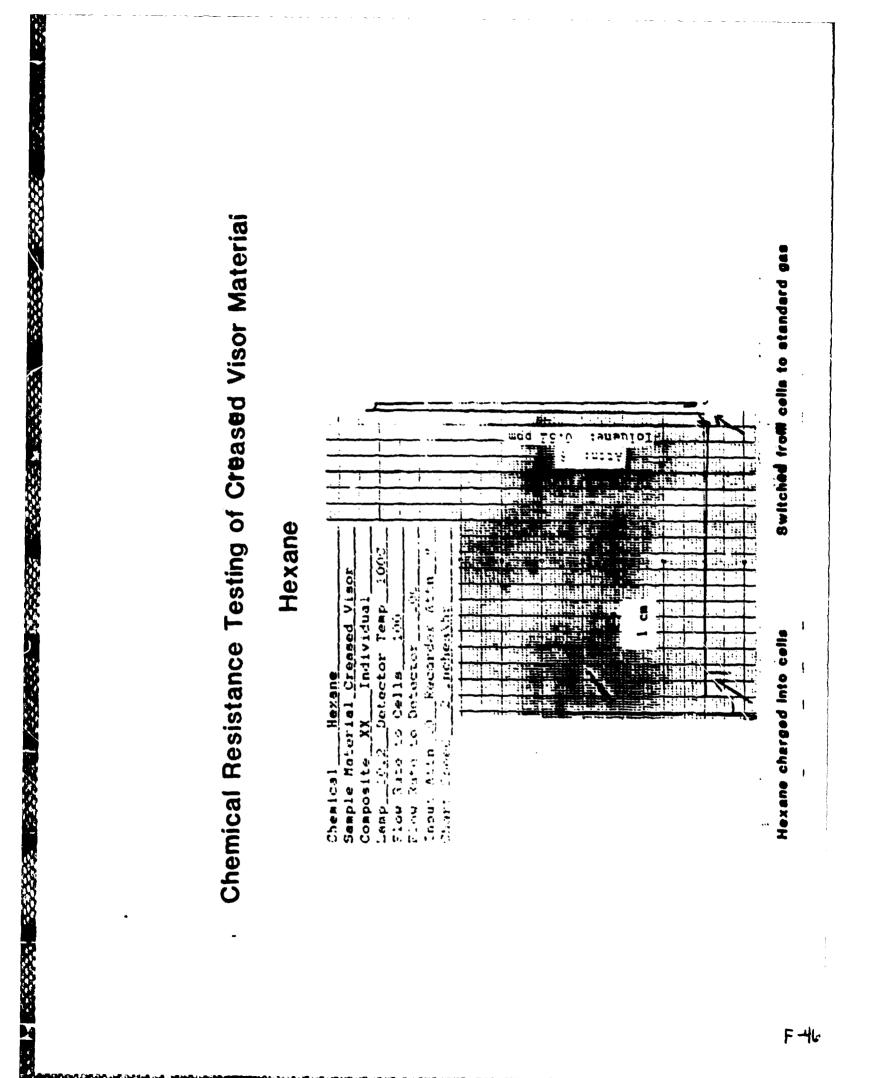
## Dimethylformamide



	1: TYPE: Teflon 2: PROTECTIVE MATER	141 CODE + 00		
		TEST: Unused, no vis	this imperfections	
	4: MANUFACTURER: D			
	5: PRODUCT IDENTIFI			
	6: LOT OR MANUFACTU			والاختلاف الالانبانية المحمد ويوري ويستعمل والمحمد والمحمد والمحمد والمحمد والمحمد والمحمد والمحمد والمحمد والم
	7: NOMINAL THICKNES		ین و الاستان و به بندو به ترج مگمند به می پرد 7	
			insparent sheet. San	mple was creased using
		istance Test procedure		
2.	TEST METHOD			
				aves Road, Austin, TX
			onization detection	with a 10.20 eV lamp.
	3. TEMPERATURE: 22- 4. COLLECTION MEDIU			
	4. COLLECTION MEDIU 5. COLLECTION SYSTE			
		: 1 inch cells were	used. /Devector To-	Deratuse = 100C.
	7. DEVIATIONS FROM	ASTM F739 METHOD: F10	W rate to cells we	re 100 cc/min.
3.	CHALLENGE CHEMICAL	1 :	CONFORENT 2	• 3
	1. CHEM NAME (s) :		N/A	N/A
	- ·	141-78-6 :	¥/A	: N/A
	3. CONC. (IF MIX)		<u>N/A</u>	:N/A
	4. CHEMICAL SOURCE:	EM Science :	N/A	.: N/A
	3. BREAKTHROUGH TIME			
	3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1	EATION RATE N/A	: CONCENTRATION : : :	: CONCENTRATION : : : : :
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1: 2:	EATION RATE <u>N/A</u> <u>12 mils</u> NTS <u>N/A</u>	CONCENTRATION	: CONCENTRATION : : : : :
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1: 2:	EATION RATE <u>N/A</u> <u>12 mils</u> NTS <u>N/A</u>	CONCENTRATION	: CONCENTRATION : : : : : : :
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1: 2: 3: 4; 5: 6: 7: 8:	EATION RATE <u>N/A</u> <u>12 mils</u> NTS <u>N/A</u>	CONCENTRATION	: CONCENTRATION : : : : : : : :
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1: 2: 3: 4: 5: 6: 7: 8: 9:	EATION RATE <u>N/A</u> <u>12 mils</u> NTS <u>N/A</u>	: CONCENTRATION : : : : :	: CONCENTRATION : : : : : : : : : :
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1	EATION RATE <u>N/A</u> <u>12 mils</u> NTS <u>N/A</u> CONCENTRATION	: CONCENTRATION : : : : : : : :	: CONCENTRATION : : : : : : : : : : : : : : : : : : :
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1: 2: 3: 4: 5: 6: 7: 8: 9:	EATION RATE <u>N/A</u> <u>12 mils</u> NTS <u>N/A</u> CONCENTRATION	: CONCENTRATION : : : : : : :	: CONCENTRATION : : : : : : : : : : : : : : : : : : :
5.	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI TIME : 1	EATION RATE <u>N/A</u> <u>12 mils</u> NTS <u>N/A</u> CONCENTRATION		



2:	: TYPE: Teflon : PROTECTIVE MATER			
3		TEST: Unused, no via	this importantions	
4:		upont	sible imperiections	
S				
6				
7:			والمحاكمة المحصور بالناكات والمراجع فكالوافية	
8		terial was a white tra	ansparent sheet. Sam	ple was creased u
	CHEMFAB Fold Res	istance Test procedure	e of 5 September 198	6
Ti	EST METHOD			
1.		RY: Texas Research Ins		
2.	. TEMPERATURE: 22-	D: Continuous photoi	onization detection	with a 10.20 ev 1
- 3. - 4.				
5				
		: 1 inch cells were	used. /Detector Tem	erature = 100C.
7	. DEVIATIONS FROM	ACTM F739 METHOD: F1	ow rate to cells wer	e 100 cc/min.
a	HALLENGE CHEMICAL	1 :	COMPONENT 2	. 3
1.			N/A	: : N/A
		110-54-3 :	N/A	: N/A
3.	. CONC. (IF MIX)		N/A	: N/A
1.	. CREMICAL SOURCE:	TH Science	N/A	s N/A
TI 1	EST RESULTS . DATE TESTED: <u>4-</u> 8	-87	N/R	sN/A
TI 1. 2. 3.	EST RESULTS . Date tested: 4-8 . Number of samples	-87 TESTED: <u>Three</u> : No breakthrough was		··,
TF 1. 2. 3. 4. 5.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM	-87 TESTED: Three : No breakthrough was MIT .21 ppm EATION RATE N/A		··,
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS:	-87 TESTED: Three MIT .21 ppm EATION RATE N/A 12 mile		··,
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM	-87 TESTED: Three MIT .21 ppm EATION RATE N/A 12 mile		··,
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME :	-87 TESTED: <u>Three</u> : <u>No breakthrough was</u> MIT .21 ppm EATION RATE <u>N/A</u> 12 mile NTS <u>N/A</u>		hours.
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1;	-87 TESTED: <u>Three</u> : <u>No breakthrough was</u> MIT .21 ppm EATION RATE <u>N/A</u> <u>12 mile</u> NTS <u>N/A</u>	s observed after 3.1	hours.
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-8 NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1. 2. 3.	-87 TESTED: <u>Three</u> : <u>No breakthrough was</u> MIT .21 ppm EATION RATE <u>N/A</u> <u>12 mile</u> NTS <u>N/A</u>	s observed after 3.1	hours.
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-8 NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1	-87 TESTED: <u>Three</u> : <u>No breakthrough was</u> MIT .21 ppm EATION RATE <u>N/A</u> <u>12 mile</u> NTS <u>N/A</u>	s observed after 3.1	hours.
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1	-87 TESTED: <u>Three</u> : <u>No breakthrough was</u> MIT .21 ppm EATION RATE <u>N/A</u> <u>12 mile</u> NTS <u>N/A</u>	s observed after 3.1	hours.
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1	-87 TESTED: <u>Three</u> : <u>No breakthrough was</u> MIT .21 ppm EATION RATE <u>N/A</u> <u>12 mile</u> NTS <u>N/A</u>	s observed after 3.1	hours.
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1	-87 TESTED: <u>Three</u> : <u>No breakthrough was</u> MIT .21 ppm EATION RATE <u>N/A</u> <u>12 mile</u> NTS <u>N/A</u>	s observed after 3.1	hours. : CONCENTRATION : : : : :
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1	-87 TESTED: <u>Three</u> : <u>No breakthrough was</u> MIT .21 ppm EATION RATE <u>N/A</u> <u>12 mile</u> NTS <u>N/A</u>	s observed after 3.1	hours. : CONCENTRATION : : : : :
TI 1. 2. 3. 4. 5. 6.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1	-87 TESTED: <u>Three</u> : <u>No breakthrough was</u> MIT .21 ppm EATION RATE <u>N/A</u> <u>12 mile</u> NTS <u>N/A</u>	s observed after 3.1	hours. : CONCENTRATION : : : : :
TI 1. 2. 3. 4. 5. 6. 7.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME 1	E-87 TESTED: <u>Three</u> : No breakthrough was MIT .21 ppm EATION RATE <u>N/A</u> 12 mile NTS <u>N/A</u> CONCENTRATION	s observed after 3.1	hours. : CONCENTRATION : : : : :
TI 1. 2. 3. 4. 5. 6. 7.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1	-87 TESTED: <u>Three</u> : No breakthrough was MIT .21 ppm EATION RATE <u>N/A</u> 12 mils NTS <u>N/A</u> CONCENTRATION	s observed after 3.1	hours. : CONCENTRATION : : : : :
TI 1. 3. 4. 5. 6. 7. 8.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME 1	-87 TESTED: <u>Three</u> : No breakthrough was MIT .21 ppm EATION RATE <u>N/A</u> 12 mils NTS <u>N/A</u> CONCENTRATION	s observed after 3.1	hours. : CONCENTRATION : : : : :
TI 1. 3. 4. 5. 6. 7. 8.	EST RESULTS DATE TESTED: 4-E NUMBER OF SAMPLES BREAKTHRCUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI TIME : 1	-87 TESTED: <u>Three</u> : No breakthrough was MIT .21 ppm EATION RATE <u>N/A</u> 12 mils NTS <u>N/A</u> CONCENTRATION	CONCENTRATION	hours.



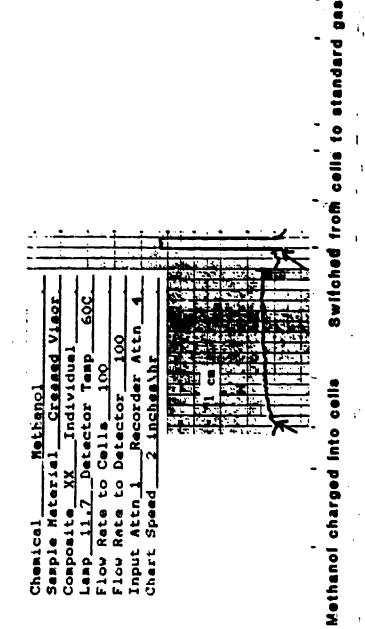
	1:	TY	E: Teflon			
	2:	780	TECTIVE MAT	ERIAL CODE: 09 RE TEST: Unused, no y	dethis treatfoortone	
	3: 4:		UTACTURER:		TETOTE IMPELLECTOR	
	5:	PRO	DUCT IDENTI	FICATION: Visor		
				TURER DATE: N/A		
	7:	NON	CRIPTICN:	ESS: 11-13 mil	transparent sheet. Samp	le was creased using
	0.	СН	MFAB Fold R	esistance Test procedu	are of 5 September 1986	þ.
	TES	st Me	THOD			
					Institute, 9063 Bee Cav	
					bionization detection a	with a 11.70 eV lamp
	3.		(PERATURE: 2) LECTION MED			
	5.	<b>C</b> 01	LLECTION SYS	TEM: N <sub>2</sub>		
	6.	OTI	ER CONDITIO	NS: 1 inch cells we	re used./Detector Tempe	erature = 60C.
	7.	DE	VIATIONS FRO	M ASTM F739 METHOD:	flow rate to cells were	e lou cc/min.
<b>L</b>	Ci	LLE	ice chenical	L	: COMPONENT 2 :	3
			M NAME (s) :		: <u>N/A</u>	:N/A
			S SUMBER(s):			N/A
			NC. (IF MIX) Emical Sourc			: <u> </u>
		ψn:	MICAL SOURC	L. <u>F101181</u>		·
•	TES	ST RI	ESULTS			
				4-16-87 ·		
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI	BER OF SAMPLI AKTHROUGH TIL DETECTABLE	ES TESTED: Three ME: No breakthrough LIMIT 1.42 ppm RMEATION RATE N/A S: 12 mils	was observed after 3 h	ours
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI	BER OF SAMPLI AKTHROUGH TIL Detectable Ady state pe Ple Thicknes	ES TESTED: Three ME: No breakthrough LIMIT 1.42 ppm RMEATION RATE N/A S: 12 mils	: CONCENTRATION	OUTS CONCENTRATION
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI SALI	BER OF SAMPL AKTHROUGH TIL Detectable Ady state pe Ple Thicknes Ected Data P	ES TESTED: <u>Three</u> ME: No breakthrough LIMIT <u>1.42 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>	: CONCENTRATION	
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI	BER OF SAMPL AKTHROUGH TIL Detectable Ady state pe Ple Thicknes Ected Data P	ES TESTED: <u>Three</u> ME: No breakthrough LIMIT <u>1.42 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>	: CONCENTRATION	
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI SALI	BER OF SAMPL AKTHROUGH TIL Detectable Ady state pe Ple Thicknes Ected Data P	ES TESTED: <u>Three</u> ME: No breakthrough LIMIT <u>1.42 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>	: CONCENTRATION : : : :	
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI VELI	BER OF SAMPL AKTHROUGH TIL Detectable Ady state pe Ple Thicknes Ected Data P	ES TESTED: <u>Three</u> ME: No breakthrough LIMIT <u>1.42 ppm</u> RMEATION RATE <u>N/A</u> S: <u>12 mils</u> OINTS <u>N/A</u>	: CONCENTRATION : : : : :	
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI SALI	BER OF SAMPL AKTHROUGH TIL Detectable Ady state pe Ple Thicknes Ected Data P	ES TESTED: Three ME: No breakthrough LIMIT 1.42 ppm RMEATION RATE N/A S: 12 mils OINTS N/A	: CONCENTRATION : : : : : : :	
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI 2 3 4 5 6 7 8	BER OF SAMPL AKTHROUGH TIL Detectable Ady state pe Ple Thicknes Ected Data P	ES TESTED: Three ME: No breakthrough LIMIT 1.42 ppm RMEATION RATE N/A S: 12 mils OINTS N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI 2 3 5 7 8 9	BER OF SAMPL AKTHROUGH TIL Detectable Ady state pe Ple Thicknes Ected Data P	ES TESTED: Three ME: No breakthrough LIMIT 1.42 ppm RMEATION RATE N/A S: 12 mils OINTS N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	2. 3. 4. 5. 6.	NUMI BREA MIN STEA SAMI 2 3 4 5 6 7 8	BER OF SAMPL AKTHROUGH TIL Detectable Ady state pe Ple Thicknes Ected Data P	ES TESTED: Three ME: No breakthrough LIMIT 1.42 ppm RMEATION RATE N/A S: 12 mils OINTS N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	2. 3. 4. 5. 6. 7.	NUMI BREA MIN STEA SAMI SALI 1	BER OF SAMPL AKTHROUGH TIL Detectable Ady state pe Ple Thicknes Ected Data P	ES TESTED:Three ME: No breakthrough ( LIMIT1.42 ppm RMEATION RATEN/A S: 12 mils OINTSN/A : CONCENTRATION : : : : : : : : : : : : :	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	2. 3. 4. 5. 6. 7.	NUMI BREA MIN STEA SAMI SALI 1	BER OF SAMPLA AKTHROUGH TIL DETECTABLE ADY STATE PE PLE THICKNES ECTED DATA P TIME	ES TESTED:Three ME: No breakthrough ( LIMIT1.42 ppm RMEATION RATEN/A S: 12 mils OINTSN/A : CONCENTRATION : : : : : : : : : : : : :	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	2. 3. 4. 5. 6. 7.	NUMI BREA MIN STEA SAMI 2 3 4 5 6 7 8 9 10 0THI	BER OF SAMPLI AKTHROUGH TIL DETECTABLE ADY STATE PE PLE THICKNES ECTED DATA P TIME ER OBSERVATI	ES TESTED:Three ME: No breakthrough ( LIMIT	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	: CONCENTRATION : : : : : :
	2. 3. 4. 5. 6. 7.	NUMI BREA MIN STEA SAMI 2 3 4 5 6 7 8 9 10 0THI	BER OF SAMPLI AKTHROUGH TIL DETECTABLE ADY STATE PE PLE THICKNES ECTED DATA P TIME ER OBSERVATI	ES TESTED:Three ME: No breakthrough ( LIMIT	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	: CONCENTRATION : : : : : :
j.	2. 3. 4. 5. 6. 7.	NUMI BREA MIN STEA SAMI 2 3 4 5 6 7 8 9 10 0THI	BER OF SAMPLI AKTHROUGH TIL DETECTABLE ADY STATE PE PLE THICKNES ECTED DATA P TIME ER OBSERVATI	ES TESTED:Three ME: No breakthrough ( LIMIT	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	: CONCENTRATION : : : : : :
	2. 3. 4. 5. 6. 7.	NUMI BREA MIN STEA SAMI 2 3 4 5 6 7 8 9 10 0THI	BER OF SAMPLI AKTHROUGH TIL DETECTABLE ADY STATE PE PLE THICKNES ECTED DATA P TIME ER OBSERVATI	ES TESTED:Three ME: No breakthrough ( LIMIT	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	: CONCENTRATION : : : : : :

# **Chemical Resistance Testing of Creased Visor**

二日の時間時間です。時間時間時間で

一時間の花

## Methanol



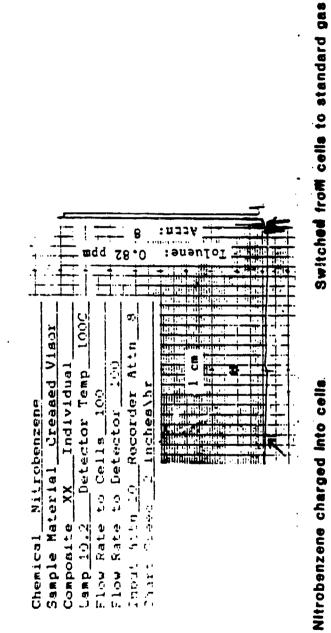
## 1

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¥+	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon
	2: PROTECTIVE MATERIAL CODE: 09
	3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Dupont
	5: PRODUCT IDENTIFICATION: Visor
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 11-13 mil
	8: DESCRIPTION: Material was a white transparent sheet. Sample was creased using
	CHEMFAB Fold Resistance Test procedure of 5 September 1986.
2.	TEST METHOD
<b></b>	
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp.
	3. TEMPERATURE: 22-25°C
	4. GOLLECTION MEDIUM: No
	<ol> <li>COLLECTION SYSTEM: N2</li> <li>OTHER CONDITIONS: 1 inch cells were used./Detector Temperature = 100C.</li> </ol>
	<ul> <li>6. OTHER CONDITIONS: 1 inch cells were used./Detector Temperature = 100C.</li> <li>7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells were 100 cc/min.</li> </ul>
	· DEVIRITONS TROM REIM F. S.S. METHOD. TIDW TALE CO CETIS WELE TOO CC/MIN.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	: : 1. CHEM NAME(s): Nitrobenzene : N/A : N/A
	2. CAS NUMBER(s): 98-95-3 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	4. CHEMICAL SOURCE: Mallinckrod: N/A : N/A
4.	TEST RESULTS
	1. DATE TESTED: 4-9-87 2. NUMBER OF SAMPLES TESTED: Three
	<ol> <li>NUMBER OF SAMPLES LESTED: Inree</li> <li>BREAKTHROUGH TIME: No breakthrough was observed after 4 hours.</li> </ol>
	4. MIN DETECTABLE LIMIT .04 ppm
	5. STEADY STATE PERMEATION RATE N/A
	6. SAMPLE THICKNESS: 12 mils
	7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	2: 3:
	4. : : : :
	5.
	6. : : : :
	7. : : :
	8:
	9
	10: : :
•	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA
	Samples were run by Denise McDonald on April 9, 1987.



## Nitrobenzene

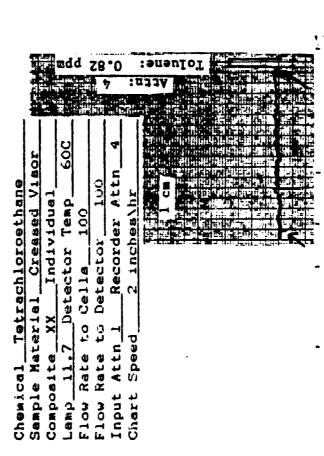


## 1. DESCRIPTION OF PRODUCT EVALUATED

4:		DRE TEST: Unused, no v Dupont	Visible imperiectio		
5:			······································		
6:	LOT OR MANUFAC	TURER DATE: N/A			
7:		ESS: 11-13 mil			
8:		Material was a white t			was creased u
	CHEMFAB Fold I	lesistance Test procedu	ire of 5 September	1986.	
TES	ST METHOD				
1.	TESTING LABORA	TORY: Texas Research I	Institute, 9063 Bee	e Caves	Road, Austin,
2.			pionization detects	lon with	a 11.70 eV 1
3.					
4.					· · · · · · · · · · · · · · · · · · ·
_	COLLECTION SYS		- wood /Detector 1		
		M ASTM F739 METHOD: F	re used./Detector 1		
	ALLENCE CHEMICAL		: CONFORENT 2	:	3
			:	:	•
		Tetrachloroethane	: N/A	:	N/A
2.	CAS NUMBER(s):		: N/A	:	N/A
-	- AANA /78 WTV	N/A	: N/A	:	N/A
	CONC. (IF MIX)				
4.	CHEMICAL SOURC		: <u>N/A</u>		N/A
4. TES 1.	CHEMICAL SOURCEST RESULTS	E: <u>Aldrich</u> 9-24-87			;•
4. TES 1. 2.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI	E: <u>Aldrich</u> -24-87 ES TESTED: Three	: <u>N/A</u>		;e
4. TES 1. 2. 3.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI	E:Aldrich -24-87 ES TESTED: Three ME: No breakthrough wa	: <u>N/A</u>		;e
4. TES 1. 2. 3. 4.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE	E:Aldrich -24-87 ES TESTED: Three ME: No breakthrough wa	: <u>N/A</u>		;e
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES	CE: <u>Aldrich</u> =-24-87 ES TESTED: Three ME: No breakthrough wa LIMIT .38 ppm CRMEATION RATE <u>N/A</u> S: 12 mils	: <u>N/A</u>		;e
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAXTHROUGH TI MIN DETECTABLE STEADY STATE PE	CE: <u>Aldrich</u> =-24-87 ES TESTED: Three ME: No breakthrough wa LIMIT .38 ppm CRMEATION RATE <u>N/A</u> S: 12 mils	: <u>N/A</u>		;e
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAXTHRCUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME	CE: <u>Aldrich</u> =-24-87 ES TESTED: Three ME: No breakthrough wa LIMIT .38 ppm CRMEATION RATE <u>N/A</u> S: 12 mils	: N/A as observed after :	3 hours.	;e
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAXTHRCUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F	CE:Aldrich -24-87 ES TESTED: Three ME: No breakthrough wa LIMIT38 ppm CRMEATION RATE N/A S: 12 mils POINTS N/A	: N/A as observed after :	3 hours.	;e ,
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAXTHRCUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1.	CE:Aldrich -24-87 ES TESTED: Three ME: No breakthrough wa LIMIT38 ppm CRMEATION RATE N/A S: 12 mils POINTS N/A	: N/A as observed after :	3 hours. ON :	;e ,
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2.	CE:Aldrich -24-87 ES TESTED: Three ME: No breakthrough wa LIMIT38 ppm CRMEATION RATE N/A S: 12 mils POINTS N/A	: N/A as observed after :	3 hours. ON :	;e ,
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: NUMBER OF SAMPI BREAXTHRCUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1 3	CE: <u>Aldrich</u> S-24-87 ES TESTED: <u>Three</u> IME: <u>No breakthrough wa</u> LIMIT <u>.38 ppm</u> CRMEATION RATE <u>N/A</u> SS: <u>12 mils</u> POINTS <u>N/A</u> : <u>CONCENTRATION</u> : :	: N/A as observed after :	3 hours. ON :	;e ,
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAKTHRCUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 6.	CE: <u>Aldrich</u> S-24-87 ES TESTED: <u>Three</u> IME: <u>No breakthrough wa</u> LIMIT <u>.38 ppm</u> CRMEATION RATE <u>N/A</u> SS: <u>12 mils</u> POINTS <u>N/A</u> : <u>CONCENTRATION</u> : :	: N/A as observed after :	3 hours. ON :	;e ,
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAXTHRCUGH TIMIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 6. 7.	CE: <u>Aldrich</u> S-24-87 ES TESTED: <u>Three</u> IME: <u>No breakthrough wa</u> LIMIT <u>.38 ppm</u> CRMEATION RATE <u>N/A</u> SS: <u>12 mils</u> POINTS <u>N/A</u> : <u>CONCENTRATION</u> : :	: N/A as observed after :	3 hours. ON :	;e ,
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAKTHRCUCH TIMIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 5. 6. 7. 8.	CE: <u>Aldrich</u> S-24-87 ES TESTED: <u>Three</u> IME: <u>No breakthrough wa</u> LIMIT <u>.38 ppm</u> CRMEATION RATE <u>N/A</u> SS: <u>12 mils</u> POINTS <u>N/A</u> : <u>CONCENTRATION</u> : :	: N/A as observed after :	3 hours. ON :	;e ,
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED:A NUMBER OF SAMPI BREAXTHRCUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1 3 4 5 6 9	CE: <u>Aldrich</u> S-24-87 ES TESTED: <u>Three</u> IME: <u>No breakthrough wa</u> LIMIT <u>.38 ppm</u> CRMEATION RATE <u>N/A</u> SS: <u>12 mils</u> POINTS <u>N/A</u> : <u>CONCENTRATION</u> : :	: N/A as observed after :	3 hours. ON :	;e ,
4. TES 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCEST RESULTS DATE TESTED: 4 NUMBER OF SAMPI BREAKTHRCUCH TIMIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 5. 6. 7. 8.	CE: <u>Aldrich</u> S-24-87 ES TESTED: <u>Three</u> IME: <u>No breakthrough wa</u> LIMIT <u>.38 ppm</u> CRMEATION RATE <u>N/A</u> SS: <u>12 mils</u> POINTS <u>N/A</u> : <u>CONCENTRATION</u> : :	: N/A as observed after :	3 hours. ON :	; e , ·
4. TES 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCEST RESULTS DATE TESTED:A NUMBER OF SAMPI BREAXTHRCUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1 3 4 5 6 9	CE:Aldrich -24-87 ES TESTED: Three IME: No breakthrough wa LIMIT .38 ppm CRMEATION RATE N/A SS: 12 mils POINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: N/A as observed after : : CONCENTRATIO : : : : : : : : : : : : : : : : : : :	3 hours. ON :	;e ,

# Chemical Resistance Testing of Creased Visor

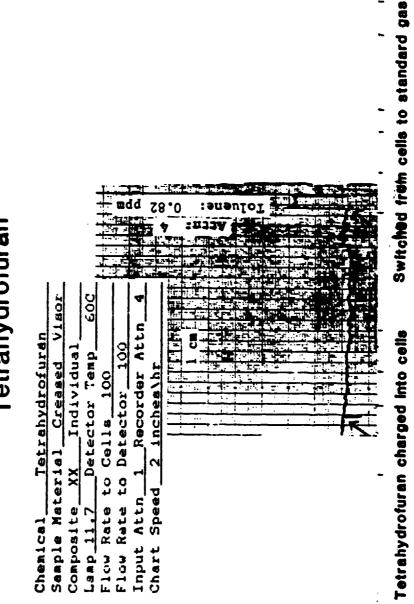
## Tetrachioroethane



Switched from cells to standard gas Tetrachloroethane charged into cella

## 1. DESCRIPTION OF PRODUCT EVALUATED

	1:	TYPE: Teflor	1					
	2:	PROTECTIVE M		CODE: 09				
	3:			ST: Unused, no	visib	le imperfectio	ns	
	4:							
	5:							
	6:							
	7:		-					
	8:				trans	parent sheet.	Sample	e was creased using
		CHEMFAB Fold	Resist	ance Test proced	ure o	f 5 September	1986.	
2.	TES	T METHOD						
	1.	TESTING LABO	RATORY:	Texas Research	Insti	tute, 9063 Bee	Caves	Road, Austin, TX
	2.				oioni	zation detecti	on wit	th a 11.70 eV lamp.
	3.		ć					
	4.	COLLECTION M		N <sub>2</sub>				
	5.			N <sub>2</sub>				
	6,			l inch cells we				
	7.	DEVIATIONS F	ROM AST	M F739 METHOD:	Flow	rate to cells	were .	100 cc/min.
3.	CIL	LIENCE CHEMIC	AL	1	: 1	COMPONENT 2	:	3
	1.	CHEM NAME (s)	: Tet	rahvdrofuran	:	N/A	•	N/A
		CAS NUMBER(s			- <b>-</b>	N/A		N/A
		CONC. (IF MI	-		 :	N/A		N/A
		CHEMICAL SOU			-`	N/A	:	N/A
۵.	TES	T RESULTS						
	169	I RESULIS						
	1. 1	DATE TESTED:	4-16-8	.7				
		NUMBER OF SAM						······································
				No breakthrough	WAS O	bserved after	3.2 h	011 F.S.
		MIN DETECTABL						
				ION RATE N/A				
		SAMPLE THICKN		12 mils				
		SELECTED DATA				······································		······································
						<u> </u>		
		TIME	:	CONCENTRATION	:	CONCENTRATIO	N :	CONCENTRATION
		1	:		:		:	
		2	:		:		:	
		3	:				:	····
		4					:	····
		5						
		6				<u> </u>		
		7						
		8						
		9	<u> </u>		:			
		10						
	8. (	OTHER OBSERVA	TIONS					
	(							
			<u> </u>	·····				
5.	ន០ហ	RCE OF DATA						
-			vere ru	n by Denise McDo	nald a	on April 16. 1	987-	
		•						



Chemical Resistance Testing of Creased Visor

## Tetrahydrofuran

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## 1. DESCRIPTION OF PRODUCT EVALUATED

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POLY BOOM TO SALES

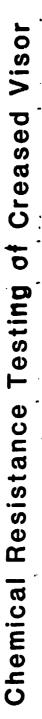
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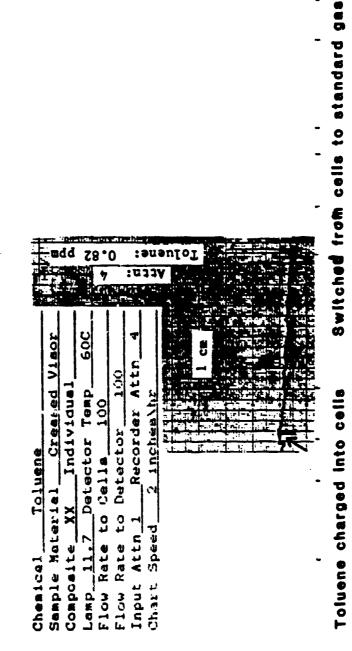
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	1: TYPE: Teflon			······································
	2: PROTECTIVE MATERI			
		TEST: Unused, no v	sible imperiection	<b>,</b>
	4: MANUFACTURER: Du 5: PRODUCT IDENTIFIC			
	6: LOT OR MANUFACTUR			
	7: NOMINAL THICKNESS			
			renerant cheat. S	ample was creased using
	CHEMFAB Fold Resi	stance Test procedur	re of 5 September 1	986.
2.	TEST METHOD			
	1. TESTING LABORATOR 2. ANALYTICAL METHOD	Y: Texas Research In	nstitute, 9063 Bee (	Caves Road, Austin, TX h with a 11.70 eV lamp.
	3. TEMPERATURE: 22-2		tonization detection	a with a 11.70 ev lamp.
	4. COLLECTION MEDIUM			
	5. COLLECTION SYSTEM			
		l inch cells were	used. /Detector Ter	perature = 60C.
	7. DEVIATIONS FROM A	STA F739 METHOD: F	low rate to cells we	ere 100 cc/min.
3.	CHALLENGE CHEMICAL	1 -	COMPONENT 2	: 3
	1. CHEM NAME(s) : T	oluene	N/A	: N/A
		08-88-3	N/A	
	3. CONC. (IF MIX) N		N/A	
	4. CHEMICAL SOURCE :M		N/A	: N/A
	<ol> <li>DATE TESTED: 4-24</li> <li>NUMBER OF SAMPLES</li> <li>BREAKTHROUGH TIME:</li> <li>MIN DETECTABLE LIM</li> <li>STEADY STATE PERME</li> <li>SAMPLE THICKNESS:</li> </ol>	TESTED: Three No breakthrough was IT .40 ppm ATION RATE N/A	s observed after 3.	3 hours.
	7. SELECTED DATA POIN	TS N/A		
	TIME :	CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	1: 2:		<u>.</u>	
	3	······································	• •	•
	4		:	•
	5;	ويسوا فالين والمسابع مندكر والملاحم	:	:
	6. :		;	:
	7. :		:	:
	8:		:	
	9:		:	:
	10:		:	:
	8. OTHER OBSERVATIONS	:		<del> </del>
5.				<u> </u>
J.	SOURCE OF DATA	run by Denise McDons	ald on April 24, 19	87.
	······································			



## Toluene



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## APPENDIX G

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۱. ۲, PERMEATION TEST DATA FOR INNER GLOVE MATERIAL SAMPLES

(Data Provided by Texas Research Institute Under Contract)

## DESCRIPTION OF PRODUCT EVALUATED 1.

	TYPE: Teflon
2:	PROTECTIVE MATERIAL CODE: 044
3:	CONDITION BEFORE TEST: Unused, no visible imperfections
	MANUFACTURER: Chemfab Corp.
5:	PRODUCT IDENTIFICATION: Inner glove sheet stock
6:	LOT OR MANUFACTURER DATE: N/A
7:	NOMINAL THICKNESS: 7-9 mils
8:	DESCRIPTION:

TEST METHOD 2.

## 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX

- 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp
- 3. TEMPERATURE: 22-25°C
- 4. COLLECTION MEDIUM: N<sub>2</sub>
- 5. COLLECTION SYSTEM: N2
- 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min.

•	CHALLENCE CHEMICAL	1	:	COMPONENT 2	:	3	
	1. CHEM NAME(s) :	Acetone	:	N/A	:	N/A	
	2. CAS NUMBER(s):	67-64-1	:	N/A		N/A	
	3. CONC. (IF MIX)	N/A	;-	N/A	;	N/A	
	4. CHEMICAL SOURCE	:Mallinckrodt	:	N/A		N/A	

## TEST RESULTS

З.

- 1. DATE TESTED: 12-17-86
- 2. NUMBER OF SAMPLES TESTED: One (Run I)
- 3. BREAKTHROUGH TIME: 2.5 minutes 4. MIN DETECTABLE LIMIT .75 ppm
- 5. STEADY STATE PERMEATION RATE 128.87 ug/cm2\*hr
- 6. SAMPLE THICKNESS: 7 mils
- 7. SELECTED DATA POINTS N/A

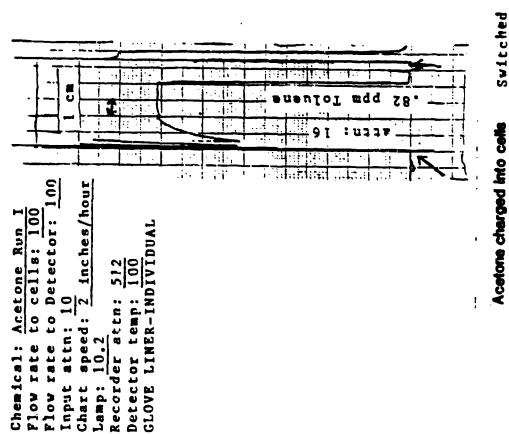
_	TIME	CONCENTRATION	: CONCENTRATION	: CONCENTRATION
1		······································	•	
<u>-</u>			· · · · · · · · · · · · · · · · · · ·	
· · -				
6			·	•
7			•	•
8			•	•
9			•	•
10.	····	، ویک ملک کو مالی ہوتی ہے ، میں محمد میں میں مرکز میں ا	······································	•
			·	

## 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Sample was run by Denise McDonald on December 17, 1986.

Acetone Run I



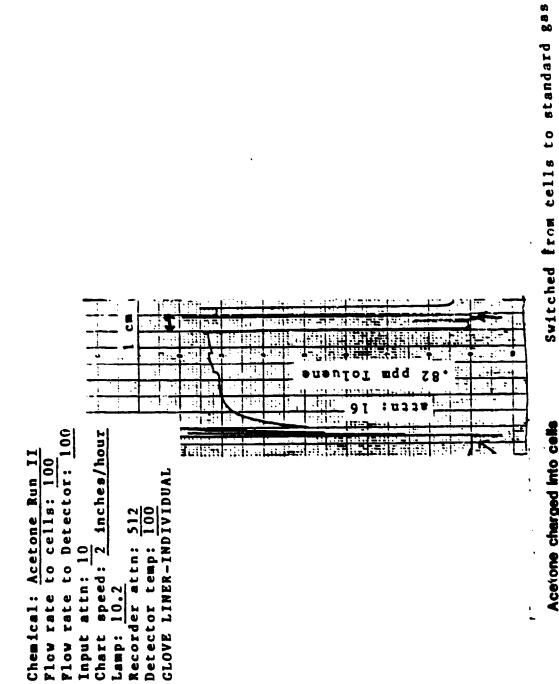
Switched from cells to standard gas

G-2

• •

	1: TYPE: Teflon		
	2: PROTECTIVE MATERIAL CODE: 044		
	3: CONDITION BEFORE TEST: Unused, no v	isible imperfections	
	4: MANUFACTURER: Chemfab Corp.		
	5: PRODUCT IDENTIFICATION: Inner glove	sheet stock	
	6: LOT OR MANUFACTURER DATE: N/A		مور ومنهم الكريمة الله المستخدمة والمن المراجع المراجع
	7: NOMINAL THICKNESS: 7-9 mils		
	8: DESCRIPTION:		
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research I		
	2. ANALYTICAL METHOD: Continuous photo	ionization detection w	ith a 10.20 eV lamp.
	3. TEMPERATURE: 22-25°C		
	4. COLLECTION MEDIUM: N2		
	5. COLLECTION SYSTEM: N2		
	6. OTHER CONDITIONS: 1 inch cell was 7. DEVIATIONS FROM ASTM F739 METHOD: F		
3.	CHALLENCE CHEMICAL 1	: COMPONENT 2 :	3
		:	~ / .
	1. CHEM NAME(s): Acetone	: <u>N/A</u> :	<u> </u>
	2. CAS NUMBER(s): 67-64-1		N/A
	3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE:Mallinckrodt	: <u>N/A</u> :	<u> </u>
	TEST RESULTS	:N/A:	N/A
	1. DATE TESTED:       12-18-86         2. NUMBER OF SAMPLES TESTED:       One (Run I         3. BREAKTHROUGH TIME:       2.5 minutes         4. MIN DETECTABLE LIMIT       .85 ppm         5. STEADY STATE PERMEATION RATE       145.66         6. SAMPLE THICKNESS:       7 mils         7. SELECTED DATA POINTS       N/A         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :		CONCENTRATION
	10: 8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA Sample was run by Denise McDonald	on December 18, 1986	

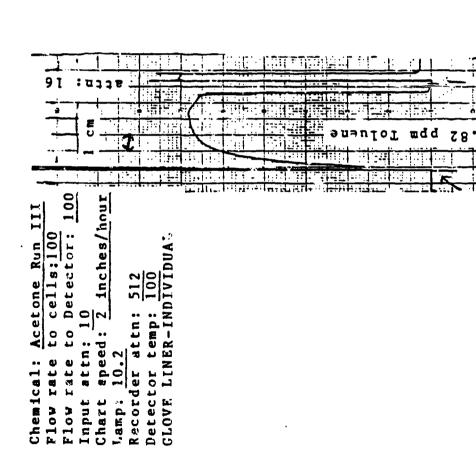
## Acetone Run II



Acetone charged into cella

		••				
	CHEMI	CAL PROTECTIVE CLC	THING PR	ODUCT EVALUATI	ON REC	CORD
DE	SCRIPTION OF PROD	UCT EVALUATED				
	TYPE: Teflon					
	PROTECTIVE MATE					
	CONDITION BEFORE MANUFACTURER: (		O VISIDI	e imperiection	5	
5:	PRODUCT IDENTIFI	ICATION: Inner glo	ve sheet	stock		
	LOT OR MANUFACTI					
	NOMINAL THICKNES	SS: 7-9 mils				
8:	DESCRIPTION:					
	<u></u>		·····			
. TE	ST METHOD					
	TESTING LABORATO					
	ANALYTICAL METHO TEMPERATURE: 22-		01010112	TION detection	n with	a 10.20 eV lamp
	COLLECTION MEDI					
5.	COLLECTION SYSTE	$\mathbf{M}: \mathbf{N}_2$				
<b>5</b> .	OTHER CONDITIONS	: linch cell w	as used.	Detector Tem	Perate	iz = 100C.
7.	DEVIATIONS FROM	ASTM F739 METHOD:	Flow T	ate was 100 cc	min.	
. 8	ALLENCE CHENICAL	1	: 0	DEPONENT 2	2	3
1	CHEM NAME (s) :	Acatona	:	N/A	: •	N/A
2.	CAS NUMBEP(s):	67-64-1	<u>`</u>	N/A N/A	<b>^</b>	<u>N/A</u>
3.	CONC. (IF MIX)	N/A		N/A		N/A
	CHEMICAL SOURCE		;	N/A		N/A
2. 3. 4. 5. 6.	DATE TESTED: 12 NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE 11 STEADY STATE PERN SAMPLE THICKNESS SELECTED DATA POI	TESTED: One (Ru 2: 2.5 minutes MIT .89 pp MEATION RATE 145. 7 mils		/hr		
	TIME	CONCENTRATI	ON :	CONCENTRATION	:	CONCENTRATION
	1 :				;	
	2.		:		:	
	3				<b></b>	
	4. 5.	) 				
	6.	·	:		<u></u> -	
	7		:		:	
	8.		:		:	
	9.		:			
	10	· · · · · · · · · · · · · · · · · · ·	•			وموساعين المستودي والمستركين الدعيدة والمكتب
8.	OTHER OBSERVATION	NS:				
	·····					
. SO	URCE OF DATA Sample was	run by Denise McDo	nald on	December 18, 1	986.	
		<b></b>		· · · · · · · · · · · · · · · · · · ·		
						6-
						C,

## Acetorie Run IN



Switched from cells to standard gas

Acetone charged into celle

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G-6

	2:	TYPE: Teflon PROTECTIVE NA	TERIAL CODE: 044			
	3:	CONDITION BEF	ORE TEST: Unused, n	o visible imperfecti	ons	
	4:	PRODUCT IDENT	Chemfab Corp.	love sheet stock		<u></u>
	6:	LOT OR MANUFA		INCOL SHEET SLOCK		
	7:	NOMINAL THICK	NESS: 7-9 mils			
	8:	LESCRIPTION:				
2.	TES	T METHOD				
	1.	TESTING LABOR	ATORY: Texas Researc	ch Institute, 9063 Be	e Caves R	oad, Austin, TX
			THOD: Gas Chromatog	raphy		
		TEMPERATURE:				
	4. E	COLLECTION ME	DIUM: <u>Charcoal</u> STEM: Charcoal	<u> </u>	<u></u>	
	5. 6.	OTHER CONDITI	ONS: 1 inch cells	were used.		
			OM ASTM F739 METHOD:			
3.	. CHA	LIENCE CHEMICA	1	: COMPONENT 2	2	3
	1_	CHEM NAME (s)	: Acetonitrile	:N/A	:	N/A
	2.	CAS NUMBER(s)	: 2206-26-0	: N/A		N/A
	3.	CONC. (IF MIX	N/A	: <u>N/A</u>	;	N/A
	4.	CHEMICAL SUUK	CE:Fisher-Posticide Grade	: <u>N/A</u> : N/A		<u>N/A</u> N/A
4.	TES	T RESULTS	UTAUE	······································		N/A
	4. 5. 6.	MIN DETECTABLE STEADY STATE P SAMPLE THICKNE	IME: 5.0 minutes LIMIT 0.6 ppm ERMEATION RATE (Ave SS: 19-20 mils POINTS 60,80,100,	eraze) 62 (ug/cm*hr)	)	
	/•	SELECIED DATA	• <u></u>			
			ug/cm <sup>2</sup> *hr	ug/cm <sup>2</sup> *hr		g/cm <sup>2</sup> *hr
		TIME 1. 60 minutes	: Cell l : 60	: Cell 2 : 67	: (	Cell 3 73
		2. 80 minutes		. 70		64
		3. 100 minute		: 61	:	52
		4. 120 minute	s: 57	: 65	:	60
		5			:	
		6 7				
		8.	•	•		
		9.		·	 :	······································
		10	:		•	
	8.			ole was collected 5 r as were collected at		
5.	sou	RCE OF DATA Samples we	re run by Denise McI	Donald on February 6	<u>, 1987.</u>	

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## CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD DESCRIPTION OF PRODUCT EVALUATED 1. 1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 5. OTHER CONDITIONS: 1 inch cell was used. /Detector Temperature = 50C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. THALLENGE CHEMICAL : COMPONENT 2 3 1 = 1. CHEM NAME(s) : Dichloromethane N/A N/A : 2. CAS NUMBER(s): 75-09-2 3. CONC. (IF MIX) N/A N/A N/A :\_ N/A **:\_** N/A \_:\_\_\_\_ 4. CHEMICAL SOURCE: Fisher : N/A N/A : 4. TEST RESULTS 1. DATE TESTED: 1-28-87 2. NUMBER JF SAMPLES TESTED: One (Run I) 3. BREAKTHROUGH TIME: 2.5 minutes 4. MIN DETECTABLE LIMIT 2.57 PPm 5. STEADY STATE PERMEATION RATE 487.10 (ug/cm<sup>2</sup>\*hr) 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : 2. : : 3. : : : 4. : : : 5. : : : 6. : : : 7. : : : 8. : : : 9. : : : 10. : : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Sample was run by Denise McDonald on January 28, 1987.

