

CHEM-WEAR Inc.

Telephone: GRamercy 5-2308

740 BROADWAY, NEW YORK 3, N. Y.

December 22, 1949

Dr. R. A. Kehoe
Kettering Laboratory
Univ. Cincinnati College
of Medicine
Cincinnati 19, Ohio

Dear Dr. Kehoe:

At the suggestion of Dr. Clyde Berry, of Esso Standard Oil, New Jersey, I am writing to you regarding clothing which we believe may be de-contaminated after contact with lead, tetra-ethyl.

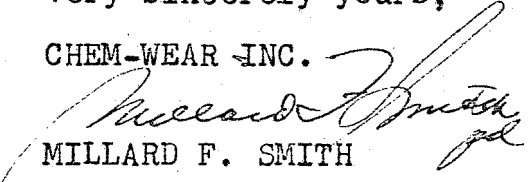
According to the opinion of the chemists of Standard Oil, a 20% solution of HCL at a boil should make sufficient chemical change in the lead to make it soluble in ordinary washings. Our tests show very little deterioration at the end of 20 hours submersion in a 38% solution of HCL at 100° C.

It is our belief that if this type fabric was to be used in clothing for your workers, the contaminated clothing could be subjected to a washing in HCL and then laundered by ordinary methods. This should mean a considerable savings in dollars and cents, due to the lower need of replacement garments.

We are taking the liberty of sending you our chemical report. We are also having the Mill send you some sample fabric for testing. We hope that this will be of interest to you, and that we can have the pleasure of working with you on this problem in the future.

Very sincerely yours,

CHEM-WEAR INC.


MILLARD F. SMITH

MFS/pd

RE 0020316

N20710

BETTER FABRICS TESTING BUREAU, INC. NEW YORK

Chem-Wear, Inc.
740 Broadway
New York City

CCC-1482

REPORT OF EFFECT OF SPECIFIED CHEMICALS ON "CHEM-WEAR" FABRIC

A heavy duck identified as "Chem-Wear" was submitted for tests to determine the resistance of this immersion in various chemical reagents. Tests for visual appearance, shrinkage and deterioration at various concentrations showed the following:

<u>Reagents</u>	<u>% Conc.</u>	<u>Temp. °C.</u>	<u>Percent Shrinkage</u>		<u>Tensile Strength In Pounds</u>		<u>Percent Loss Or Gain In Strength</u>		<u>Percent Elongation</u>		<u>Percent Elongation Gain Or Loss</u>	
			<u>Warp</u>	<u>Fill-ing</u>	<u>Warp</u>	<u>Fill-ing</u>	<u>Warp</u>	<u>Fill-ing</u>	<u>Warp</u>	<u>Fill-ing</u>	<u>Warp</u>	<u>Fill-ing</u>
ORIGINAL (CONTROL)	—	—	—	—	391	383	—	—	82	47	—	—
ACETIC ACID	100	90	1.0/	0.0	356	363	9.0-	5.2-	89	41	8.5/	12.8-
BLEACHED (NACLO ₂)	—	—	0.0	0.0	408	359	4.4/	6.3-	85	43	3.7/	8.5-
CALCIUM CHLORIDE	50	100	0.0	0.0	373	379	4.6-	1.0-	82	48	0.0	2.1/

* Refer to color identification chart for staining or approximate appearance.

- Equals loss.

/ Equals gain.

<u>Reagents</u>	<u>% Conc.</u>	<u>Temp. °C.</u>	<u>Percent Shrinkage</u>		<u>Tensile Strength In Pounds</u>	
			<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>
CARBON TETRA- CHLORIDE	100	45	0.0	0.0	383	370
CHLOROFORM	100	55	0.0	0.0	380	361
CHROMIC ACID	50	100	0.0	0.5/	131	118
CHROMIC ACID	50	50	0.0	0.0	352	315
CHROMIC ACID	50	25	0.0	0.0	362	331
CHROMIC ACID	25	100	0.0	0.0	232	218
CHROMIC ACID	25	50	0.5/	0.0	376	322
CHROMIC ACID	25	25	0.5/	0.0	381	336
CYCLO- HEXANONE	100	100	---	---	---	---

* Refer to color identification chart for staining or app

- Equals loss.

