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EVALUATION OF MATERIALS PROPOSED FOR USE IN SPACE FLIGHT

FINAL REPORT

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TESTING OF FLAME-RESISTANT TREATED COTTON KNIT SHIRTS

PURPOSE OF STUDY: To evaluate the primary irritancy and allergenicity of flame resistant treated cotton knit shirts proposed for use in space flight.

METHODS: This study consisted of a single phase of evaluation; material for preliminary patch testing was not provided.

1. Usage tests by human volunteers

The knitted shirts were supplied by NASA as follows: Knitted shirts with collars were made of two-ply mercerized single-knit cotton jersey. The fabric was treated with tetrakis (hydroxymethyl) phosphonium hydroxide and subsequently cured with gaseous ammonia ($THPOH/NH_3$). The final treatment comprised adding on diammonium phosphate (DAP)/Urea. The treated fabric was process scoured to remove extraneous materials, top softened and mechanically or chemically finished as required for specific needs. Diammonium phosphate is a more efficient flame inhibitant than the phosphonuim, thus, the combination treatment served to impart higher resistance to ignition and sustained combustion as required by NASA test standard. This treatment process was developed by Cottom, Inc., Raleigh, North Carolina.

Twelve volunteers were selected from among the members of the Department of Dermatology so as to give as wide a range of usage testing as possible. Thus, the shirts were worn against the bare skin in air-conditioned offices as well as upon the athletic field and in gymnastic classes. Several of the subjects slept in the shirts. The subjects were instructed to wear the shirts for a minimum of twelve hours prior to washing in their regular home laundry and thereafter to wear them a minimum of fifty hours spaced over a period of three weeks. This was followed by a two week "rest period" during which the shirts were not worn. Each subject then wore the shirt for five additional hours, continuously. Most of the subjects, however, wore the shirts in excess of seventy hours during the three week period. The shirts were laundered as necessary during the test period.

There were no complaints of primary irritancy, itching, or discomfort at any time during the wearing of the shirts. One individual believed that a pruritic papular dermatitis over the abdomen which developed while wearing the shirt was due to it; however, subsequent wearing of the shirt and standard patch testing with two inch squares of the fabric did not invoke any reaction.

CONCLUSION:

The flame resistant treated cotton knit shirts provided by NASA do not appear to have any primary irritant qualities nor potential for producing allergic contact dermatitis in humans, under conditions of usage, which, as stated previously, included

athletic endeavors. I would anticipate that this material would be entirely suitable for fabrication of garments for use in space flight.