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## Dichloromethane Run I

Chemical: Dichloromethane Run I Flow rate to cells: 100 Flow rate to Detector: 100 Input attn: 1 Cdart speed: 2 in/hr Lamp: 11.7 Recorder attn: 512 Detector temp: 60 GLOVE LINER, INDIVIDUAL

ורבש:

mqq\_28.0 ansuloT

Switched from cells to standard gas

G-10

,:

Dichloromethane charged into cella

## 1. DESCRIPTION OF PRODUCT EVALUATED

1:			
-	: TYPE: Teflon		
2:			· · · · ·
3:	CONDITION BEFORE TEST: Unused, no	visible imperfections	
	MANUFACTURER: Chemfab Corp.		
5:		ve sheet stock	
6:			· · · · · · · · · · · · · · · · · · ·
7:			
8:	DESCRIPTION:		
ŤI	EST METHOD		
	. TESTING LABORATORY: Texas Research		
	ANALYTICAL METHOD: Continuous phot	Olonization detection	WITH & II./U ev lamp.
3.			
-	COLLECTION MEDIUM: N2		
	COLLECTION SYSTEM: N2		
	OTHER CONDITIONS: 1 inch cell was		
7.	DEVIATIONS FROM ASTM F739 METHOD:	Flow rate was 100 cc/	
CH	HALLENGE CHEMICAL 1	: COMPONENT 2	: 3
1-	CHEM NAME(s) : Dichloromethane	: N/A	: N/A
	CAS NUMBER(s): 75-09-2		: N/A
	CONC. (IF MIX) N/A	: N/A	: N/A
	CHEMICAL SOURCE: Fisher	-:	-:N/A
2.	DATE TESTED: 1-29-87 NUMBER OF SAMPLES TESTED: One (Run BREAKTHROUGH TIME: 2.5 minutes	11)	
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: One (Run BREAKTHROUGH TIME: 2.5 minutes MIN DETECTABLE LIMIT 2.57 ppm STEADY STATE PERMEATION RATE 507.95 SAMPLE THICKNESS: 7 mils		
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: One (Run BREAKTHROUGH TIME: 2.5 minutes MIN DETECTABLE LIMIT 2.57 ppm STEADY STATE PERMEATION RATE 507.95		
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT 2.57 ppm         STEADY STATE PERMEATION RATE 507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :       CONCENTRATION	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT 2.57 ppm         STEADY STATE PERMEATION RATE 507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         CONCENTRATION       1.	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION :
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT 2.57 ppm         STEADY STATE PERMEATION RATE       507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION :
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT       2.57 ppm         STEADY STATE PERMEATION RATE       507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : :
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT       2.57 ppm         STEADY STATE PERMEATION RATE       507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : :
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT       2.57 ppm         STEADY STATE PERMEATION RATE       507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : : :
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT       2.57 ppm         STEADY STATE PERMEATION RATE       507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : : : :
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT 2.57 ppm         STEADY STATE PERMEATION RATE 507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : : : : : :
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT 2.57 ppm         STEADY STATE PERMEATION RATE       507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         CONCENTRATION       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : : : : : : :
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT 2.57 ppm         STEADY STATE PERMEATION RATE 507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : : : : : : : : : : : : : : : : : :
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT 2.57 ppm         STEADY STATE PERMEATION RATE       507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         CONCENTRATION       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : : : : : : : : : : : : :
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT       2.57 ppm         STEADY STATE PERMEATION RATE       507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         CONCENTRATION       1.         .       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : : : : : : : : : : : : : : : : : :
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT       2.57 ppm         STEADY STATE PERMEATION RATE       507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         CONCENTRATION       1.         :       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : : : : : : : : : : : : : : : : : :
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT 2.57 ppm         STEADY STATE PERMEATION RATE 507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       CONCENTRATION         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :         OTHER OBSERVATIONS:	(ug/cm <sup>2</sup> *hr)	: CONCENTRATION : : : : : : : : : : : : : : : : : : :
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: One (Run BREAKTHROUGH TIME: 2.5 minutes MIN DETECTABLE LIMIT 2.57 ppm STEADY STATE PERMEATION RATE 507.95 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : 0 THER OBSERVATIONS:	i (ug/cm <sup>2</sup> *hr) : CONCENTRATION : : : : : : : : : : : : :	
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT 2.57 ppm         STEADY STATE PERMEATION RATE 507.95         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       CONCENTRATION         1.       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :         OTHER OBSERVATIONS:	i (ug/cm <sup>2</sup> *hr) : CONCENTRATION : : : : : : : : : : : : :	
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: One (Run BREAKTHROUGH TIME: 2.5 minutes MIN DETECTABLE LIMIT 2.57 ppm STEADY STATE PERMEATION RATE 507.95 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : 0 THER OBSERVATIONS:	i (ug/cm <sup>2</sup> *hr) : CONCENTRATION : : : : : : : : : : : : :	
2. 3. 4. 5. 6. 7. 8.	NUMBER OF SAMPLES TESTED: One (Run BREAKTHROUGH TIME: 2.5 minutes MIN DETECTABLE LIMIT 2.57 ppm STEADY STATE PERMEATION RATE 507.95 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : 0 THER OBSERVATIONS:	i (ug/cm <sup>2</sup> *hr) : CONCENTRATION : : : : : : : : : : : : :	
2. 3. 4. 5. 6. 7. 8.	NUMBER OF SAMPLES TESTED: One (Run BREAKTHROUGH TIME: 2.5 minutes MIN DETECTABLE LIMIT 2.57 ppm STEADY STATE PERMEATION RATE 507.95 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : 0 THER OBSERVATIONS:	i (ug/cm <sup>2</sup> *hr) : CONCENTRATION : : : : : : : : : : : : :	
2. 3. 4. 5. 6. 7. 8.	NUMBER OF SAMPLES TESTED: One (Run BREAKTHROUGH TIME: 2.5 minutes MIN DETECTABLE LIMIT 2.57 ppm STEADY STATE PERMEATION RATE 507.95 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : 0 THER OBSERVATIONS:	i (ug/cm <sup>2</sup> *hr) : CONCENTRATION : : : : : : : : : : : : :	

## Dichloromethane Run II

3

Chemcial: Dichloromethane Run II Flow rate to ce<sup>3</sup>1s: 100 Flow rate to Detector: 100 Input attn: 1 Chart speed: 5 in/hr Lamp: 11.7 Recorder attn: 512 Detector temp: 60 GLOVE LINER, INDIV/DUAL :2228

28-0

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mdd



Dichloromethane charged into cells

小学校内容の言言

## 1. DESCRIPTION OF PRODUCT EVALUATED 1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: 2. TEST METHOD TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 2. TEMPERATURE: 22-25°C 3. COLLECTION MEDIUM: N2 4. COLLECTION SYSTEM: N2 5. 6. OTHER C NDITIONS: 1 inch cell was used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. CHALLENCE CHEMICAL l : COMPONENT 2 1 3 2 • 2 1. CHEM NAME(s): Dichloromethane N/A N/A 2. CAS NUMBER(s): 75-09-2 3. CONC. (IF MIX) N/A :\_ N/A N/A :\_ N/A N/A 4. CHEMICAL SOURCE: Fisher N/A N/A TEST RESULTS 4. 1. DATE TESTED: 1-29-87 2. NUMBER OF SAMPLES TESTED: One (Run III) 3. BREAKTHROUGH TIME: 2.5 minutes 4. MIN DETECTABLE LIMIT 2.60 PPm 5. STEADY STATE PERMEATION RATE 498.52 (ug/cm<sup>2</sup>\*hr) 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A CONCENTRATION TIME : CONCENTRATION : **CONCENTRATION** 1 1. : 2. : : 3. : : : 4. : : : 5. : : : 6. : : : 7. : : : 8. : ; : 9. : : : 10. : : : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Sample was run by Denise McDonald on January 29, 1987.

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## Dichloromethane Run IN

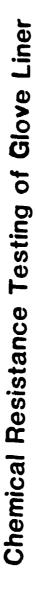
udd 85 ansulor 0 Chemical: Dichloromethane Run III Flow rate to Detector: 100 Lamp: <u>11.7</u> Recorder attn: <u>512</u> Detector temp: <u>60</u> GLOVE LINER, INDIVIDUAL Flow rate to cells: 100 2 in/hr ţ Chart speed: Input attn:

Switched from cells to standard gas

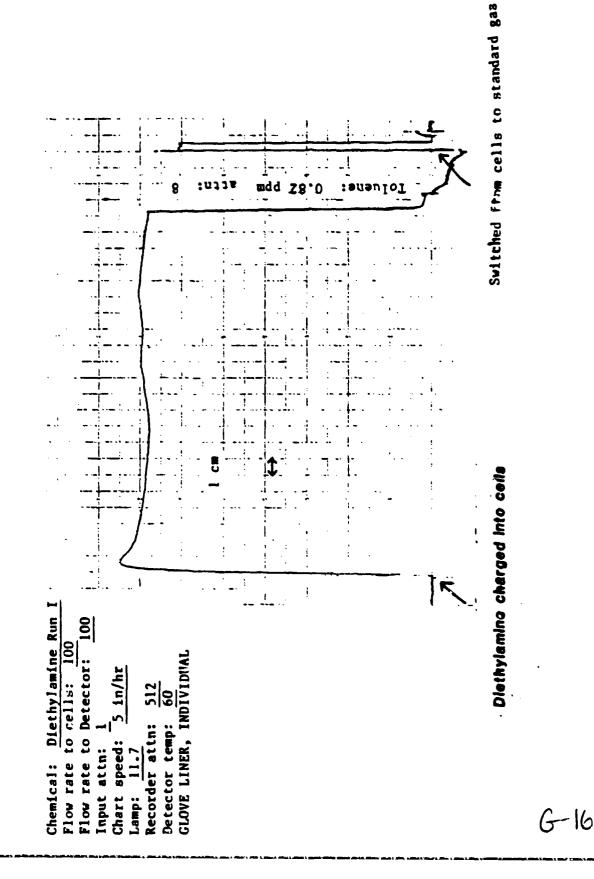
Dichloromethane charged into cells

## 1. DESCRIPTION OF PRODUCT EVALUATED 1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. CHALLENGE CHEMICAL 2 : COMPONENT 2 3 : 3 2 1. CHEM NAME(s):Diethylamine2. CAS NUMBER(s):109-89-73. CONC. (IF MIX)N/A <u>N/A</u> N/A \_:\_\_\_ N/A N/A N/A N/A 4. CHEMICAL SOURCE: EM Science : N/A N/A 4. TEST RESULTS 1. DATE TESTED: 2-2-87 2. NUMBER OF SAMPLES TESTED: One(Run I) 3. BREAKTHROUGH TIME: 2.5 minutes 4. MIN DETECTABLE LIMIT 4.75 ppm 5. STEADY STATE PERMEATION RATE 1124 (ug/cm<sup>2</sup>\*hr) 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : 2. \_ : 1 3. : : : 4. . : : 5. \_ : : : 6. : : : 7. : : 1 8. : : : 9. : : : 10. : : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Sample was run by Denise McDonald on February 2, 1987.

G-15



## Diethylamine Run |



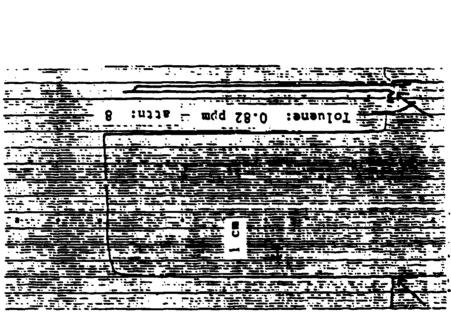
## 1. DESCRIPTION OF PRODUCT EVALUATED 1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Foad, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 50C. 7. DEVIATIONS FROM ASTN F739 METHOD: Flow Tate was 100 cc/min. CHALLENGE CHEMICAL : COMPONENT 2 3 1 2 3 2 N/A 1. CHEM NAME(s) : Diethylamine :\_\_\_\_ N/A N/A 2. CAS NUMBER(s): 109-89-7 N/A 3. CONC. (IF MIX) $\overline{N/A}$ N/A N/A . 4. CHEMICAL SOURCE: EM Science - : N/A N/A 4. TEST RESULTS 1. DATE TESTED: 2-3-87 2. NUMBER OF SAMPLES TESTED: One (Run II) 3. BREAKTHROUGH TIME: 2.5 minutes 4. MIN DETECTABLE LIMIT 4.72 ppm 5. STEADY STATE FERMEATION RATE 1116 (ug/cm2\*hr) 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A : CONCENTRATION : CONCENTRATION : CONCENTRATION TIME

NAMES OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTIONO

# Chemical Resistance Testing of Glove Liner

## Diethylamine Run II

Chemical: <u>Diethylamine Run II</u> Flow rate to cells: 100 Flow rate to Detector: 100 Input attn: <u>1</u> Chart speed: <u>2 in/hr</u> Lamp: <u>11.7</u> Recorder attn: <u>512</u> Petector temp: <u>60</u> CLOVF LINER, INDIVIDUAL



Switched from cells to standard gas

Diethylamine charged into cella

## DESCRIPTION OF PRODUCT EVALUATED 1. 1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: TEST METHOD 2. 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. TEMPERATURE: 22-25°C 3. COLLECTION MEDIUM: N2 4. 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used. /Detector Temperature = 60C. ZEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 7. CHALLENCE CHEMICAL 3 3. COMPONENT 2 1 : 2 1 2 1. CHEM NAME(s) : Diethylamine : N/A N/A 2. CAS NUMBER(s): 109-89-7 N/A N/A 3. CONC. (IF MIX) N/A N/A N/A : CHEMICAL SOURCE: EM Science N/A N/A 4. : TEST RESULTS 4. 1. DATE TESTED: 2-3-87 2. NUMBER OF SAMPLES TESTED: One (Run III) 3. BREAKTHROUGH TIME: 2.5 minutes 4. MIN DETECTABLE LIMIT 4.60 ppm 1072 (ug/cm\*hr) 5. STEADY STATE PERMEATION RATE 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A TIME CONCENTRATION CONCENTRATION : CONCENTRATION : : 1. : 2. : 2 : 3. : : : 4. : : : 5. : : : 6. : : : 7. : : : 8. : : : 9. : : : 10. : : : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Sample was run by Denise McDonald on February 3, 1987.

## Diethylamine Run III

udd 28.0 8 73 Chemical: Diethylamine Run III Flow rate to cells: 100 Flow rate to Detector: 100 Chart speed: <u>2 in/hr</u> Lamp: <u>11.7</u> Recorder attn: <u>512</u> Detector temp: <u>60</u> GLOVE LINER, INDIVIDUAL Input attn:

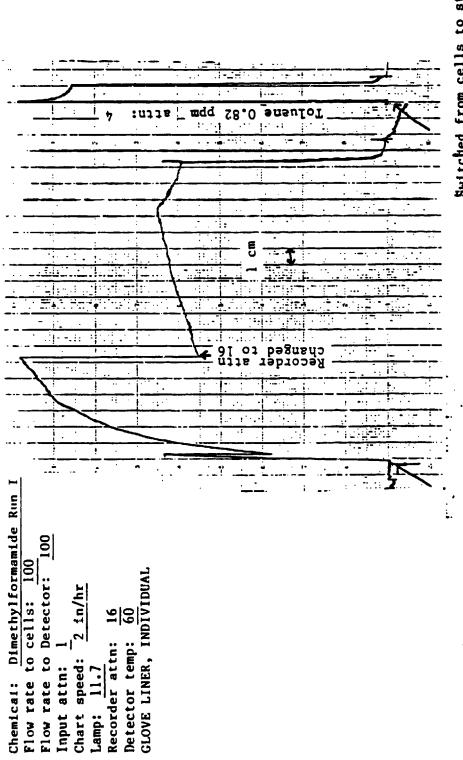
Diethylamine charged into cells

	: TYPE: Teflon									
	: PROTECTIVE MATERIAL CODE: 044 : CONDITION BEFORE TEST: Unused, no visible imperfections									
3: 4:										
	: PRODUCT IDENTIFICATION: Inner glove sheet stock									
6:	: LOT OR MANUFACTURER DATE: N/A									
	NOMINAL THIC		7-9 mils							
8:	DESCRIPTION:									
TES	T METHOD					•				
				nstitute, 9063 Be						
				ionization detect	tion with	n a 11.70 eV lam				
3. 4.			N <sub>2</sub>							
	COLLECTION E		<u>N2</u> N2							
	OTHER CONDIT			used./Detector Te		e = 60C.				
				low rate was 100						
CHA	LLENGE CHEMIC	AL	1	: COMPONENT 2	:	3				
,	CHEM NAME (-)	Di	thylformamide	: N/A	:	N/A				
	CAS NUMBER(s)			: N/A	;	<u>N/A</u>				
	CONC. (IF MI				;	N/A N/A				
	CHEMICAL SOU		inckrodt	: N/A		N/A				
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABL	IPLES TES TIME: LE LIMIT PERMEATI DESS: 7	TED: One (Run I 2.5 minutes .28 ppm ON RATE 49.19 ( mils							
	TIME	:	CONCENTRATION	: CONCENTRAT	LON :	CONCENTRATION				
	2.	:		·	 :					
	3	:		:	:					
	4.	3		:	:					
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	8 9 10			•						

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G-21

## Dimethylformamide Run I



Switched from cells to standard gas

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Dimethylformemide charged into cells

MANUFACTURE PRODUCT IDE LOT OR MANU NOMINAL THI DESCRIPTION TESTING LAB ANALYT ICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	MATERIAL C DEFORE TEST R: Chemfal NTIFICATIO UFACTURER D CCKNESS: 7- C CCKNESS: 7- C CCKNESS: 7- C CCKNESS: 7- C C CCKNESS: 7- C C METHOD: C C C METHOD: C C MEDIUM: N SYSTEM: N	: Unused, m b Corp. N: Inner gl ATE: N/A -9 mils exas Researc	ove shee	le imperfectio et stock	ns			
CONDITION B MANUFACTURE PRODUCT IDE LOT OR MANU NOMINAL THI DESCRIPTION TESTING LAB ANALYTICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	BEFORE TEST R: Chemfal INTIFICATION FACTURER DA CKNESS: 7- CKNESS: 7- CK	: Unused, m b Corp. N: Inner gl ATE: N/A -9 mils exas Researc	ove shee		ns			
MANUFACTURE PRODUCT IDE LOT OR MANU NOMINAL THI DESCRIPTION TESTING LAB ANALYT ICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	R: Chemfa NTIFICATIO FACTURER DA CKNESS: 7- I: I: BORATORY: TO METHOD: CA I: 22-25°C MEDIUM: N SYSTEM: N	b Corp. N: Inner gl ATE: N/A -9 mils exas Researc	ove shee					
PRODUCT IDE LOT OR MANU NOMINAL THI DESCRIPTION TESTING LAB ANALYT ICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	ORATORY: TO METHOD: CO MEDIUM: N SYSTEM: N	N: Inner gl ATE: N/A -9 mils exas Researc		et stock				
LOT OR MANU NOMINAL THI DESCRIPTION TESTING LAB ANALYTICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	CKNESS: 7- CKNESS: 7-	ATE: N/A -9 mils exas Researc			······································			
DESCRIPTION TESTING LAB ANALYTICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	ORATORY: TO METHOD: Co : 22-25°C MEDIUM: N SYSTEM: N	exas Researc	th Instit					
TESTING LAB ANALYTICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	ORATORY: T METHOD: C : 22-25°C MEDIUM: N SYSTEM: N		th Instit					
TESTING LAB ANALYTICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	METHOD: CO : 22-25°C MEDIUM: N SYSTEM: N		h Instit					
ANALYTICAL TEMPERATURE COLLECTION COLLECTION OTHER CONDI	METHOD: CO : 22-25°C MEDIUM: N SYSTEM: N		h Instit					
TEMPERATURE COLLECTION COLLECTION OTHER CONDI	: 22-25*C MEDIUM: N SYSTEM: N	ontinuous ph				Road Austin,		
COLLECTION COLLECTION OTHER CONDI	MEDIUM: N SYSTEM: N		otoioni:	zation detecti	on wit	th a 11.70 eV la		
COLLECTION OTHER CONDI	SYSTEM: N			······································				
OTHER CONDI								
DEVIATIONS	TIONS: 1		as used.	Detector Tem	Deratu	ITE = 60C.		
	FROM ASTM	F739 METHOD:	Flow	rate was 100 c	c/min.			
LIENGE CHEMI	ical.	1	: 1	COMPONENT 2	:	3		
CHEM NAME (s	s): Dimeti	hylformamide	•	N/A	•	N/A		
			:	N/A		N/A		
			:	N/A	:_	<u>N/A</u>		
CHEMICAL SC	DURCE:Malli	nckrodt	:	<u>N/A</u>		N/A		
ST RESULTS								
			in II)					
			3 (117/01	m <sup>2</sup> *hr)				
SAMPLE THICK	CNESS: 7 m	ils	- (08/0	/				
SELECTED DAT	A POINTS	N/A						
<b>A A A</b>	_	60 Marxing ( 61						
	:	CONCENTRATI	.ON :	CONCENTRAT 10	-	CONCENTRATION		
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10.	<u></u>		• :	<u> </u>	······			
اليوناني والمعلي المرونيك ال				. <u> </u>				
OTHER OBSERV	ATIONS:							
Sample was run by Denise McDonald on January 27, 1987.								
	CAS NUMBER ( CONC. (IF N CHEMICAL SO ST RESULTS DATE TESTED: NUMBER OF SA BREAKTHROUGH MIN DETECTAE STEADY STATE SAMPLE THICK SELECTED DAT TIME 1	CAS NUMBER(s): 68-12 CONC. (IF MIX) N/A CHEMICAL SOURCE: Malli ST RESULTS DATE TESTED: 1-27-87 NUMBER OF SAMPLES TEST BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATION SAMPLE THICKNESS: 7 m SELECTED DATA POINTS TIME : 1	CAS NUMBER(s): 68-12-2 CONC. (IF MIX) N/A CHEMICAL SOURCE:Mallinckrodt ST RESULTS DATE TESTED: 1-27-87 NUMBER OF SAMPLES TESTED: One (Ru BREAKTHROUGH TIME: 2.5 minutes MIN DETECTABLE LIMIT .30 ppm STEADY STATE PERMEATION RATE 38.7 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A TIME : CONCENTRATI 1	CONC. (IF MIX) N/A : CHEMICAL SOURCE: Mallinckrodt : ST RESULTS DATE TESTED: 1-27-87 NUMBER OF SAMPLES TESTED: One (Run II) BREAKTHROUGH TIME: 2.5 minutes MIN DETECTABLE LIMIT .30 ppm STEADY STATE PERMEATION RATE 38.73 (ug/c: SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION : 1. : : : : : : 3. : : : : : : : : : 4. : : : : : : : : : : : : : : : : : : :	CAS NUMBER(s):       68-12-2       :       N/A         CONC. (IF MIX)       N/A       :       N/A         CHEMICAL SOURCE:       Mallinckrodt       :       N/A         ST RESULTS       DATE TESTED:       1-27-87       NUMBER OF SAMPLES TESTED:       One (Run II)         BREAKTHROUGH TIME:       2.5 minutes       MIN DETECTABLE LIMIT       .30 ppm         STEADY STATE PERMEATION RATE       38.73 (ug/cm <sup>2</sup> *hr)         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :       CONCENTRATION         2.       :       :         3.       :       :         4.       :       :         5.       :       :         6.       :       :         9.       :       :         10.       :       :         COTHER OBSERVATIONS:       :	CAS NUMBER(s):       68-12-2       :       N/A       :         CONC. (IF MIX)       N/A       :       N/A       :       .         CHEMICAL SOURCE:       Mallinckrodt       :       N/A       :       .         ST RESULTS       DATE TESTED:       1-27-87       .       .       .       .         DATE TESTED:       1-27-87       .       .       .       .       .       .         DATE TESTED:       1-27-87       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .		

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# Dimethylformamide Hun II

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<u></u>	True tracks
Dimethylformamide Run II o cells: 100 o Detector: 100 i <u>1</u> tn: 16 tn: 16 mp: 60 , INDIVIDUAL	
	•.
AL IT I	
hylfo ector 15: 10/hr 16 00 VIDUA	
VI VI VI VI VI	
Dimethyl to cells: to Detect :d: 1 :d: 5 in/ ;d: 16 ittn: 16 emp: 60 :R, INDIVID	
1: The tree tree tree tree tree tree tree tr	
Chemical: <u>Dimethylfor</u> Flow rate to <u>cells: 1</u> Flow rate to <u>Detector:</u> Input attn: <u>1</u> Chart speed: <u>5 in/hr</u> Lamp: <u>11.7</u> Recorder attn: <u>16</u> Detector temp: <u>60</u> GLOVE LINER, INDIVIDUAL	
Chemic Flow r Input Chart Chart Chart Chart Chart Chart Chart Chart GLOVE	
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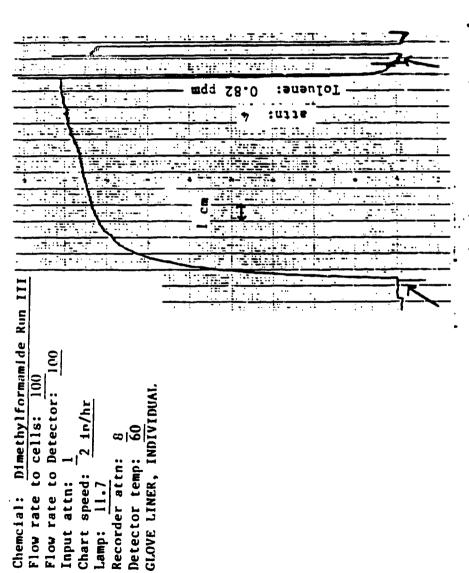
Bwitched from cells to standard gas

Dimethylformamide charged into cells

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			Cn	LEMICAL P	ROTECTIVE CLOT	AING F	RODUCI EVALUAI		
1.	DESC	RIPT	ION OF P	RODUCT E	VALUATED				
			. Teflon						
					CODE : 044				
	•				T: Unused, no	visit	le imperfectio	ns	
					ab Corp.				
					ON: Inner glo DATE: N/A	ve sne	EL BLOCK		
					7-9 mils				
			RIPTION:						
_					<u> </u>				
2.	TESI	METH	IOD		-				
									s Road, Austin, 1
						toioni	zation detecti	on wi	th a 11.70 eV lar
				22-25°C					·
				EDIUM:				·	·····
				YSTEM:	N <sub>2</sub> 1 inch cell wa	6 11000	Detertor Ter		
					F739 METHOD:				
L	CHAI	IENG	CHEMIC	AT.	1	:	Component 2	:	3
					thylformamide		N/A	;	N/A
				$(3): \frac{68-1}{N/4}$	2-2	!		<b>!</b>	N/A
			. (IF MI		inckrodt	— <u>;</u> —	N/A N/A	!	<u>N/A</u> N/A
	2. 1 3. 1 4. 1 5. 5	NUMBER BREAKI MIN DE STEADY	THROUGH	TIME: £ LIMIT PERMEATI	7 TED: One (Run 2.5 minutes .29 ppm ON RATE 40.42 mils		m <sup>2</sup> *hr)		
				POINTS					
			TIME	:	CONCENTRATIO	N :	CONCENTRATIC	)N :	CONCENTRATION
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	8. C	THER	OBSERVA	TIONS:					
	601m	CE OF	DATA						
5.	20.0%						January 28, 19		

# Dimethylformamide Run III



Switched from cells to standard gas

Cimsthylformamide charged into cells

### 1. DESCRIPTION OF PRODUCT EVALUATED

	-					
	1:	TYPE: Teflon				
	2:	PROTECTIVE MATE		<u></u>		
	3:			no visible imperfectio	115	
	4:	MANUFACTURER:	Chemfab Ccrp.			
	5:	PRODUCT IDENTIF	ICATION: Inner gl	ove sheet stock		
	6:	LOT OR MANUFACT	URER DATE: N/A			
	7:	NOMINAL THICKNE				
	6:					
2.	TES 1.	T METHOD TESTING LABORAT	ORY: Texas Researc	ch lnstitute, 9063 Bee	Caves B	load, Austin, TX
	2.	ANALYTICAL METH	OD: Continuous pl	notoionization detecti	on with	10 20 41 1400
			ion: courtudors h			10.20 ev 18mp.
	3.	TEMPERATURE: 22				10.20 ev 18mp.
	3. 4.		-25°C			10.20 ev lamp.
	-	TEMPERATURE: 22 COLLECTION NEDI	2-25°C			10.20 ev 1amp.
	4. 5.	TEMPERATURE: 22 COLLECTION MEDI COLLECTION SYST	2-25°C UM: N <sub>2</sub> TEM: N <sub>2</sub>			
	4. 5. 6.	TEMPERATURE: 22 COLLECTION MEDI COLLECTION SYST OTHER CONDITION	2-25°C UM: N2 IEM: N2 IS: 1 inch cell v	vas used./Detector Tem	perature	
	4. 5. 6.	TEMPERATURE: 22 COLLECTION MEDI COLLECTION SYST OTHER CONDITION	2-25°C UM: N2 IEM: N2 IS: 1 inch cell v		perature	
з.	4. 5. 6. <b>7</b> -	TEMPERATURE: 22 COLLECTION MEDI COLLECTION SYST OTHER CONDITION	2-25°C UM: N2 IEM: N2 IS: 1 inch cell v	vas used./Detector Tem	perature	
з.	4. 5. 6. <b>7</b> -	TEMPERATURE: 22 COLLECTION MEDI COLLECTION SYST OTHER CONDITION DEVISTIONS FROM	2-25°C UM: N2 IEM: N2 IS: 1 inch cell v	vas used./Detector Tem Flow Tate was 100 c	perature	e = 100C.
з.	4. 5. 6. 7-	TEMPERATURE: 22 COLLECTION MEDI COLLECTION SYST OTHER CONDITION DEVISTIONS FROM	2-25°C UM: N2 IM: N2 IS: 1 inch cell v ASTM F739 METHOD: 1	vas used./Detector Tem Flow Tate was 100 c	perature	e = 100C.

### TEST RESULTS 4.

4.

1.	DATE	TESTED:	12-17-86

3. CONC. (IF MIX)  $\overline{N/A}$ 

- 2. NUMBER OF SAMPLES TESTED: One (Run I)
- 3. BREAKTHROUGH TIME: 2.5 minutes

CHEMICAL SOURCE: EM Science

- 4. MIN DETECTABLE LIMIT .87 ppm 5. STEADY STATE PERMEATION RATE \_ 282.68 ug/cm<sup>2</sup>/hr
- 6. SAMPLE THICKNESS: 7 mils
- 7. SELECTED DATA POINTS N/A

	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
1		:		:		:	
2. ]		¥		:		:	
3. ]		:		:		:	
4. –		:		:		:	
5		:		:		:	
6		:		:		:	
7		:		:		ŧ	
8		:		:		:	
9. –		:		:		:	
10.		:		:		:	

N/A

N/A

### 8. OTHER OBSERVATIONS:

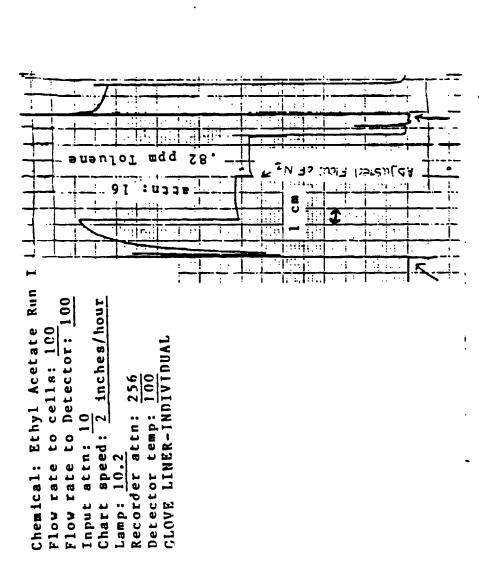
5. SOURCE OF DATA

Sample was run by Denise McDonald on December 17, 1986.