/ Equals gain.

<u>Percent</u> <u>Loss Or</u> <u>Gain In</u> <u>Strength</u>		<u>Percent</u> <u>Elonga-</u> <u>tion</u>		<u>Percent</u> <u>Elonga-</u> <u>tion Gain</u> <u>Or Loss</u>		<u>Appearance</u> <u>After 20 Hour</u> <u>Immersion</u> <u>Visible</u>		<u>*Changes From</u> <u>Original</u> <u>Color To</u>	
<u>Warp</u>	<u>Fill-</u> <u>ing</u>	<u>Warp</u>	<u>Fill-</u> <u>ing</u>	<u>Warp</u>	<u>Fill-</u> <u>ing</u>	<u>Deterio-</u> <u>ration</u>			
2.0-	3.1-	81	36	1.2-	23.4-	None		Slightly	lighter
2.8-	5.8-	85	42	3.7 $\frac{1}{2}$	10.6-	None		Slightly	lighter
66.5-	69.2-	15	11	81.7-	76.5	Stiffer		Blackish	Brown
10.0-	17.8-	82	44	0.0	6.4-	None		Chocolate	Brown
7.4-	13.6-	75	32	8.5-	31.9-	None		Golden	Brown
40.7-	42.6-	82	47	0.0	0.0	None		Blackish	Brown
3.8-	15.9-	88	40	7.3 $\frac{1}{2}$	14.9-	None		Chocolate	Brown
2.6-	12.3-	72	34	12.2-	27.6-	None		Golden	Brown
100.0-	100.0-	----	----	100.0-	100.0-	Decomposed		Amber	Gelatinous
								Mass	

roximate appearance.

<u>Reagents</u>	<u>% Conc.</u>	<u>Temp. °C.</u>	<u>Percent Shrinkage</u>		<u>Tensile Strength In Pounds</u>		<u>Percent Loss Or Gain In Strength</u>		<u>Percent Elonga- tion</u>		<u>Percent Elonga- tion Gain Or Loss</u>	
			<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>
CYCLO- HEXANONE	100	50	----	----	----	----	100.0-	100.0-	----	----	100.0-	100.
CYCLO- HEXANONE	100	25	0.5/	0.0	208	302	46.8-	21.1-	38	34	53.7-	27.6
FERRIC CHLORIDE	70	100	1.0/	0.0	296	306	24.3-	20.1-	38	38	53.7-	19.1
FERRIC CHLORIDE	70	50	0.0	0.0	360	360	7.9-	6.0-	82	41	0.0	12.8
FERRIC CHLORIDE	70	25	0.0	0.0	365	374	6.7-	2.3-	79	45	3.7-	4.3-
FERRIC CHLORIDE	25	100	0.5/	0.0	338	348	13.6-	9.0-	78	41	4.9-	12.8
FERRIC CHLORIDE	25	50	0.0	0.5/	363	378	7.2-	1.3-	84	48	2.4/	2.1/
FERRIC CHLORIDE	25	25	0.0	0.0	390	387	0.3-	1.0/	86	46	4.9/	2.1-

* Refer to color identification chart for staining or approximate appearance.

- Equals loss.

/ Equals gain.

KE 0020320

<u>Reagents</u>	<u>% Conc.</u>	<u>Temp. °C.</u>	<u>Percent Shrinkage</u>		<u>Tensile Strength In Pounds</u>	
			<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>
FORMAL- DEHYDE	40	90	1.0%	0.5%	384	382
GASOLINE (WHITE)	100	68	0.0	0.0	380	368
HYDRO- BROMIC ACID	48	100	1.5%	1.5%	360	346
HYDRO- CHLORIC ACID	38	100	1.0%	1.0%	393	374
HYDRO- FLUORIC ACID	100	---	---	---	386	374
HYDRO- FLUORIC ACID	50	---	---	---	389	374
HYDRO- FLUORIC ACID	25	---	---	---	388	372
HYDRO- FLUORIC ACID	15	---	---	---	390	380
HYDRO- FLUORIC ACID	10	---	---	---	390	381
LIGROIN (PET. ETHER)	100	40	0.0	0.0	378	392
METHYL ETHYL KETONE	100	100	---	---	---	---
METHYL ETHYL KETONE	100	50	0.0	0.0	259	310

