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E. I. du Pont de Nemours and Company
Haskell Laboratory for Toxicology and Industrial Medicine
HASKELL LABORATORY REPORT NO. 534-72 MR NO. 1677-001

Materials Tested	Haskell Nos.	Materials Submitted by
1) Tyvek® Style 1443E ("Zelec NO," L, 75 pph)	1) 7795	G. Limperos
2) Tyvek® Style 1622E ("Zelec NO," L, 75 pph)	2) 7796	Textile Fibers Department
3) Tyvek® Style 1443E ("Zelec TY," NL, 105 pph)	3) 7797	Centre Road Building
4) Tyvek® Style 1420A ("Zelec TY," NL, 105 pph)	4) 7798	
5) Tyvek® Style 1443A ("Zelec TY," NL, 105 pph)	5) 7799	
6) "Kaycel" (Improved, light)	6) 7800	
7) "Kaycel" (Dark)	7) 7801	
8) Coverall Fabric	8) 7802	

TEST FOR PERMEABILITY OF FABRIC TO ASBESTOS DUST

Procedure: A high concentration of amosite asbestos dust was generated in a 5000-liter chamber. Samples were taken to determine concentration of the dust both gravimetrically (mg/liter of air) and by fiber distribution. Fiber concentration (fibers/liter of air) was determined for total fibers, fibers greater than 5 μ in length, and greater than 10 μ in length. Similar samples of the atmosphere were then taken through each of the test materials and the % permeability* was calculated. At least two samples were taken in each case.

All samples were taken by drawing air from the chamber, using a vacuum pump, through a closed-face filter holder which was attached by a bulkhead fitting to the chamber wall. Glass fiber filters, 47 mm in diameter, were placed in the holders for gravimetric samples and 5-15-liter samples of chamber atmosphere were taken at a high flowrate. Cellulose acetate filters were used for fiber distribution samples; 50 cc of chamber air were sampled at a flowrate of 0.5 L/min. When sampling through the test fabrics, a circle of the material, 47 mm in diameter, was superimposed on the filter so that air and dust would have to be drawn through the test fabric before reaching the filter.

To determine the ease of dust removal, samples of the test fabrics were placed in the chamber with a 10 or 11 square cm area exposed face-up. These samples were weighed before and after exposure to asbestos-laden atmosphere. They were also weighed after being brushed free of dust and after being vacuumed to remove residual dust. The differences between dust accumulation and removal were determined and % efficiency of the cleaning method was calculated.

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Concentration passing through test material	X	100
Concentration in chamber		
Sample + dust (mg) - Sample after cleaning (mg)	X	100
Sample + dust (mg) - Tare weight of sample (mg)		

Results:

Maskell Number	Gravimetric Sample	% Permeability*			% Efficiency of Cleaning\$	
		Total Fibers	Fiber Distribution		Brushing	Vacuuming
			> 5 μ	> 10 μ		
7795	0	0	0	0	95	93
7796	12	71	68	63	92	92
7797	9	0	0	0	94	95
7798	7	0	0	0	94	94
7799	0	0	0	0	91	90
7800	1.5	30	11	0	91	93
7801	4	35	16	3	86	90
7802	11	47	31	22	57	96

Summary: Eight test fabrics were examined for permeability to asbestos dust by two methods. 1) Gravimetric analysis indicated that the H-7795 and H-7799 samples of Tyvek® provided excellent barriers, while H-7797 and H-7798 allowed 7 and 9 % permeability, respectively. The two "Kaycel" samples, H-7800 and H-7801, permitted 1-4% of the dust to permeate. Tyvek® sample H-7796 and the coverall fabric, H-7802, permitted greater than 10% penetration. The permeability of this Tyvek® sample, H-7796, was evident as pinpoint spots of asbestos impacted on the filter placed downstream of the fabric sample; on close examination corresponding minute holes could be seen scattered throughout this fabric. It should also be noted that a marked decrease in pressure resulted when air was drawn through all samples of Tyvek® except H-7796. This was not true of "Kaycel" or the coverall fabric.

2) When cellulose acetate filters were examined microscopically for asbestos fibers which had penetrated test samples, four of the five Tyvek® samples, H-7795, H-7797, H-7798 and H-7799, revealed no fibers, hence, no permeability under the test conditions. Tyvek® sample H-7796 revealed about 70% penetration of individual fibers. This percentage did not significantly decrease as fiber length increased above 10 μ . The two "Kaycel" samples also demonstrated a permeability to asbestos fibers; 30-35% of total fibers permeated "Kaycel" but as the fiber size increased above 10 μ , the percent permeability decreased by a factor of 10. This was also true of coverall material which was 47% permeable to asbestos fiber, but the decrease in permeability with increased fiber size was by a factor of 2.

When examined for cleaning efficiency, it was determined that 90-97% of the asbestos dust could be removed by brushing the Tyvek® or "Kaycel" fabrics. Vacuuming did not significantly increase the amount of dust removed from any test fabric except the coverall material. In the latter case, 96% was removed by vacuuming while only 57% was removed by brushing.

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