N/A

N/A

## Ethyl Acetate Run I



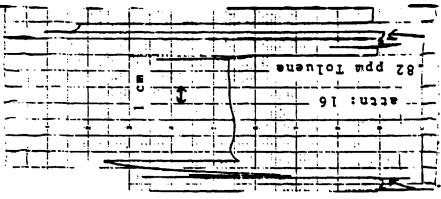
Switched from cells to standard gas

Ethyl Acetate charged into cells

	3:		used, no visible impo	erfections	
	4:				
	5:		nner glove sheet stor	<u>ck</u>	
		LOT OR MANUFACTURER DATE: NOMINAL THICKNESS: 7 mils			
		DESCRIPTION:			
2.	TES	ST METHOD			
	1.	TESTING LABORATORY: Texas	Research Institute. 9	9063 Bee Caves R	oad. Austin. TX
		COLLECTION SYSTEM: N2	- all man wood / Det	Tono and	- 1000
	в. 7.	OTHER CONDITIONS: 1 inch DEVIATIONS FROM ASTM F739	METHOD: Flow rate wa	as 100 cc/min.	re = 100C.
3.	CHA	LLENGE CHEMICAL 1	: COMPONE	ENT 2 :	3
	1.	CHEM NATE(s) : Ethyl Acet	: ate : \$/1	= L :	W/1
	2.	CAS NUMBER(s): 141-78-6	: N/A	A	N/A
		CONC. (IF MIX) N/A	: N/4		N/A
	4.	CHEMICAL SOURCE: EN Science	: N/A	A:	N/A
	2. 3.	DATE TESTED: 12-17-86 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2.5 min	utes		
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2.5 min MIN DETECTABLE LIMIT .89 pp STEADY STATE PERMEATION RAT SAMPLE THICKNESS: 7 mils	utes m E 269.64 ug/cm <sup>2</sup> *hr		
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2.5 min MIN DETECTABLE LIMIT .89 pp STEADY STATE PERMEATION RAT SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C	ONCENTRATION
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         CCNC         1.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C	ONCENTRATION
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C	ONCENTRATION
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         CCNC         1.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C : : : :	ONCENTRATION
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C : : : : :	ONCENTRATION
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :         4.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C : : : : : : :	ONCENTRATION
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C : : : : : : : :	ONCENTRATION
	2. 3. 5. 6. 7.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C : : : : : : : : :	ONCENTRATION
	2. 3. 5. 6. 7.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C : : : : : : : : : : : : : : : : : :	ONCENTRATION
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C : : : : : : : : : : :	ONCENTRATION
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C : : : : : : : : : : :	ONCENTRATION
	2. 3. 5. 6. 7. 8.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :         OTHER OBSERVATIONS:	utes m E <u>269.64 ug/cm<sup>2</sup>*hr</u>	ENTRATION : C	ONCENTRATION
ð.	2. 3. 5. 6. 7. 8.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :	utes m E 269.64 ug/cm <sup>2</sup> *hr ENTRATION : CONCE : : : : : : : : : : : : :		ONCENTRATION
•	2. 3. 5. 6. 7. 8.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 min         MIN DETECTABLE LIMIT       .89 pp         STEADY STATE PERMEATION RAT         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :         OTHER OBSERVATIONS:	utes m E 269.64 ug/cm <sup>2</sup> *hr ENTRATION : CONCE : : : : : : : : : : : : :		

## Ethyl Acetate Run II

Chemical: Ethyl Acetate Run II Flow rate to cells: 100 Input attn: 10 Chart speed: 2 inches/hour Lamp: 10.2 Recorder attn: 512 Detector temp: 100 GLOVE LINER-INDIVIDUAL



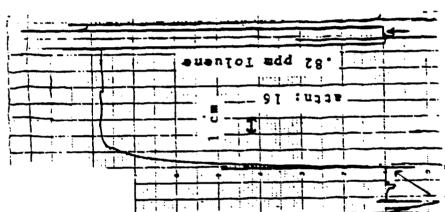
Switched from cells to standard gas Ethyl Acetate charged into cells

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2:	TYPE: Teflon PROTECTIVE MAT	ERIAL CODE: 044		
			visible imperfections	<u></u>
4:	MANUFACTURER:	Chemfab Corp.		
5:	PRODUCT IDENTI	FICATION: Inner glo	ve sheet stock	
	LOT OR MANUFAC			
	NOMINAL THICKN DESCRIPTION:	ESS: <u>7-9 mil</u>		
0:			······	
TE	ST METHOD			
1.	TESTING LABORA	TORY: Texas Research	Institute, 9063 Bee Cav	es Road. Austin. TX
2.	ANALYTICAL MET	HOD: Continuous phot	coionization detection w	with 10.20 eV lamp.
3.	TEMPERATURE: 2	2-25°C		
-	COLLECTION MED			
	COLLECTION SYS			
	OTHER CONDITIO		s used./Detector Tempera Flow rate was 100 ct/mi	ture = 100C.
/ •	DEVIATIONS PRO	TASIM F/39 MEIHOD:	FIOW TALE WAS TOU CETT	n
<b>A</b>	ALLENCE CHEMICAL	1	: COMPONENT 2 :	.3
1.	CHEM NAME (s) :	Ethyl Acetate	_:N/A:	N/A
	CAS NUMBER(s):	141-78-6	:N/A :	N/A
2.	CONC (TE NIX)	NY / A	N/A	
з.	CONC. (IF MIX) CHEMICAL SOURC	N/A	: <u>N/A</u> : : <u>N/A</u> :	<u>N/A</u> N/A
3. 4.	CONC. (IF MIX)	N/A		
3. 4. Te	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS	N/A E:EM Science		
3. 4. TE	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED:	N/A E:EM Science	: <u>     N/A    </u> :	
3. 4. TE: 1. 2.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPT	N/A E:EM Science 12-17-86 ES TESTED: One (Run	: <u>     N/A    </u> :	
3. 4. TE: 1. 2. 3. 4.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE	N/A E:EM Science 12-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm	: <u>N/A</u> :	
3. 4. TE: 1. 2. 3. 4. 5.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE	N/A E:EM Science 12-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2	: <u>N/A</u> :	
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNES	N/A E:EM Science 12-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils	: <u>N/A</u> :	
3. 4. TE: 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE _258.2 S: 7 mils	: <u>N/A</u> :	
3. 4. TE: 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNESS SELECTED DATA PO TIME	N/A E:EM Science 12-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA P	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3. 4. TE: 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNES SELECTED DATA PO TIME 1.	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3. 4. TE: 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNES SELECTED DATA PO TIME 1. 2. 3. 4.	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3. 4. TE 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNES SELECTED DATA PO TIME 1. 2. 3. 4. 5.	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3. 4. TE: 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNES SELECTED DATA PO TIME 1	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3. 4. TE: 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHENICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNES SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7.	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3. 4. TE: 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHENICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 6. 7. 8.	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3. 4. TE: 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHENICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3. 4. TE: 1. 2. 3. 4. 5. 6.	CONC. (IF MIX) CHENICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNES SELECTED DATA P TIME 1. 2. 3. 4. 5. 6. 7. 8.	N/A E:EM Science I2-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3.4. TE 1.23.4.5.6.7.	CONC. (IF MIX) CHENICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	N/A E:EM Science 12-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A : CONCENTRATION : : : : : : : : : : : :	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3.4. TE 1.23.4.5.6.7.	CONC. (IF MIX) CHEMICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	N/A E:EM Science 12-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A : CONCENTRATION : : : : : : : : : : : :	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	N/A
3.4. TE: 1.2.3.4.5.6.7. 8.	CONC. (IF MIX) CHENICAL SOURC ST RESULTS DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE T STEADY STATE PE SAMPLE THICKNES SELECTED DATA PO TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 0THER OBSERVATIO	N/A E: EM Science 12-17-86 ES TESTED: One (Run ME: 2.5 minutes LIMIT .90 ppm RMEATION RATE 258.2 S: 7 mils OINTS N/A : CONCENTRATION : : : : : : : : : : : : :	: <u>N/A</u> : III) 24 ug/cm <sup>2</sup> /hr	CONCENTRATION

## Ethyl Acetate Run III

Chemical: Ethyl Acetate Run III Flow rate to cells: 100 Flow rate to Detector: 100 Input attn: 10 Chart speed: 2 inches/hour Lamp: 10.2 Recorder attn: 256 Detector temp: 100 GLOVE LINER-INDIVIDUAL



Switched from cells to standard gas

Ethyl Acetate charged into cells

G-32

### 1. DESCRIPTION OF PROPUCT EVALUATED

8

8: 1	PRODUCT IDENTIFI LOT OR MANUFACTU NONINAL THICKNES DESCRIPTION:		sheet stock	
TEST	METHOD			
1.	TESTING LABORATO	DRY: Texas Research In	stitute, 9063 Bee Cav	es Road, Austin, TX
2	ANALYTICAL METHO TEMPERATURE: 22-	D: Continuous photoi	onization detection w	ith a 10.20 eV lamp.
	COLLECTION MEDIL			
	COLLECTION SYSTE			
, 6. (	OTHER CONDITIONS	: l inch cell was u	sed. / Detector Tempe	rature = 100C.
7. 1	DEVIATIONS FROM	ASTN: F739 METHOD: F1	ow rate was 100 cc/mit	n.
CHALL	LENGE CHEMICAL	1 :	COMPONENT 2 :	3
1. 1	CHEM NAME(s) :	Hexane :	N/A :	N/A
	CAS NUMBER(s):		N/A :	N/A
	CONC. (IF MIX)		N/A :	N/A
4. (	CHEMICAL GOURCE:	Aldrich :	<u> </u>	<u>N/A</u>
5. S' 6. S/	IN DETECTABLE LI TEADY STATE PERM ANPLE THICKNESS: ELECTED DATA POI	EATION RATE 1898 ug/c 7 mils	m²/hr	
	TIME :	CONCENTRATION	: CONCENTRATION :	CONCENTRATION
1	•		•	
2			:	
3 4			:	
5				
6			:	
7			:	
7 8				
7 8 9			· · · · · · · · · · · · · · · · · · ·	
7 8 9	0			
7 8 9 1		<pre>XS:</pre>		

# **Chemical Resistance Testing of Glove Liner**

### Hexane Run I

Chemical: Hexane Run I Flow rate to cells: 100 Flow rate to Detector: 100 Input attn: 10 Chart speed: 2 inches/hour Lamp: 10.2 Recorder attn: 1024 Detector temp: 100 GLOVE LINER

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-	1	· · · · ·		• <u></u>	<b>.</b>		
							entrol mqq 28.

Switched from cells to standed Rus Hexane charged into cells

### 1. DESCRIPTION OF PROL/UCT EVALUATED

2: 1	PROTECTIVE MAT	TELIAI	CODE: 044			
			T: Unused, no vis	ible imperfection	16	
4: 1	MANUFACTURER:	Cherf	ab Corn.	able imperiection	19	
			ON: Inner glove s	heet stock		
	LOT OR MANUTA			Incel BLOCK		
	NOMINAL THICK				<u> </u>	
	DESCRIPTION:	-				
-						
TEST	METHOD					
						s Road, Austin, TX
				nization detection	on wi	th a 10.20 eV lamp
	TEMPERATURE:					
	COLLECTION ME			* * *		
	COLLECTION SYS					
			1 inch cell was up 1 F739 METHOD: Flo			
CHALL	letige chemical	L	1 :	COMPONENT 2	:	3
1 4	CHEM NAME (S)	• · Pore	:	N/A	:	N/A
	CAS NUMBER(s):			<u> </u>	— <u>'</u> –	<u> </u>
	CONC. (IF MIX			<u> </u>	:	<u> </u>
	CHENICAL SOUR			<u> </u>	:	N/A
				#/A	*	
1 5						
2. NU 3. BI 4. MI	REAKTHROUGH T IN DETECTABLE	LES TES IME: - 2 LIMIT	TED: One (Run II) 2.5 minutes 9.60 ppm			
2. NU 3. BI 4. MI 5. SI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI	LES TES IME: - 2 LIMIT ERMEATI	TED: <u>One (Run II)</u> 2.5 minutes 9.60 ppm ON RATE <u>1838 ug/cr</u>			
2. NI 3. BI 4. MI 5. SI 6. SI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: <u>One (Run II)</u> 2.5 minutes 9.60 ppm ON RATE <u>1838 ug/cr</u> 7 mils			
2. NI 3. BI 4. MI 5. SI 6. SI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	p²/hr		
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE P AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: <u>One (Run II)</u> 2.5 minutes 9.60 ppm ON RATE <u>1838 ug/cr</u> 7 mils		N :	CONCENTRATION
2. NU 3. BI 4. MI 5. SI 6. SI 7. SI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE P AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	p²/hr	N :	CONCENTRATION
2. NU 3. BI 4. MI 5. SI 6. SI 7. SI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	CONCENTRATIO	:	CONCENTRATION
2. NU 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3.	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	CONCENTRATIO	N : : :	CONCENTRATION
2. NU 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3. 4	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	CONCENTRATIO	:	CONCENTRATION
2. NU 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3. 4 5.	UMBER OF SAMP: REAKTHROUGH T IN DETECTABLE TEADY STATE PI ANPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	CONCENTRATIO	: : : :	CONCENTRATION
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3. 4 5. 6	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	D <sup>2</sup> /hr : CONCENTRATION : : : : :	:	CONCENTRATION
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3. 4 5. 6 7. 7	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA T TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	2/hr : CONCENTRATIO : : : : :	: : : : :	CONCENTRATION
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3. 4 5. 6 7. 8	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A		: : : : : :	CONCENTRATION
2. NU 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3. 4 5. 6 7. 8 9	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	2/hr : CONCENTRATIO : : : : :	: : : : :	CONCENTRATION
2. NU 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3. 4 5. 6 7. 8 9	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS:	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A		: : : : : :	CONCENTRATION
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3. 4 5. 6 7. 8 9 10	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS: POINTS : : : : : : : : : : : : : : : : : : :	TED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A	2/hr : CONCENTRATIO : : : : : : : : : : : : :	: : : : : :	CONCENTRATION
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI 1 2 3 4 5 6 7 8 9 1( 8. OI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI ANPLE THICKNES ELECTED DATA I TIME 	LES TES IME: - 2 LIMIT ERMEATI SS: POINTS : : : : : : : : : : : : : : : : : : :	STED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A CONCENTRATION	2/hr : CONCENTRATIO : : : : : : : : : : : : :	: : : : : :	CONCENTRATION
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI 1 2 3 4 5 6 7 8 9 1( 8. OI	UMBER OF SAMP: REAKTHROUGH T: IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME	LES TES IME: - 2 LIMIT ERMEATI SS: POINTS : : : : : : : : : : : : : : : : : : :	STED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A CONCENTRATION	2/hr : CONCENTRATIO : : : : : : : : : : : : :	: : : : : :	CONCENTRATION
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI 1 2 3 4 5 6 7 8 9 1( 8. OI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME 	LES TES IME: - 2 LIMIT ERMEATI SS: POINTS : : : : : : : : : : : : : : : : : : :	STED: One (Run II) 2.5 minutes 9.60 ppm ION RATE 1838 ug/cm 7 mils N/A CONCENTRATION	CONCENTRATIO		CONCENTRATION
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI 1 2 3 4 5 6 7 8 9 1( 8. OI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME 	LES TES IME: - 2 LIMIT ERMEATI SS: POINTS : : : : : : : : : : : : : : : : : : :	STED: One (Run II) 2.5 minutes 9.60 ppm ON RATE 1838 ug/cm 7 mils N/A CONCENTRATION	CONCENTRATIO		CONCENTRATION
2. NI 3. BI 4. MI 5. SI 6. SI 7. SI 1 2 3 4 5 6 7 8 9 1( 8. OI	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME 	LES TES IME: - 2 LIMIT ERMEATI SS: POINTS : : : : : : : : : : : : : : : : : : :	STED: One (Run II) 2.5 minutes 9.60 ppm ON RATE 1838 ug/cm 7 mils N/A CONCENTRATION	CONCENTRATIO		CONCENTRATION
2. NU 3. BI 4. MI 5. SI 6. SI 7. SI 1. 2 3. 4 5. 6 7. 8 9 10 8. 01	UMBER OF SAMP REAKTHROUGH T IN DETECTABLE TEADY STATE PI AMPLE THICKNES ELECTED DATA I TIME 	LES TES IME: - 2 LIMIT ERMEATI SS: POINTS : : : : : : : : : : : : : : : : : : :	STED: One (Run II) 2.5 minutes 9.60 ppm ON RATE 1838 ug/cm 7 mils N/A CONCENTRATION	CONCENTRATIO		CONCENTRATION

### Hexane Run II

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wdd 91 u EU Flow rate to Detector: 100 Chart specd: 2 inches/hour Chemical: Hexane Run IJ Flow rate to cells: 100 Recorder attn: 1024 Detector temp: 100 Input attn: 10 CLOVE LINER Lamp: 10.2

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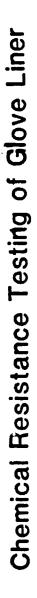
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Switched from cells to standard gas

Hexane charged into cells

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	2:	TYPE: Teflon PROTECTIVE MATER				
		CONDITION BEFORE MANUFACTURER: C		, no visibl	e imperfections	
		PRODUCT IDENTIFI		glove shee	t stock	
	6:	LOT OR MANUFACTU	RER DATE: N/A			
		NOMINAL THICKNES DESCRIPTION:	S: 7 mils			
2.	TES	T METHOD				
			Teves Rese	arch Instit	ute 9063 Ree Cav	es Rozd, Austin, TX
						ith a 10.20 eV lamp.
	-	TEMPERATURE: 22-		······································		
		COLLECTION MEDIU COLLECTION SYSTE			**	
				l wrs used.	/ Detector Tempe	rature = 100C.
	7.	DEVIATIONS FROM	ASTI F739 METHO	DD: Flow I	ate was 100 cc/mi	n •
	CHA	LIENCE CHEMICAL	1	4 C :	OMIONENT 2 :	3
		CHEM NAME(s) :			<u>N/A</u> :	<u> </u>
		CAS NIMBER(s): CONC. (IF MIX)		i	<u>N/A</u> : N/A:	<u> </u>
		CHEMICAL SOURCE:			N/A :	<u>N/A</u>
•	TES	T RESULTS				
		DATE TESTED: 12-				
		NUMBER OF SAMPLES BREAKTHROUGH TIME		(Run III)		
		MIN DETECTABLE LI		····	·····	
		STEADY STATE PERM		$10 \text{ ug/cm}^2/t$	۱ <b>۲</b>	
	υ.	SAMPLE THICKNESS:				
	7.	SELECTED DATA POI			CONCENTRATION :	CONCENTRATION
	7.	SELECTED DATA POI	CONCENTRA	ATION :	UUNCENTRALIUN :	
		TIME : 1:	CONCENTRA	ATION :	CONCENTRATION :	
		TIME : 1: 2:	CONCENTR	ATION :		
		TIME : 1: 2: 3:	CONCENTRA	ATION :		
		TIME : 1: 2: 3:		ATION : : : : : :		
		TIME :		ATION : : : : : : : :		
		TIME :		ATION :	CONCENTRATION : : : : : : : : : : : : : : : : : : :	
		TIME :		ATION : : : : : : : : : : : : : :	CONCENTRATION : : : : : : : : : : : : : : : : : : :	
		TIME         1.         2.         3.         4.         5.         6.         7.         8.		ATION : 	CONCENTRATION : : : : : : : : : : : : : : : : : : :	
		TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.		ATICN : : : : : : : : : : : : : : : : : : :	CONCENTRATION : : : : : : : : : : : : : : : : : : :	
		TIME :		ATION : : : : : : : : : : : : : : : : : : :		
	8.	TIME :		ATICN : : : : : : : : : : : : : :		
5.	8.	TIME :	NS :			
5.	8.	TIME :	NS :		December 22, 1986.	
5.	8.	TIME :	NS :			
÷.	8.	TIME :	NS :			



### Hexane Run III

100 speed: 2 inches/hour Chemical: Hcxane Run Ill Flow rate to Detector: Input attn: 10 to cells: 100 1024 Recorder attn: Detector temp: GLOVE LINER Input attn: Chart speed 10.2 Flow rate Lamp:

Switched from cells to standard gas

ZB

mdd

101

9

Hexane charged into cells

### 1. DESCRIPTION OF PRODUCT EVALUATED

	SCRIPTION OF PRODUCT			
1:	TYPE: Teflon			•
2:				
3:	CONDITION BEFORE T	EST: Unused, no v	isible imperfection	15
4:	MANUFACTURER: Che	mfab Corp.		
5:	PRODUCT IDENTIFICA	TION: Inner glove	sheet stock	
6:		R DATE: N/A		
7:	NOMINAL THICKNESS:	7-9 mils		
8:	DESCRIPTION:	<u></u>		
TE	ST METHOD		· · · · · · · · · · · · · · · · · · ·	
1.	TESTING LABORATORY	: Texas Research 1	institute. 9063 Bee	Caves Road, Austin,
2.				on with a 11.70 eV la
	TEMPERATURE: 22-25			
	COLLECTION MEDIUM:			
	COLLECTION SYSTEM:			
	ATHER CONDITIONS:		used. /Detector Temp	erature = 60C.
7.	DEVIATIONS FROM AS	TM F739 METHOD: F	low rate was 100 cc	:/min.
Сн	ALLENGE CHEMICAL	1	: COMPONENT 2	: 3
1.	CHEM NAME(s): Me	thanol	: N/A	: : N/A
	CAS NUMBER(s): 81		: N/A	: N/A
3.	CONC. (IF MIX) N/	A	: N/A	N/A
4.	CHEMICAL SOURCE: F1	sher	: N/A	
2.	DATE TESTED: 1-26 NUMBER OF SAMPLES T BREAKTHROUGH TIME: MIN DETECTABLE LIMI	ESTED: One (Run 1	)	
5.	STEADY STATE PERMEA	TION RATE 20.21 (	ug/cm <sup>2</sup> *hr)	
	SAMPLE THICKNESS:			
	SELECTED DATA POINT		<u> </u>	
	TIME :	CONCENTRATION	: CONCENTRATION	N : CONCENTRATION
	2:		:	:
	3:		:	:
	4:		:	:
	5:		:	:
	6:		:	
	7:		:	
	8:		:	
	9:		:	
	10. :		:	•
8.	OTHER OBSERVATIONS:			

Sample was run by Denise McDonald on January 26, 1987.

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G-3

### Methanol Run I

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Chemical: Methanol Run I Flow rate to cells: 100 Flow rate to Detector: 100 Input attn: 1 Chart speed: <u>2 in/hr</u> Lamp: 11.7 Recorder attn: 16 Detector temp: 60 CLOVE LINER INDIVIDUAL RUN

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28.0 snsulol

5

Switched from tells to standard gas

### Methanol charged into celle

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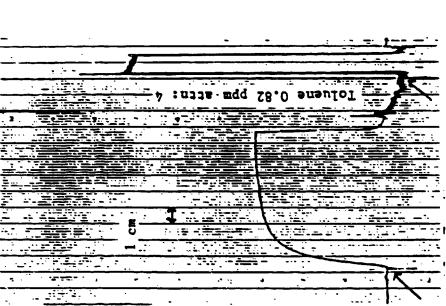
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	1:	TYPE: Teflon						
	2:	PROTECTIVE M	ATERIAL CO	DE: 044				
	3:	CONDITION BE	FORE TEST:	Unused, n	o visib	le imperfectio	ns	
	4:	MANUFACTURER	: Chemfab	Corp.				
	5:	PRODUCT IDEN	TIFICATION	: Inner gl	ove she	et stock		
	6:	LOT OR MANUF	ACTURER DA	TE: N/A				
		NOMINAL THIC						
		DE SCRIPTION:						
2.	TES	T METHOD	<u> </u>					<u> </u>
	1.	TESTING LABO	RATORY: Te	xas Researc	h Insti	tute, 9063 Bee	Caves	Ford. Austin
	2.	ANALYTICAL M	ETHOD: Co	ntinuous ph	otoioni	zation detecti	on with	11.70 eV
	3.	TEMPERATURE:	22-25 °C					
		COLLECTION M						
		COLLECTION ST						
	6	OTHER CONDIT:	$10NS \cdot 1$	tech cell to		./Detector Tem		
	7	DEVIATIONS E		730 METHOD.	as used	Tate was 100 c	peratur	e = 000.
	<b>′</b> •	DEVIATIONS FI	KUTI AS LTI F	JJ9 MEIHOD:	W	TALE WAS INU C	2/212.	والمحادث والمحادين فالمحاد
3.	CHA	LLENGE CHEMICA	NL.	1	:	COMPONENT 2	:	3
	1.	CHEM NAME (s)	: Methan	01	* *	¥/A		\$/A
	2.	CAS NUMBER(s)	): 811-98	-3		N/A		N/A
	3.	CONC. (IF HI)	K) N/A			N/A		N/A
	4.	CHEMICAL SOUL	RCE:Fisher		:	N/A		N/A
4.	2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMI BREAKTHROUGH ? MIN DETECTABLE STEADY STATE H SAMPLE THICKNE	PLES TESTE TIME: 2. LIMIT . PERMEATION	5 minutes 64 ppm RATE 15.54		m <sup>2</sup> *hr)		
•	2. 3. 4. 5. 6.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE	PLES TESTE TIME: 2. E LIMIT . PERMEATION ESS: 7 m1	5 minutes 64 ppm RATE 15.54 1s		m <sup>2</sup> *hr)		
	2. 3. 4. 5. 6.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I	PLES TESTE TIME: 2. E LIMIT . PERMEATION ESS: 7 m1	5 minutes 64 ppm RATE 15.54 1s		m <sup>2</sup> *hr)		
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s	4 (ug/c	m <sup>2</sup> *hr) CONCENTRATIO		CO NCE NTRAT 10
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME 1.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c		)N :	CO NCE NTRAT 10
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME 1. 2.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c		)N : : :	CO NCE NTRAT 10
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME 1.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c		DN :	CO NCE NTRAT 10
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME 1. 2.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c		DN :	CO NCE NTRAT 10
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH 2 MIN DETECTABLE STEADY STATE 1 SAMPLE THICKN SELECTED DATA TIME 1. 2. 3. 4. 5.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c		DN :	CO NCE NTRAT IO
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME 1. 2.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c			CO NCE NTRAT IO
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH CONTRACTOR MIN DETECTABLE STEADY STATE IN SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c			CO NCE NTRAT IO
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c			CONCENTRATIO
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 6. 7. 8. 9.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c			CONCENTRATIO
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8.	PLES TESTE TIME: 2. LIMIT . PERMEATION SS: 7 m1 POINTS	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c			CONCENTRAT 10
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH : MIN DETECTABLE STEADY STATE I SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 6. 7. 8. 9.	PLES TESTE TIME: 2. E LIMIT PERMEATION ESS: 7 m1 POINTS : : : : : : : : : : : : :	5 minutes 64 ppm RATE 15.54 1s N/A	4 (ug/c			CONCENTRATIO
5.	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH COMPARIENT DETECTABLE STEADY STATE IN SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 0THER OBSERVAT	PLES TESTE TIME: 2. E LIMIT . PERMEATION ESS: 7 m1 POINTS . : : : : : : : : : : : : :	5 minutes 64 ppm RATE 15.54 1s N/A CONCENTRATIO	4 (ug/c ON : : : : : : : : :			CONCENTRATIO
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH COMPARIENT DETECTABLE STEADY STATE IN SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 0THER OBSERVAT	PLES TESTE TIME: 2. E LIMIT . PERMEATION ESS: 7 m1 POINTS . : : : : : : : : : : : : :	5 minutes 64 ppm RATE 15.54 1s N/A CONCENTRATIO	4 (ug/c ON : : : : : : : : :			CONCENTRATIO
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH COMPARIENT DETECTABLE STEADY STATE IN SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 0THER OBSERVAT	PLES TESTE TIME: 2. E LIMIT . PERMEATION ESS: 7 m1 POINTS . : : : : : : : : : : : : :	5 minutes 64 ppm RATE 15.54 1s N/A CONCENTRATIO	4 (ug/c ON : : : : : : : : :			CONCENTRATIO
	2. 3. 4. 5. 6. 7.	NUMBER OF SAM BREAKTHROUGH COMPARIENT DETECTABLE STEADY STATE IN SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 0THER OBSERVAT	PLES TESTE TIME: 2. E LIMIT . PERMEATION ESS: 7 m1 POINTS . : : : : : : : : : : : : :	5 minutes 64 ppm RATE 15.54 1s N/A CONCENTRATIO	4 (ug/c ON : : : : : : : : :			CONCENTRATIO

G-4

### Methanol Run II

2 20 Chemical: Methanol Run II Flow rate to cells: 100 Flow rate to Detector: Recorder attn: 16 Detector temp: 60 GLOVE LINER INDIVIDUAL 2 in/hr Lamp: 11.7 Recorder attn: Chart speed: Input attn:



Switched from teils to standard gas

G-42

Methanol charged into cells

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### 1. DESCRIPTION OF PRODUCT EVALUATED

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<pre>3: CONDITION BFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemisb Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER MATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: TEST METHOD 1. TESTING LABORATORY: T-xas Research Institute, 9063 Bee Caves Road, Austin, 2. ANALTICAL METHOD: Continuous photoionization detection with a 11.70 eV 1 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N<sub>2</sub> 5. COLLECTION MEDIUM: N<sub>2</sub> 5. COLLECTION MEDIUM: N<sub>2</sub> 6. OTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. TEALINE CONDITIONS: 1 inch cell was used./Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. TEALINEE CHEMIAL: 1 : COMPOSENT 2 : 3 1. CHEM NAME(s): Mil-98-3 :: N/A :: N/A 2. CAS NUMBER(s): Bil-98-3 :: N/A :: N/A 3. CONC. (IF MIX) N/A N/A :: N/A 4. CHEMICAL SOURCE:Fisher :: N/A :: N/A 4. CHEMICAL SOURCE:Fisher :: N/A :: N/A 5. STADY STATE PERMENTION RATE 21.79 (ug/cm<sup>2</sup>/mr) 5. STADY STATE PERMENTION RATE 21.79 (ug/cm<sup>2/m</sup>r) 5. SAMPLE THICKNES: 7 mils 7. SELECTED DATA POINTS N/A 5. CONCENTRATION :: CONCENTRATION :: CONCENTRATION :: CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :</pre>	ວ:		ATERIAL CODE:				
5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, 2. ANALY ICAL METHOD: Continuous photoionization detection with a 11.70 eV 1 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION MEDIUM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 6DC. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. TEMPERATURE: 1 : COMPONENT 2 : 3 1. CHEM MAME(s): Methonol : N/A : N/A 2. CAS NUMBER(s): 811-98-3 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE: Fisher : N/A : N/A 5. STADY STATE PERMEATION RATE 21.79 (ug/cm <sup>2</sup> *hr) 5. STADY STATE PERMEATION RATE 21.79 (ug/cm <sup>2</sup> *hr) 5. SAMPLE THEFTION RATE 21.79 (ug/cm <sup>2</sup> *hr) 5. STADY STATE PERMEATION RATE 21.79 (ug/cm <sup>2</sup> *hr) 5. STADY STATE PERMEATION RATE 21.79 (ug/cm <sup>2</sup> *hr) 5. STADY STATE PERMEATION RATE 21.79 (ug/cm <sup>2</sup> *hr) 5. SAMPLE THEFTION NATE 21.79 (ug/cm <sup>2</sup> *hr) 5. SAMPLE THEFTION NATE 21.79 (ug/cm <sup>2</sup> *hr) 5. STADY STATE PERMEATION RATE 21.79 (ug/cm <sup>2</sup> *hr) 5. SAMPLE THICKNESS: 7 mils 7. UNE : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : 3. : : : : : : : 4. : : : : : : : : : : : : : : : : : : :	1	CONDITION DE	FORE LESI: Un	uses, no vis:	ible imperiecti	ons	
6:       LOT OR MANUFACTURER DATE: N/A         7:       NOMINAL THICKNESS: 7-9 mils         8:       DESCRIPTION:         TEST METHOD         1.       TESTING LABORATORY: Taxas Research Institute, 9063 Bee Caves Road, Austin,         2.       ANALYTICAL METHOD:         2.       TENTING LABORATORY: Taxas Research Institute, 9063 Bee Caves Road, Austin,         2.       ANALYTICAL METHOD:         2.       TEMPERATURE: 22-25°C         4.       COLLECTION MEDIUM:         1.       TEMPERATURE: 22-25°C         4.       COLLECTION MEDIUM:         7.       TOTHER CONDITIONS:         1.       THE CONDITIONS:         1.       1 since call was used./Detector Temperature = 60C.         7.       DEVIATIONS FROM ASTM F739 METHOD:         9.       CHEM DAME(s):         8.       DESCRIPTION:         1.       1 since call was used./Detector Temperature = 60C.         7.       DEVIATIONS:         1.       SINCHARC(s):         8.       N/A         2.       NA         2.       N/A         3.       CONC. (IF MIX)         3.       CONCE.         4.       CHEMICAL SOURCE: Fisher <t< th=""><th></th><th>MANUPALIURER</th><th>TTTTCATION. T</th><th><u>P.</u></th><th></th><th></th><th></th></t<>		MANUPALIURER	TTTTCATION. T	<u>P.</u>			
7:       NOMINAL THICKNESS: 1-9 mils         8:       DESCRIFION:         TEST METHOD         1.         TEST METHOD         1.         TEST METHOD         1.         TESTING LABORATORY: T-xas Research Institute, 9063 Bee Caves Road, Austin,         Auxilian Structure 100         Auxilian Structure 2003 Bee Caves Road, Austin,         Collection Structure 2005         Collection Structure 2005         Collection Structure 2005         Beta Structure 2005         Deviations FROM ASTM F739 METHOD: Flow rate was 100 cc/min.         Componentiation Structure 2005         Colspan= Structure 2005 <th></th> <th></th> <th></th> <th></th> <th>NEET STOCK</th> <th></th> <th></th>					NEET STOCK		
8: DESCRIPTION:							
<pre>1. TESTING LABORATORY: T=xas Research Institute, 9063 Bee Caves Road, Austin, 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV 1 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION MSTEM: N2 6. UTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Slow rate was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: Slow rate was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: MADE was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: MADE was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: MADE was 100 cc/min. 7. DEVIATIONS FROM ASTM F739 METHOD: MADE was 100 cc/min. 7. N/A : N/A : N/A 7. CAS NUMBER(s): 811-98-3 : N/A : N/A 7. CAS NUMBER(s): 811-98-3 : N/A : N/A 7. CHEMICAL SOURCE:Fisher : N/A : N/A 7. CHEMICAL SOURCE:Fisher : N/A : N/A 7. N/A : N/A : N/A 7. DATE TESTED: 1-26-87 7. NUMBER OF SAMPLES TESTED: One (Run III) 7. SELECTED LIMIT .65 ppm 7. STEADY STATE PERMEATION RATE 21.79 (ug/cm<sup>2</sup>*hr) 7. SELECTED DATA POINTS N/A 7. I : : : : : : 7 : : : : : 7 : : : : : : : 7 : : : : : : : 7 : : : : : : : : : 7 : : : : : : : : : : : : : : : : : :</pre>							
2. ANALYTICAL METHOD: Continuous photoionization detection with a 12.70 eV 1 3. TEMPERATURE: 22-25°C 4. COLLECTION WEDIUM: N2 5. COLLECTION SYSTEM: N2 6. UTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min.  CMALIENT TEMMILE: 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Methanol : N/A : N/A 2. CAS NUMBER(s): 811-98-3 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE:Fisher : N/A : N/A 4. CHEMICAL SOURCE:Fisher : N/A : N/A 7. DATE TESTED: 1-26-87 7. NUMBER OF SAMPLES TESTED: One (Run III) 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED DATA POINTS N/A 7. SELECTED	TE	ST METHOD					
2. ANALYTICAL METHOD: Continuous photoionization detection with a 12.70 eV 1 3. TEMPERATURE: 22-25°C 4. COLLECTION WEDIUM: N2 5. COLLECTION SYSTEM: N2 6. UTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min.  CHALLENE TEMMINE: 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Methanol : N/A : N/A 2. CAS NUMBER(s): 811-98-3 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE:Fisher : N/A : N/A 4. CHEMICAL SOURCE:Fisher : N/A : N/A 7. TEST RESULTS 7. DATE TESTED: 1-26-87 7. NUMBER OF SAMPLES TESTED: One (Run III) 7. SELECTED BATA POINTS N/A 7. SELECTED DATA POINTS	1.	TESTING LABO	RATORY: Texas	Research Ins	titute, 9063 Be	e Caves	Road, Austin, 7
4. COLLECTION MEDIUM: N2         5. COLLECTION SYSTEM: N2         6. OTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 6DC.         7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min.         COMPONENT 2 : 3         I : COMPONENT 2 : 3         I : COMPONENT 2 : 3         I : COMPONENT 2 : 3         I : COMPONENT 2 : 3         I : COMPONENT 2 : 3         I : COMPONENT 2 : 3         I : COMPONENT 2 : 3         I : COMPONENT 2 : 3         I : COMPONENT 2 : 3         I : N/A : N/A         I : I : I : I : N/A         I : I : I : I : I : I : I : I : I : I :	2.	ANALYTICAL M	ETHOD: Contin	uous photoio	nization detect	ion with	a 11.70 eV lar
5. COLLECTION SYSTEM:       N2 <b>COTHER CONDITIONS:</b> 1 inch cell was used./Detector Temperature = 6DC.         7. DEVIATIONS FROM ASTM F739 METHOD:       Flow rate was 100 cc/min.         TEMPETE THEMILE:         1       :       COMPONENT 2       :         1.       CHEM NAME(s):       Methenol       :       N/A         2.       CAS NUMBER(s):       Methenol       :       N/A         2.       CAS NUMBER(s):       811-98-3       :       N/A         3.       CONC. (IF MIX)       N/A       :       N/A         4.       CHEMICAL SOURCE:       Fisher       :       N/A         1.       DATE TESTED:       1-26-87       :       N/A         2.       NUMBER OF SAMPLES TESTED:       One (Run III)       :       SELECTED I         3.       BREAKTHROUCH TIME:       2.5 minutes       :       :         4.       MIN DETECTABLE LIMIT .       65 ppm       :       :       :							
Solution         1 inch cell was used./Detector Temperature = 60C.           7. DEVIATIONS FROM ASTM F739 METHOD:         Flow rate was 100 cc/min.           CHACLENCE CHEMILA:         1         : COMPONENT 2         : 3           1. CHEM NAME(s):         Methanol         :         N/A         :         N/A           2. CAS NUMBER(s):         811-98-3         :         N/A         :         N/A           2. CAS NUMBER(s):         811-98-3         :         N/A         :         N/A           3. CONC. (IF MIX)         N/A         :         N/A         :         N/A           3. CONC. (IF MIX)         N/A         :         N/A         :         N/A           4. CHEMICAL SOURCE:         Fisher         :         N/A         :         N/A           4. CHEMICAL SOURCE:         Fisher         :         N/A         :         N/A           5. STESULTS         1.         DATE TESTED:         1-26-87         :         N/A         :         N/A           7. NUMBER OF SAMPLES TESTED:         One (Run III)         3.         BREAKTHROUGH TIME:         2.5 minutes         .         .         .         .         .         .         .         .         .         .         . <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
7. DEVIATIONS FROM ASTM F739 METHOD:       Flow rate ves 100 cc/min.         CDMEDIENT 2 : 3         : COMPONENT 2 : 3         : N/A :: N/A         N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : Steady State PerMeation Rate 21.79 (ug/cm <sup>2</sup> *hr)         : Steady State PerMeation Rate 21.79 (ug/cm <sup>2</sup> *hr)         : Steady State PerMeation Rate :: : : : : : : : : : : : : : : : : :	5.	COLLECTION S	YSTEM: N2				
7. DEVIATIONS FROM ASTM F739 METHOD:       Flow rate ves 100 cc/min.         CDMEDIENT 2 : 3         : COMPONENT 2 : 3         : N/A :: N/A         N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : N/A :: N/A         : Steady State PerMeation Rate 21.79 (ug/cm <sup>2</sup> *hr)         : Steady State PerMeation Rate 21.79 (ug/cm <sup>2</sup> *hr)         : Steady State PerMeation Rate :: : : : : : : : : : : : : : : : : :	<b>6.</b>	UTHER CONDIT	IONS: 1 inch	cell was use	ed. /Detector Te	speratur	e = 60C.
1. CHEM NAME(s): Methanol       :       N/A       :       N/A         2. CAS NUMBER(s): 811-98-3       :       N/A       :       N/A         3. CONC. (IF MIX) N/A       :       N/A       :       N/A         4. CHEMICAL SOURCE: Fisher       :       N/A       :       N/A         4. CHEMICAL SOURCE: Fisher       :       N/A       :       N/A         7. CHEMICAL SOURCE: Fisher       :       N/A       :       N/A         7. CHEMICAL SOURCE: Fisher       :       N/A       :       N/A         7. DATE TESTED:       1-26-87       :       :       N/A         7. NUMBER OF SAMPLES TESTED:       One (Run III)       :       N/A         8. BREAKTHROUGH TIME:       2.5 minutes       .       .       .         4. MIN DETECTABLE LIMIT65 ppm       .       .       .       .       .         5. STEADY STATE PERMEATION RATE 21.79 (ug/cm <sup>2</sup> *hr)       .       .       .       .       .       .         6. SAMPLE THICKNESS: 7 mils       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .	7.	DEVIATIONS F	ROM ASTM F739	METHOD: Flow	w rate was 100	cc/min.	
2. CAS NUMBER(3):       811-98-3       :       N/A       :       N/A         3. CONC. (IF MIX)       N/A       :       N/A       :       N/A         4. CHEMICAL SOURCE:       Fisher       :       N/A       :       N/A         4. CHEMICAL SOURCE:       Fisher       :       N/A       :       N/A         4. CHEMICAL SOURCE:       Fisher       :       N/A       :       N/A         7. CONC. (IF MIX)       N/A       :       N/A       :       N/A         4. CHEMICAL SOURCE:       Fisher       :       N/A       :       N/A         7. NUMBER OF SAMPLES TESTED:       One (Run III)       :       :       N/A         3. BREAKTHROUGH TIME:       2.5 minutes       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       : <t< th=""><th></th><th>LIENCE CHEMIC</th><th><b>E</b> 1</th><th>:</th><th>COMPONENT 2</th><th>1</th><th>3</th></t<>		LIENCE CHEMIC	<b>E</b> 1	:	COMPONENT 2	1	3
2. CAS NUMBER(3):       811-98-3       :       N/A       :       N/A         3. CONC. (IF MIX)       N/A       :       N/A       :       N/A         4. CHEMICAL SOURCE:       Fisher       :       N/A       :       N/A         4. CHEMICAL SOURCE:       Fisher       :       N/A       :       N/A         4. CHEMICAL SOURCE:       Fisher       :       N/A       :       N/A         7. CONC. (IF MIX)       N/A       :       N/A       :       N/A         4. CHEMICAL SOURCE:       Fisher       :       N/A       :       N/A         7. NUMBER OF SAMPLES TESTED:       One (Run III)       :       :       N/A         3. BREAKTHROUGH TIME:       2.5 minutes       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       : <t< td=""><td>1.</td><td>CHEM NAME (s)</td><td>: Methanol</td><td>:</td><td>N/A</td><td>:</td><td>N/A</td></t<>	1.	CHEM NAME (s)	: Methanol	:	N/A	:	N/A
3. CONC. (IF MIX) N/A       :       N/A       :       N/A         4. CHEMICAL SOURCE: Fisher       :       N/A       :       N/A         TEST RESULTS       .       .       N/A       :       N/A         1. DATE TESTED:       1-26-87       .       .       N/A       :       N/A         2. NUMBER OF SAMPLES TESTED:       One (Run III)       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .       .				``			
4. CHEMICAL SOURCE: Fisher       :       N/A       :       N/A         TEST RESULTS         1. DATE TESTED:       1-26-87         2. NUMBER OF SAMPLES TESTED:       One (Run III)         3. BREAKTHROUGH TIME:       2.5 minutes         4. MIN DETECTABLE LIMIT .65 ppm         5. STEADY STATE PERHEATION RATE 21.79 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS:       7 mils         7. SELECTED DATA POINTS       N/A         IMA         CONCENTRATION : CONCENTRATION : CONCENTRATION         1.       :       :         2.       :       :         3.       :       :         2.       :       :         3.       :       :         2.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         4.       :       :         5.       :       :         6.       :       :         7.       :       :         8.       :       :         9.       :       :       :      <				`			· · · · · · · · · · · · · · · · · · ·
1. DATE TESTED:       1-26-87         2. NUMBER OF SAMPLES TESTED:       One (Run III)         3. BREAKTHROUGH TIME:       2.5 minutes         4. MIN DETECTABLE LIMIT       .65 ppm         5. STEADY STATE PERMEATION RATE       21.79 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS:       7 mils         7. SELECTED DATA POINTS       N/A         CONCENTRATION : CONCENTRATION : CONCENTRATION         1.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         4.       :         5.       :         6.       :         1.       :         2.       :         2.       :         3.       :         2.       :         3.       :         2.       :         3.       :         5.       :							
2. NUMBER OF SAMPLES TESTED: One (Run III)         3. BREAKTHROUGH TIME: 2.5 minutes         4. MIN DETECTABLE LIMIT .65 ppm         5. STEADY STATE PERMEATION RATE 21.79 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS: 7 mils         7. SELECTED DATA POINTS N/A         TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION :	TE	ST RESULTS					
3. BREAKTHROUGH TIME:       2.5 minutes         4. MIN DETECTABLE LIMIT       .65 ppm         5. STEADY STATE PERMEATION RATE       21.79 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS:       7 mils         7. SELECTED DATA POINTS       N/A         TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION :         1.       :       :         2.       :       :         3.       :       :         4.       :       :         5.       :       :         6.       :       :         7.       :       :         8.       :       :         9.       :       :       :         10.       :       :       :	1.	DATE TESTED:	1-26-87				
4. MIN DETECTABLE LIMIT .65 ppm         5. STEADY STATE PERMEATION RATE 21.79 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS: 7 mils         7. SELECTED DATA POINTS N/A         TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : 2.         1.       :       :         2.       :       :       :         3.       :       :       :         4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         6.       :       :       :         7.       :       :       :         9.       :       :       :         10.       :       :       :	2.	NUMBER OF SAM	PLES TESTED:	One (Run III	)		
5. STEADY STATE PERMEATION RATE       21.79 (ug/cm <sup>2</sup> *hr)         6. SAMPLE THICKNESS:       7 mils         7. SELECTED DATA POINTS       N/A         TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION :         1.       :       :         2.       :       :         3.       :       :         4.       :       :         5.       :       :         6.       :       :         7.       :       :         8.       :       :         9.       :       :       :         10.       :       :       :							
6. SAMPLE THICKNESS: 7 mils         7. SELECTED DATA POINTS N/A         TIME : CONCENTRATION : CONCENTRATION         1.       :       :         2.       :       :         3.       :       :         4.       :       :         5.       :       :         6.       :       :         7.       :       :         8.       :       :         9.       :       :         10.       :       :       :	4.	MIN DETECTABL	E LIMIT .65	PPm			
7. SELECTED DATA POINTS <u>N/A</u> TIME       :         1.       :       :         2.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         3.       :       :         4.       :       :         5.       :       :         6.       :       :         7.       :       :         8.       :       :         9.       :       :         10.       :       :	5.	STEADY STATE	PERMEATION RAT	E 21.79 (ug	/cm <sup>2</sup> *hr)		
TIME       :       CONCENTRATION       :       CONCENTRATION         1.       :       :       :       :         2.       :       :       :       :         3.       :       :       :       :         3.       :       :       :       :         4.       :       :       :       :         5.       :       :       :       :         6.       :       :       :       :         7.       :       :       :       :         9.       :       :       :       :         10.       :       :       :       :							
1.       :       :       :         2.       :       :       :         3.       :       :       :         3.       :       :       :         4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         8.       :       :       :         9.       :       :       :         10.       :       :       :	7.	SELECTED DATA	POINTS N/A				
2.       :       :       :         3.       :       :       :         4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         8.       :       :       :         9.       :       :       :         10.       :       :       :			: CONC	ENTRATION	CONCENTRATI	ON :	CONCENTRATION
3.       :       :       :         4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         8.       :       :       :         9.       :       :       :         10.       :       :       :							
4.       :       :       :         5.       :       :       :         6.       :       :       :         7.       :       :       :         8.       :       :       :         9.       :       :       :         10.       :       :       :			•		•		
5.       :       :       :         6.       :       :       :         7.       :       :       :         8.       :       :       :         9.       :       :       :         10.       :       :       :			·	·····		<u> </u>	
7.     :     :     :       8.     :     :     :       9.     :     :     :       10.     :     :     :			:	······································			
B		5.	•			:	
9. : : : : 10. : : : : : :		6.	•			:	
10: : :		6				-	
		6. 7. 8.	•				
8. OTHER OBSERVATIONS:		6 7 8 9	· · · · ·			:	
		6. 7. 8. 9. 10.	• • • • • • • • • • • • • • • • • • • •			:	

Sample was run by Denise McDonald on January 26, 1987.