* Refer to color identification chart for staining or

<u>Percent Loss Or Gain In Strength</u>		<u>Percent Elonga- tion</u>		<u>Percent Elonga- tion Gain Or Loss</u>		<u>Appearance After 20 Hour Immersion</u>	<u>*Changes From Original Color To</u>
<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Visible Deterio- ration</u>	
1.8-	03.-	86	45	4.9%	4.3-	None	Noticeably lighter
2.8-	3.9-	82	41	0.0	12.8-	None	Slightly lighter
7.9-	9.4-	82	39	0.0	17.0-	None	Light Brown
0.5%	2.3-	89	46	8.5%	2.1-	None	Brown
1.3-	2.3-	-----	-----	-----	-----	None	No change
0.7-	2.3-	-----	-----	-----	-----	None	No change
0.8-	2.8-	-----	-----	-----	-----	None	No change
0.2-	0.8	-----	-----	-----	-----	None	No change
0.2-	0.5	-----	-----	-----	-----	None	No change
3.3-	2.3%	90	35	9.8%	25.6-	None	Slightly lighter
100.0-	100.0-	-----	-----	100.0-	100.0-	Decomposed	Brown Mass
33.7-	19.1-	79	37	3.7-	21.2-	Some de- composi- tion	Lighter. Orange warp thread at partially

approximate appearance.

KE 0020321

<u>Reagents</u>	<u>% Conc.</u>	<u>Temp. °C.</u>	<u>Percent Shrinkage</u>		<u>Tensile Strength In Pounds</u>		<u>Percent Loss Or Gain In Strength</u>		<u>Percent Elonga- tion</u>		<u>Percent Elonga- tion Gain or Loss</u>	
			<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>
METHYL ETHYL KETONE	100	25	0.5/	0.0	372	343	4.9-	10.4-	90	39	9.8/	17.0
NITRIC ACID	70	80	---	---	---	---	100.0-	100.0-	---	---	100.0-	100
NITRIC ACID	70	50	---	---	---	---	100.0-	100.0-	---	---	100.0-	100
NITRIC ACID	70	25	---	---	---	---	100.0-	100.0-	---	---	100.0-	100
NITRIC ACID	30	80	0.0	0.0	355	341	9.2-	11.0-	78	45	4.9-	4.3
NITRIC ACID	20	80	0.0	0.0	362	351	7.4-	10.2-	75	41	8.5-	12.8
NITRIC ACID	20	50	0.0	0.0	375	365	4.1-	4.7-	90	45	9.8/	4.3
NITRIC ACID	20	25	0.0	0.0	386	384	1.3-	0.3/	86	45	4.9/	4.3
NITRIC ACID	5	80	0.5/	0.0	362	360	7.4-	6.0-	94	48	14.6/	2.1
NITRIC ACID	5	50	0.5/	0.0	380	377	2.8-	1.6-	80	45	2.4-	4.3
NITRIC ACID	5	25	0.0	0.0	390	381	0.3-	0.5-	82	46	0.0	2.1

* Refer to color identification chart for staining or approximate appearance.

- Equals loss.

/ Equals gain.

