

# APPAREL FOR CLEANER CLEAN ROOMS

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Among spinoff innovations in medicine, pharmaceuticals and medical systems manufacture is a line of garments for improved contamination control



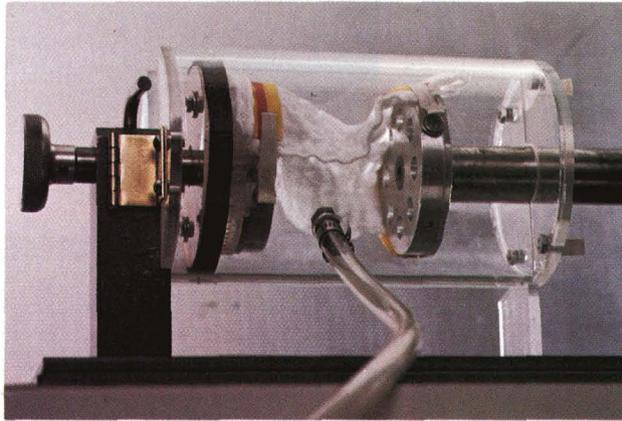
*Technicians engaged in production of nuclear diagnostic pharmaceuticals at Medi-Physics, Arlington Heights, Illinois are wearing new Micro-Clean anticontamination garments developed and manufactured by American Hospital Supply Corporation.*

Spacecraft equipment is necessarily rugged, because it must withstand launch vibration and the rigors of an inhospitable space environment. But the most rugged equipment can cause trouble in space if it is contaminated during fabrication. A tiny mote of dust in a sensitive system might trigger a malfunction that could at best impair the system's accuracy or precision, and at worst induce mission failure.

To bar such occurrences, NASA and its contractors have developed elaborate precautions. Flight

equipment is assembled in "clean rooms" that often surpass hospital standards of cleanliness. These facilities are designed to eliminate nooks and crannies where dust particles might collect, their air is filtered, their temperature and humidity precisely controlled. Workers wear special lint-free clothing and they enter the clean room through an airlock that prevents contamination from outside air.

In the 1960s, NASA pioneered contamination control technology, providing a base from which



*The photo at left shows an earlier method of testing the effectiveness of clean room apparel. The apparatus twists woven fabric to release minute particles as air is passed through the fabric and into a particle counter. Micro-Clean garments are made of non-woven material, hence have no "windows" to allow air passage. So project engineer Rem Siekmann devised the new testing apparatus he is using below, a computerized system for counting particles dislodged by abrasion when a metal block is rubbed over the fabric.*

aerospace contractors could develop advanced control measures. NASA conducted a number of special courses for clean room technicians and supervisors, and published a series of handbooks with input from Marshall Space Flight Center (MSFC), Johnson Space Center (JSC), Kennedy Space Center, Lewis Research Center and Sandia Laboratories. These handbooks, which represented the most comprehensive body of knowledge on contamination control techniques available at the time, extended aerospace experience to the medical, pharmaceutical, electronics and other industries wherein extreme cleanliness is important.

NASA's work provided an information base for a new contamination control development, the Micro-Clean™ line of garments for hospitals and industrial clean rooms introduced last year by American Convertors Division of American Hospital Supply Corporation (AHSC), Evanston, Illinois. The garments are distributed by another AHSC division, American Scientific Products, in McGaw Park, Illinois.

AHSC researchers—in particular Rem Siekmann, project engineer in American Convertors' Department of Product Development—felt that high technology products with increasingly stringent operating requirements in aerospace, electronics, pharmaceuticals and medical equipment manufacture demanded improvement in some contamination control techniques. In 1980, Siekmann started research on the subject. He began by studying the NASA handbooks, then visited JSC, MSFC's Michoud, Louisiana facility and several industrial clean room operations, acquiring through interviews a wealth of information on current anticontamination technology and



problem areas.

The line of clean room garments that emerged from Siekmann's research and subsequent development stemmed from the company's conclusion that the greatest sources of clean room contamination are the people who work in such facilities; they exude infinitesimal body particles that escape through tiny "windows" in the woven garments they wear. American Convertors, therefore, made its Micro-Clean apparel of soft, non-woven material that is capable of blocking well over 99 percent of all particulate matter smaller than half a micron, a millionth of a meter—which compares with about 15 percent for one material commonly used in clean room wear. Micro-Clean garments are disposable, eliminating the costs of repairs and processing associated with reusable garments. The product line includes pullover hoods, caps, coveralls and "high-top" shoe covers that reach

all the way to the knee. The apparel offers two-way contamination control, meaning that it not only protects the product from the people but, where pertinent, protects people from the product or from certain chemical hazards.

In experimenting with new fibers and materials to develop non-woven garments, American Convertors had to find new ways of evaluating the apparel. The company thus provided an additional advance in contamination control technology by devising new tests and testing apparatus, for example, a test to determine how effectively a fabric blocks passage of microscopic particles and a technique for counting the particles removed from a fabric. Developed by Rem Siekmann, the tests are being considered for adoption as industry standards by the Institute of Environmental Sciences.

™Micro-Clean is a trademark of American Hospital Supply Corporation.