### Methanol Run III

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Chemical: Methanol Run III Flow rate to cells: 100	Flow rate to Detector: 100	Chart speed: 2 in/hr Lamp: 11.7	Recorder attn: 16 Detortur temp: 60	'Q	

Switched from cells to standard gas

Methanol charged into cella

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### 1. DESCRIPTION OF PRODUCT EVALUATED

2000 Mar 100 COCC

22.0

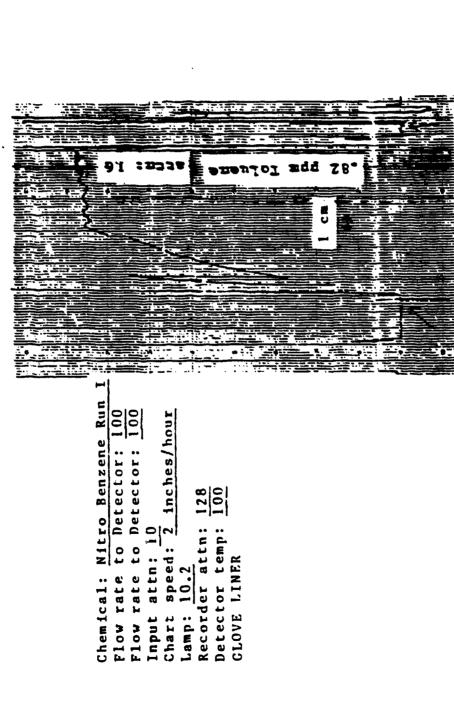
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4: 5: 6: 7:	CONDITION BEFORE MANUFACTURER: C PRODUCT IDENTIFIC LOT OR MANUFACTUR NOMINAL THICKNESS DESCRIPTION:	nemfab Corp. CATION: Inner glo RER DATE: N/A	visible imperfectio	ns	
TE	ST METHOD				
1.	TESTING LABORATOR	V. Towar Basarah	Institute, 9063 Bee	C	
2.	ANALYTICAL METHOD	: Continuous pho	toionization detecti	on with	a 10.20 eV lam
3.	TEMPERATURE: 22-2	25°C			
	COLLECTION MEDIUM				
5.	COLLECTION SYSTEM	1:_ <u>N</u> 2	1 / 2		
7_	DEVIATIONS FROM A	SIM F739 METHOD:	s used./Detector Tem Flow rate was 100 c	peratur c/min-	e =100C.
CH	LLENCE CHEMICAL	1	: COMFONENT 2	:	3
1.	CHEM NAME(s) : N	litrohenzene	= : N/A ·	2	N/A
	CAS NUMBER(s): 9				N/A
3.	CONC. (IF MIX) N	17A	: N/A		N/A
	CHEMICAL SOURCE : M		. N/A	;	N/A
1. 2. 3.	T RESULTS DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME:	TESTED: One (Run 2.50 minutes	I)		
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS:	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils			
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils			
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS:	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils	ug/cm <sup>2</sup> *hr		CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1. :	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A	ug/cm <sup>2</sup> *hr	N :	CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1;	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A	ug/cm <sup>2</sup> *hr	N :	CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1;	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A CONCENTRATIO	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A CONCENTRATIO	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A CONCENTRATIO	ug/cm <sup>2</sup> *hr	:	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 12-2 NUMBER OF SAMPLES BREAKTHROUGH TIME: MIN DETECTABLE LIM STEADY STATE PERME SAMPLE THICKNESS: SELECTED DATA POIN TIME : 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : 0THER OBSERVATIONS	TESTED: One (Run 2.50 minutes IT .13 ppm ATION RATE 57.18 7 mils TS N/A CONCENTRATIO 	ug/cm <sup>2</sup> *hr		CONCENTRATION

### Nitrobenzene Run I



# Switched from cells to standard gas Nitrobenzene charged into cells

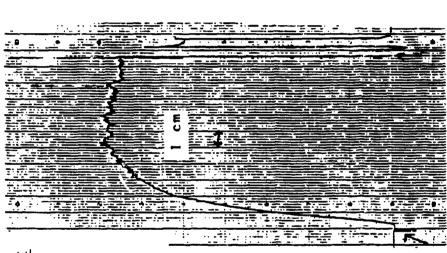
G-46

2:	TIPE: Teflon PROTECTIVE MA	TERIAL	CODE: 044			
				sible imperfection	ons	
	MANUFACTURER:					
			DN: Inner glove	sheet stock		
	LOT OR MANUFA					
	NOMINAL THICK					
	DESCRIPTION:					
ΓE	ST METHOD	<u> </u>				
				stitute, 9063 Ber		
2.	ANALYTICAL ME	THOD: 0	Continuous photei	onization detects	ion wit	th a 10.20 eV la
	TEMPERATURE:					
4.	COLLECTION ME	DIUM: 1	N <sub>2</sub>			
	COLLECTION SY					
6.	OTHER CONDITI	ons :	l inch cell was u	sed-/Detectoe Ter	perat	ure = 100C.
7.	DEVIATIONS FR	ION ASTM	F739 METHOD: F1	ow rate was 100 c	c/min	•
Chi	ALLERGE CHEMICA	L	1 :	COMPOSENT 2	:	3
1.	CHEM NAME (s)	: Nitro	obenzene :	N/A	:	N/A
2.	CAS NUMBER(s)	: 98-9	5-3 :	N/A		N/A
3.	CONC. (IF MIX	$\frac{N}{N}$		N/A		N/A
	CHEMICAL SOUR	CE:Mall	inckrodt :	NAMES OF TAXABLE PARTY OF TAXABLE PARTY.		N/A
ΓE 1. 2.		12-23-80 LES TEST	5 TED: One (Run I	1)		
CE 2.2.3.	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P	12-23-80 LES TEST IME: 2 LIMIT ERMEATIO	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug			
CE 2	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils			
CE 2	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils			
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils			CONCENTRATION
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1.	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr		CONCENTRATION
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1.	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr	DN : : :	CONCENTRATION
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1.	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr	DN : : : :	CONCENTRATION
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1.	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr	DN : : : : :	CONCENTRATION
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6.	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr	DN : : : : : :	CONCENTRATION
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr	DN : : : : : : :	CONCENTRATION
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr	DN : : : : : : :	CONCENTRATION
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKTE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr	DN : : : : : : : : : : : : : :	CONCENTRATION
E	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1	12-23-80 LES TEST IME: LIMIT ERMEATIONS: 7 r	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr		CONCENTRATION
	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKTE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	12-23-80 LES TEST IME: 2 LIMIT ERMEATIO SS: 7 T POINTS : : : : : : : : : : : : : : : : : : :	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr	DN : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	12-23-80 LES TEST IME: 2 LIMIT ERMEATIO SS: 7 T POINTS : : : : : : : : : : : : : : : : : : :	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr	DN : : : : : : : : : :	CONCENTRATION
	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	12-23-80 LES TEST IME: 2 LIMIT ERMEATIO SS: 7 T POINTS : : : : : : : : : : : : : : : : : : :	5 TED: One (Run I 2.50 minutes .14 ppm DN RATE 55.97 ug mils N/A	/cm <sup>2</sup> /hr		CONCENTRATION

# Chemical Resistance Testing of Glove Liner

## Nitrobenzene Run II

Chemical: Nitro Benzene Run II Flow rate to cells:100 Flow rate to Detector: 100 Input attn: 10 Chart speed: 2 inches/hour Lamp: 10.2 Recorder attn: 128 Detector temp: 100 CLOVE LINER



8 8 8 8 Nikrobenzene charged into celle Switched from cells to standard

G-48

### 1. DESCRIPTION OF PRODUCT EVALUATED 1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow Tate was 100 cc/min. : COMPONENT 2 3. CHALLENCE CHEMICAL 1 3 1 1. CHEM NAME(s): <u>Nitrobenzene</u> 2. CAS NUMBER(s): <u>98-95-3</u> 3. CONC. (IF MIX) <u>N/A</u> N/A N/A :\_ N/A N/A N/A N/A ÷. .... 4. CHEMICAL SOURCE: Malinckrodt : N/A N/A TEST RESULTS 1. DATE TESTED: 12-23-86 2. NUMBER OF SAMPLES TESTED: One (Run III) 3. BREAKTHROUGH TIME: 2.50 minutes 4. MIN DETECTABLE LIMIT .14 ppm 5. STEADY STATE PERMEATION RATE 57.79 ug/cm<sup>2</sup>\*hr 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : 2. : : з. : : 4. : : : 5. : : 6. : : : 7. : : : 8. : : : 9. : : : 10. : 8. OTHER OBSERVATIONS: 5. SOURCE OF DATA Sample was run by Denise McDonald on December 23, 1986

## Nitrobenzene Run III

Chemical: <u>Nitro Benzene Run III</u> Flow rate to cells: <u>100</u> Flow rate to Detector: <u>100</u> Input attn: <u>10</u> Chart speed: <u>2 inches/hour</u> Lamp: <u>10.2</u> Recorder attn: <u>128</u> Detector temp: <u>100</u> GLOVE LINER Switched from cells to standard gas Nitrobenzene charged into cella

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### 1. DESCRIPTION OF PRODUCT EVALUATED

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No. of the second second second second second second second second second second second second second second s

2: 3:	TYPE: Teflon			
7.	PROTECTIVE MATERIAL CODE: 044			
	CONDITION BEFORE TEST: Unused, no	visible imperfection	ns	
4:	MANUFACTURER: Chemfab Corp.			
5:	PRODUCT IDENTIFICATION: Inner glov	e sheet stock		
6:	LOT OR MANUFACTURER DATE: N/A			
7:	NOMINAL THICKNESS: 7-9 mils			······································
8:	DESCRIPTION:			
TES	T METHOD			
1.	TESTING LABORATORY: Texas Research	Thetitute 9063 Bee	Caves R	oad Austin T
2.				
		CIONIDICION OCCCCI		
	COLLECTION MEDIUM: N2			
	COLLECTION SYSTEM: N2	· · · · · · · · · · · · · · · · · · ·		
	OTHER CONDITIONS: 1 inch cell was	mend Detertor Ter		= 600
7.	DEVIATIONS FROM ASTM F739 METHOD:	Flow rate was 100 c	c/min.	
CHA	LIENTE CHEMICAL	: COMPONENT 2	:	3
1.	CHEM NAME(s) : Tetrachloroethane	: : N/A	:	N/A
	CAS NUMBER(s): 79-34-5			N/A
	CONC. (IF MIX) N/A	-:	`	N/A N/A
	CHEMICAL SOURCE: Aldrich		:	N/A N/A
TES	TRESULTS			
3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:       One (Run         BREAKTHROUGH TIME:       2.5 minutes         MIN DETECTABLE LIMIT       2.81 ppm         STEADY STATE PERMEATION RATE       1189         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A			
	TIME : CONCENTRATION	: CONCENTRATIO	ON : C	ONCENTRATION
	1:	<u>:</u>	:	
	2:			
	3:	:		
	4		:	
	5. :		•	
		•	• <u> </u>	and the second second second second second second second second second second second second second second second
	6:	•	•	
		: :	:	
	6: 7: 8:	· · · · · · · · · · · · · · · · · · ·	•	
	6: 7: 8: 9:	•	• • • • •	
	6: 7: 8:	· · · · ·	• • • • •	· · · · · · · · · · · · · · · · · · ·
	6. : 7. : 8. : 9. : 10. :	: : : : : :	• • • • •	
	6: 7: 8: 9:	· · · · ·		
٤.	6: 7: 8: 9: 10: OTHER OBSERVATIONS: RCE OF DATA		· · · ·	
٤.	6: 7: 8: 9: 10: OTHER OBSERVATIONS:		: : : :	

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# Tetrachloroethane Run I

Chemical: Tetrachloroethane Run I Flow rate to celis: 100 Flow rate to Detector: 100 Input attn: 1 Chart speed: 2 in/hr Lamp: 11.7 Recorder attn: 256 Detector temp: 60 CLOVE LINER, INDIVIDUAL

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Switched from tells to standard gas

Tetrachloroethane charged into cells

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1:	TYPE: Teflon					
2:	PROTECTIVE MAT					
3: 4:	MANUFACTURER:	RE TEST: Unused, m	0 V1517	1 1mperiecti	ONS	
4:		FICATION: Inner gl	ove she	at stock		
	LOT OR MANUFAC		.ove snet	EL BLYCK		
	NOMINAL THICKN					
	DESCRIPTION:			· · · · · · · · · · · · · · · · · · ·		
TES	T METHOD					
1.		TORY: Texas Researc				
	ANALYTICAL MET		otoionia	ation detect	ion with	a 11.70 eV 1a
3.	TEMPERATURE: 2					
	COLLECTION MED.					
	COLLECTION SYS		<del>_</del>			
	OTHER CONDITION	NS: <u>linch cell</u> w M ASTM F739 METHOD:	as used	/Detector Te	aperatur	<u>e = 50C.</u>
7.	DEVIATIONS FROM	ASIM F/39 MLIHUD:	I TOM J	TATE Was 100	CC/min.	· · · · · · · · · · · · · · · · · · ·
	LIENCE CHEMICAL	1	: ( :	COMPONENT 2	:	3
1.	CHEM NAME(s) :	Tetrachloroethane	: :	N/A	:	N/A
	CAS NUMBER(s):			N/A		N/A
3.	CONC. (IF MIX)	N/A		N/A		N/A
4.	CHEMICAL SOURCE	E:Aldrich ·	:	N/A	:	N/A
2. 3. 4. 5. 6.	NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE	LIMIT 2.78 ppm RMEATION RATE 113 S: 7 mils		m <sup>2</sup> *hr)		
·•	TIME	CONCENTRATI	ON :	CONCENTRATI		CONCENTRATION
	1				<u> </u>	
	2.	<u>.</u>			:	
	3		<u> </u>			
	5.	·		·····		
	6.	•				
	7.	•	<u> </u>			
	8.					
	9.	•				
	10.	t.				
0	0711ED 000ED114ET	<u></u>				کی بین ہے ہیں جانی میں اسلامی کا ایک ہے ج
0.	OTHER OBSERVATIO	UNS:				

# Chemical Resistance Testing of Glove Liner

# Tetrachloroethane Run II

Chemical: Tetrachloroethane Run II Flow rate to cells: 100 Flow rate to Detector: 100 Input attn: 1 Chart speed: 2 in/hr Lamp: 11.7 Recorder attn: 256 Detector temp: 60 GLOVE LINER, INDIVIDUAL

 Switched from cells to standard gas

Tetrachloroethane charged into cells

### 1. DESCRIPTION OF PRODUCT EVALUATED

3:	PROTECTIVE MATERIAL CODE:	044			
			ble imperfection	ONS	
4:					
5:			eet stock		
6:					· · · · · · · · · · · · · · · · · · ·
7:					
8:				······································	
TE	ST METHOD				
1.	TESTING LABORATORY: Texas	Research Inst	itute, 9063 Be	e <u>Caves</u> Ro	ad, Austin, T
2.	ANALYTICAL METHOD: Conti	inuous photoion	ization detect:	ion with a	11.70 eV lam
3.	TEMPERATURE: 22-25 °C				
4.	COLLECTION MEDIUM: N2				
5.	COLLECTION SYSTEM: N2	· · · · · ·			
	DIHER CONDITIONS: 1 inc				- 500-
7.	DEVIATIONS FROM ASTM F739	METHOD: Flow	rate was 100	cc/min.	
	ALIENTE CHEMICAL	1 :	COMPONENT 2	2	3
1.	CHEM NAME(s) : Tetrachic	oroethane :	N/A	;	N/A
2.	CAS NUMBER(s): 79-34-5	:	N/A	:;	N/A
	CONC. (IF MIX) N/A		N/A	:	N/A
4.	CHEMICAL SOURCE: Aldrich		N/A	;	N/A
	ST RESULTS				
_			·		
	DATE TESTED: 1-30-87 NUMBER OF SAMPLES TESTED:	One (Pup III)			
2.	NUMBER OF SAMPLES TESTED:				
2. 3.	NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2.5	inutes			
2. 3. 4.	NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2.5 MIN DETECTABLE LIMIT 2.9	ninutes 2 ppm			
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2.5 MIN DETECTABLE LIMIT 2.92 STEADY STATE PERMEATION RA	ninutes 2 ppm	cm*hr)		
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2.5 MIN DETECTABLE LIMIT 2.9	ninutes 2 ppm ATE 1049 (ug/	cm*hr)		
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2.5 m MIN DETECTABLE LIMIT 2.92 STEADY STATE PERMEATION RA SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A	ninutes 2 ppm ATE 1049 (ug/			
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2.5 m MIN DETECTABLE LIMIT 2.92 STEADY STATE PERMEATION RA SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A	ninutes 2 ppm ATE 1049 (ug/	cm*hr) CONCENTRATIO	ON : CC	ONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.92         STEADY STATE PERMEATION R         SAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :       CON	ninutes 2 ppm ATE 1049 (ug/		ON : CC :	ONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.92         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         1.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : :	ONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.97         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : : :	ONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.92         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : : : : :	ONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.92         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : : : : :	ONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.92         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : : : : : : :	ONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.97         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : : : : : : :	ONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.97         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : : : : : : : : : :	ONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.97         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : : : : : : : : : : : :	ONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.92         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :         10.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : : : : : : : : : :	ONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED:         BREAKTHROUGH TIME:       2.5 m         MIN DETECTABLE LIMIT       2.92         STEADY STATE PERMEATION RASAMPLE THICKNESS:       7 mils         SELECTED DATA POINTS       N/A         TIME       :         2.       :         3.       :         4.       :         5.       :         6.       :         7.       :         8.       :         9.       :	ninutes 2 ppm ATE 1049 (ug/		ON : CC : : : : : : : : :	ONCENTRATION

Sample was run by Denise McDonald on January 30, 1987.

<u>G</u>-55

# **Tetrachloroethane Run Ill**

wdd 28 •0 7 -÷ Chemical: Tetrachloroethane Run III Flow rate to cells: 100 Flow rate to Detector: 100 Recorder attn: 256 Detector temp: 60 GLOVE LINER, INDIVIDUAL 2 in/hr Chart speed: 2 Lamp: 11.7 Recorder attn: ; Input atts:

Switched from cells to standard gas

Tetrachioroethane charged into cells

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### DESCRIPTION OF PRODUCT EVALUATED 1. 1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: TEST WETHOD 2. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. CHALLENGE CHEMICAL : COMPONENT 2 3 1 2 : 2 N/A 1. CHEM NAME(s) : Tetrahydrofuran N/A : . 2. CAS NUMBER(s): 109-99-9 N/A N/A ..... 3. CONC. (IF MIX) N/AN/A N/A . 4. CHEMICAL SOURCE: Aldrich N/A : N/A 1 TEST RESULTS 4. 1. DATE TESTED: 1-30-87 2. NUMBER OF SAMPLES TESTED: One (Run I) 3. BREAKTHROUGH TIME: 2.5 minutes 4. MIN DETECTABLE LIMIT 8.04 ppm 5. STEADY STATE PERMEATION RATE 1655 (ug/cm2\*hr) 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : 2. : : : 3. : : 4. : : 2 5. : : : 6. ; : : 7. : : : 8. : : : · 9. : : 2 10. : : : 8. OTHER OBSERVATIONS:

5. SOURCE OF DATA

Sample was run by Denise McDonald on January 30, 1987.

## Tetrahydrofuran Run I

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:uaam-mdd 28'0 ù! -: • . . . · • • Ē ÷ Chemical: Tetrahydrofuran Run I Flow rate to cells: 100 Flow rate to Detector: 100 Recorder att: 512 Detector temp: 60 GLOVE LINER, INDIVIDUAL 2 1n/hr Lamp: <u>11.7</u> Recorder attn: Input attn: Chart speed: Chemical:

Switched from cells to standard gas

Tetrahydrofuran charged into cells

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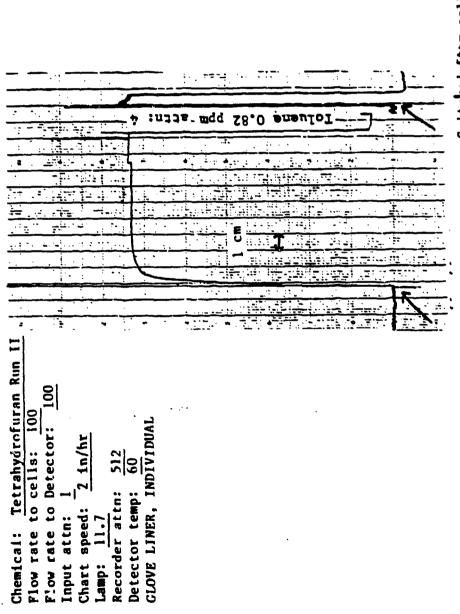
2:	TYPE: Teflon PROTECTIVE MATE	RIAL CODE: 044			
3:			visible imperfectio	ns	
4:	MANUFACTURER:				
5:		ICATION: Inner glo	ve sheet stock		
6:					
7:		SS: <u>7-9 mils</u>			
8:	DESCRIPTION:				
TE	ST METHOD				
1. 2.		ORY: Texas Research	Institute, 9063 Bee toionization detecti	Caves	Road, Austin,
3.	TEMPERATURE: 22		COIOMIZECIÓN dececci	UII WIC	
4.	COLLECTION MEDI				
5.					
6.	OTHER CONDITION	S: 1 inch cell wa	s used. /Detector Ter	peratu	re = 60C.
7.	JEVIATIONS FROM	ASTM F739 METHOD:	Flow rate was 100 c	c/min.	
CH	LLENGE CHEMICAL	1	: COMPONENT 2	:	3
ì	CHEM NAME (a)	Tetrahydrofuran	: N/A	•	N/A
	CAS NUMBER(s):			<u>;</u>	N/A N/A
	CONC. (IF MIX)				N/A
4.	CHEMICAL SOURCE				N/A
2. 3. 4.	BREAKTHROUGH TIM MIN DETECTABLE L	S TESTED: One (Run E: 2.5 minutes IMIT 9.57 ppm			
2. 3. 4. 5.	NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L	S TESTED: One (Run E: 2.5 minutes IMIT 9.57 ppm MEATION RATE 1905			
2. 3. 4. 5. 6.	NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER	S TESTED: One (Run E: 2.5 minutes IMIT 9.57 ppm MEATION RATE 1905 : 7 mils			
2. 3. 4. 5. 6.	NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS	S TESTED: One (Run E: 2.5 minutes IMIT 9.57 ppm MEATION RATE 1905 : 7 mils	(ug/cm <sup>2</sup> *hr)		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2.	S TESTED: One (Run E: 2.5 minutes IMIT 9.57 ppm MEATION RATE 1905 : 7 mils INTS N/A	(ug/cm <sup>2</sup> *hr)	DN :	CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3.	S TESTED: One (Run E: 2.5 minutes IMIT 9.57 ppm MEATION RATE 1905 : 7 mils INTS N/A	(ug/cm <sup>2</sup> *hr)	DN : : :	CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4.	S TESTED: <u>One (Run</u> E: <u>2.5 minutes</u> IMIT <u>9.57 ppm</u> MEATION RATE <u>1905</u> : <u>7 mils</u> INTS <u>N/A</u> : CONCENTRATIO : : :	(ug/cm <sup>2</sup> *hr)	DN : : : :	CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO TIME 1. 2. 3. 4. 5.	S TESTED: <u>One (Run</u> E: <u>2.5 minutes</u> IMIT <u>9.57 ppm</u> MEATION RATE <u>1905</u> : <u>7 mils</u> DINTS <u>N/A</u> : <u>CONCENTRATIO</u> : : :	(ug/cm <sup>2</sup> *hr)	DN :	CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLE         BREAKTHROUGH TIM         MIN DETECTABLE L         STEADY STATE PER         SAMPLE THICKNESS         SELECTED DATA PO         TIME         1.         2.         3.         4.         5.         6.	S TESTED: <u>One (Run</u> E: <u>2.5 minutes</u> IMIT <u>9.57 ppm</u> MEATION RATE <u>1905</u> : <u>7 mils</u> INTS <u>N/A</u> : <u>CONCENTRATIO</u> : : : :	(ug/cm <sup>2</sup> *hr)		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLE         BREAKTHROUGH TIM         MIN DETECTABLE L         STEADY STATE PER         SAMPLE THICKNESS         SELECTED DATA PO         TIME         1.         2.         3.         4.         5.         6.         7.	S TESTED: <u>One (Run</u> E: <u>2.5 minutes</u> IMIT <u>9.57 ppm</u> MEATION RATE <u>1905</u> : <u>7 mils</u> INTS <u>N/A</u> : <u>CONCENTRATIO</u> : : : : :	(ug/cm <sup>2</sup> *hr)		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLE         BREAKTHROUGH TIM         MIN DETECTABLE L         STEADY STATE PER         SAMPLE THICKNESS         SELECTED DATA PO         TIME         1.         2.         3.         4.         5.         6.         7.         8.	S TESTED: <u>One (Run</u> E: <u>2.5 minutes</u> IMIT <u>9.57 ppm</u> MEATION RATE <u>1905</u> : <u>7 mils</u> INTS <u>N/A</u> : <u>CONCENTRATIO</u> : : : :	(ug/cm <sup>2</sup> *hr)		CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAMPLE         BREAKTHROUGH TIM         MIN DETECTABLE L         STEADY STATE PER         SAMPLE THICKNESS         SELECTED DATA PO         TIME         1.         2.         3.         4.         5.         6.         7.	S TESTED: <u>One (Run</u> E: <u>2.5 minutes</u> IMIT <u>9.57 ppm</u> MEATION RATE <u>1905</u> : <u>7 mils</u> INTS <u>N/A</u> : CONCENTRATIO : : : : : : :	(ug/cm <sup>2</sup> *hr)		CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLE         BREAKTHROUGH TIM         MIN DETECTABLE L         STEADY STATE PER         SAMPLE THICKNESS         SELECTED DATA PO         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.	S TESTED: <u>One (Run</u> E: <u>2.5 minutes</u> IMIT <u>9.57 ppm</u> MEATION RATE <u>1905</u> : <u>7 mils</u> DINTS <u>N/A</u> : <u>CONCENTRATIO</u> : : : : : : : :	(ug/cm <sup>2</sup> *hr) (ug/cm <sup>2</sup> *hr) CONCENTRATION : : : : : : : : : : : : :		CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLE         BREAKTHROUGH TIM         MIN DETECTABLE L         STEADY STATE PER         SAMPLE THICKNESS         SELECTED DATA PO         TIME         1.         2.         3.         4.         5.         6.         7.         8.         9.         10.	S TESTED: <u>One (Run</u> E: <u>2.5 minutes</u> IMIT <u>9.57 ppm</u> MEATION RATE <u>1905</u> : <u>7 mils</u> INTS <u>N/A</u> : CONCENTRATIO : : : : : : : :	(ug/cm <sup>2</sup> *hr) (ug/cm <sup>2</sup> *hr) CONCENTRATION : : : : : : : : : : : : :		CONCENTRATION

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والمحمد مند فخذ فالرغان المطالبة الاكتراري

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## Tetrahydrofuran Run II



Switched from cells to standard gas

Tet-shydrofuran charged into celle

### CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD

2. ANALYTICAL METHOD:       Continuou         3. TEMPERATURE:       22-25 °C         4. COLLECTION MEDIUM:       N2         5. COLLECTION SYSTEM:       N2         6. OTHER CONDITIONS:       1 inch ce         7. DEVIATIONS FROM ASTM F739 HED         CHALLENCE CHEMICAL       1         1. CHEM NAME(s):       Tetrahydrofun	ed, no visible imperfections er glove sheet stock A search Institute, 9063 Bee Caves Road, Austin, Ty us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C.
3: CONDITION BEFORE TEST: Unuse 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inne 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: TEST METHOD 1. TESTING LABORATORY: Texas Res 2. ANALYTICAL METHOD: Continuou 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch ce 7. DEVIATIONS FROM ASIM F739 MED CHALLENCE CHEMICAL 1 1. CHEM NAME(s) : Tetrahydrofuu	ed, no visible imperfections er glove sheet stock A search Institute, 9063 Bee Caves Road, Austin, T us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.
4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inne 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: TEST METHOD 1. TESTING LABORATORY: Texas Res 2. ANALYTICAL METHOD: Continuou 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch ce 7. DEVIATIONS FROM ASIM F739 MEDI CHALLENCE CHEMICAL 1 1. CHEM NAME(s): Tetrahydrofuu	er glove sheet stock A search Institute, 9063 Bee Caves Road, Austin, The us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.
5: PRODUCT IDENTIFICATION: Inne 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: TEST METHOD 1. TESTING LABORATORY: Texas Res 2. ANALYTICAL METHOD: Continuou 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch ce 7. DEVIATIONS FROM ASIM F739 MEDI CHALLENCE CHEMICAL 1 1. CHEM NAME(s) : Tetrahydrofuu	er glove sheet stock A search Institute, 9063 Bee Caves Road, Austin, T us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.
6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: TEST METHOD 1. TESTING LABORATORY: Texas Res 2. ANALYTICAL METHOD: Continuou 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 6. OTHER CONDITIONS: 1 inch ce 7. DEVIATIONS FROM ASIM F739 MEDIUM CHALLENCE CHEMICAL 1 1. CHEM NAME(s) : Tetrahydrofun	A search Institute, 9063 Bee Caves Road, Austin, T) us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.
7: NOMINAL THICKNESS: 7-9 mils 8: DESCRIPTION: TEST METHOD 1. TESTING LABORATORY: Texas Res 2. ANALYTICAL METHOD: Continuou 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 6. OTHER CONDITIONS: 1 inch ce 7. DEVIATIONS FROM ASIM F739 MED CHALLENCE CHEMICAL 1 1. CHEM NAME(s) : Tetrahydrofuu	<pre>search Institute, 9063 Bee Caves Road, Austin, T) us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.</pre>
8: DESCRIPTION: TEST METHOD 1. TESTING LABORATORY: Texas Res 2. ANALYTICAL METHOD: Continuou 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch ce 7. DEVIATIONS FROM ASTM F739 MED CHALLENCE CHEMICAL 1 1. CHEM NAME(s) : Tetrahydrofuu	<pre>search Institute, 9063 Bee Caves Road, Austin, T) us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.</pre>
TEST METHOD 1. TESTING LABORATORY: Texas Res 2. ANALYTICAL METHOD: Continuou 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch ce 7. DEVIATIONS FROM ASTM F739 MED CHALLENCE CHEMICAL 1 1. CHEM NAME(s): Tetrahydrofuu	us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.
<ol> <li>TESTING LABORATORY: Texas Res</li> <li>ANALYTICAL METHOD: Continuou</li> <li>TEMPERATURE: 22-25°C</li> <li>COLLECTION MEDIUM: N2</li> <li>COLLECTION SYSTEM: N2</li> <li>OTHER CONDITIONS: 1 inch ce</li> <li>DEVIATIONS FROM ASIM F739 MEDICE</li> <li>CHALLENCE CHEMICAL 1</li> <li>CHEM NAME(s): Tetrahydrofuu</li> </ol>	us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.
2. ANALYTICAL METHOD:       Continuou         3. TEMPERATURE:       22-25 °C         4. COLLECTION MEDIUM:       N2         5. COLLECTION SYSTEM:       N2         6. OTHER CONDITIONS:       1 inch ce         7. DEVIATIONS FROM ASTM F739 HED         CHALLENCE CHEMICAL       1         1. CHEM NAME(s):       Tetrahydrofun	us photoionization detection with a 11.70 eV lamp ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.
3. TEMPERATURE: 22-25 °C         4. COLLECTION MEDIUM: N2         5. COLLECTION SYSTEM: N2         6. OTHER CONDITIONS: 1 inch ce         7. DEVIATIONS FROM ASIM F739 MED         CHALLENCE CHEMICAL         1. CHEM NAME(s) : Tetrahydrofun	ell was used./Detector Temperature = 60C. THOD: Flow rate was 100 cc/min.
4. COLLECTION MEDIUM: N2         5. COLLECTION SYSTEM: N2         6. OTHER CONDITIONS: 1 inch ce         7. DEVIATIONS FROM ASIM F739 MED         CHALLENCE CHEMICAL         1. CHEM NAME(s) : Tetrahydrofun	THOD: Flow rate was 100 cc/min.
5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch ce 7. DEVIATIONS FROM ASIM F739 MED CHALLENCE CHEMICAL 1 1. CHEM NAME(s) : Tetrahydrofur	THOD: Flow rate was 100 cc/min.
<ul> <li>6. OTHER CONDITIONS: <u>1 inch ce</u></li> <li>7. DEVIATIONS FROM ASIM F739 MEI</li> <li>CRALLENCE CHEMICAL 1</li> <li>1. CHEM NAME(s) : Tetrahydrofur</li> </ul>	THOD: Flow rate was 100 cc/min.
7. DEVIATIONS FROM ASTM F739 HEI CHALLENGE CHEMICAL 1 1. CHEM NAME(s) : Tetrahydrofur	THOD: Flow rate was 100 cc/min.
CHALLENCE CHEMICAL 1 1. CHEM NAME(s) : Tetrahydrofur	
1. CHEM NAME(s) : Tetrahydrofur	: COMPONENT 2 : 3
1. CHEM NAME(s) : Tetrahydrofu	•
	ran : N/A : N/A
2. CAS NUMBER(s): 109-99-9	: N/A : N/A
2. CAS NUMBER(s): 109-99-9 3. CONC. (IF MIX) N/A	N/A : N/A
4. CHEMICAL SOURCE: Aldrich	: N/A : N/A
2. NUMBER OF SAMPLES TESTED: One 3. BREAKTHROUGH TIME: 2.5 minut 4. MIN DETECTABLE LIMIT 8.99 ppr 5. STEADY STATE PERMEATION RATE	tes
6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A	
TIME : CONCENT 1. :	TRATION : CONCENTRATION : CONCENTRATION
2:	· · · · · · · · · · · · · · · · · · ·
3:	· · · ·
4. :	: :
5:	
6:	;
7:	:
8:	· · · · · · · · · · · · · · · · · · ·
9:	;
10	: .
· · · · · · · · · · · · · · · · · · ·	
8. OTHER OBSERVATIONS:	
8. OTHER OBSERVATIONS:	
8. OTHER OBSERVATIONS: SOURCE OF DATA	McDonald on February 2, 1987.

## Chemical Resistance Testing of Glove Liner

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## Tetrahydrofuran Run 🕅

Toluene 0.82 ppm attn: 4
E
Tetrahydrofuran Run o cells: 100 o betector: 100 l: 2 in/hr itn: 512 mp: 60 t, INDIVIDUAL
au 100
VI
Ils: <u>1n/hr</u> <u>512</u> <u>512</u> <u>512</u> <u>512</u>
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Chemical: Tetrahydrofu Flow rate to cells: 10 Flow rate to Detector: Input attn: 1 Chart speed: 2 in/hr Lamp: 11.7 Recorder attn: 512 Detector temp: 60 GLOVE LINER, INDIVIDUAL
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0 F F H O J & C O

Switched from cells to standard gas

Tetrahydrofuran charged ito cella

EXAMPLE AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A CALCULAR AND A

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### CREMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECOLD

### 1. DESCRIPTION OF PRODUCT EVALUATED

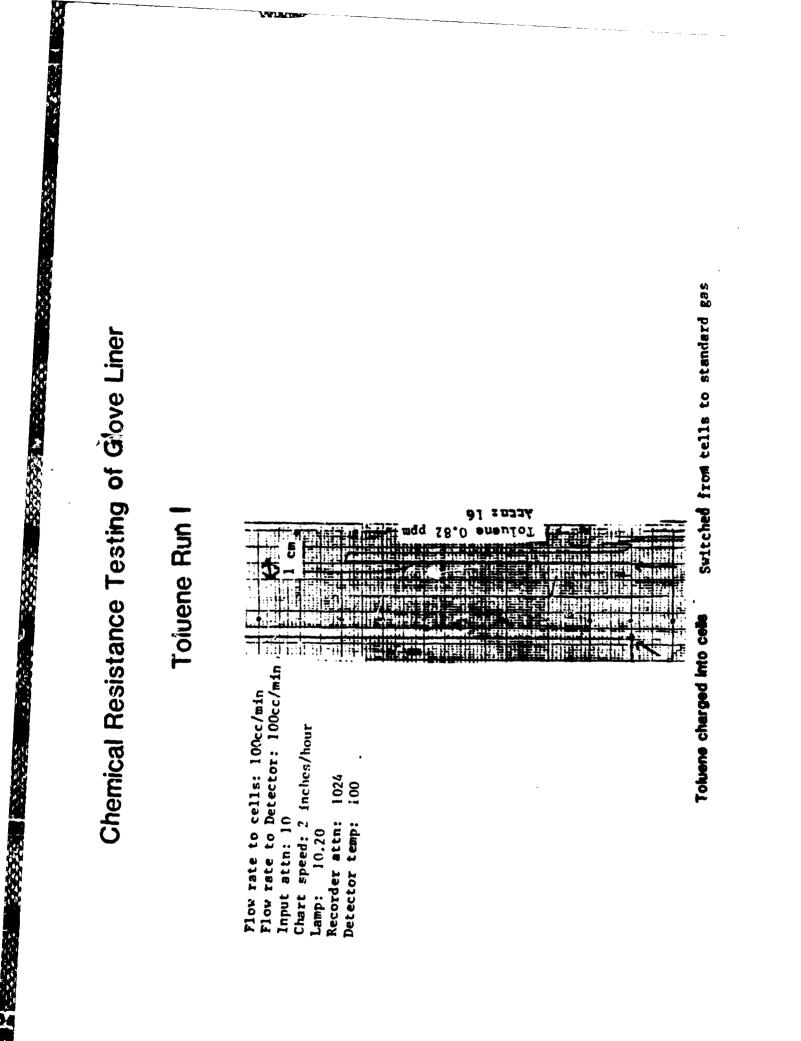
2.

3.

2:				
3:		visible imperfecti	ons	
4:	MANUFACTURER: Chemfab Corp.			
5:		sheet stock		
6:	· · · · · · · · · · · · · · · · · · ·			
7:				
8:	DESCRIPTION:			
TE	ST METHOD			
1.		Institut:, 7063 Be	e Caves I	Road, Austin, T
	ANALYTICAL METHOD: Continuous phot	oionization detect	ion with	a 10.20 eV lam
	TEMPERATURE: 22-25°C			
	COLLECTION MEDIUM: N2			
	COLLECTION SYSTEM: N2			
	OTHER CONDITIONS: 1 inch cell was			re = 100C.
7.	DEVIATIONS FROM ASTM F739 METHOD:	Flow rate was 100	cc/min.	
CHI	ALLENGE CHEMICAL 1	: COMPONENT 2	:	3
1.	CHEM KAME(s) : Toluene	. N/A	:	N/A
2.	CAS NUMBER(s): 108-88-3	: N/A		N/A
з.	CONC. (IF MIX) N/A	: N/A		N/A
4.	CHEMICAL SOURCE: Mallinckrodt	: N/A		N/A
4. 5.	BREAKTHROUGH TIME: 2.50 minutes MIN DETECTABLE LIMIT .39 ppm STEADY STATE PERMEATION RATE Not me	asureable		
6.	SAMPLE THICKNESS: 7 mils			
7.	SFLECTED DATA POINTS N/A			
	TIME : CONCENTRATION	: CONCENTRATI	ION :	CONCENTRATION
	1. :	:	:	
	2. :	\$	:	
	3:	;		
	4:	:	:	
	5;	:	:	
	6. :	:	:	
	7:		:	
	8:	:	:	
	9:	:	<u> </u>	
	10:	:	:	
8.	OTHER OBSERVATIONS: Toluene broke th	rough at a rate en	xceeding	the limits of t
	detection systems. The steady st	ate permeation rat	LE WAS ST	eater than 500
	ug/cm <sup>2</sup> /hr.			
	URCE OF DATA Sample was run by Denise McDona			

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### CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD

### DESCRIPTION OF PRODUCT EVALUATED

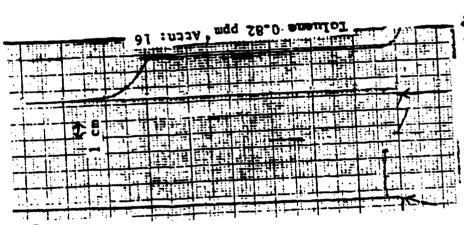
.