KE 0020322

<u>Reagents</u>	<u>% Conc.</u>	<u>Temp. °C.</u>	<u>Percent Shrinkage</u>		<u>Tensile Strength In Pounds</u>		<u>Percent Loss Or Gain In Strength</u>		<u>Percent Elongation</u>		<u>Percent Elongation Gain Or Loss</u>	
			<u>Warp</u>	<u>Fill-ing</u>	<u>Warp</u>	<u>Fill-ing</u>	<u>Warp</u>	<u>Fill-ing</u>	<u>Warp</u>	<u>Fill-ing</u>	<u>Warp</u>	<u>Fill-ing</u>
OLEIC ACID	100	100	0.0	0.5 /	372	399	4.9-	4.2 /	82	49	0.0	4.3 /
OXALIC ACID	50	100	1.5 /	0.0	368	388	5.9-	1.3 /	90	45	9.8 /	4.3-
PERCHLORO-ETHYLENE	100	100	1.0 /	1.0 /	355	359	9.2-	6.3-	84	40	2.4 /	14.9
PHENOL	5	100	0.0	0.0	209	204	46.5-	46.8-	72	35	12.2-	25.6
PHENOL	5	50	1.0 /	0.5 /	240	249	38.6-	35.0-	75	33	8.5-	29.8
PHENOL	5	25	0.0	0.0	302	340	22.7-	11.2-	80	35	2.4-	25.6
PHOSPHORIC ACID	85	100	0.5 /	0.5 /	388	361	0.8-	5.7-	85	45	3.7 /	4.3-
SILVER NITRATE	30	100	1.5 /	0.5 /	105	142	73.0-	62.9-	5	5	93.9-	89.5
SILVER NITRATE	30	50	0.0	0.5 /	347	362	11.2-	5.5-	82	40	0.0	14.9
SILVER NITRATE	30	25	0.0	0.0	358	371	8.4-	3.1-	84	46	2.4 /	2.1-
SODIUM BICHROMATE	50	100	0.0	0.0	351	355	10.2-	7.3-	86	43	4.9 /	8.5-

* Refer to color identification chart for staining or approximate appearance.

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/ Equals gain.

KE 0020323

<u>Reagents</u>	<u>% Conc.</u>	<u>Temp. °C.</u>	<u>Percent Shrinkage</u>		<u>Tensile Strength In Pounds</u>		<u>Percent Loss Or Gain In Strength</u>		<u>Percent Elongation</u>		<u>Percent Elongation Gain Or Loss</u>	
			<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>
SODIUM HYDROXIDE	50	100	0.5/	0.0	320	310	18.2-	19.1-	83	34	1.2/	27.6
SODIUM HYDROXIDE	30	100	0.0	0.0	362	344	7.4-	10.2-	83	44	1.2/	6.4-
SODIUM HYDROXIDE	5	100	0.0	0.0	373	358	4.6-	6.5-	86	44	4.9/	6.4-
STEAM (15 lbs. Pressure One Hour)			0.0	0.0	405	390	3.6/	1.8/	90	41	9.8/	12.8
STODDARD SOLVENT	100	90	0.5/	0.0	368	350	5.9-	8.6-	82	36	0.0	23.
SULFURIC ACID	96	100	---	---	---	---	100.0-	100.0-	---	---	100.0-	100
SULFURIC ACID	96	50	---	---	---	---	100.0-	100.0-	---	---	100.0-	100
SULFURIC ACID	70	100	---	---	---	---	100.0-	100.0-	---	---	100.0-	100
SULFURIC ACID	70	50	0.0	0.0	330	355	15.6-	7.3-	80	40	2.4-	14.
SULFURIC ACID	25	100	0.0	0.0	377	363	3.6-	5.2-	82	48	0.0	2.1

* Refer to color identification chart for staining or approximate appearance.

- Equals loss.

/ Equals gain.

KE 0020324

<u>Reagents</u>	<u>% Conc.</u>	<u>Temp. °C.</u>	<u>Percent Shrinkage</u>		<u>Tensile Strength In Pounds</u>		<u>Percent Loss or Gain In Strength</u>		<u>Percent Elonga- tion</u>		<u>Percent Elonga- tion Gain Or Loss</u>	
			<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>	<u>Warp</u>	<u>Fill- ing</u>
SULFURIC ACID	25	50	0.0	0.0	386	365	1.3-	4.7-	84	48	2.4/	2.1/
SULFURIC ACID	5	100	0.5/	0.0	389	362	0.5-	5.5-	78	42	4.9-	10.6
SULFURIC ACID	5	50	0.0	0.5/	384	364	1.8-	5.0-	86	46	4.9/	2.1-

* Refer to color identification chart for staining or approximate appearance.

- Equals loss.

/ Equals gain.

EVALUATION OF TEST RESULTS

Results of above tests show the reagents have the following effect on the "Chem-Wear" fabric: shrinkage, elongation, visible deterioration and change in shade from the original color after 20 hours at the specified temperatures and concentrations.

The "Chem-Wear" fabric showed NO SHRINKAGE whatsoever and practically no change in dimensions after 20 hour immersion in each of the above reagent concentrations at specified temperatures, after treatment with steam pressure for one hour or after prolonged bleaching at boiling temperature. Slight discoloration of material was noted after immersion in some of the reagents but this gain in no instance exceeded 20% that the fabric possesses dimensional stability to above conditions.

Tests show the fabric to possess excellent resistance to decomposition by most chemicals with only a small total decomposition at higher concentrations and temperatures, and only four others showing an excess of 20% as evaluated by tensile strength tests after the 20 hour reagent immersion. The fabric was totally decomposed by only the following reagents at the following concentrations:

	<u>Concentration</u>	<u>°C. Temperature</u>
Cyclohexanone	100	100
Cyclohexanone	100	50
Methyl Ethyl Ketone	100	100
Nitric Acid	70	80
Nitric Acid	70	50
Nitric Acid	70	25
Sulfuric Acid	96	100
Sulfuric Acid	96	50
Sulfuric Acid	70	100

In addition to the above complete deterioration the "Chem-Wear" fabric also showed deterioration of 20% or over by treatment with the following reagents:

	<u>Concentration</u>	<u>°C. Temperature</u>
Chromic Acid	50	100
Chromic Acid	25	100
Cyclohexanone	100	25
Ferric Chloride	70	100
Methyl Ethyl Ketone	100	25
Phenol	5	100
Phenol	5	50
Phenol	5	25
Phenol	5	100

KE 0020325

The other 44 determinations on the remaining 18 reagents showed deteriorations below 20% with the loss in some instance no doubt being due to strength variations in the fabric itself rather than deterioration as the results reported are based on the average of two warp and two filling breaks of sufficient fabric to make a complete strength test.

The Bureau would rather report the strength average on a greater number of breaks as the results may be either higher or lower due to strength variations on this type fabric than would be found averaging a greater number of tensile breaks.

Elongation tests showed either slight increases or decreases in elongation in the majority of instances noted, however, that a stiffening of the material by the reagent also decreased the pliability.

An examination of the reagent treated samples showed that many of the reagents stained or carbonized with the alteration or change in shade being as noted in report.

Visible deterioration was shown by only several samples and was discerned mostly by stiffness or and discoloration of individual threads by Cyclohexanone or Methyl Ethyl Ketone.

A summary of test results show the following:

That the "Chem-Wear" fabric does not shrink after immersion for 20 hours in 26 specified reagents at various concentrations and temperatures.

That only four of the specified reagents totally decomposed the fabric. That only four other reagents will deteriorate the "Chem-Wear" fabric in excess of a 20% loss in strength and this occurring only at higher concentrations or a combination of high concentration and temperature.

That the reagents in most instances do not appreciably affect the fabric's pliability and hand, but that a stiffening or loss of pliability also showed a loss in elongation of the fabric as well as in tensile strength.

BETTER FABRICS TESTING BUREAU

B. Rioux

B. Rioux, Chemist

April 27, 1949

METHOD OF TEST

Conditioning:

Tensile Strength

The fabrics were conditioned for four hours in an atmosphere of 65% relative humidity at 70 degrees Fahrenheit temperature before testing.

Made by the strip method where each test specimen was stripped to one inch or 76 ends in the warp and 24 picks in the filling, subjected to the various reagents as shown above and then broken three inches between jaws using three inch front jaws, three inch back jaws with speed of moving jaw 12 inches per minute.