: TYPE: Teflon			
: PROTECTIVE MATERIAL CODE: 044			
	isible imperfect	ions	
	sheet stock		مراجع المحمد والمراجع المتعاد والمحمد والمحمد
		·	المنبية التراكما بعواد وعلماني والبنديون بورجيه
: DESCRIPTION:			
EST METHOD			
	ionization detec	tion with a	10.20 eV lamp
OTUTE CONDITIONS: N2	word / Decharge	T	- 1000
DEVIATIONS FROM ASTA F739 METHOD: F	low rate was 100	cc/min.	. = 1000.
HALLENGE CHEMICAL	: COMPONENT 2		3
	:	:	N / A
			<u> </u>
CAS NURIBLER(S): 105-88-3			N/A
			<u> </u>
. CHEMICAL SOURCE: Mailinckrodt	: <u>N/A</u>		<u>N/N</u>
• NUMBER OF SAMPLES TESTED: One (Run 1 • BREAKTHROUGH TIME: 2.50 minutes • MIN DETECTABLE LIMIT .44 ppm			
	sureable		
		·····	
. SELECTED DATA POINTS N/A			
TIME : CONCENTRATION	: CONCENTRAT	10N : C	DNCENTRATION
3	:	:	
4. :	:	:	
5	:	:	
6:	•	:	
	:	:	
		:	
	:	:	
10:	:	:	
detection systems. The steady sta	rough at a rate enter the permeation ra	exceeding t	he limits of the ater than 500
ug/cm <sup>2</sup> /hr.			
ug/cm <sup>2</sup> /hr.			
ug/cm <sup>2</sup> /hr. OURCE OF DATA Sample was run by Denise McDona	ld on January 15.	, 1987.	
	CONDITION BEFORE TEST: Unused, no v MANUTACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Inner Elove LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 7-9 mils DESCRIPTION: TESTING LABORATORY: Texas Research I ANAL THICAL METHOD: Continuous photo TENPERATURE: 22-25°C COLLECTION MEDIUM: N <sub>2</sub> COLLECTION MEDIUM: N <sub>2</sub> COLLECTION SYSTEM: N <sub>2</sub> OTHER CONDITIONS: 1 inch cell was DEVIATIONS FROM ASTM: F739 METHOD: F HALLENGE CHEMICAL 1 DIFM NAME(s): Tolene CAS NUMBER(s): 108-88-3 CONC. (IF MIX) N/A CHEMICAL SOURCE: Mallinckrodt CST RESULTS DATE TESTED: 1-15-87 NUMBER OF SAMPLES TESTED: One (Run I BREAKTHROUGH TIME: 2.50 minutes MIN DETECTABLE LIMIT .44 ppm STEADY STATE PERMEATION RATE Not mes SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. 2. 3. 4. 5. 6. 1. 10. 10. 10. 10. 11. 10. 11. 10. 11. 11	CONDITION BEFORE TEST: Unused. no visible imperfect MANUTACTURER: Chemish Corp. PRODUCT IDENTIFICATION: Inner glove sheet stock IDT OR MANUFACTUREN DATE: N/A NOMINAL THICNNESS: 7-9 mile DESCRIPTION: TESTING LABORATORY: Texas Research Institute, 2063 B ANALYTICAL METHOD: Continuous photoionization detec TE:PERATURE: 22-25°C COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 COTHER CONDITIONS: I inch cell was used./ Detector DEVIATIONS FROM AST: F739 METHOD: Flow rate was 100 MALLENGE CHEMICAL 1 : COMPONENT 2 : MA CAS KUMBER(s): TO':ene : N/A CONC. (IF MIX) N/A CONC. (IF MIX) N/A CONC. (IF MIX) N/A CONC. (IF MIX) N/A CHEMICAL SUGNCE: Mallinckrodt : N/A CONC. (IF MIX) N/A CHEMICAL SUGNCE: Mallinckrodt : N/A CONC. (IF MIX) N/A ST RESULTS DATE TESTED: 1-15-87 NUMBER OF SAMPLES TESTED: One (Run 11) BREAKTHROUGH TIME: 2.50 minutes MIN DETECTABLE LIMIT .44 ppm STEADY STATE PERMEATION RATE NOT measureable SAMPLE THICKNESS: 7 mile SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION 1	CONDITION BEFORE TEST: Unused, no visible imperfections MANUTACTURER: Chemist Corp. TRODUCT IDENTIFICATION: Inner flows sheet stock 107 OR MANUFACTUREN DATE: K/A NOMINAL THICHNESS: 7-9 mile DESCRIPTION: TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Re ANALYTICAL METHOD: Continuous photoionization distection with a TENTERATURE: 22-25°C COLLECTION MEDIUM: N2 COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 COLLECTION SYSTEM: N2 CONTINUOUS I Inch cell was used./ Detector Temperature DEVIATIONS FROM ASTM: F739 METHOD: Flow tate was 100 cc/min. MALENCE CHEMICAL 1 : COMPONENT 2 : CAS KUMBER(s): TO::ene : N/A : CONC. (IF MIX) N/A CONC. (IF MIX) N/A CONC. (IF MIX) N/A CONC. (IF MIX) N/A CONC IIINT : 44 ppm STEADY STATE PERMENTION RATE Not measureable SAMPLE THICKNESS: 7 mile SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATIO

## Chemical Resistance Testing of Glove Liner

### **Toluene Run II**

Flow rate to cells: 100cc/min Flow rate to Detector: 100cc/min Input attn: 10 Chart speed: 2 inches/hour Lamp: 10.20 Recorder attn: 1024 Detector temp: 100



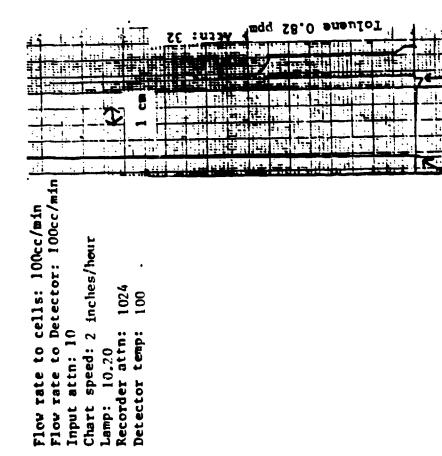


1: TYFL: Teflon 2: FRUTECTIVE NATENIAL CODE: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MA:UFACTURER: Chemfab Corp. 5: FRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOWTHAL THICKNESS: 7-9 mlls 8: DESCRIPTION: 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves R 2. ANALYI CAL METHOD: Continuous photoionization detection with 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEN: N2 6. OTHER CONDITIONS: 1 Inch cell was used./ Detector Temperatur 7. DEVIATIONS FROM: ASTN F739 METHOD: Flow Tate was 100 cc/min. 3. CHNIENCE CHEMICAL 1 : COMPONENT 2 : 1. CHEM KAME(s): Toluene : N/A : 2. CAS NONSER(s): 100-88-3 : N/A : 3. CONC. (IF MIX) N/A 4. TEST RESULTS 1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Run T11) 3. BRAKTHROUGH TIME: 2.50 minutes 4. MIN DETECTABLE LIMIT '.47 ppm 5. STEADY STATE PERMEATION RATE NOT measureable 5. STEADY STATE PERMEATION RATE NOT measureable 5. STEADY STATE PERMEATION RATE NOT measureable 5. SILECTED DATA POINTS N/A 1	a 10.20 eV
2: PROTECTIVE MATERIAL COD: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUTACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MAUTACTURER DATE: N/A 7: NOVT NAL THICKNESS: 7-9 mils 8: DESCRIPTION: 2. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves R 2. ANALYICAL METHOD: Continuous photoionization detection with 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperatur 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 3. CHALTERGE CHEMICAL 1 : COMPONENT 2 : 1. CHEMISTICAL SOURCE: Nollinchard : N/A 4. CHEMICAL SOURCE: Nollinchard : N/A 4. CHEMICAL SOURCE: Nollinchard : N/A 4. TEST RESULTS 1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Run 111) 3. BREANTHROUGH TIME: 2.50 minutes 4. MIN DETECTALL I. N/A 5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNES: 7 mils 7. SELECTED DATA POINTS N/A 5. CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CO	a 10.20 eV e = 100C. 
4: NANUTACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MARUFACTURER DATE: N/A 7: NONTINAL THICHNESS: 7-9 mils 8: DESCRIPTION: 2. TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves R 2. ANALYTICAL METHOD: Continuous photoionization detection with 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperatur 7. DEVIATIONS FROM ASTN F739 METHOD: Flow rate was 100 cc/min. 3. CENLERGE CHEMICAL 1 : COMPONENT 2 : 1. CHEMS NAME(s): Toluene : N/A : 2. CAS WINBER(s): 106-88-3 :: N/A : 3. CONC. (IF MIX) N/A :: N/A : 4. CHEMICAL GOURCE: Mellinckrodt :: N/A : 4. TEST RESULTS 1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Rum 111) 3. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS 7 mils 7. SELECTED DATA POINTS N/A : 3. CONCENTRATION RATE NOT measureable 6. SAMPLE THICKNESS 7 mils 7. SELECTED DATA POINTS N/A : 3. CONCENTRATION : CONCENTRATION : CONCENTRATION : 0 1. : : : : : : : : : : : : : : : : : : :	a 10.20 eV e = 100C. 
5:       PRODUCT IDENTIFICATION: Inner glove sheet stock         6:       LOT OR MANUFACTURER DATE: N/A         7:       NO'T NAL THICKNESS: 7-9 mils         8:       DESCRIPTION:         2.       TEST METHOD         1.       TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves R         2.       ANALYTICAL METHOD: Continuous photoionization detection with         3.       TEMPERATURE: 22-25°C         4.       COLLECTION MEDIUM: N2         5.       COLLECTION MEDIUM: N2         6.       OTHER CONDITIONS: 1 inch cell was used./ Detector Temperatur         7.       DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min.         3.       CRALLERCE CHEWICAL       1         1.       COMPONENT 2       :         2.       CAS KDMMEK(a): Toluene       :       N/A         3.       CORC. (IF MIX) N/A       :       N/A         4.       CHEMICAL SOURCE: Nallinckrodt       :       N/A         4.       TEST RESULTS       :       N/A         1.       DATE TESTED: 1-15-87       :       :         2.       .       :       :       :         3.       SELECTED DATA POINTS N/A       :       :       :         3.<	a 10.20 eV e = 100C. 
6: LOT ON MANUFACTURER DATE: N/A 7: NONTNAL THICKNESS: 7-9 mile 8: DESCRIPTION: 4: TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves R 2. ANALYTICAL NETHOD: Continuous photoionization detection with 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEN: N2 6. OTHER CONDITIONS: I finch cell was used./ Detector Temperature 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 3. CHEMICAL 600 (FMIC) 106-88-3 : N/A : 1. CHEMICAL 600 (FMIC) 106-88-3 : N/A : 2. CAS KDATEK(s): 106-88-3 : N/A : 3. CONC. (IF MIX) N/A : N/A : 4. TEST RESULTS 1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Run 111) 3. STEADY STATE PERMEATION RATE NOT measureable 6. SAMPLE THICKNESS : 7 mile 7. SELECTED DATA POINTS N/A : 3. CONCENTRATION : CONCENTRATION : CONCENTRATION : 0 1	a 10.20 eV e = 100C. 
7:       NOYTNAL THICKNESS:       7-9 mile         8:       DESCRIPTION:         2.       TEST METHOD         1.       TESTING LABORATORY:       Texas Research Institute, 9063 Bee Caves R         2.       ANALYTICAL METHOD:       Continuous photoionisation detection with         3.       TEMPERATURE: 22-25°C       4.         4.       COLLECTION MEDIUM:       N2         5.       COLLECTION SYSTEM:       N2         6.       OTHER CONDITIONS:       1 inch cell was used./ Detector Temperatur         7.       DEVIATIONS FROM ASTM F739 METHOD:       Flow rate was 100 cc/min.         3.       CRALLERGE CHEMICAL       1 :       1 :         4.       OTHEM CONDITIONS:       Toluene       :       N/A :         2.       CAS NOMBER(e):       106-88-3       :       N/A :         3.       CONC. (IF MIX) N/A       :       N/A :       :         4.       TEST RESULTS       1.       DATE TESTED:       1-15-87         2.       NUMBER OF SAMPLES TESTED: One (Run 111)       3.       BREAKTHROUGH TIME: 2.50 minutes         4.       MIN DETECTABLE LIMIT -47 ppm       5.       SELECTED DATA POINTS N/A         5.       TIME :       CONCENTRATION :       CONCENTRATION	a 10.20 eV e = 100C. 
8: DESCRIPTION:	a 10.20 eV e = 100C. 
<pre>1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves R 2. ANALYTICAL METHOD: Continuous photoionization detection with 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperatur 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 3. CENLLENGE CHEMICAL 1 : COMPONENT 2 : 1. CHEMS KAME(s): Toluene : N/A : 2. CAS KOMBER(s): Toluene : N/A : 3. CONC. (IF MIX) N/A 3. CHEMICAL 60URCE: Mallinckrodt : N/A : 4. TEST RESULTS 1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Run 111) 3. BREAKTHROUGH TIME: 2.50 minutes 4. MIN DETECTABLE LIMIT _47 ppm 5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS 7 mils 7. SELECTED DATA POINTS _N/A 1</pre>	a 10.20 eV e = 100C. 
2. ANALYTICAL METHOD: Continuous photoionization detection with 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperatur 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 3. CHALLENCE CHEMICAL 1 : COMPONENT 2 : 1. CHEM KAME(s): Toluene : N/A : 2. CAS KUNBER(s): Toluene : N/A : 3. CONC. (IF MIX) N/A : N/A : 4. CHEMICAL SOURCE: Mellinckrodt : N/A : 4. TEST RESULTS 1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Run 111) 3. BREAKTHROUGH TIME: 2.50 minutes 4. MIN DETECTABLE LIMIT .47 ppm 5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A 1	a 10.20 eV e = 100C. 
2. ANALYTICAL METHOD: Continuous photoionization detection with 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperatur 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 3. CHALLENCE CHEMICAL 1 : COMPONENT 2 : 1. CHEM KAME(s): Toluene : N/A : 2. CAS KUNBER(s): Toluene : N/A : 3. CONC. (IF MIX) N/A : N/A : 4. CHEMICAL SOURCE: Mellinckrodt : N/A : 4. TEST RESULTS 1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Run 111) 3. BREAKTHROUGH TIME: 2.50 minutes 4. MIN DETECTABLE LIMIT .47 ppm 5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A 1	a 10.20 eV e = 100C. 
4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperatur 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 3. CRALLENCE CHEMICAL 1 : COMPONENT 2 : 1. CHEM NAME(s): Toluene : N/A : 2. CAS NUMBER(s): 106-86-3 : N/A : 3. CONC. (IF MIX) N/A : N/A : 4. CHEMICAL GOURCE: NellInckrodt : N/A : 4. TEST RESULTS 1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Run 111) 3. BREAKTHROUGH TIME: 2.50 minutes 4. MIN DETECTABLE LIMIT .47 ppm 5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONC	3 <u>N/A</u> N/A N/A
5. COLLECTION SYSTEM:       N2         6. OTHER CONDITIONS:       1 inch cell was used./ Detector Temperatur         7. DEVIATIONS FROM ASTM F739 METHOD:       Flow rate was 100 cc/min.         3. CHALLERGE CHEMICAL       1       : COMPONENT 2 :         1. CHEM NAME(s):       Toluene       : N/A :         2. CAS KUMBER(s):       1008-88-3       : N/A :         3. CONC. (IF MIX)       N/A       : N/A :         4. CHEMICAL & OURCE:       NA       : N/A :         4. CHEMICAL & OURCE:       NA       : N/A :         4. TEST RESULTS       1       DATE TESTED:       One (Run 111)         3. BREAKTHROUGH TIME:       2.50 minutes       .         4. MIN DETECTABLE LIMIT       .47 ppm         5. STEADY STATE PERIEATION RATE Not measureable       .         6. SAMPLE THICKNESS: 7 mils       .         7. SELECTED DATA POINTS       N/A         1	3 <u>N/A</u> N/A N/A
6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperatur 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min. 3. CHALLENCE CHEMICAL 1 : COMPONENT 2 : 1. CHEM RAME(s) : Toluene : N/A : 2. CAS KONBER(s): 106-88-3 : N/A : 3. CONC. (IF MIX) N/A : N/A : 4. CHEMICAL GOURCE: Nellinckrodt : N/A : 4. TEST RESULTS 1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Run 111) 3. BREAKTHROUGH TIME: 2.50 minutes 4. MIN DETECTABLE LIMIT .47 ppm 5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENTRATION : CONCENT	3 <u>N/A</u> N/A N/A
7. DEVIATIONS FROM ASTM F739 METHOD:       Flow rate was 100 cc/min.         3. CHALLENCE CHEMICAL       1       : COMPONENT 2         1. CHEM RAME(s):       Toluene       :         1. CHEM RAME(s):       106-88-3       :         2. CAS KONDER(s):       106-88-3       :         3. CONC. (IF MIX)       N/A       :         4. CHEMICAL GOURCE:       106-88-3       :         4. TEST RESULTS       106-88-3       :         1. DATE TESTED:       1-15-87         2. NUMBER OF SAMPLES TESTED:       One (Run III)         3. BREAKTHROUGH TIME:       2.50 minutes         4. MIN DETECTABLE LIMIT       .47 ppm         5. STEADY STATE PERMEATION RATE Not measureable         6. SAMPLE THICKNESS: 7 mils         7. SELECTED DATA POINTS       N/A         1	3 <u>N/A</u> N/A N/A
3. CHALLENGE CHEMICAL       1       : COMPONENT 2       :         1. CHEM NAME(s): Toluene       :       N/A       :       :         2. CAS NUMBER(s): 108-88-3       :       N/A       :       :         3. CONC. (IF MIX)       N/A       :       N/A       :       :         4. CHEMICAL & GOURCE: Nallinckrodt       :       N/A       :       :       :         4. TEST RESULTS       1       DATE TESTED: 1-15-87       :       N/A       :       :         1. DATE TESTED: 1-15-87       :       One (Run 111)       :       :       :       :         3. BREAKTHROUGH TIME: 2.50 minutes       .       .       .       :       :       :         4. TEST RESULTS       .       .       .       .       .       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :	<u>N/A</u> <u>N/A</u> N/A
1. CHEM NAME(s): Toluene       :       N/A         2. CAS NUMBER(s): 106-86-3       :       N/A         3. CONC. (IF MIX)       N/A       :       N/A         4. CHEMICAL GOURCE: Nellinckrodt       :       N/A       :         4. TEST RESULTS         1. DATE TESTED:       1-15-87         2. NUMBER OF SAMPLES TESTED:       One (Run 111)         3. BREAKTHROUGH TIME:       2.50 minutes         4. MIN DETECTABLE LIMIT       .47 ppm         5. STEADY STATE PERMEATION RATE Not measureable         6. SAMPLE THICKNESS:       7 mils         7. SELECTED DATA POINTS       N/A         1	<u>N/A</u> <u>N/A</u> N/A
2. CAS KUNBER(s): 106-86-3       :       N/A         3. CONC. (IF MIX) N/A       :       N/A         4. CHEMICAL SOURCE: Nellinckrodt       :       N/A         4. TEST RESULTS         1. DATE TESTED: 1-15-87         2. NUMBER OF SAMPLES TESTED: One (Run III)         3. BREAKTHROUGH TIME: 2.50 minutes         4. MIN DETECTABLE LIMIT .47 ppm         5. STEADY STATE PERMEATION RATE Not measureable         6. SAMPLE THICKNESS: 7 mils         7. SELECTED DATA POINTS N/A         TIME : CONCENTRATION : CONCENTRATION : (         1	N/A N/A
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4. CHEMICAL SOURCE: Nellinckrodt       :       N/A         4. TEST RESULTS         1. DATE TESTED:       1-15-87         2. NUMBER OF SAMPLES TESTED:       One (Run III)         3. BREAKTHROUGH TIME:       2.50 minutes         4. MIN DETECTABLE LIMIT       .47 ppm         5. STEADY STATE PERMEATION RATE Not measureable         6. SAMPLE THICKNESS:       7 mils         7. SELECTED DATA POINTS       N/A         1.       :       :         2.       :       :         3.       :       :         4.       :       :         5.       :       :         6.       :       :         7.       :       :         8.       :       :         9.       :       :	
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4.       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       :       : <td:< td=""> <td:< td=""> <td:< td=""></td:<></td:<></td:<>	
5.     1     1       6.     1     1       7.     1     1       8.     1     1       9.     1     1	
6. : : : : : 7. : : : : : : 8. : : : : : : : : 9. : : : : : :	·
7.     :     :     :       8.     :     :     :       9.     :     :     :	
8. <u>: : :</u> 9. <u>:</u> : : :	
9. : : :	
8. OTHER OBSERVATIONS: Toluene broke through at a rate exceeding	
detection systems. The steady state permeation rate was greated	eater than
ug/cm <sup>2</sup> /hr.	
5. SOURCE OF DATA	
Sample was run by Denise McDonald on January 15, 1987.	

G-6

## Chemical Resistance Testing of Glove Liner

### Toluene Run IN



Switched from cells to standard gas Towena charged into cella

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APPENDIX H

PENETRATION TEST DATA FOR SEAM AND CLOSURE SAMPLES

(Contract Report by Anderson Associates)

### Penetration and Degradation Tests of Selected Samples

Final Report August 1986

Anderson Associates

### Penetration and Degradation Tests of Selected Samples

### R. Objectives

This was a two-part study. One part was to conduct tests for the resistance of Challenge 5100 seams, neoprene zippers, and Teflon glove material to penetration by five chemicals; the second part was to evaluate butyl aubber gloves for resistance to degradation by fitteen chemicals.

### P. Approach

The approach used in the penetration test was the ASTM Standard Test Method for Resistance of Protective Clothina Materials to Penetration by Liquids (Designation: F903-84)(Appendix i); and that for degradation was Test Method for Evaluating Protective Clothina Materials For Resistance to Degradation by Liquid Chemicals (Designation: NIOGH 200-84-2702 Deg(Revision 4))(Appendix ii). Penetration is defined in the method as the flow of a chemical through closures, porous materials, seams and pinholes, or other imperfections in a protective clothing material on a nonmolecular level. Degradation is defined as a deleterious change in one or more physical properties of a protective clothing material due to contact with a chemical.

### II. Penetration Tests

Four materials were tested:

- 1. Challenge 5100/ Challenge 5100 Seam
- 2. Challenge 5100/ 10 mil FEP Seam
- 3. 6" Talon zipper on neoprene
- 4. Tellon imergiove (4 mil)

Each material was studied for penetration by five chemicals: water, hexane, toluene, methyl ethyl ketone, and hydrochloric acid. The method was essentially that described in the Standard except that expandable Teflon tape was used in place of the nubber cell-gasket for samples like seams that varied in thickness. It was also necessary to tighten the nuts that hold the cell together to about 15 lbs with a torque wrench. To minimize the amount of liquid leaking, the cell was filled only to cover the test material when it was in the horizontial position and the air pressure was reduced to 1 psig (in accordance with latest draft version of the method).

Final printing and photographs used in this report were prepared by the U.S. Coast Guard Research and Development Center, Avery Point, Groton, CT 05340-6096

Figure 1(a) shows the standard penetration cell. It was necessary to use a different cell for testing the zippers (Figures 1(b) and 1(c)). The cell was designed by MSTC Walke and constructed at the U.S. Coast Guard Research and **Development Center's** machine shop. The upper chamber was designed to accomodate the heavy zipper and permit liquid to cover it under pressure (Figure 2). This cell required a great deal of care to seal property and needs modifications.

Each zipper was tested for leaks with water before any other chemical was tested.

All samples were measures using the same micrometer and thickness was recorded as an averaged value of five readings.

None of the tests required using a dye for visibility.

### IV. Degradation Tests

Butyl rubber gloves from North Hand Protection, a division of Siebe North, Inc., were evaluated for resistance to degradation by:

### Acetone Acetonitrile Carbon Disulfide

Dichloromethane Dimethyl formamide Ethyl Acetate n-Hexane Methanol Nitrobenzene 50% Sodium Hydroxide Concentrated Sulturic Acid Tetrachloroethylene Tetrachloroethylene Tetrachloroethylene

The method was that described in the Standard Method with no modifications. (The method was awkwardly written and required study to insure it was interpreted as its author intended.) The standard degradation test apparatus is shown in Figure 3. Figure 4 shows the setup used to measure elongation.

### V. Recommendations

### Zipper Test Cell

The zipper test cell should be revamped. First, the gap between the plexiglass and the frame of the cell is a potential hazard; the plexiclass should be fastened to the frame with more than four screws. Second, the opening in the plate for the zipper seems to be too large; the neoprene does not get good support. This may be one source of leakage. Third, the cell material should be changed. Not only did the acid attack the cell but also components of the cell had rusted from the water. Finally the cell is too heavy and cumbersome to handle safely. A lighter weight material in a more comp design should be used. A new support that would fit more easily in the hood would allow more work to be done in the hood adjacent to the test.

### **Elongation Test**

The elongation test procedure should indicate how much material should be in the clamp. The elongation measurement also seem to depend on the contour of the material. Since the butyl rubber samples were cut from gloves the samples varied in contour, e.g. around the thumb hole.

Test samples were very difficult to cut after exposure to a destructive

chemical, i.e. one that swells the sample and makes it gummy. Results cannot be precise because of inaccurately cut samples.

Room air currents (from the hood, air conditioner, " dehumidifier) also affected measurements.

### Weight measurements

The blotting paper drying technique did not always give "dry" samples. A few samples had to be air dried before they where meer :red.

The Ziploc<sup>®</sup> bag used as a weighing bottle is a very handy device, but care must be taken that the test **clemical closs not wect** with the bag. And it was not always possible to remove all the gases by "burping" the bag and weight was naturally affected.

The description of the calculations for the weight change seemed needlessly complex.

### **Cleaning the cells**

Better methods for cleaning the test cells should be outlined.

### Safety

The degradation cell should come with a fitted cover. This would prevent loss of test chemical and also prevent accidential spilling when the test setup is in the hood.

### VI. Penetration Conclusions

No penetration was observed durin() any of these tests, either during the first 5-minute test at 1 atmosphere pressure or the subsequent 10 minutes at 1 or 2 psig. Thickness measurements varied widely on single seam samples.

### VII. Degradation Conclusions

The results of the degradation tests are summarized in Table I. While no chemical totally destroyed the glove material, several chemicals have enough of an effect on the rubber to pose a hazard for using these gloves for protection. These chemical are listed in Table II.

Table 1. Results of the Degradation Tests on Butyl Rubber

Chemical	Thickness (percent change)	Elongation (percent change)	Weight (percent change)	Visible Changes
Acetone	3.40	0.76	3.20	Discolored
Acetonotrile	0.95	2.10	1.80	
Carbon Disulfida	24.00	28.70	19.20	Softened/bubbled
Dichloromethane	9.80	46.50	7.75	Softened/distorted
Diethylamine	17.20	65.70	4.50	
Dimethylformamide	0.05	4.10	8.00	I
Ethyl Acetate	0.31	0.84	1.32	
N-Hexane	11.40	57.96	3.80	Cracked
Methanol	0.66	3.30	1.70	
Nitrobenzene	1.60	3.20	1.40	
50% Sodium Hydroxidi	e 0.95	0.86	4.50	
Sulfuric Acid	0.98	0	0.87	
Tetrachloroethylene	80.50	Tore	86.60	Sticky/softened
Tetrahydrofuran	9.20	93.40	10.40	-
Toluene	46.00	90.00	33.00	Softened/discolored

### Table II. Hazardous to use with Butyl Rubber

Carbon Disulfide Dichloromethane Diethylamine N-Hexane Tetrachloroethylene Tetrahydrofuran Toluene

Yable III.           Penetration Test Conditions for 6 inch Zippers					
Toluer	ie v "				
	Initial	RH	Temp	Date	
	Thickness		•C	('86)	
1.	12	78%	.22	6/5	
2.	11.4	78%	22	6/5	
3.	12.8	78%	22	f/5	
Hexan	e 📝 🕻	· · ·		: 4 0	
1.	12.2	77%	22	6.2	
2.	13.4	77%	22	6/2	
3.	12.7	77%	22	5/2	
HCI					
1.	15.2	75%	25	7/2	
2.	12.4	75%	25	7/2	
3.	10.3	75%	25	7/2	
Methyl	Ethyl Keto	one	" `` <b>_</b> •	1 Low -	
1.	4.2	77%	24	6/5	
2.	4.3	7735	24	6/5	
3.	42	77%	24	6/5	
Water					
1.	10.3	69%	23	5/29	
2.	10.3	69%	23	5/29	
3.	11.3	69%	23	5/29	

Penetra	Tab tion Test Con	le IV. Iditions f	or 4 mil Te	eflon
Toluene	5		N	
1.	Initial Thickness	RH	Temp °C	Date ('86)
2. 3.	3.5 3.7	78% 78%	24 24	6/5 6/5
Hexâne	3.7	78%	24	6/5
1. 2. 3.	12.2 13.4 12.7	68% 68% 68%	19 19 19 19	6/2 6/2 6/2
HCI				
1. 2. 3.	3.8 3.5 3.4	75% 75% 75%	25 25 25	7/2 7/2 7/2 7/2
		ле		
1. 2. 3.	3.4 3.7 3.7	77% 77% 77%	24 24 24	6/5 6/5 6/5
Water				
1. 2	4.3 4.3	68% 68%	19 19	6/2 8/2
3.	4.3	68%	19	6/2

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Penetrati	Tat on Test Condit	ole V.	5100/10 m	nil FEP
Toluen			-	
•	initial Thickness	RH	Temp °C	Date ('83)
1. 2.	11	75%	24	6/26
2. 3.	9.6	75%	24	6/26
	10.2	75%	24	6/26
Hexane				\$ 
1.	9.9	65%	19	6/26
2.	9.7	65%	19	6/26
3.	10.1	65%	19	6/26
HCI			<b>1</b> 5	L
1.	8.9	75%	25	7/2
2.	8.5	75%	25	7/2
3.	7.0	75%	25	7/2
Methyl	Ethyl Kełc	one		
1.	11.6	65%	23	6/27
2.	10.7	65%	23	6/27
3.	8	05%	23	6/27
Water		۰ , , , ,	•	
1.	11.8	65%	19	<b>6/2</b> 6
2.	13.9	05%	19	6/26
3.	11.8	65%	19	6/26

Table VI.           Penetration Test Conditions for 6 inch Zippers						
Toluçne						
	<b>Initial Thickness</b>	RH	Temp ℃	Date ('86)		
1. 2.	21.4 22.6	77% 77%	25 25	6/16 6/16		
Hexañe						
1. 2.	20.4 20.7	77% 60%	25 26	6/16 6/17		
HCL						
1. 2.	20.95 21.00	75% 75%	25 25	7/2 7/2		
Methyl	Ethyl Ke	tone				
1. 2.	20.00 19.90	60% 60%	25 25	6/17 6/17		

Degrad	lation Da	Table VI	l. yl Rubber (	Gloves
Hexane	RH	73%.	Temp 26	C 6/20/86
Thickness	Before	After	% Diff.	Elong.
1	11.1	10.6	-4.5	46.2
2	10.1	11.0	+8.9	60.8
3	10.1	8.0	-20.7	66.9
			avg 1.4 a	vg 57.96
Weight	Before	Change	Corrected	% Diff.
1	7.338	<b>Q.572</b>	2.20	7B
2	7.779	0.177	2.33	2.3
: 3	7.838	0.112	2.36	14
				avg 3.5
Dichlord	emethar	ne 73%	265-	. 6/20/86
Thickness	Before	After	% Diff.	Elong.
1	10.7	9.6	-10.1	63
2	10.3	11.3	+9.7	45
3	10.3	9.4	-9.1	31.5
<u></u>			avg 9.8	avg 46.5
Weight	Before	Change	Corrected	% Diff.
1	7.815	0.212	2.56	9.25
2	8.054	0.140	2.42	5.80
3	7.863	0.192	<b>2.3</b> 5	8.20
				avg 7.75
, Methano	DI RH	73%	Temp 26	C 6/19/86
Thickness	<b>Before</b>	After	% Diff.	Elong.
1	10.1	10.0	-0.99	3.1
2	10.1	10.0	<b>-0.9</b> 9	2.2
3	10.6	10.6	0	4.6
			avg 0.66	avg 3.3
Weight	Before	Change	Corrected	% Diff.
1	<b>7.9</b> 57	0.05	2.39	2.1
2	8.134	0.05	2.44	2.1
3	7.833	0.02	2.35	0.8
				avg 1.67

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Degrad		VII. (cor ta for But	ntinued) yl Rubber (	Gloves
Acelone	, RH	17 <mark>.3</mark> °° 1	ſemp 25(	C 6/19/86
Thickness	Before	Aîter	% Diff.	Elong.
1	11.6	11.0	-5.6	0.76
2	10.8	10.8	0	0.77
3	11.1	10.6	-4.5	0.76
·			avg 3.4	avg 0.76
Weight	Before	Change	Corrected	% Diff.
1	7.679	0.021	2.30	0.9
2	7.798	0.040	2.34	1.7
3	7.338	0.570	2.20	· <b>7.8</b>
-				avg 3.2
Toluene	RH	72°。 1	[emp 276	C 6 18/86
Thickness	Before	After	% Diff.	Elong.
1	10.2	6.32	-38.04	115.60
2.	10.2	4.9	-51.96	96.20
3	10.3	5.4	-47.76	58.56
		a\	/g 45.92 /	avg 90.05
Weight	Before	Change	Corrected	<b>%</b> Diff.
1	<b>7.8</b> 61	0.49	2.36	20.8
2	<b>8.030</b>	0.59	2.41	24.6
3	<b>8</b> .038	1.29	2.41	53.5
				avg 32.96
Ethyl A	cetate.	RH 7.2	<sup>6</sup> / <sub>6</sub> Temp	27C 6/18
Thickness	Before	After	% Diff.	Elong.
1	10.7	10.7	0	.76
2	10.7	10.7	0	1.5
3	10.3	10.8	0	1.7
	ومحاصرها والمراجع		avg 0	avg 0.84
Weight	Before	Change	Corrected	d % Diff.
1	8.300	0.055	2.49	2.2
	8.228	0.055	2.47	0.07
2 3	8.229	0.042	2.47	1.7
				avg 1.32

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Degrad		VII. (cor Ita for But	ntinued) syl Rubber (	Gloves
Acetonit	rile R	H73% *	lemp 25	C 6 19 86
Thickness	Before	After	% Diff.	Elong.
1	10.8	10.5	-1.9	1.5
2	10.6	10.5	-0.94	1.5
3	10.3	10.3	0	3.4
			avg 0.95	avg 2.1
\A/oight	Poloro	Change	Corroctod	9/ Diff
Weight 1	Before 8.212	Change <b>3.047</b>	Corrected	% Diff. <b>1.9</b>
2	8.511	0.011	2.55	0.43
2	8.133	<b>D.075</b>	2.55	<b>3.1</b>
5	0.100	4.914	6.MM	avy 1.6
Televentel				
Tetrachic	progray		2020 270	6.18.86
Thickness	Before	After	% Diff.	Elong.
1	10.9	2.2	-79.82	tore
2	10.7	2.2	-77.60	tore
3	10.7	1.7	-84.11	tore
		8	/g 80.51	tore
Weight	Before	Change	Corrected	% Diff.
1	8.320	2.32	2.50	92.8
2	8.045	.655	2.41	27.2
3	8.253	3.47	2.48	140
-	••	••••		avg 86.6
Diethylan	nine A	H62.5°。	Temp	24C 6 18
Thickness	Before	After	% Diff.	Elong.
1	10.6	9.6	-9.6	67.70
2	10.0	9.6	-3.6	60.77
3	10.7	6.6	-38.25	69.23 05 70
		8	/g 17.22	avg 65.70
Weight	Beiore	Change	Corrected	l % Diff.
1	8.259	0.15	2.48	6.2
2	8.071	0.04	2.42	1.6
3	8.220	0.14	2.47	5.8
				avg 4.5
			-	

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Table VII. (continued)         Degradation Data for Butyl Rubber Gloves						
Nitrobenz	ene R	H62.5°	. Temp	24°C 6°19		
Thickness	Before	After	% Diff.	Elong.		
1	10.6	10.8	-1.9	4.2		
2	11.0	11.0	0	2.6		
3	10.5	6.6	-37.1	2.9		
		-	avg 13.0	avg 3.2		
Weight	Before	Change	Corrected	% Diff.		
1	8.259	0.05	2.47	0.6		
2	8.129	0.41	2.44	1.7		
3	8.251	0.26	2.42	2.0		
				avg 1.4		
Qimethyl	formam	ide	62° <sub>°s</sub> 210	0 6 25 86		
Thickness	Before	After	% Diff.	Elong.		
1*	10.6	9.9	-6.6	5.0		
2	10.4	10.4	0	3.4		
3	10.5	10.6	+.95	4.7		
-			avg 0.05	avg 4.7		
Weight	Before	After	Corrected	% Diff.		
1	8.212	6.615	2.46	64.9		
2	8.122	.8.126	2.43	0.16		
3	8.626	8.217	2.59	15.8		
•		<b></b>		avg 8.0		
Carbon	Disulfic	le 62	.5°。 240	C 6/18 86 ×		
Thickness	Before	After	% Diff.	Elong.		
1	10.2	9.9	-2.9	30		
	10.8	5.2	-52	38		
2 3	10.7	8.9	-17	18		
•			avg 23.97	avg 28.7		
Weight	Before	After	Corrected	% Diff.		
1	8.160	8.213	2.448	2.17		
	8.165	8.234	2.450	30.0		
2 3	8.065	7.921	2.420	6.0		
Ŭ				avg 19.2		

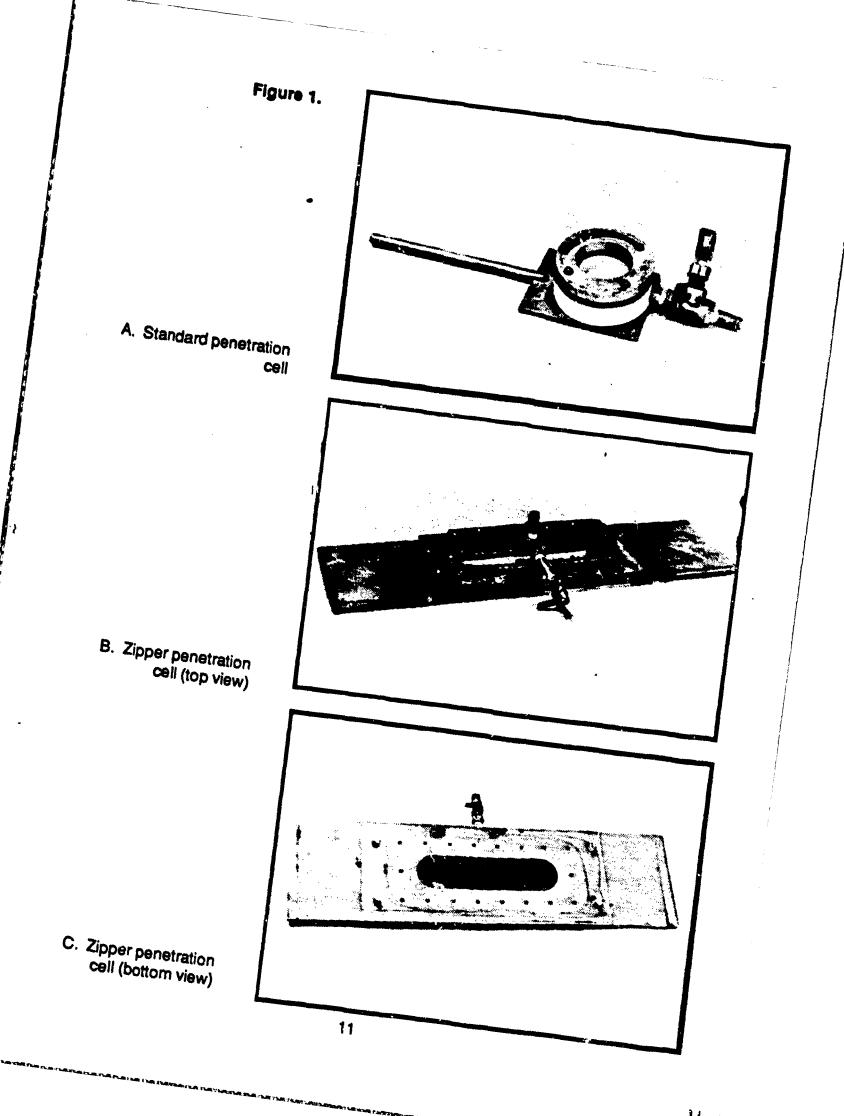
\* Glove label dissolved

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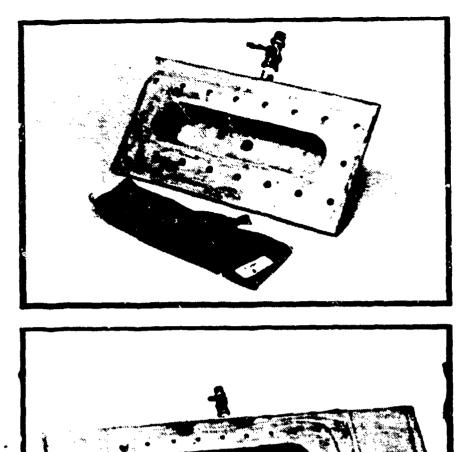
Table VII. (continued)         Degradation Data for Butyl Rubber Gloves						
Sodium	Hydrox	ide 62	2° <sub>o</sub> 2-1 C	6 26 86		
Thickness	Before	After	% Diff.	Elong.		
1	10.3	10.5	+1.9	1.5		
2	10.0	10.0	0	0.38		
· 3	10.6	10.5	-0.94	0.69		
			avg 0.95	avg 0.86		
Weight	Before	After	Corrected	% Diff.		
1	8.226	8.232	2.47	D.24		
2	8.200	8.320	2.46	4.8		
- 3	8.342	8.126	2.50	86		
_				100 4.5		
Sulfurio	Acid	.65°2	230	6 25 86		
Thickness	Before	After	% Diff.	Elong.		
1	10.6	10.6	0	none		
2	9.96	9.76	-2.0	none		
3	10.7	10.6	-0.93	none		
			avg 0.98			
Weight	Before	After	Corrected	% Diff.		
1	8.307	8.359	2.49	2.09		
2	7.949	.7.944	2.39	0.21		
3	8.260	<b>8</b> .268	2.48	0.32		
				avg 0.87		
Tetrahydi	ofuran	62°。	21°C	6 18 86		
Thickness	Before	After	% Diff.	Elong.		
1	10.5	10.3	-1.9	142		
2	10.3	8.8	-14.6	<b>9</b> 0.7		
3	10.0	8.8	-11.2	47.6		
	_		avg 9.2	avg 93.4		
Weight	Before	After	Corrected	% Diff.		
1	7.881	8.258	2.36	16		
2	8.163	8.457	2.45	4,		
3	7.994	7.261	2.40	11.1		
-	•••••			avg 10.4		

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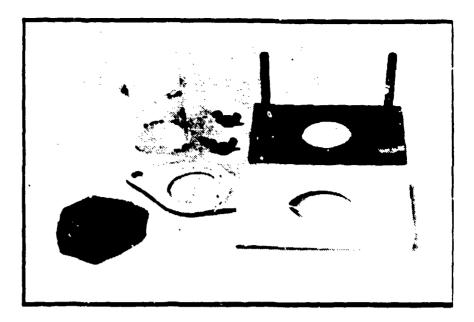
Figure 2.





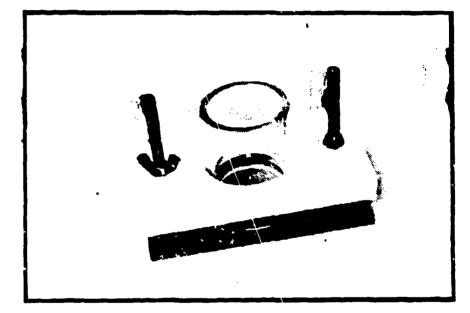
B. With zipper in place

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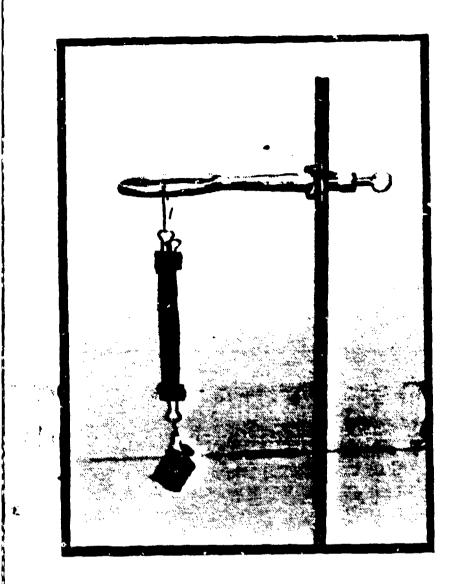


### Figure 3.

Standard degradation test apparatus



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### Figure 4.

### Elongation test setup

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### APPENDIX I

PERMEATION TEST DATA FOR SEAM SAMPLES

(Data Provided by Texas Research Institute Under Contract)

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_	: TYPE: Teflon la : PROTECTIVE MATE : CONDITION BEFOR			
_		Chemfab Corp.		
5	: PRODUCT IDENTIF	ICATION: Samed 5100		
-	: LOT OR MANUFACT			
8	: NOMINAL THICKNE : DESCRIPTION: <u>M</u>	ss: 40-50 mil aterial was buff color	ed.	
T	EST METHOD			
1	. TESTING LABORAT	ORY: Texas Research In	stitute, 9063 Bee Cav	ves Road. Austin.
	ANALYTICAL METH	OD: Continuous photoi	onization detection .	tth a 10.20 eV 1
_	. TEMPERATURE: 22			
	COLLECTION MEDI			
-		S: 1 inch cell was u	sed. /Detector Tempers	ture = 100C.
-		ASTM F739 METHOD: F1		
ď	RALLENCE CHENICAL	1 :	COMPONENT 2	3
	CHEM NAME(s) :	Ethyl Acetate :	N/A	N/A
		141-78-6 :	N/A	
3.	. CONC. (IF MIX) . CHEMICAL SOURCE		<u> </u>	<u> </u>
2.3.	NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L	E: 6 minutes IMIT N/A	>	
5.		MEATION RATE N/A		
6.	SAMPLE THICKNESS			
1.	SELECTED DATA PO			
	TIME	CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	2	•		
	4.	• • •	· ·	
	5.		:	
	6.		:	
	7.			
	8		·····	
	2 N		· · · · · · · · · · · · · · · · · · ·	
	10.			
8.	10OTHER OBSERVATIO	NS: Sample was sealed	in ASTM cell with 2	Neoprene gaskets

No. Control of

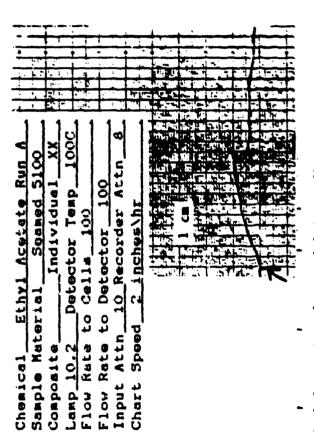
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# Chemical Resistance Testing of Seamed 5100

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## Ethyl Acetate Run A

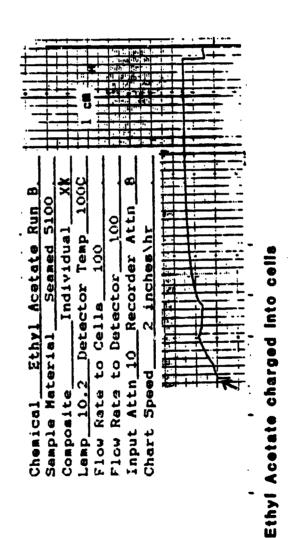


Ethyl Acetate charged into cella

	1: 2:	TYPE: Teflon las PROTECTIVE MATER	inated Nomex			
				: visible imperfectio	ns	
	4:	MANUFACTURER: C	hemfab Corp.			
			CATION: Seamed 5	100		
		LOT OR MANUFACTU				
		NOMINAL THICKNES ESCRIPTION: Ma	terial was buff c	olored.		
2.	_	T METHOD		5 T 0062 B	C	
				h Institute, 9053 Bee otoionization detecti		
		TEMPERATURE: 22-				
		COLLECTION MEDIU				
		COLLECTION SYSTE				
				as used./Detector Tem		
	/•	DEVIATIONS FROM	ASIM F/39 METROD:	Flow rate to cell w	as IUU co	c/min.
3.	"CHA	LLENCE CHEMICAL	1	: COMPOSENT 2	:	3
	1.	CHEM NAME (s) :	Ethyl Acetate	:N/A	:	N/A
		CAS NUMBER(s):		: ¥/A		N/A
		CONC. (IF MIX)		: <u>N/A</u>		N/A
	4.	CHEMICAL SOURCE:	EM Science	:N/A		N/A
	2. 3. 4. 5. 6.	DATE TESTED: 5- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI	: 7.5 minutes MIT N/A EATION RATE N/ 45 mils			
		TIME : 1. :	CONCENTRATI	ON : CONCENTRATIO	•N : CC :	DNCENTRATION
		2:			:	
		3:			:	
	4	4: 5:		··	:	
		5:		· · · · · · · · · · · · · · · · · · ·		
		7:		······································	<u> </u>	
	ł	B. :		:	:	
		:		;	:	
		:		:	:	
	8. 0	THER OBSERVATION	S: Sample was as	aled in ASTM cell wit		
		and 2 Teflon	gaskets.	BUILL GEAL WAL	A NEUDI	SUE BEBACLE
	SOU	RCE OF DATA		·		
5.		Sample was ru	n by Denise McCon	ald on May 7, 1987.		
5.						
5.						
5.						
5.		CE OF DATA Sample was ru				

# Chemical Resistance Testing of Seamed 5100

## Ethyl Acetate Run B



I-4

### CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD

### 1. DESCRIPTION OF PRODUCT EVALUATED

	CONDITION BEFORE TEST: Unused, no visible imperfections MANUFACTURER: Chemfab Corp.					
4:		00				
6:						
7:						
8:	المتكالي المتحديد والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع و	ored.				
TE	EST METHOD					
1.		Institute, 9063 Ree	Caves R	oed. Austin, TX		
2.						
3.	and the second second second second second second second second second second second second second second second					
4.						
	COLLECTION SYSTEM: N2					
	OTHER CONDITIONS: 1 inch cell was	used. /Detector Tem	erature	= 100C.		
	DEVIATIONS FROM ASTM F739 METHOD:					
C	HALLENGE CHEMICAL 1	: -CONFONENT 2	:	3		
		•	:			
1.	. CHEM NAME(s) : Ethyl Acetate	:N/A	:	N/A		
2.	. CAS NUMBER(s): 141-78-6	:N/A	:	N/A		
' <b>3</b> .	. CUT. (IF MIX) N/A	:N/A ·	:	N/A		
4.	. CHEMICAL SOURCE: EM Science	:N/A	;	N/A		
2.	. NUMBER OF SAMPLES TESTED: One (Run	n C)				
3. 4. 5. 6.	BREAKTHROUGH TIMS: 96 minutes MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A					
3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils	: CONCENTRATIO	N ; C	ONCENTRATION		
3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. :	: CONCENTRATIO	N : C	ONCENTRATION		
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3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1: 2: 3:	CONCENTRATIO	N : C	ONCENTRATION		
3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1: 2: 3: 4:	CONCENTRATIO	N : C	ONCENTRATION		
3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. :	CONCENTRATIO	N ; C : : : : :	ONCENTRATION		
3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. :	<pre></pre>	N : C	ONCENTRATION		
3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1	CONCENTRATIO : : : : : : : : :	N : C	ONCENTRATION		
3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A         STEADY STATE PERMEATION RATE N/A         SAMPLE THICKNESS: 46 mils         SELECTED DATA POINTS N/A         TIME : CONCENTRATION         1.         2.         3.         4.         5.         6.         7.         8.	CONCENTRATIO	N : C	ONCENTRATION		
3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A         STEADY STATE PERMEATION RATE N/A         SAMPLE THICKNESS: 46 mils         SELECTED DATA POINTS N/A         TIME :         CONCENTRATION         1.         2.         3.         4.         5.         6.         7.         8.         9.	CONCENTRATIO : : : : : : : : : : : : :	N : C	ONCENTRATION		
3. 4. 5. 6.	MIN DETECTABLE LIMIT N/A         STEADY STATE PERMEATION RATE N/A         SAMPLE THICKNESS: 46 mils         SELECTED DATA POINTS N/A         TIME : CONCENTRATION         1.         2.         3.         4.         5.         6.         7.         8.	I       CONCENTRATIO         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :         :       :      :       :      :	N ; C : : : : : : : : : : : : : : : : : : :	ONCENTRATION		
3. 4. 5. 6. 7.	<pre>MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : 0THER OBSERVATIONS: Sample was seal</pre>	: : : : : : : : : : : : : : : : : : :				
3. 4. 5. 6. 7.	MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1	: : : : : : : : : : : : : : : : : : :				
3. 4. 5. 6. 7.	<pre>MIN DETECTABLE LIMIT N/A STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 46 mils SELECTED DATA POINTS N/A TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : 0THER OBSERVATIONS: Sample was seal</pre>	: : : : : : : : : : : : : :				

# Chemical Resistance Testing of Seamed 5100

## Ethyl Acetate Run C

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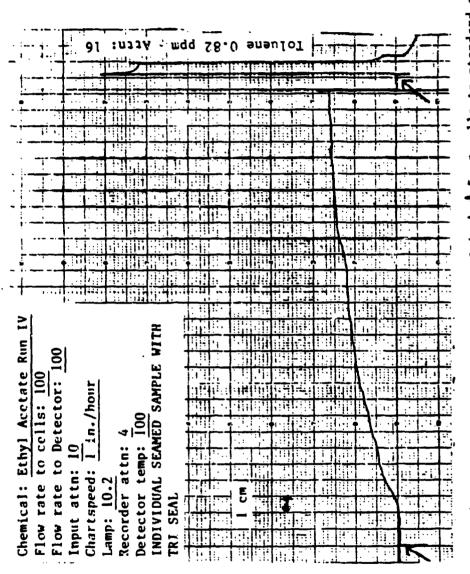
Ethyl Acetat's charged into cells

_	SCRIPTION OF PRO					
1:		laminated Nomex TERIAL CODE: 065				والمرابقة والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع وا
3:		ORE TEST: Unused	d. no visib	le imperfectio	ns.	<del></del>
4:	MANUFACTURER :	Chemfab Corp.				
5:		IFICATION: Seam	ed 5100			
6: 7:		TURER DATE: N/A TESS: 40-50 mil				
8:		Material was but	ff colored.			
TES	T METHOD					
1.						s Road, Austin, J
2.			s photoioni	zation detecti	on wit	th a 10.20 eV lan
3.	TEMPERATURE: 2 COLLECTION MED					
5.						·
6.	OTHER CONDITIC	ons: 1 inch ce		· / Detector T		
7.	DEVIATIONS FRO	DN: ASTM F739 MET	HOD: Flow	rate was 100 c	c/min.	•
CHA	ALLENGE CHEMICAL	. 1	:	COMPONENT 2	:	3
1.		Ethyl Acetate	<u> </u>	<u>N/A</u>	:	N/A
	CAS NUMBER(s):			N/A	;	N/A
د 4.	CONC. (IF MIX) CHEMICAL SOUR			<u>N/A</u> N/A	—_ <u>`</u>	<u> </u>
1.		12-31-86				
1. 2. 3. 4. 5.	DATE TESTED: 1 NUMBER OF SANPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE	LES TESTED: One IME: 60 minutes LIMIT .16 ppm ERMEATION RATE 1	5	hr		
1. 2. 3. 4. 5. 6.	DATE TESTED: 1 NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE	LES TESTED: One IME: 60 minutes LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils	5	hr		
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SANPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES	LES TESTED: One IME: 60 minutes LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils	5 .08 ug/cm <sup>2</sup> /	hr CONCENTRATIC		CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SANPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2.	LES TESTED: One IME: 60 minute LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils POINTS N/A	5 .08 ug/cm <sup>2</sup> / RATION :		)N : :	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SANPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3.	LES TESTED: One IME: 60 minute LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils POINTS N/A	5 .08 ug/cm <sup>2</sup> / RATION : : :		: : :	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SANPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4.	LES TESTED: One IME: 60 minute LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils POINTS N/A	5 .08 ug/cm <sup>2</sup> / RATION : : : :		: : : :	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SANPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 6.	LES TESTED: One IME: 60 minute LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils POINTS N/A	5 .08 ug/cm <sup>2</sup> / RATION : : :		: : :	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 6. 7.	LES TESTED: One IME: 60 minute LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils POINTS N/A	5 .08 ug/cm <sup>2</sup> / RATION : : : : :		: : : :	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1	LES TESTED: One LME: 60 minuter LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils POINTS N/A : CONCENTR : : : : : : : :	5 .08 ug/cm <sup>2</sup> / RATION : : : : : : : :			CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SANPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	LES TESTED: One IME: 60 minute LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils POINTS N/A	5 .08 ug/cm <sup>2</sup> / RATION : : : : : : : : :			CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 0THER OBSERVATI	LES TESTED: One IME: 60 minute LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils POINTS N/A : CONCENT : : : : : : : : : : : : :	5 .08 ug/cm <sup>2</sup> / RATION : : : : : : : : :	CONCENTRATIC		
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1 NUMBER OF SANPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	LES TESTED: One IME: 60 minute LIMIT .16 ppm ERMEATION RATE 1 SS: 7 mils POINTS N/A : CONCENT : : : : : : : : : : : : :	5 .08 ug/cm <sup>2</sup> / RATION : : : : : : : : :	CONCENTRATIC		

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# Chemical Resistance Testing of Seamed 5100

### Ethyl Acetate Run IV



cons Switched from cells to standard gas

Ethyl Acetate charged into cells

### CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION RECORD

### DESCRIPTION OF PRODUCT EVALUATED 1.

l:	TYPE:	Teflon	laminated	Nomex

PROTECTIVE MATERIAL CODE: 068 2:

CONDITION BEFORE TEST: Unused, no visible imperfections 3:

4: MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Seamed 5100 5:

- LOT OR MANUFACTURER DATE: N/A 6:
- NOMINAL THICKNESS: 40-50 mil 7:
- 8: DESCRIPTION: Material was buff colored.

### 2. TEST METHOD

- TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 1.
- ANALYTICAL METHOD: Continuous photoion zation detection with a 10.20 eV lamp. 2.
- TEMPERATURE: 22-25°C з.
- COLLECTION MEDIUM: N2 COLLECTION SYSTEM: N2 4.
- 5.
- 1 inch cell was used./Detector Temperature = 100 C. 6. OTHER CONDITIONS:
- 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100 cc/min.

<b>L</b>	CHALLENCE CHEMICAL	1	:	COMPONENT 2	:	3	
			:		:		
	1. CHEM NAME(s):	Ethyl Acetate	:	N/A	:	N/A	
	2. CAS SUMBER(s):	141-78-6		N/A		N/A	
	3. CONC. (IF MIX)	N/A		N/A		N/A	
	4. CHEMICAL SOURCE	EM Science	::	N/A		N/A	

### TEST RESULTS 4.

£

- 1. DATE TESTED: 6-03-87
- 2. NUMBER OF SAMPLES TESTED: One

3. BREAKTHROUGH TIME: No breakthrough was observed in 4.5 hours.

- 4. MIN DETECTABLE LIMIT .17 ppm
- 5. STEADY STATE PERMEATION RATE N/A
- 6. SAMPLE THICKNESS: 47 mils
- 7. SELECTED DATA POINTS N/A

	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
<u>.</u> –	<u> </u>			:		:	
<u> </u>		:		:		:	
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4		<u> </u>		:		:	
<u>}.                                    </u>				:		:	
<u>6</u>		;		:		:	
7		:		;		:	
8.		:		:		:	
9		:		:		:	
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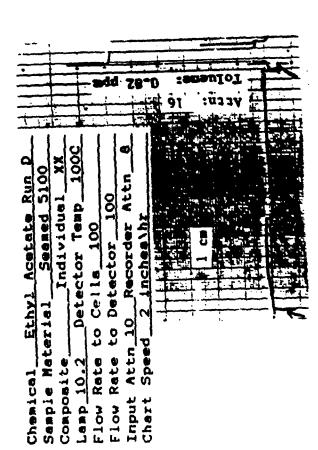
8. OTHER OBSERVATIONS: Sample was sealed on both sides of ASTM cell with 1/4" expanded P.T.F.E. cord.

5. SOURCE OF DATA

Sample was run by Denise McDonald on June 3, 1987.

CHEMICAL RESISTANCE TESTING OF SEAMED 5100

## ETHYL ACETATE RUN D



Ethy! Acetate charged into cells

Switched from cells to standard gas

### APPENDIX J

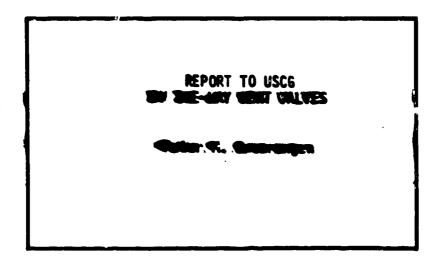
INTERIM REPORT OF SUIT EXHAUST VALVE TESTING

(Contractor Report by Lawrence Livermore National Laboratory)

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## Safety Science Group



Lawrence Livermore National Laboratory

Evaluation of the Performance of One-Way Valves Used in Chemical Protective Suits\*

#### Introduction

We are reporting preliminary results from a study on low-pressure vent valves that we are conducting for the U.S. Coast Guard. Test results from four valves will be discussed here. The valve currently used in the Coast Guard totally-encapsulating chemical protective (TECP) suit is made by Stratotech Corporation. A second suit valve that was evaluated is made in Sweden by Trelleborg. Then, to provide a comparison for the evaluation, we included two valves that are used in respirators. These valves are made by MSA Corporation, and included a standard flapper valve and a pressure demand valve.

#### Background

The U.S. Coast Guard has developed a new totally-encapsulating suit for the protection of personnel during chemical spill response. Low-pressure one-way vent valves are used in the suit to allow escape of exhaust air from the occupant's self-contained breathing apparatus, and to maintain a small positive pressure (1 to 3 inches water column pressure) inside the suit. This latter feature minimizes diffusion or penetration of chemical vapors through poor seams, material punctures, or improperly closed zippers. Satisfactory operation of these valves is critical to the functionality and protective qualities of encapsulating suits.

While protection factors have been measured for the overall suit in operation, there has been no attempt to exclusively determine suit exhaust valve protection factors. Furthermore, recent overall suit testing has shown differences in suit protection factors when the internal suit probe is located near the breathing zone as compared to locating the probe internally near the exhaust valve. This information indicates that diffusion of the challenge agents through the suit exhaust valves may be significant.

\*This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-ENG-48.

#### Experimental Considerations

We prepared an experimental system that would provide for a high degree of control over the valve environment. A small caSt aluminum box (roughly 9 inches long by 5 inches wide by 6 inches high) was fitted with several openings to provide for breathing and test air input3, analytical sampling ports and environmental measurements (pressure, temperature). A diagram of the box is shown in Fig. 1. The box was constructed so that a plastic plate could be inserted between the two halves. At the center of the plate, a recessed orifice was machined that allowed the different valves to be inserted with a leak tight seal. When the box and plate were assembled, the valve was positioned to function as the only conduit between the two resulting compartments. One compartment could then function as the "inmide" of a TECP suit, and the other as the "outside."

The complete assembly was tested for leakage with a Stratotech value installed. A solid cap was threaded onto the inside half of the value. The outside compartment was filled with methane from a lecture bottle. With the pressure differential between the two chambers at zero, no methane was detected within the second (inside) chamber. We interpreted this data to is that the test box was leaktight when the insert plate containing a value was installed. Conversely, with the cap removed, future measurement of methane in the inside chamber would have to indicate the value as the source of penetration. A diagram of the Stratotech value in this testing arrangement is shown in Fig. 2.

A schematic of the complete test assembly is given in Fig. 3. The top left of the diagram shows a source of air that allowed precise control of flow, temperature, and relative humidity (Miller-Nelson Research, HCS-301). At the top center is shown a source (lecture bottle) of test gas (methane) which can be added to the air flow through a mass flow controller. The mixture of air and test gas is passed through a calibrated infrared analyzer (Foxboro Corporation, Miran 1A) to measure test gas concentration. When pure methane was used in this work, the air source and infrared analyzer were disconnected and the methane from the lecture bottle passed through the mass flow controller and then directly to the test chamber.

The previously described test box is shown as a diviced box in the lower right of the schematic. Also shown are the probes for differential pressure measurement between the two chambers of the box. In addition, a single pressure transducer could be placed in either part of the box to measure chamber pressure relative to the atmosphere. Finally, the exhaust flow from the lower half of the box was checked for temperature with a thermistor probe (YSI Series 700, Yellow Springs Instrument Company) and a digital thermometer (Cole-Parmer Model 8502-20). A comparison of temperature was continually made between the test box exhaust flow and either the controlled air source or the room air. The concentration of test gas within the inside chamber of the box was measured with a calibrated total hydrocarbon analyzer (Beckman, Model 400, FID principle).

We chose methane as a test gas for several reasons. First, under the conditions of this experiment, this gas is inert to the materials used in the several values. Second, this hydrocarbon can be detected at very low levels with conventional methods. In addition, the THC can be calibrated to measure methane over a very large linear dynamic range. Finally, the measured diffusion coefficient for methane is on the same order of magnitude as that reported for hydrogen<sup>1,2</sup>, and gaseous diffusion of the compound is therefore quite rapid.

#### Test Results

Our first test was to observe the values under static conditions, i.e., without use of simulated breathing. A value was installed in the plastic insert, and the plate was assembled between the box halves. The outside chamber of the test box was filled with pure methane. Leakage rates were determined from the change in the observed concentration of methane in the inside chamber over a specified time period. The calculated volume of the upper chamber is 1616 cm<sup>3</sup> (24.4 cm x 13.0 cm x 5.1 cm). If we take the definition of parts-per-million by volume to be ppmv = [(vol. of analyte) / (vol. of dilutant)] x  $10^6$ , and then make the appropriate substitutions, the leak rates can be determined.

Two valves were tested in this manner, the Stratotech valve, and the MSA positive pressure valve. After an initial measurement at a pressure differential of zero, compressed air was forced to the inside chamber through a precision valve, and the new concentration recorded over time at the higher pressure. The result of ele preliminary testing is shown in Fig. 4. Our technique shows an observable leak of the outside gas into the inside champer. To provide comparison, we make reference to the current Bureau of Mines Standard for Respiratory Protection Devices.<sup>3</sup> The standard used by the Bureau of Mines is the same as that reported in use by the Chemical Warfare Service during WWI1.<sup>4</sup> In this standard, the designated respirator exhalation valve leakage is not to exceed 30 ml min<sup>-1</sup> at a suction of 25 mm of water column height. The implication from this standard is that there is measurable leakage through respirator exhaust valves under normal operating conditions. To provide data comparable to the respirator standard, the suit's pre-way vent valves would have to be tested in the same manner.

**ENERGY** 

Our next experiment was to observe the values during the simulated breathing provided from a breathing machine. We tested four values at two separate breathing rates, 10 and 20 breaths  $\min^{-1}$ , respectively. In all cases except one, a constant inside concentration of methane was achieved. Our technique was to observe the background signal of the THC analyzer with the breathing machine on, and then to fill the outside compartment of the box with methane. The internal concentration of methane would rise and then level off at an equilibrium value, which is the data reported in Fig. 5. The exception occurred with the MSA pressure demand value at the 10 cycle  $\min^{-1}$  breathing rate. Over the 10-min duration of the test, the internal concentration continued to rise (at a rate of 4.8 µl  $\min^{-1}$ ).

In all the other cases except one, we observed the internal concentration to fluctuate within a few ppmv. The single exception was that the Trelleborg valve exhibited large oscillations around an average internal concentration. It is these (sawtooth appearing) concentration variations that are shown in the bar graph of Fig. 5. Finally, in addition to the small sinusoidal type fluctuations seen in the other valves, and the large variation seen in the Trelleborg valve, there was in every case a very small oscillation

superimposed on the general trend. This occurred in exact sequence with the cycles of the breathing machine. We could only attribute this fluctuation to the immediate changes that occurred when the valve opened and closed.

We also made observations of the differential pressure during operation of the breathing machine. This was done for each valve and was recorded as a positive pressure within the inner chamber relative to the pressure within the outside chamber. The data are presented graphically in Fig. 6. This data separated the four valves by pairs. The two valves that were controlled by spring tension (to open only after a certain pressure threshold was attained) allowed larger internal chamber pressures. The two flapper type valves maintained lower pressures. The pressures seen were higher at faster breathing rates, and again the flapper type valves maintained lower pressure than the spring tension valves.

#### <u>Conclusions</u>

We have developed a method to test TECP vent-values. This method isolates the value between two chambers and tests for leakage of the values by measuring concentration of a test gas in the inside chamber of the test box. The use of a removable plate that contains a value installed in a leaktight manner allows for simple and rapid exchange of values for testing. Our preliminary data indicates that there is leakage of the test gas under normally closed conditions (zero differential pressure). When the pressure on the inside chamber is increased, this leak rate is observed to decrease. One conclusion that follows from these test results is that the vent values may be a major leak source for the intact suit. Further research is necessary to allow more general conclusions to be drawn.

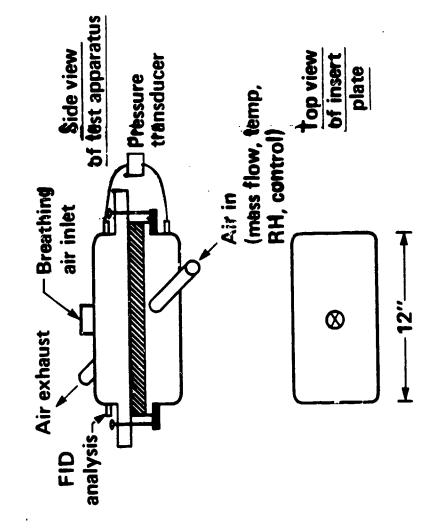
#### References

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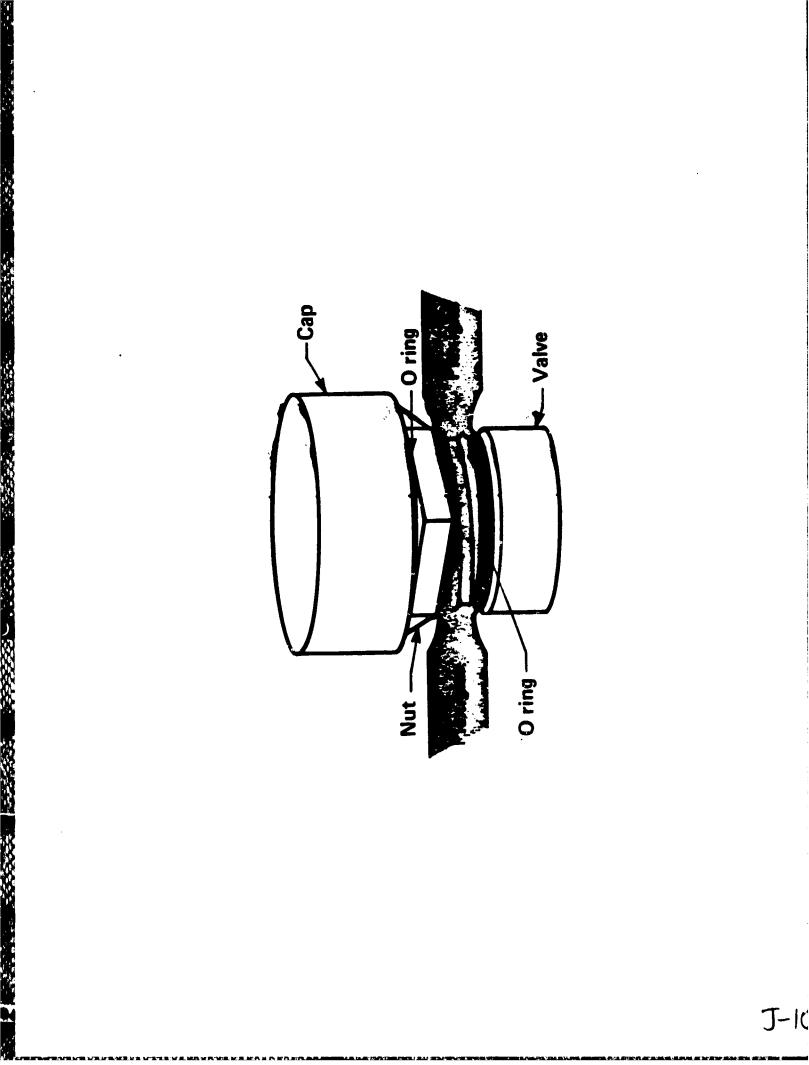
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- 2. CRC Handbook of Chem. and Physics, 61st Ed., R.C. Weast, ed., p. F-62.
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- L. Silverman, R.C. Lee, and G. Lee, "Fundamental Factors in the Design of Protective Respiratory Equipment", Office of Scientific Research and Development, Report No. 1864, 1943, p. 6.

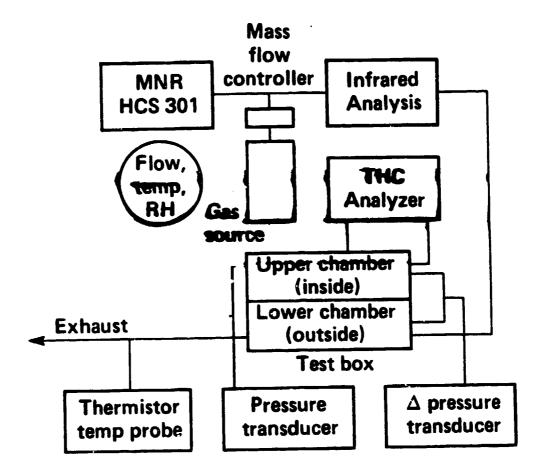
#### Figure Captions

- Figure 1. A schematic of the cast aluminum box that was used in the valve testing experiment.
- Figure 2. drawing of the Stratotech value as it appears when installed in the  $Plexiglas^R$  plate.
- Figure 3. Schematic of the experimental test system used in the study on oneway vent valve performance.
- Figure 4. Graphic representation of the leak rates observed during static leak testing of one-way vent valves.
- Figure 5. Graphic representation of the concentration of methane observed in the "inside" chamber of the test box during simulated breathing.
- Figure 6. Differential pressure observed with different valves during breathing machine operation.

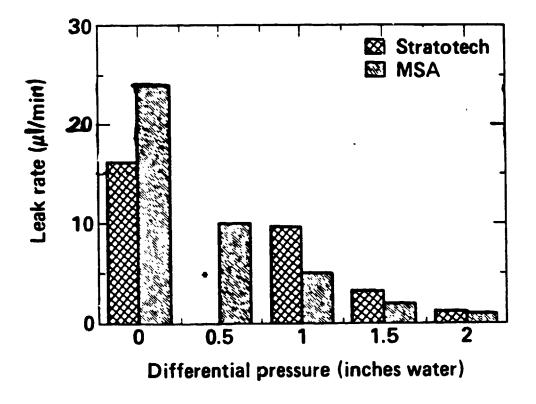


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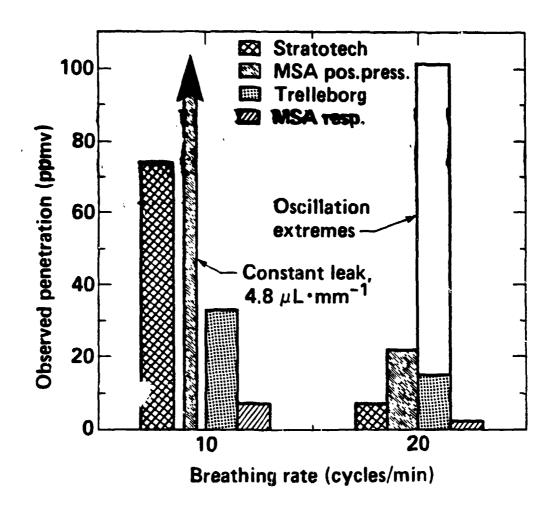




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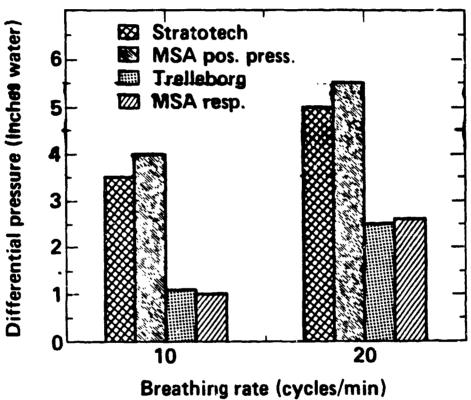


\* Stratotech data not available



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### APPENDIX K

#### EVALUATION OF SUIT INTEGRITY IN PROTECTION FACTOR TESTS

(Contractor Report by Lawrence Livermore National Laboratory)

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TECP SUIT TEST PROTOCOL

for

USCG/USFA PROJECT

## Safety Science Group



Lawrence Livermore National Laboratory

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#### Introduction

The need to provide complete encapsulation of workers to allow them to carry out their jobs safely is becoming very commonplace. Such jobs as hazardous material response, toxic waste dump cleanup, and chemical manufacture and use require complete encapsulation of employees routinely or during accidents. With the increase use of complete encapsulation in the workplace, a high degree of performance is now expected from commercially available totally-encapsulating chemical protective (TECP) suits. This high degree of performance was also identified by John B. Moran, Head, Division of Safety Research, National Institute for Occupational Safety and Health, when the referred to chemical protective clothing as "the last line of defense" for the worker.

A TECP suit is made up of many components (Fig. 1). Many of these components are in themselves individual items of chemical protective clothing for which chemical permeation data is available. Some items however, such as suit closures, vent valves, lens material, suit membranes, and seams are unique to a TECP suit and therefore require individual chemical permeation testing. This type of data however, does not provide the user with a measure of complete TECP suit integrity. To measure the complete integrity and performance of TECP suits, quantitative chamber testing can be used. By simultaneously using both an aerosol and gas test agent one can determine the TECP suit leak rate accurately. If these measurements are made while the suit is being worn by a person performing a series of exercises, a good estimate of field TECP suit performance can be obtained.

#### Experimental Setup

To measure TECP suit leak rates accurately separate gas (freon R 12) and

aerosol polyethylene glycol molecular weight 400 (PEG 400) detection systems will be used. The Freon<sup>R</sup> 12 subsystem uses a man-test chamber concentration of 1000 ppm as determined by a Wilks Nodel 1A infrared spectropholometer. The interior of the TECP suit is monitored for Freon<sup>R</sup> 12 intrusion using a Varian Model 2700 gas chromatograph (GC) equipped with an electron capture detector (ECD). Since the GC/ECD detection limit for Freon<sup>R</sup> 12 is 0.01 - 0.001 ppm, this measurement technique enables one to measure an intrusion coefficient of 100,000 to 1,000,000. A gas sampling valve is used to collect discrete samples from the interior TECP suit air approximately every two minutes.

To measure the aerosol concentrations in the man-test chamber (Fig. 2) within the TECP suit a Phoenix Precision Instrument's Model JM 7000 forward light scattering photometer will be used. The test aerosol of PEG 400 will be generated using a Laskin nozzle generator which creates a mass median aerosol diameter aerosol of approximately 0.68 )m, sg = 2.10. Aerosol concentrations within the man-test chamber will be  $25 \pm 5 \text{ mg/M}^3$ . A sample of two liters per minute is withdrawn from the suit and passed through the photometer providing a real time measure of aerosol concentrations within the suit.

Sample line penetrations into the TECP suit will take advantage of existing penetrations for such things as airline cooling or communication. If these types of penetrations are not available a cuff ring with sampling port will be attached using a removable glove connection. If these methods are not applicable a hole will be cut in the suit and a sampling line will be sealed into the suit. The last method is the least desirable but necessary when no other sampling line penetration is available. The minimum number of connections necessary to connect the sampling line to the proper monitoring instrument will be used with a minimum length of sampling line. During a

K-3

typical test, samples of both Freon<sup>R</sup> 12 and PEG 400 will be taken simultaneously and used to determine TECP suit performance.

A series of light exercises have been chosen to stress the suit in a manner similar to typical work routines. Each exercise is carried out for two minutes completing the prescribed number of repetitions.

o Stand in place.

- Raise hands from waist to above the head, completing at least 15 raising motions per minute.
- b Walk in place completing at least 15 raising motions of each leg per minute.
- o Touch the toes, making at least 10 complete motions of the arms from above the head to the toes per minute.
- o Perform deep knee bends, making at least 10 complete standing and squatting motions per minute.
- o Repeat complete exercise series.
- o Exit man-test chamber.

The exercise series requires approximately 20 minutes plus donning and doffing time. A 30-minute SCBA bottle will work some of the times, but a 60-minute bottle is preferred.

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Two USCG/USFA TECP suits will be evaluated along with single suits from four commercial manufacturers.

#### Data Analysis

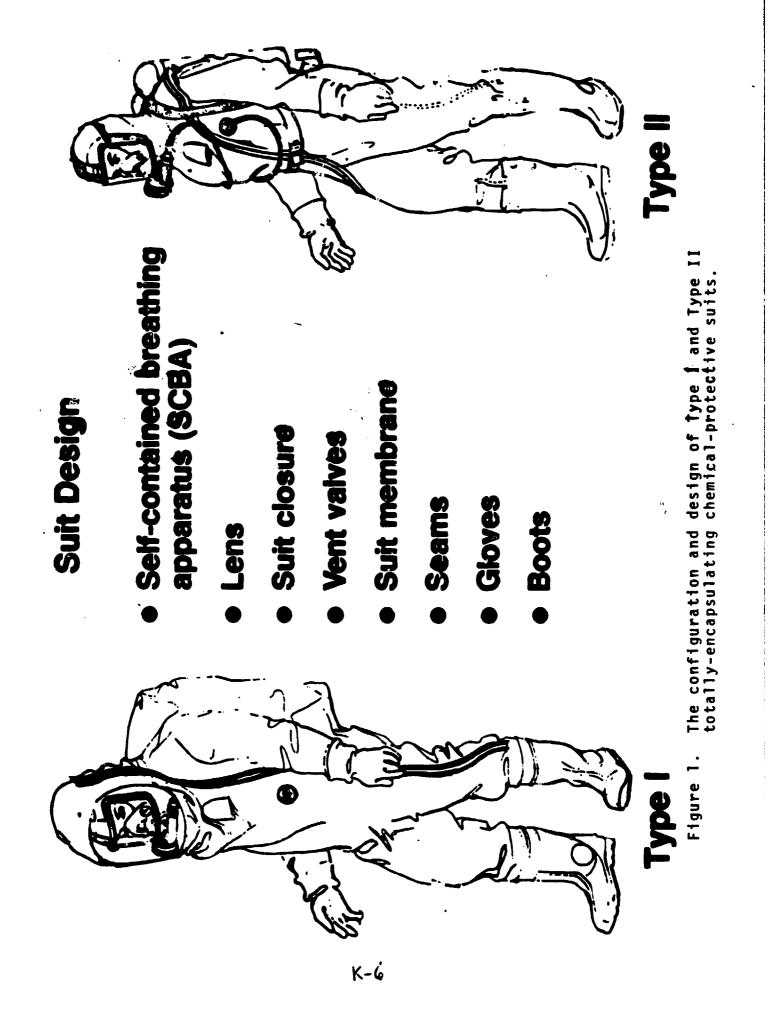
The output from the photometer, GC/ECD and infrared spectrophotometer will be collected on a DEC LSI 11/23 lab computer. Suit intrusion coefficients<sup>1</sup> will be calculated for both aerosol and Freen<sup>R</sup> 12 test agents and their results compared. Graphs showing these intrusion coefficients will be included in the final report.

To determine if various components of the TECP suit are leaking the internal samplings lines will be placed in close proximity \* a the component in question.

#### Final Report

A final report will be prepared summarizing the results of the various TECP suits along with any conclusions with reference to specific suit component performance.

<sup>1</sup> Intrusion Coefficient = <u>Outside Concentration</u> Interior Suit Concentration



		Test atmospheres: Freen <sup>TM</sup> 12 (gas)
Anteroom	Environmental test chamber	PEG 400 (aerosol) Streat testing: Treadmill
		Monitoring:
	<b>•</b>	
		Photometer
		Optical particle sizer
		Size/charge particle counter
		<ul> <li>Humidity monitor</li> </ul>
	Control	Air flow monitor
	room	Presture monitor
		Heaft rate monitor
		Computeit interface:
		• <b>DEG</b> LSI 11/23

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TECP Suit Man-Test

Results for the USCG/USFA/OSHA

Project

## Safety Science Group



Lawrence Livermore National Laboratory

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Experimental Results
Discussion
Conclusion

#### Introduction

In our report titled, "TECP Suit Test Protocol for USCG/USFA Project" we discussed the general design of a totally encapsulating chemical protective (TECP) suit and the test method we have developed to evaluate the TECP suit performance. In this report we will summarize the results from our test on the new U.S. Coast Guard's TECP suit made from Teflon<sup>R</sup>-coated Nomex<sup>R</sup> fabric (Figure 1).

#### Human Subjects Approval

The Lawrence Livermore National Laboratory (LLNL) is operated by the University of California for the U. S. Department of Energy (DOE). DOE requires that all experiments involving haman volunteers at LLNL must be reviewed by the Human Subjects Committee and found acceptable. The experimental test procedures described in this report have been reviewed and approved by the Human Subjects Committee.

#### Experimental Description

#### Freon Leak Detection System

To measure TECP suit leak rates accurately, a separate gas (Freon<sup>R</sup> 12) and aerosol [polyethylene glycol molecular weight 400 (PEG 400)] detection systems is used. The Freon<sup>R</sup> 12 subsystem uses a man-test chamber concentration of 1000 ppm as determined by a Wilks Model 1A infrared spectrophotometer. The interior of the TECP suit is monitored for Freon<sup>R</sup>12 intrusion using a Varian Model 2700 gas chromatograph (GC) equipped with an electron capture detector (ECD). The sampling time for the GC sampling loop is two minutes. In an upgrade of this system a second sampling loop

-1-

and ECD detector is being added. Thus, by alternating the sampling cycles, a sample can be collected approximately every minute. Since the GC/ECD detection limit for Freon<sup>R</sup> is 0.01 - 0.001 ppm, this measurement technique enables SSG to measure a suit intrusion coefficient of 100,000 to 1,000,000.

#### Aerosol Leak Detection System

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The aerosol concentrations in the man-test chamber and within the TECP suit were measured using a Phoenix Precision Instrument's Model JM 7000 forward light scattering photometer. The test aerosol of PEG 400 was generated using a Laskin nozzle generator which created a mass median aerosol diameter of approximately 0.68  $\mu$ m, sg = 2.10. Aerosol concentrations within the man-test chamber were 25 ± 5 mg/M<sup>3</sup>. A sample of two liters per minute was withdrawn from the suit and passed through the photometer, providing a real time measure of aerosol concentrations within the suit.

#### Suit Modifications

Sample line penetrations into the TECP suit would normally take advantage of existing penetrations for such things as airline cooling or communication. Since no penetration was available in the U.S. Coast Guard TECP suit, a hole was cut in the suit to enable the mounting of a sealed sampling line. The hole was located in a reinforced section in the front waist area of the suit. The minimum number of connections necessary to connect the sampling line to the proper monitoring instrument were used with a minimum length of sampling line. During the TECP suit test, samples of both Freon<sup>R</sup> 12 and PEG 400 were taken simultaneously and used to determine TECP suit performance.

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#### Exercise Protocol

A series of light exercises were chosen to stress the suit in a manner similar to typical work routines. Each of the following exercises was carried out for two minutes completing the prescribed number of repetitions. The exercises were carried out in the Safety Science Group's man-test chamber (Figure 2).

- o Stand in place.
- Raise hands from waist to above the head, completing at least 15
   raising motions per minute.
- o Walk in place completing at least 15 raising motions of each leg comminute.
- Perform deep knee bends, making at least 10 complete standing and squatting motions per minutes.
- o Touch the toes, making at least 10 complete motions of the arms from above the head to the toes per minute.
- o Repeat complete exercise series.
- o Exit man-test chamber.

The exercise series required approximately 20 minutes plus donning and doffing time. A 30-minute SCBA bottle provided enough experimental time, but a 60-minute bottle was used because of its additional weight and duration.

#### Internal Pressure Monitoring

The pressure inside the TECP suit was measured using a Validyne model, P24 pressure transducer with a range of  $\pm 15^{\circ}$  water gauge (wg) and an accuracy  $\pm 0.08^{\circ}$  wg.

#### Vent Volume Monitoring

The volume of air exhausted from the TECP suit was measured using a Kurtz Instruments, Inc. flow meter equipped with a probe for Model 505 which was placed in a specially designed tube.

#### Data Analysis

1

The output from the photometer, GC/ECD, infrared spectrophotometer, pressure transducer, and flow monitor was collected on a DEC LSI 11/23 lab computer at a sampling rate of 250 ms per entry. Suit intrusion coefficients<sup>1</sup> or protection factors were calculated for both aerosol and Freon<sup>R</sup> 12 test agents. Graphic output from the computer was plotted as the concentration of aerosol penetrating the suit interior (suit penetration) during the various exercises. Real time pressure and flow traces throughout the various exercises were also recorded. The actual results are presented in the Experimental Results Section and a discussion of their meaning is presented in the Discussion and Conclusion Sections.

Intrusion Coefficient = <u>Outside Concentration</u> Interior Suit Concentration

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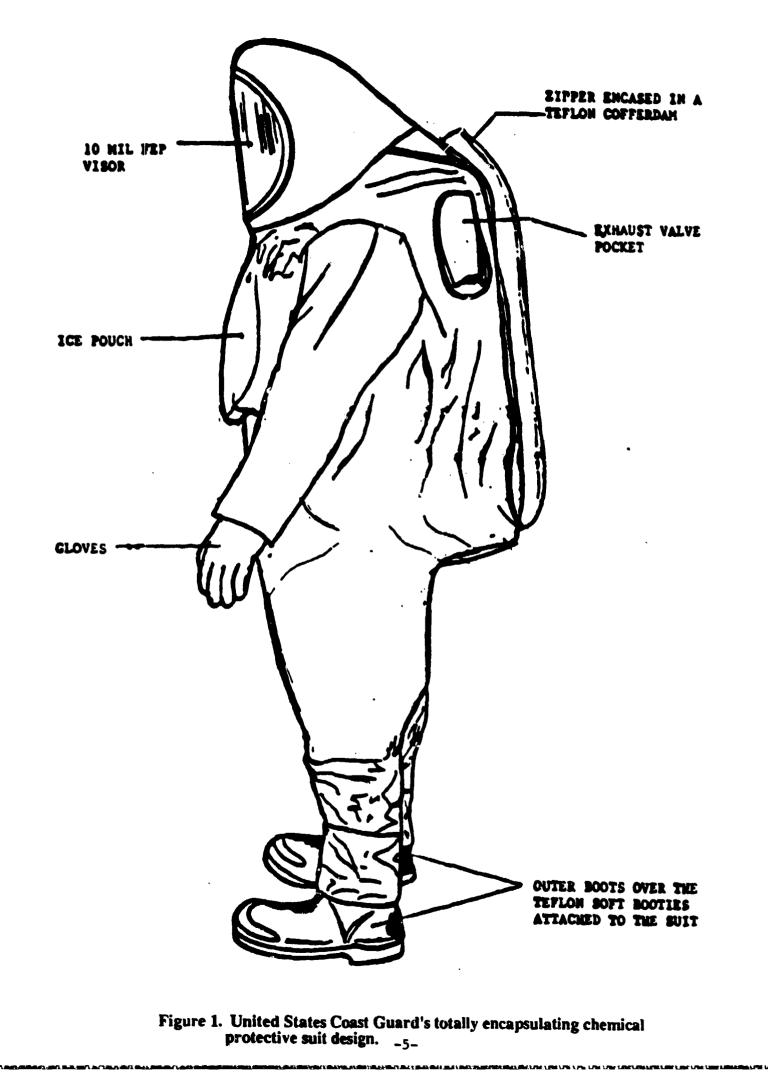


Figure 2. Saftey Science Group man-test chamber.

- DEC LSI 11/23

# Computer Interface:

Environmental chember ğ Control FOOT Anteroom

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Test atmospheres: Fredm<sup>TM</sup> 12 (gas)

- PEG 400 (atrosol)
- Stress with
  - Treedhill

# Monitoring:

- QC with Mectron capture detectors
- Z
- Pictomoter
- **Opticel particle sizer**
- Stan/chatte perticle counter
- Humidity monitor
- At flow Monitor
  - · Preserve Monitor
- Her rate monitor

#### Experimental Results

Figures 3 through Figure 39 and Table 1 present the various experimental parameters recorded during each of the three test runs. Due to start up conditions and monitoring or recording failures, some experimental parameters were not recorded. All experimental data which was collected is presented, nothing has been omitted by the investigator.

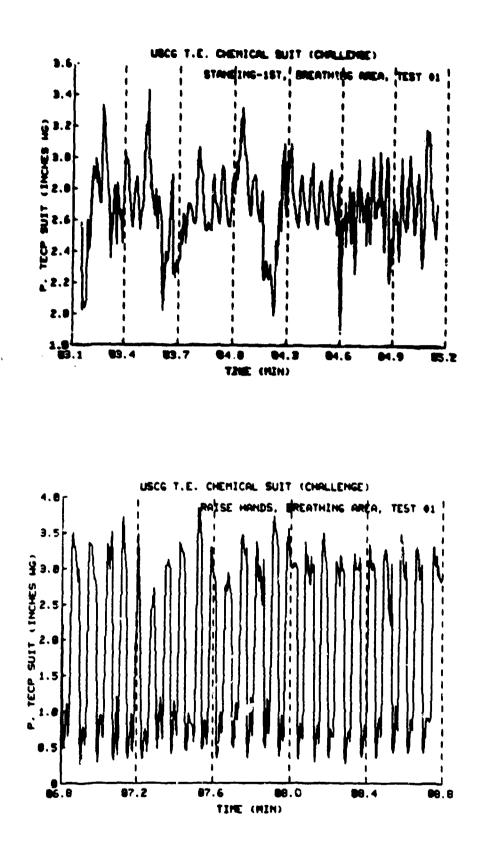


Figure 3. Internal TECP suit pressure for standing in place and rasing the hands above the head.

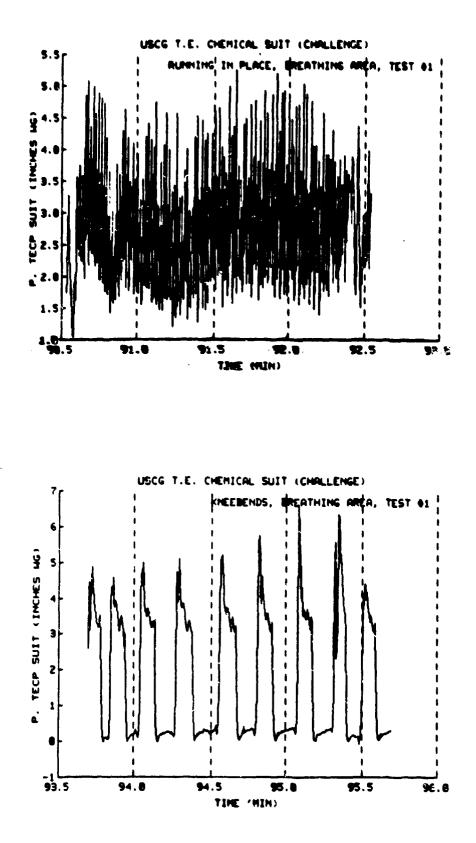


Figure 4. Internal TECP suit pressure for running in place and during kneebends.

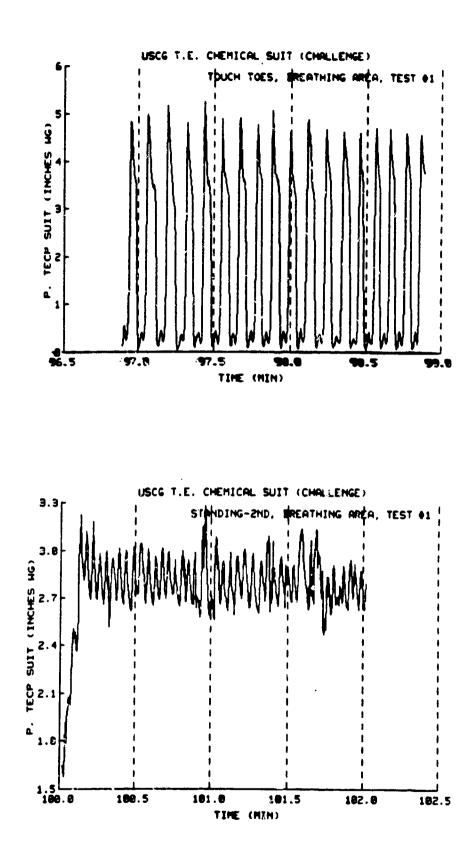


Figure 5. Internal TECP suit pressure for touching the toes and standing in place.

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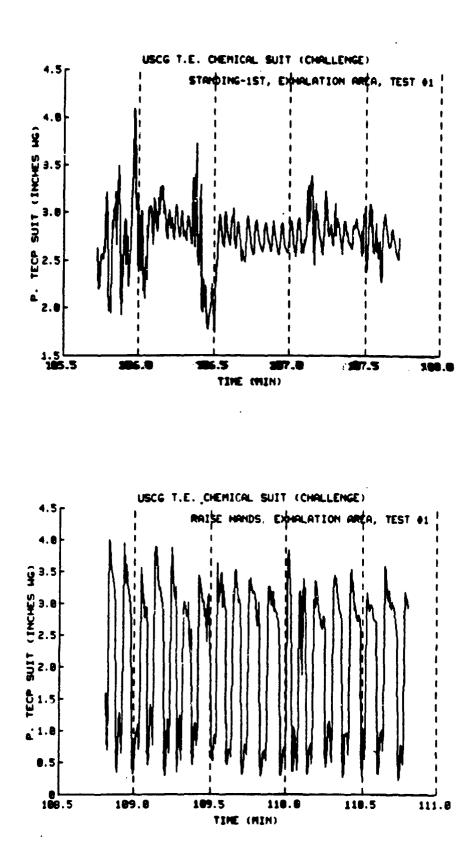
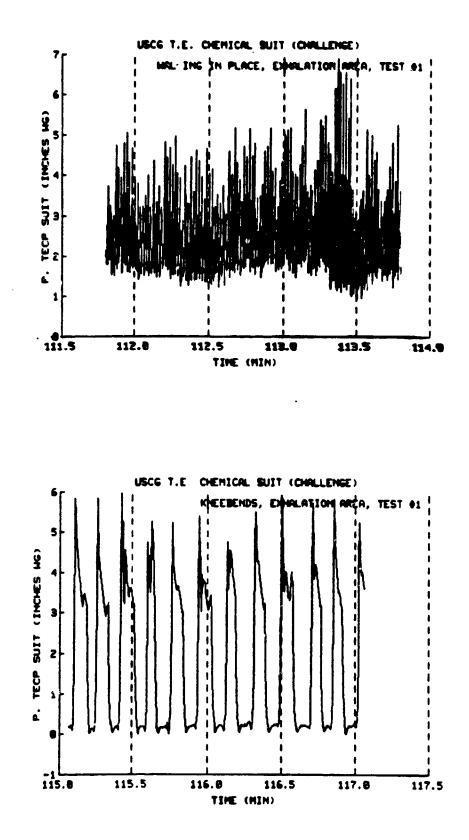


Figure 6. Internal TECP suit pressure for standing in place and rasing the hands above the head.

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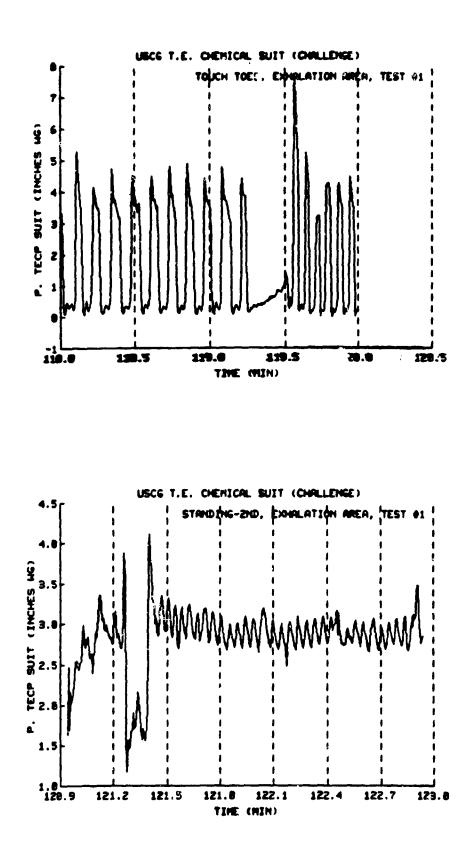


Figure 8. Internal TECP suit pressure for touching the toes and standing in place.

-13-

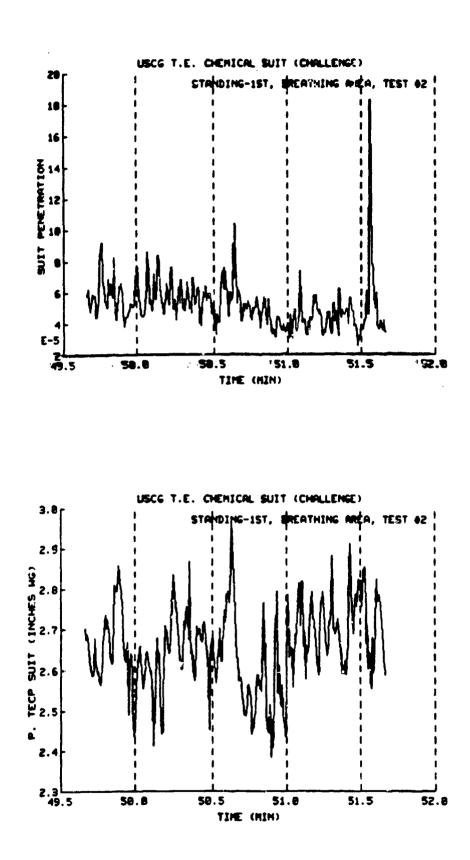


Figure 9. TECP suit aerosol penetration (BZ) and pressure plots for standing in place.

-14-

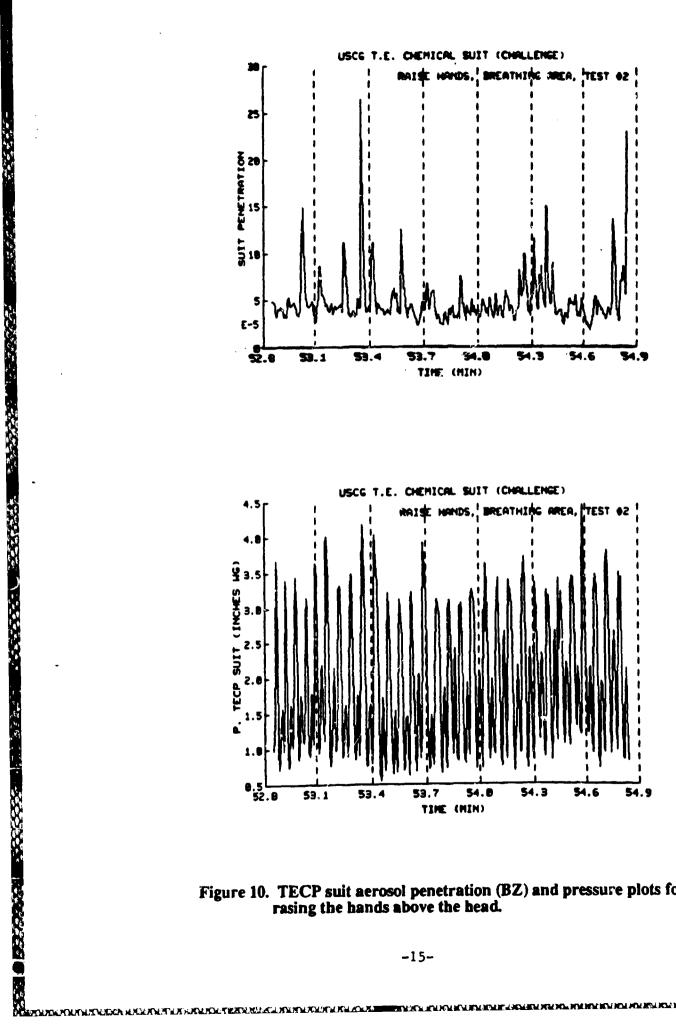


Figure 10. TECP suit aerosol penetration (BZ) and pressure plots for rasing the hands above the head.

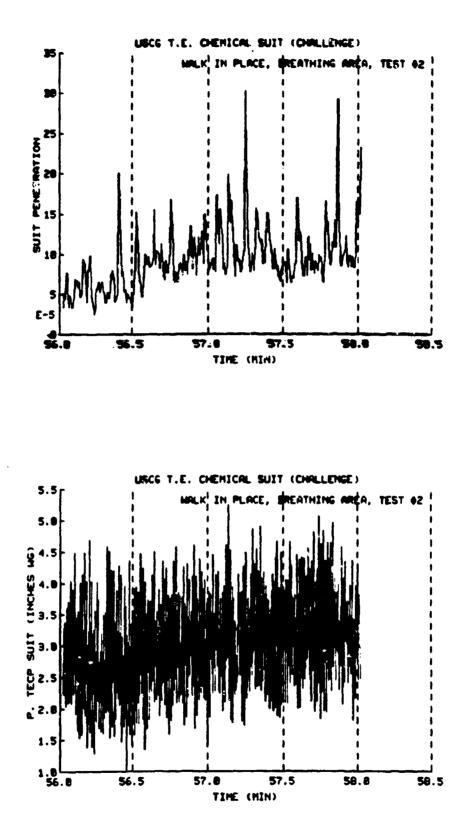


Figure 11. TECP suit aerosol penetration (BZ) and pressure plots for walking in place.

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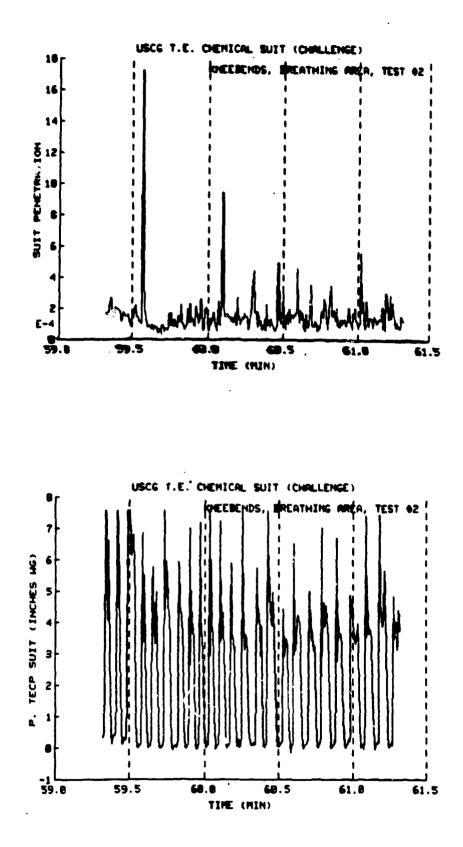


Figure 12. TECP suit aerosol penetration (BZ) and pressure plots during kneebends.

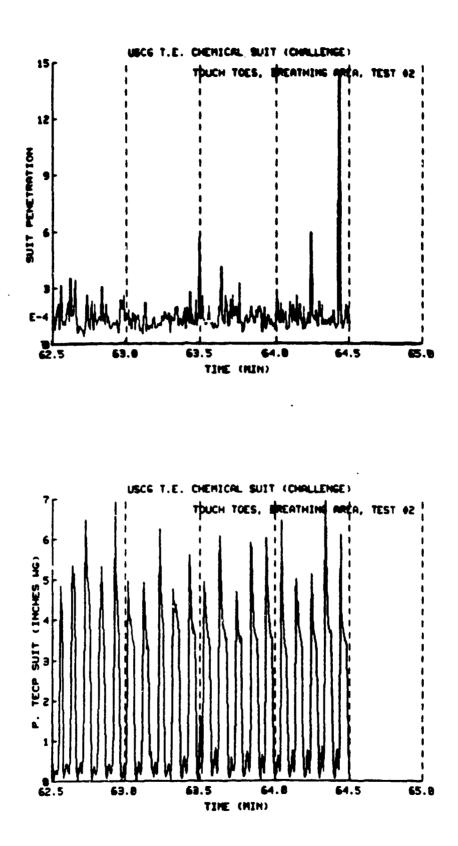
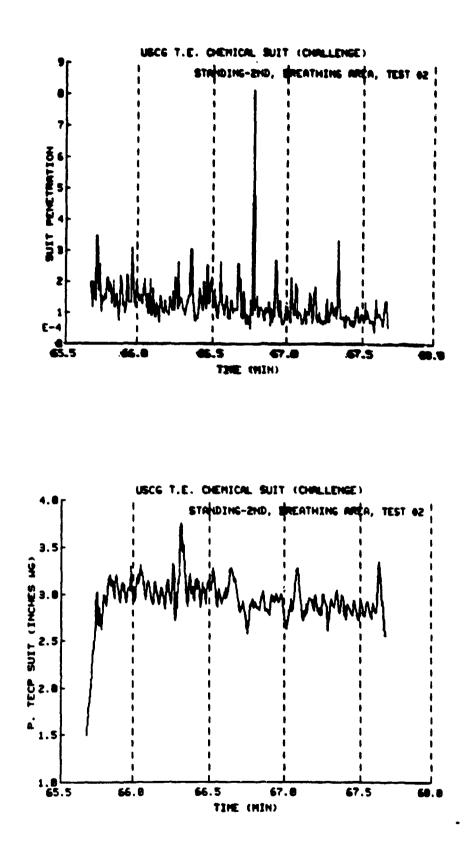


Figure 13. TECP suit aerosol penetration (BZ) and pressure plots for touching the toes.

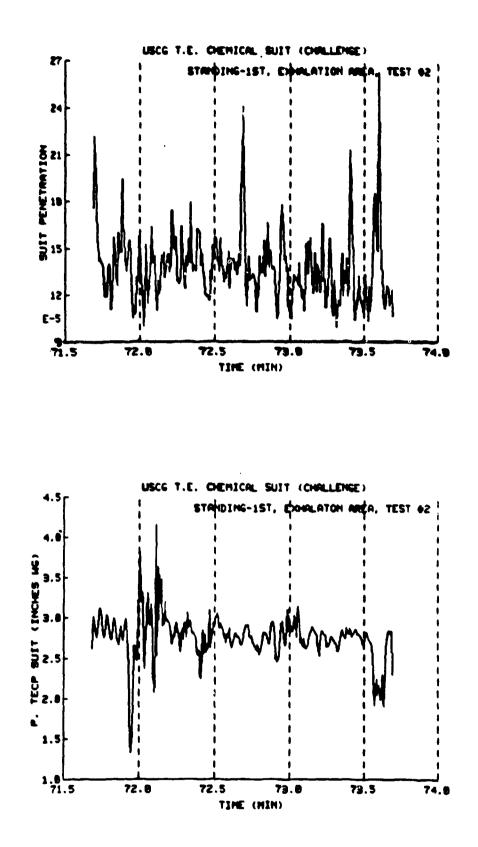
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Figure 14. TECP suit aerosol penetration (BZ) and pressure plots for standing in place.

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Figure 15. TECP suit aerosol penetration (VVZ) and pressure plots for standing in place.

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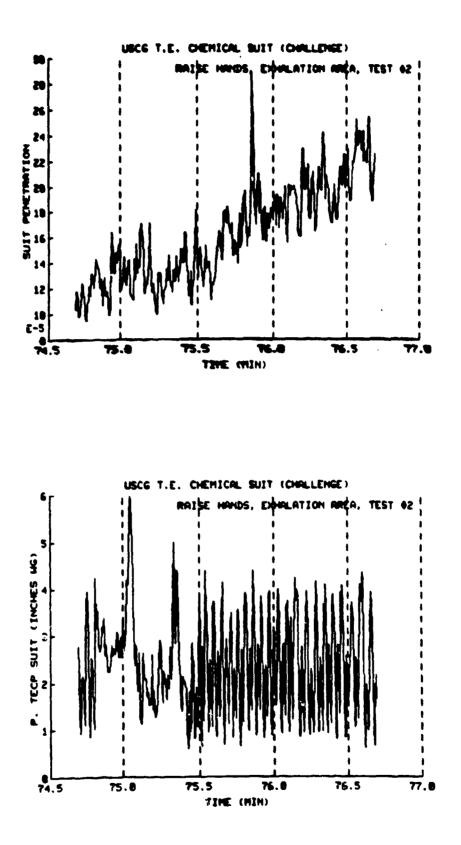
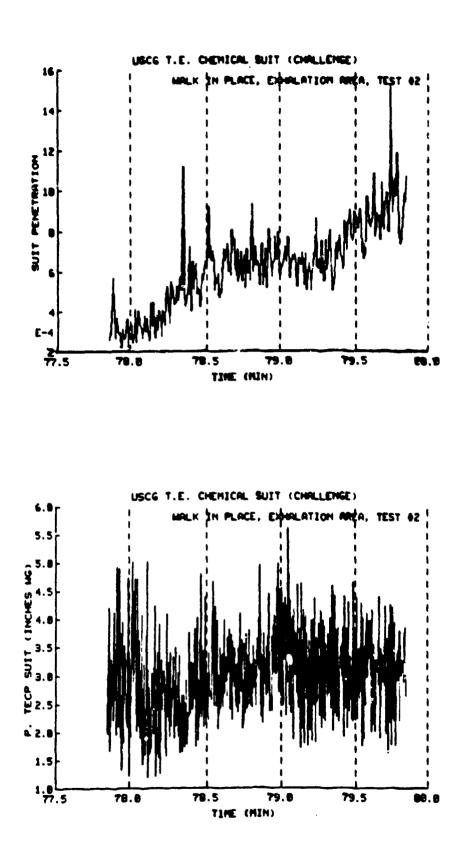


Figure 16. TECP suit aerosol penetration (VVZ) and pressure plots for rasing the hands above the head.

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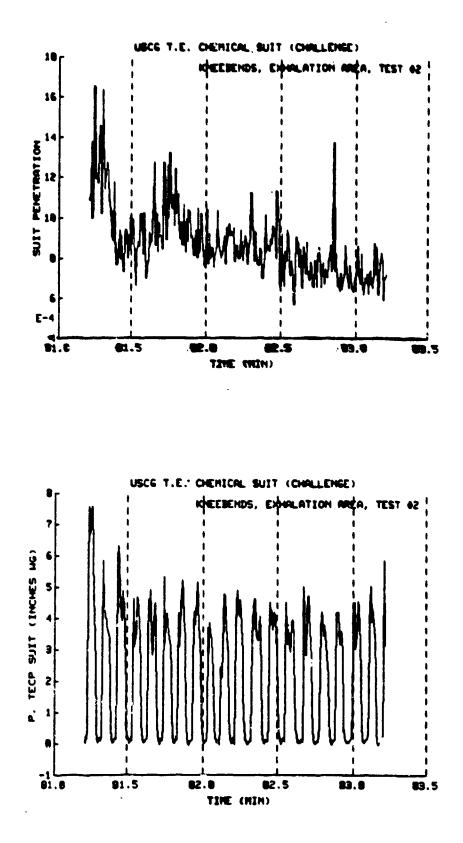


Figure 18. TECP suit aerosol penetration (VVZ) and pressure plots during kneepends

-23-

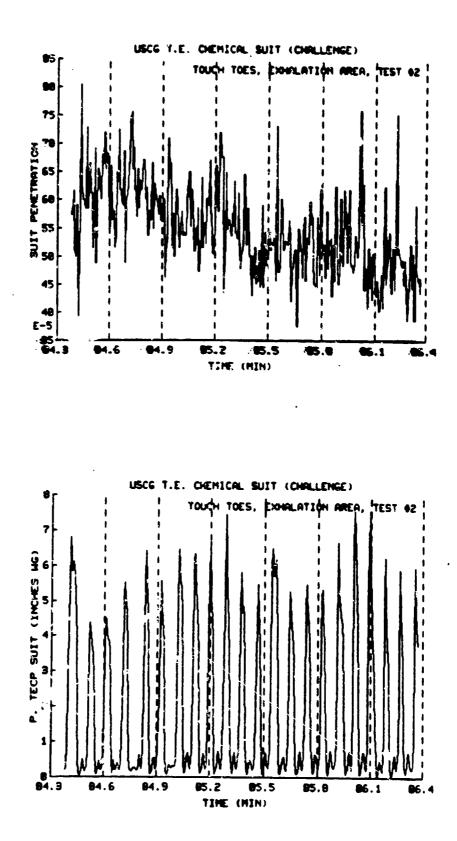


Figure 19. TECP suit aerosol penetration (VVZ) and pressure plots for touching the toes.

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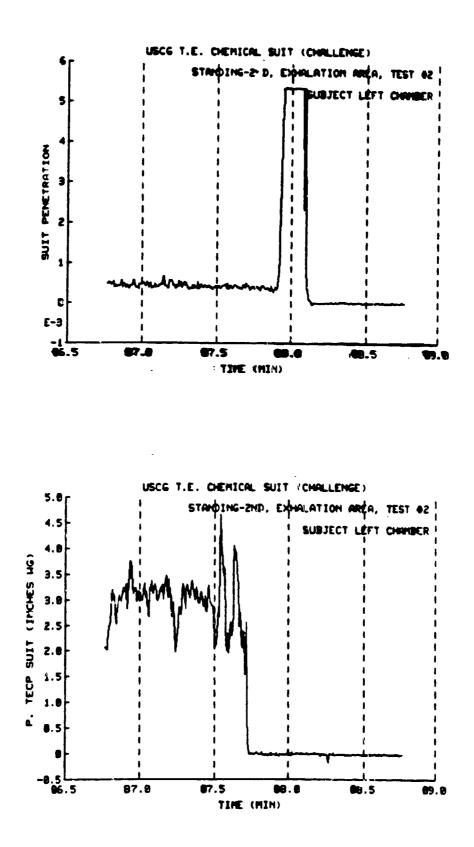
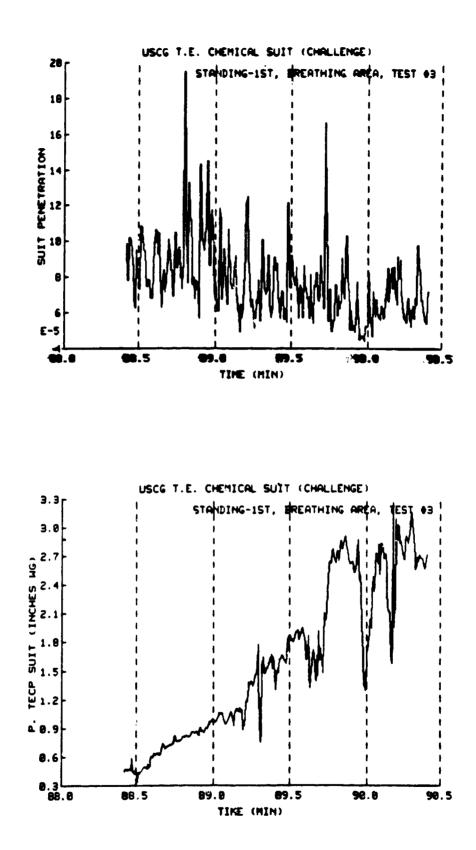


Figure 20. TECP suit aerosol penetration (VVZ) and pressure plots for standing in place.





-26-

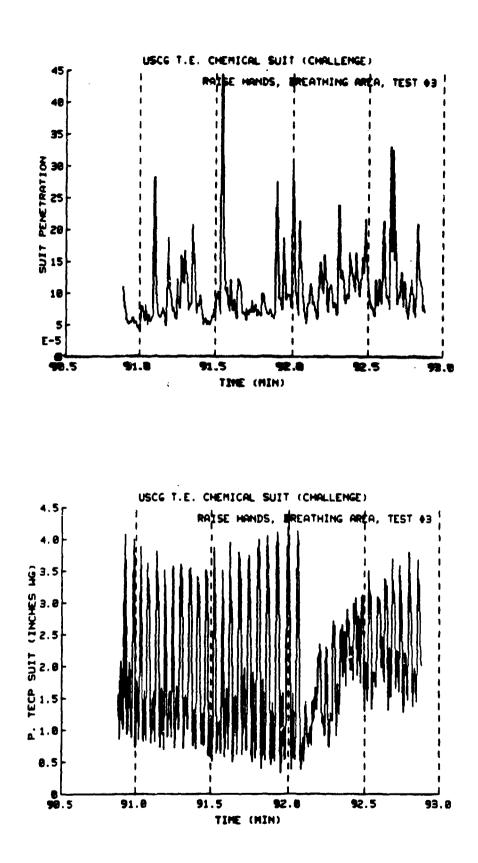


Figure 22. TECP suit aerosol penetration (BZ) and pressure plots for rasing the hands above the head.

-27-

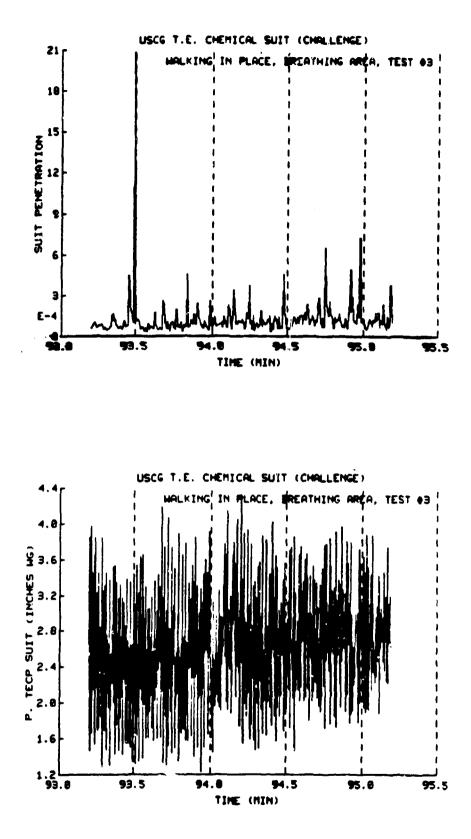




Figure 23. TECP suit aerosol penetration (BZ) and pressure plots for walking in place.

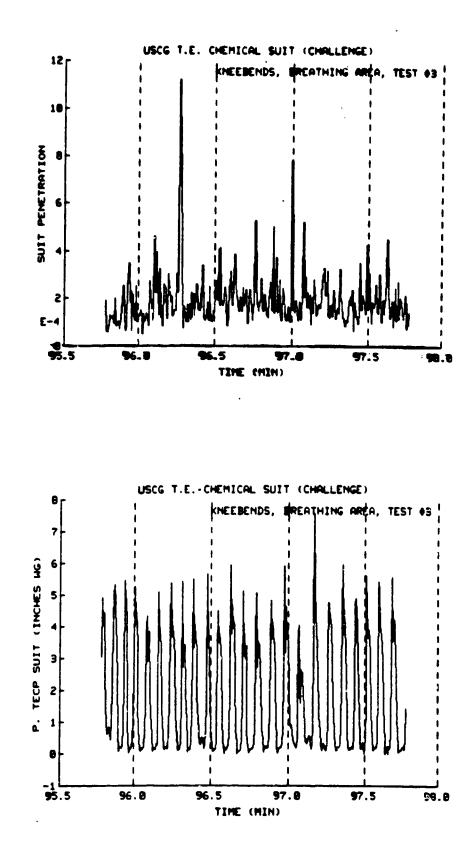


Figure 24. TECP suit acrosol penetration (BZ) and pressure plots during kneepends.

-29-

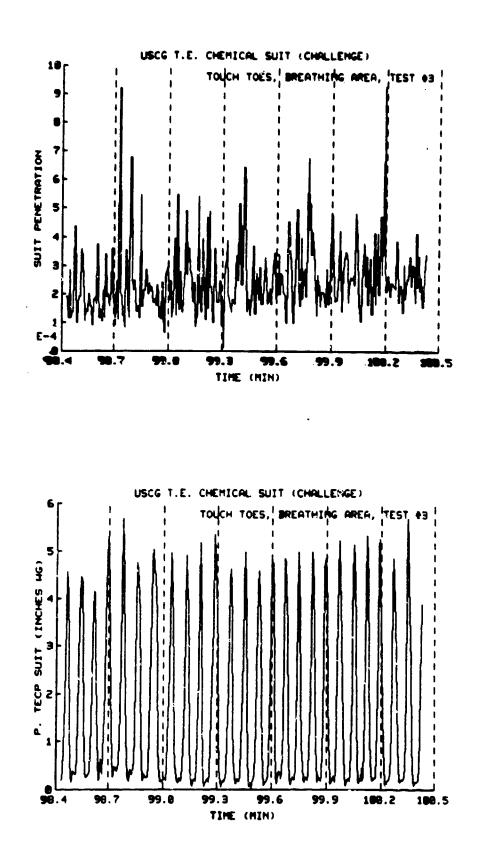


Figure 25. TECP suit aerosol penetration (BZ) and pressure plots for touching the toes.

-30-

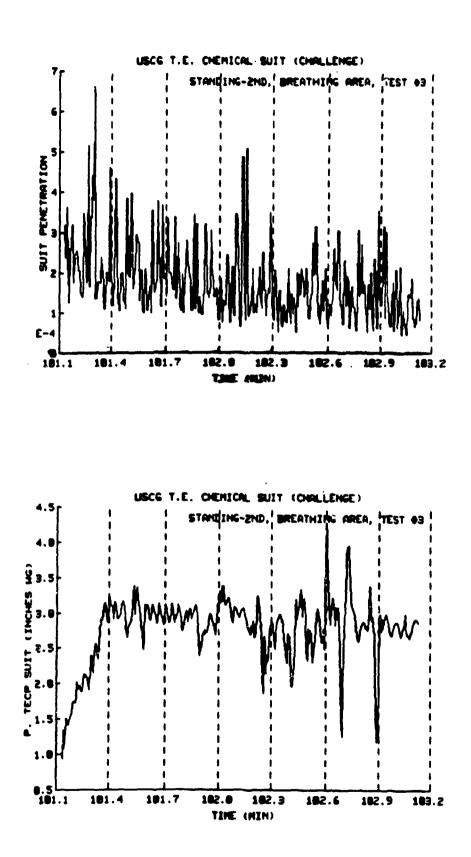


Figure 26. TECP suit aerosol penetration (BZ) and pressure plots for standing in place.

-31-

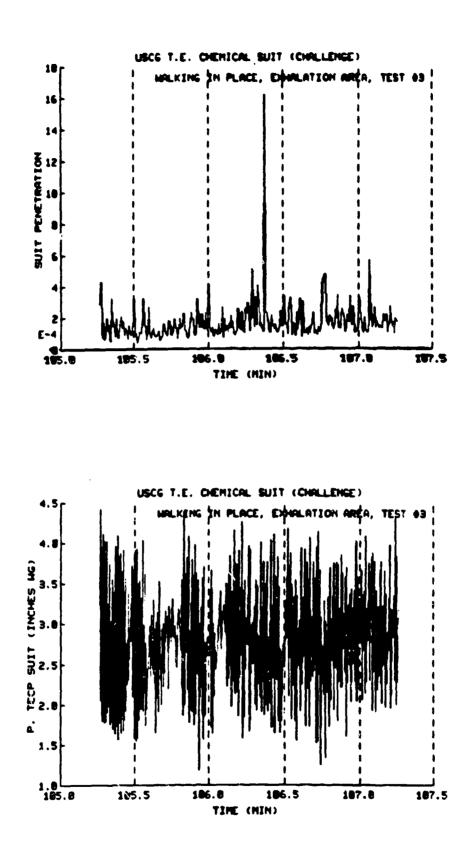


Figure 27. TECP suit aerosol penetration (VVZ) and pressure plots for walking in place.

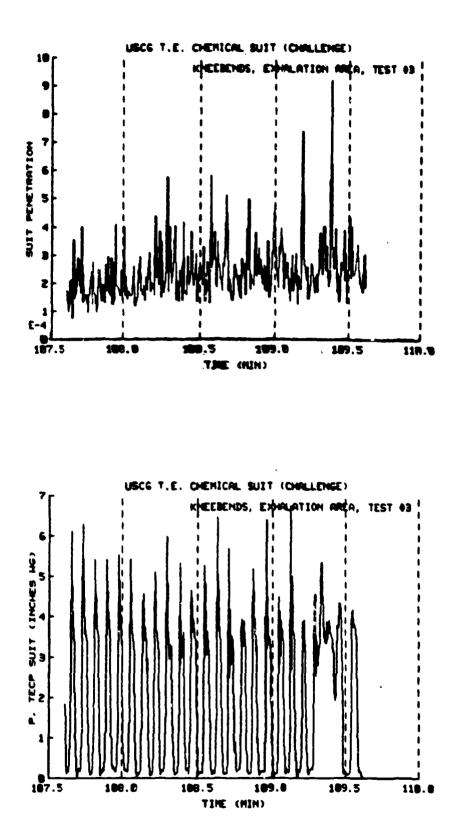
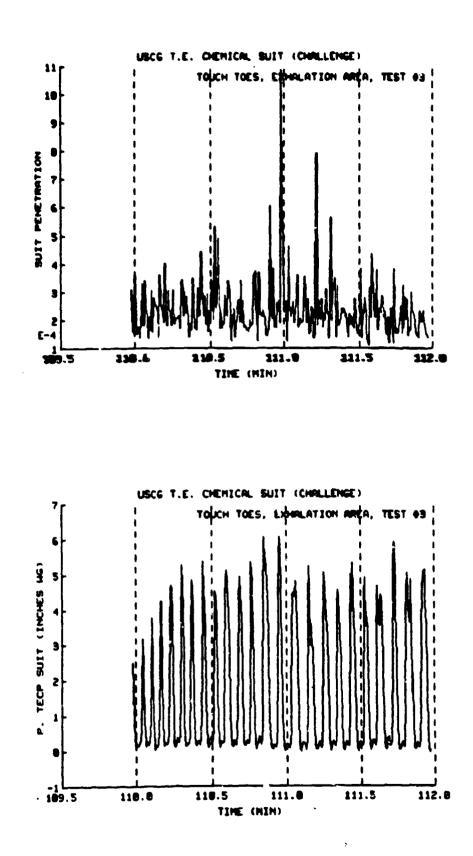


Figure 28. TECP suit aerosol penetration (VVZ) and pressure plots during kneebends

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Figure 29. TECP suit aerosol penetration (VVZ) and pressure plots for touching the toes.

-34-

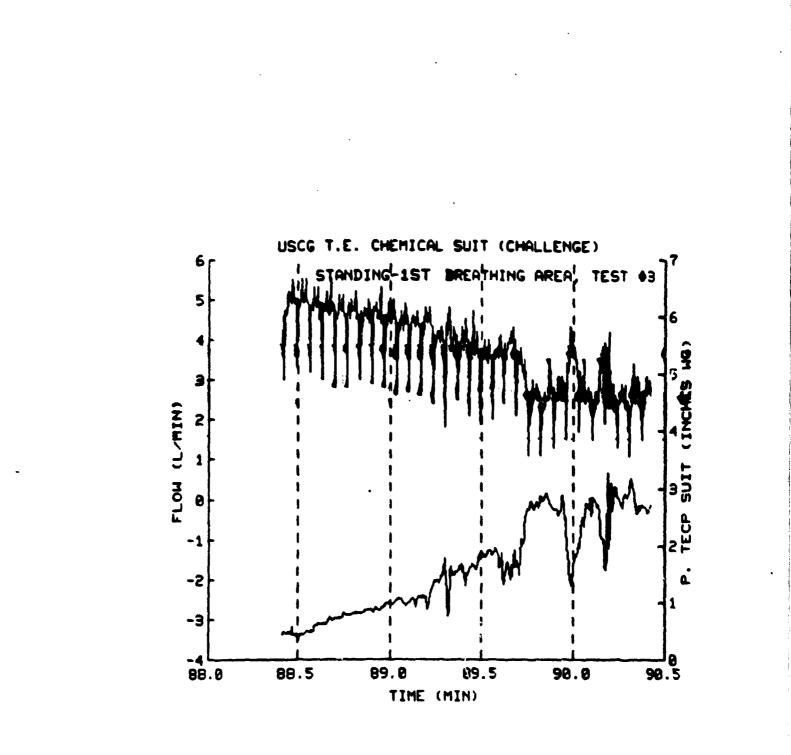


Figure 30. TECP suit pressure and flow plots for standing in place.

-35-

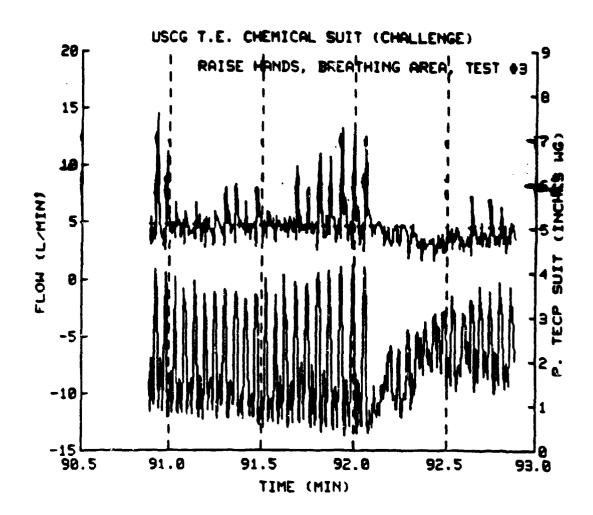


Figure 31. TECP suit pressure and flow plots for raising the hands.

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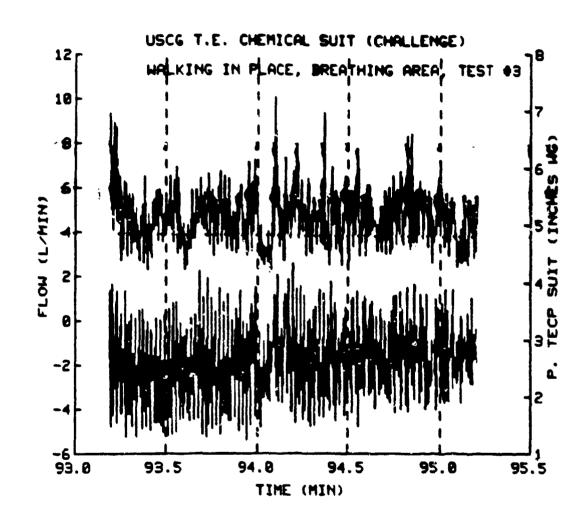
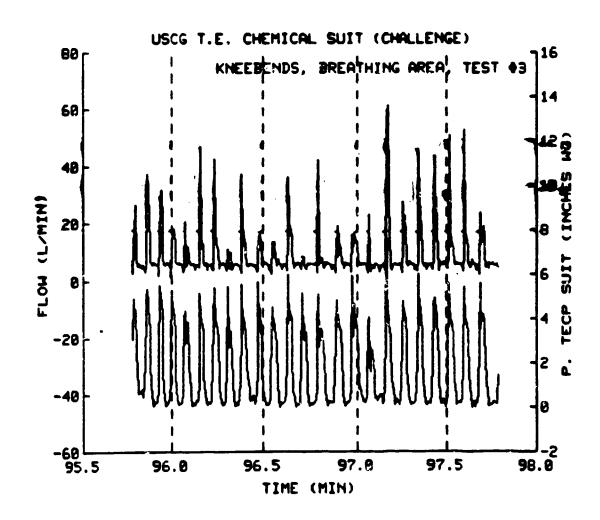


Figure 32. TECP suit pressure and flow plots for walking in place.

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Figure 33. TECP suit pressure and flow plots during kneebends.

-38-

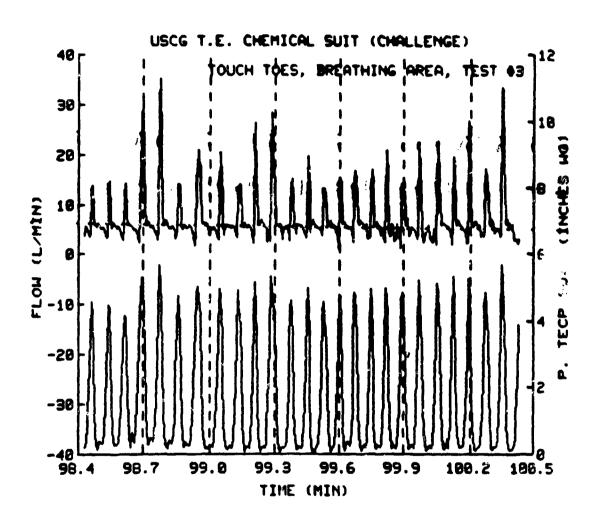


Figure 34. TECP suit pressure and flow plots for touching the toes.

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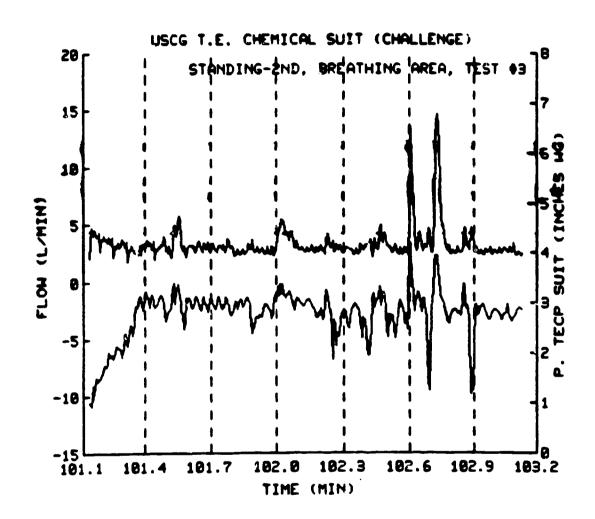


Figure 35. TECP suit pressure and flow plots standing in place.

-40-

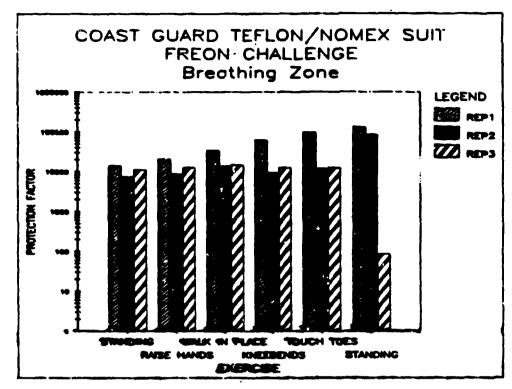


Figure 36. Bar chart showing achieved protection factors for various exercises while wearing the Coast Guard's Teflon<sup>R</sup>/Nomex<sup>R</sup> TECP suit and sampling in the breathing zone for Freon<sup>R</sup>.

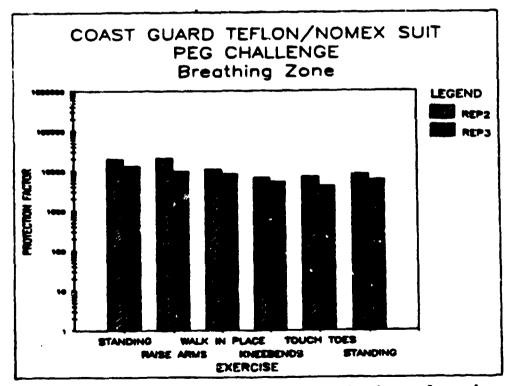
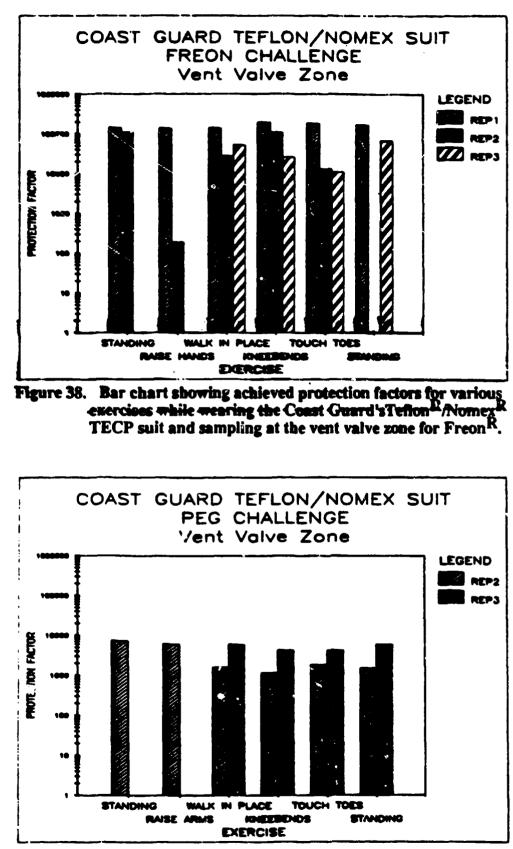


Figure 37. Bar chart showing achieved protection factors for various exercises while wearing the Coast Guard's Teflon<sup>R</sup>/Nomex<sup>R</sup> TECP suit and sampling in the breathing zone for PEG 400.



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Figure 39. Bar chart showing achieved protection factors for various exercises while wearing the Coast Guard'sTeflon<sup>R</sup>/Nomex<sup>R</sup> TECP suit and sampling at the vent valve zone for PEG 400.

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	Test 1		Test 2		Test 3	
<u></u>	min	max	min	max	min	ma>
Standing	1.9	3.4	2.4	3.0	0.3	3.3
Raise hands	0.25	3.8	0.5	4.5	0.5	4.2
Walking in place	1.0	5.3	1.0	5.3	1.2	4.3
Knee bends	0.1	6.8	0.1	7.5	0.1	7.6
Touch toes	0.1	5.3	0,1	5.9	D. 1	5.8
Standing	2.5	3.3	2.7	3.7	1.3	4.2
Standing	1.8	4.7	1.4	4.1	Not taken	
Raise hands	0.3	4.0	0.6	6.0	Not taken	
Walking in place	1.0	7.0	1.2	5.7	1.2	4.4
Knee bends	0.1	ð.0	0.1	7.5	0.1	6.8
Touch toes	0.1	7.8	0.1	7.6	0.1	6.0
Standing	1.2	4.2	2.0	4.7	1.9	4.1
lowest min	(+) 0.1		(+) 0.1		(+) 0.1	
highest max	(+) 7.8		(+) 7.6		(+) 7.6	

Table 1. Approximate internal suit pressure variation (positive inches water gauge) during man tests.

## Discussion

The actual leak rate of TECP suits has not been measured accurately in hazardous material accidents. This lack of monitoring data is mainly due to the complicated nature of most accidents along with their unknown schedule. To obtain a reasonable estimate of TECP suit performance in "HazMat" operations a laboratory experiment has been designed to measure simulated TECP suit intrusion coefficients of the Coast Guard's new Teflon<sup>R</sup>-coated Nomex<sup>R</sup> suit. A man-test chamber equipped with both aerosol and gas leak-rate monitoring equipment was used. A series of light exercises designed to stress the various parts of the TECP suit was followed. The pressure inside the TECP suft was monitored continuously during the various exercises. The venting flaw rate was also measured during one of the test runs.

Until this evaluation, there has been no information available describing the variation in internal pressure and venting flow rate of a TECP suit during actual use. Table 1 summarizes the various pressure extremes in the suit. They range from + 0.1 to + 7.8 inches w.g This indicates that the positive pressure vent valves do function as planned. The restrictions to movement due to suit tightness from being pressurized was found to be acceptable. The actual value of the positive pressure however, at reducing leak rates into the suit, is still unproven. This information was also useful background information for establishing the inflation pressures of ASTM's "Standard Practice for Pressure Testing of Gas Tight Totally Encapsulating Chemical Protective Suits" (ASTM F 1052). It also provides a measure of the minimum strength suit materials, seams, and components must have. The venting flow rate, on the other hand, provides an accurate measure of the volume of air vented from the suit during the various exercises.

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If one examines the plot of TECP suit pressure vs time for standing in place in Figs. 3, 5, 6, and 8, a measure of the positive pressure vent valve performance can be obtained. An eyeball average of the peaks produces an average cracking pressure of between 2.8 to 3.0 inches w.g. The pattern is somewhat irregular because it is dependent on the breathing patterns of the human subject and body movements which depress the suit volume. The pressure plot for standing in place in Fig. 8 however, illustrates the relatively small operational range under which the valves can open and close (AP approximately 1/2 inch w.g.). Since there were three vent valves in the suit during this test series, one cannot identify pressure variations due to individual valve cracking pressure differences. It can be said qualitatively from the vent valve sounds that only one valve was venting most of the time, aspecially during the standing in place exercise. The need for more than one valve is also questionable from this observation and the corresponding pressure traces. The ability of the Stratotech one-way vent valve to operate at  $\gamma$ adjusted cracking pressure of 2 inches w.g. is also questionable due to the 2.8 to 3.0 inches w.g. operational range which was observed throughout this experiment.

By comparing aerosol suit penetration vs time to the pressure variation vs time, a measure of the effect of suit leakage to pressure variation can be obtained. A careful review of Figs. 9 - 14 and 21 - 26 where aerosol penetration in the breathing zone vs time is compared to internal suit pressure vs time does not produce an obvious relationship. The lack of pressure vs leak rate relationship for the vent valve zone (VVZ) in Figs. 15 - 20 and 27 - 29 can also be seen. Additional experiments will have to be made on a more detailed basis before this relationship can be completely understood.

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In Figs. 36 and 37 the average protection factors for the various exerci es are illustrated as measured by Freon<sup>R</sup> 12 and PEG penetration in the breathing zone area of the suit. There is a minimum of variability between the two methods in this sampling area. This is indicative of good mixing of the challenge agents before they reach the sensors and general agreement with reference to the existence and magnitude of the TECP suit leaks. Since the Freon monitoring system uses grab samples to analyze, it can be expected to miss leak rate peaks, especially if they are short in duration.

The PEG monitoring system operates on a continuous basis and gives a better measure of the overall suit leak rate. The large variability between the protection factors as measured by Freon<sup>R</sup> 12 and PEG are therefore understandable if the challenge agent occurs in pulses which are not mixed well. Thus, a more accurate measurement of VVZ leakage is provided by the PEG system which indicates the possibility of a significant leak from the vent valves. A more detailed evaluation of the leak rate of vent valves will be needed to determine if they present a significant leak source as they are used in the new Coast Guard TECP suit. This evaluation should examine valve performance during actual suit use and valve performance utilizing a laboratory test fixture.

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## Conclusion

A series of test exercises have been carried out wearing the new U.S. Coast Guard's Teflon<sup>R</sup>-coated Nomex<sup>R</sup> totally-encapsulating chemical protective (TECP) suit. The leak rate of this new TECP suit was measured using both an aerosol (PEG 400) and gas (Freon<sup>R</sup> 12) during a prescribed series of test exercises. The internal suit pressure was also monitored and found to range from 0.1 to 7.8 inches of water gauge during the entire exercise series. This indicates that the positive pressure vent valves do function as planned, and keep the TECP suit positive. The need for more than one vent valve should be examined more closely since it appeared that only one valve was operating in an effective manner during the three tests. Protection factor/intrusion coefficient walves for PEG 400 and Freen<sup>R</sup> 12 within the breathing zone area of the TECP suit were found to agree generally. Larger variations between the two challenge agents were found in the vent valve zone. This may be indicative of back streaming through the vent valves as venting takes place to relieve internal suit pressure. Additional studies which measure challenge concentrations inside the suit at various sampling locations are necessary to better quantify this preliminary observation. Laboratory experiments measuring the leak rates of TECP suit vent valves in an isolation test fixture are also necessary to better understand valve performance.

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## APPENDIX L

## EVALUATION OF SUIT INTEGRITY BY FIELD EXPOSURE TO HYDROGEN FLUORIDE VAPOR

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(Report by Lawrence Livermore National Laboratory)



HYDROGEN FLUORIDE TESTING OF

THE U. S. COAST GUARD'S

TOTALLY-ENCAPSULATING

CHEMICAL PROTECTIVE SUIT

# Safety Science Group



Lawrence Livermore National Laboratory

#### HYDROGEN FLUORIDE EXPOSURE TESTING OF

## U.S. COAST GUARD'S TOTALLY-ENCAPSULATING CHEMICAL PROTECTIVE SUIT

ABSTRACT: The U. S. Const Guard Chemical Response Suit was field tested at the Department of Energy's Nevada Test Site in controlled releases of hydrogen fluoride. Two suits were placed on specially designed mannequins in two separate tests and subjected to hydrogen fluoride vapor concentrations up to 12,000 ppm for a 6 minute period. The mannequins contained a pulsed breathing air supply to simulate normal operation of the suit's exhaust valves and four different hydrogen fluoride detection systems. The analytical results of the two tests indicated no penetration of hydrogen fluoride into the suit.

KEYWORDS: Totally-encapsulated chemical protective suit, Fluoropolymer Materials, Overall Protective Suit Testing, Suit Integrity, Hydrogen Fluoride

# INTRODUCTION:

The U. S. Coast Guard has developed a new totally-encapsulated chemical protective suit for protection of personnel during chemical spill response. This suit involves a novel fluor polymer (Teflon)/aramid composite material which has demonstrated a high level of chemical resistance relative to existing commercial protective materials. Most of the suit's exterior components and materials have been evaluated for chemical resistance.<sup>1</sup> Furthermore, the overall physical integrity of the Chemical Response Suit has been assessed using several different methods.<sup>2</sup> However, the ability of the entire suit to maintain its chemical resistance integrity during realistic field exposure conditions has not been tested. Documented evidence from suit failures in a dimethyl amine accident at Benicia, California demonstrate that chemical protective suit components can fail, exposing the wearer to hazardous chemicals.<sup>3</sup>

The U. S. Department of Energy has constructed a large-scale spill test facility for liquified gaseous fuels and other hazardous materials in the Frenchman Flat Basin on the Nevada Test Site. The Lawrence Livermore National Laboratory (LLNL) assists the Department of Energy with the operation of this facility which provides data for public safety by studying the controlled spills of hazardous substances. In 1983, large scale releases of ammonis and nitrogen tetroxide were carried out to measure the atmospheric dispersion of the spilled chemicals.<sup>4</sup> In the summer of 1986, releases of hydrogen fluoride and liquified petroleum gas of similar magnitude were conducted Proposed future activities at the spill facility will involve chlorine and other gases.

The U. S. Coast Guard funded the Safety Science Group of Lawrence Livermore National Laboratory to carry out a small experiment to evaluate the chemical protection of their new Chemical Response Suit in high concentrations of highly corrosive hydrogen fluoride. This evaluation was done as part of the hydrogen fluoride spill series sponsored independently by AMOCO Corporation to develop and test atmospheric dispersion models. This spill test series afforded the Coast Guard and Lawrence Livermore National Laboratory the opportunity to determine if the new Chemical Response Suit provided protection against high vapor concentrations of hydrogen fluoride. The tests also assessed the feasibility of using high concentrations of hazardous materials to test the performance of chemical protective clothing.

EXPERIMENTAL

Coast Guard Chemical Response Suit. Two different Coast Guard Chemical Response Suits were tested in separate hydrogen fluoride spills. The Chemical Response Suit is a totally-encapsulating chemical protective suit developed to provide a high level of protection in chemical spill response. This suit is designed to fully enclose both the wearer and his or her breathing apparatus (Figure 1). Features of this suit include a full body garment with a hood and visor, internal positive pressure operation, a gas-tight zipper, and integral gloves and boots. The suit uses fluorop; iymer based materials for the garment, visor, and gloves; non-fluoropolymer components include the suit zipper and exhaust valves. Only the garment material has been tested against hydrogen fluoride in laboratory testing and showed no permeation in a three hour period.<sup>5</sup> The suit exhaust valves are protected by an inverted pocket to reduce the likelihood of direct contact with chemical splashes. The suit closure is protected by a cofferdam arrangement with two flaps of garment material which are temporarily heat-sealed over the zipper (Figure 2). Positive pressure is achieved within the suit by the exhaust air from a self-contained breathing apparatus. This exhaust air is vented through suit exhaust valves adjusted to maintain an internal suit pressure of 3.8 mm Hg (2.0 inches water).

Suit Mannequin and Instrumentation Package. A mannequin was constructed out of wood to both support the Chemical Response Suit in an upright position and house the instrumentation package (see Figure 3). Figure 4 shows the relative position of equipment on the mannequin. The instrumentation package included analytical devices to measure hydrogen fluoride intrusion, and an air supply system to keep the suit inflated and cool during the experiment. Four

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separate techniques were used to measure hydrogen fluoride vapor concentrations with the suits. The reason for a four-fold analytical system was to provide redundancy that would assure data collection even if one or more of the individual analytical devices failed. Two techniques were recommended by AMOCO; these included the AMOCO Integrated Field Sampler (IFS) and the GMD Systems AUTOSTEP Model 930 Portable Monitor. Both of these devices were used by the AMOCO spill site team to analyze hydrogen fluoride concentrations in the spill zone. Two other techniques were added by the Safety Science Group to provide additional analytical information: the Sensidyne SS2000 portable HF monitor and silics gel sorbent tubes. The characteristics of each analytical devices are described below.

AMOCO Integrated Field Sampler. The AMOCO IFS is a proprietary air sampling device. The instrument sequentially pulls air through each of 10 commercial Air-Sampling Field Monitors (Fisher Scientific: Gelman 4339 styrene filter holder, PN 01-038; Gelman MetricelR membrane filters, Grade CN-4, PN 09-730-47). The field monitors contain membrane filters pretreated with a proprietary method specific for retention of hydrogen fluoride. The flow volume through each cassette was precalibrated with an AMOCO data logger designed for used with the IFS. The time of flow through the cassettes is adjustable on a group basis, however, once a time interval is selected, every cassette in the series uses the same one. The interval used during this study was 65.6 seconds. Following use of the IFS, the cassettes were removed and each membrane was analyzed for HF content by use of ion selective electrodes. The measured detection limit for HF vapor was 0.03 ppm<sub>v</sub>. The specific time hydrogen fluoride was first detected is indicated by the number of the cassette which first showed a measurable content.

GMD Systems AUTOSTEP Monitor. This system uses a colorimetric principle

in an automatic incremental mode. Color producing chemicals specific for hydrogen fluoride are impregnated into a paper tape that is stored in a removable cassette. A pump pulls a calibrated air volume sample of the test atmosphere through the tape. The tape is monitored by a L.E.D. photodiode combination which translates color intensity into a readout. After a programmed interval, the tape is stepped forward and the next sample is taken. At the start of each measuring sequence, a reading is taken of the tape background color intensity, which is stored in memory, and then subtracted from the reading at the end of the sampling interval. The analog, output from the AUTOSTEP monitor was sent to a chart recorder within the instrumentation package and also transmitted by field wire to a telemetry station. During each of the suit tests, the instrument was operated in the G-30 ppm, range. The detection limit calibrated for the specific paper taped used was nominally 3 ppm..

Sensidyne SS2000 Portable Toxic Monitor. This device uses an amperometric electrochemial sensor and responds to concentrations of analyte that diffuse across a semipermeable membrane. Calibration of the instrument indicated a repeatable linear response for hydrogen fluoride with a detection limit of 0.4  $ppm_v$  and usable upper range to 10  $ppm_v$ . Sensor response was found to be within the 10 seconds specified by the manufacturer. During this project, an analog output from the Sensidyne was continuously monitored by telemetry in the control room. The signal was also monitored by a strip chart recorder within the suit instrumentation package.

Silica Gel Sorbent Tubes. Four separate SKC, Inc. (Cat. No. 226-10-03) sorbent tubes, two on each side of the mannequin, were used during the tests. A Gillian sampling pump drew air through the tubes at a calibrated flow rate for each tube of 0.2 liters/minute. Subsequent to the collection period, the tubes were desorbed with eluant solution and analyzed for fluoride by ion chromatography. The measured instrumental detection limit was 1.0 ug. With a controlled flow period of 10 minutes, the hydrogen fluoride vapor concentration would have to exceed 0.6 ppm on a continuous basis to be measured.

Suit Pressurization and Cooling System. Since these experiments were conducted under the high temperature conditions of the desert, the suit was cooled before and after the experiment to protect the instrumentation package inside the suit. A second requirement was to simulate the operation of a self-contained breathing apparatus inside the suit. First, the cooling was achieved by an air flow from four cylinders of compressed air plumbed together in series underground near the suit. Then, the breathing simulation requirement was met by using remotely operated standard sized (2700 psi) breathing air cylinders inside the suit. Figure 5 shows a schumatic of the control system for the analytical instruments and air supply (The entire experimental set-up is illustrated in Figure 6). When the experiment began, the cooling air was shut off, while internal suit cylinder air was pulsed periodically for the duration of the experiment. At the end of the experiment, the interior cylinder was shut off, and the exterior cylinders reopened to provide cooling air and to flush the interior of the suit.

Exposure Conditions. The facility's experimental test plan outlined a series of four hydrogen fluoride spills at different release rates and humidity conditions. Lawrence Livermore chose the two exposure conditions where 1000 gallons of hydrogen fluoride were released over a 6 minute period to separately expose the Coast Guard's Chemical Response Suits. One suit exposure was conducted under ambient humidity conditions. The second suit was exposed to the hydrogen fluoride under more humid conditions. Local lake bed

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flooding and a humidity generation apparatus were used to artificially humidify the environment. However, the overall effect on relative humidity was small. The suited mannequin was placed near a spill zone instrument tower located approximately 300 meters directly downwind from the chemical release point. This location offered the nearest site to the acid spill nozzle which had hydrogen fluoride monitoring equipment in place, was adjacent to a photographic tower for film recording, and had access to a telemetry station for data transmission. Data from the instrument tower were used to measure the exterior exposure of hydrogen fluoride received by the suit. The actual **exposure conditions to which each suit was subjected are given in Table 1.** 

<u>Procedure</u>. The suit mannequin assembly was placed on a suspension stand at the exposure site (Figure 7). Following the release of the hydrogen fluoride, an operator in the Test Facility control room activated the interior suit sampling equipment before the cloud reached the suit. This sampling was continued until the hydrogen fluoride cloud dissipated. Once the test director determined the site safe for entry, a two-person retrieval team decontaminated the suit and related hardware with a dilute ammonia washdown, followed by a water washdown. The effectiveness of this decontamination technique was verified by checking the wetted surfaces with pH paper for trace acidity. The exterior of the suit was then inspected before the mannequin was disassembled. Interior suit samplers were collected and sent off for analysis.

**RESULTS AND DISCUSSION** 

Table 2 shows that only the AMOCO IFS detected any hydrogen fluoride. This instrument has the lowest detection limit and the amounts indicated are close to that limit. There are two reasons which mitigate against these data

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indicating a real concentration of HF inside the suit. The first reason is that the cassettes in the first two positions (first 2.2 minutes of experiment) showed some small quantities of acid as di those in the later positions (last 2.2 minutes of experiment). This indicates a high 'blank' (zero) value because there was no hydrogen fluoride vapor outside the suit at initial stage of the experiment. It is known that silica dust will give a false positve for HF on this method. At an average wind velocity of 3-5 meters/second, the cloud has insufficient time to move 300 meters downwind to the suit location. This observation was confirmed visually for each of the two wasts. The second reason against this date showing a suit leak, is the observation of IFS precision: measurements appear random throughout its overall operation cycle. For these reasons we feel that the values are so close to the detection limit that they are merely a 'blank' reading. If a worse case position was taken in that the values were true, the measure maximum concentration (0.20 ppm.) of hydrogen fluoride would still be well below the ACGIH TWA level (3 ppm,) or Short Term Exposure Limit (6 ppm\_).<sup>6</sup> This indicates that the protection offered by the suit is quite high.

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The other three analytical techniques showed no measurable hydrogen fluoride at any time during the two field tests. The Sensidyne instrument had the second most sensitive detection limit and in each test, no measurable signal was generated (in the first test by telemetry, and in the second test by both telemetry and on the chart recorder). The consistency of this data supports our analysis of the IFS data as being variable within the analytical method. Our various monitoring data indicate that the suit maintained complete integrity against a very high external hydrogen fluoride vapor challenge.

# CONCLUSIONS

Our experience with conducting field tests of chemical protective suits under controlled hazardous material spill conditions indicates the feasibility of performing this test for other protective garments and chemicals. These methods appear useful for determining the performance of protective clothing under actual exposure conditions. While it would be both time consuming and costly to test a garment against several chemicals, field tests of this type could be conducted on a smaller scale and under more controlled conditions to assess the usefulness of related isboratory garment material testing. Furthermore, this technique offers a means to test the entire garment as used in the field.

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Test 1 (8/14/86)			Test	Test 2 (8/20/86)		
Time (min.) <sup>b</sup>	Concentrat 1 Meter <sup>C</sup>	ion (ppm) <sup>a</sup> 3 Meter	Time (min.)	Concentra 1 Meter	tion (ppm) 3 Meter	
0.00	0	0	0.00	0	0	
1.11	1400	950	1,20	8600	3400	
2.22	20000	16000	2,20	12000	2500	
3.33	18000	30000	3.30	13000	3900	
4.44	6800	15000	4.40	17000	4100	
5.55	<b>780</b> 0	8100	5.50	11000	3200	
6.66	13000	0	6.60	13000	3800	
7.77	300	22000	7.70	4200	2900	
8.88	210	6200	8.80	960	1600	
9 <b>.</b> 9 <del>9</del>	Ū	0	9, 90	270	133	
			11.00	200	110	
Maximum Conc. (Time)	20000 (2.2	2)/30000 (3.33)	) 17	000(4.40)/4	100(4.40)	
Average Conc.	12000		90	00		
Test Relative Humidity	10-12%		16	-18%		

TABLE 1 - Test Hydrogen Fluoride Exposure Conditions

<sup>a</sup>Hydrogen fluoride concentrations measured by AMOCO IFS. These concentrations represent the average of the integrated sample measurement over the sampling interval.

<sup>b</sup>This time represents the end of sampling interval.

CSpill site tower concentrations were measured at a one meter and three meter height. The Chemical Response Suit was held upright at a height of 1.5 meters.

Detection Method	Detection Limit (ppm)	Test 1 Results (ppm)	Test 2 Results (ppm)
AMOCO IFS	0.03	High: 0.20 Low: 0.04 Avg.: 0.08	High: 0.10 Low: 0.03 <sup>a</sup> Avg.: 0.05
Sensidyne SS2000	0.2	ди	ND
GMD Systems AUTOSTEP	3.0	ND	ND
Silica Gel Sorbent	0.6 <sup>c</sup>	ND	ND

# TABLE 2 - Summary of Hydrogen Fluoride Measurements Inside Chemical Response Suit

<sup>a</sup>low concentration below detection limit of analytical device

<sup>b</sup>ND - no hydrogen fluoride detected by method

.

<sup>C</sup>actual detection limit is 1 ug mass by ion chromatograph; effective detection limit is 0.6 ppm based on integrated sample over sampling interval

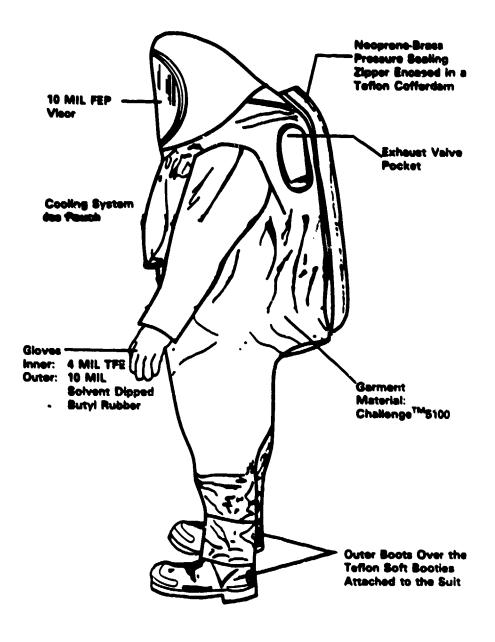


Figure 1. Coast Guard Chemical Response Suit



Figure 2. Heat Sealed Closure of Chemical Response Suit

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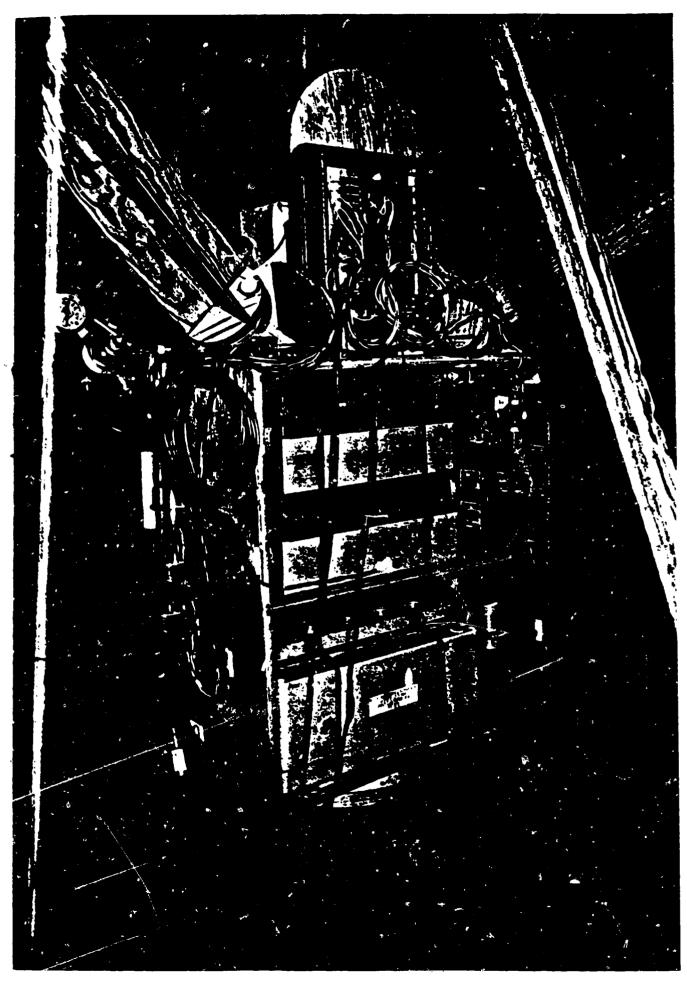


Figure 3. Photograph of instrumented test mannequin.

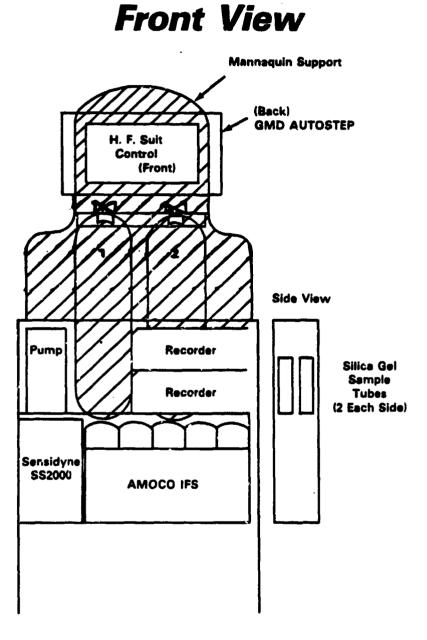


Figure 4. Diagram of Mannequin Equipment Layout

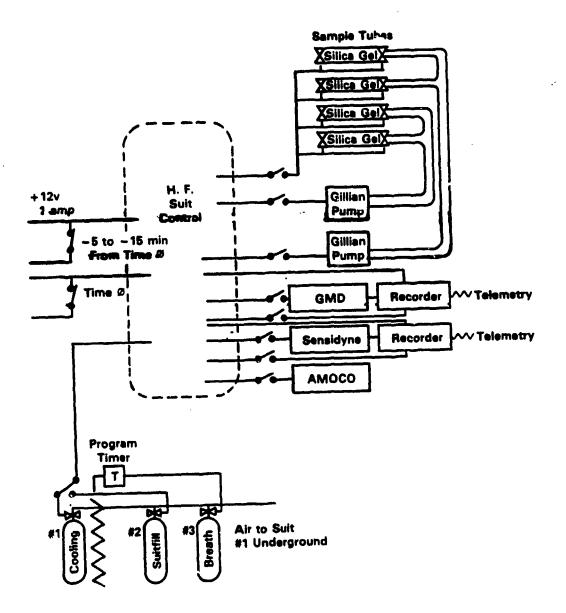


Figure 5. Suit Instrumentation Control Package

