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A Sideline Mushroomed

By Barbara Storms

The Los Alamos Scientific Laboratory's industrial hygiene group, H-5, has added more than $500,000 to its budget, doubled its staff, and grown desperate for more space and personnel. This happy state of affluence is the result of recent interagency agreements between the Atomic Energy Commission and the National Institute for Occupational Safety and Health (NIOSH) for projects in fields in which H-5 is the nation's recognized authority.

At the present time, H-5's NIOSH activities are limited to specific studies in respiratory protection, air sampling and analytical chemistry, but the potential for expansion seems unlimited.

"This thing has really mushroomed," said Harry Schulte, H-5 group leader. "NIOSH wants all this work done and we just can't take on any more. We don't have the space or the people."

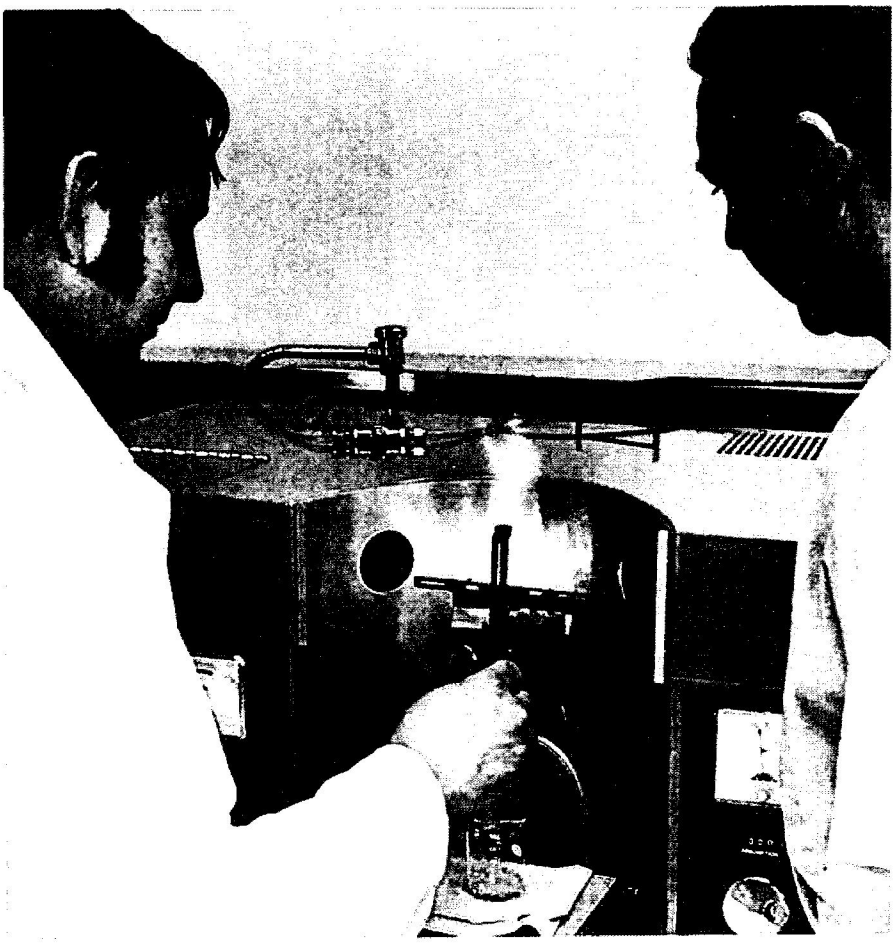
Reason for the crash program in industrial health research is the 1970 Occupational Safety and Health Act which established NIOSH and charged it with, among other things, the responsibility for conducting the research necessary to develop standards and criteria for occupational exposure for all non-radioactive materials in U.S. industry.

We've been doing this kind of work for years," Schulte said, "but it's always been a sideline while we concentrated on AEC and Laboratory problems. Now it's beginning to pay off." However, he added, "now that we're really getting into it, we're finding out how much more we need to know."

For instance, the group leader said, there is a tremendous need for research on pollutants within the plant. In-plant standards will be quite different from those for the general population because there are differences in the people in each category. The general population includes the elderly, the ill and infants, while it is assumed that only healthy adults are working in plants and that they are under medical supervision. Schulte emphasized that the NIOSH projects are related exclusively to hazards to the worker in the occupational environment and are not concerned with general environmental contamination.

One such project is a $35,000 program for a full-scale experimental evaluation of recognized analytical procedures, currently in use, for the determination of mercury in the air, blood, urine and tissue. The project is directed by Evan Campbell, leader for the Analytical and Chemical Section, assisted by Pat Trujillo and Pat Stein.

"We're taking a thorough look at the estab-



New methods for sampling mercury and separating the toxic inorganic variety from organic are tested by atomic absorption spectrometry by Pat Trujillo and Evan Campbell of the Analytical and Chemical Section.

lished methods in the hope of developing an improved basic procedure that can be used by all laboratories," Campbell said.

And it is only fitting that such work should fall to H-5. Fifteen years ago the first standard method for mercury determination was established by Campbell and Billye Head of LASL and it became the most widely used method in the United States.

"It was a specific dithizone procedure that is no longer applicable to modern mercury compounds," Campbell said. "With the advent of atomic absorption photometry, the limits to which mercury can be determined have toppled to the nanogram level." It now becomes necessary to find ways to sample both organic mercury, which is extremely toxic, and inorganic mercury, which is less so, in the working environment and then be able to analyze them separately.

NIOSH's present recommended sampling absorbent is iodine-activated charcoal but, because charcoal absorbs "everything," the group has proposed that "anything would be better than charcoal and H-5 would like to find it," Campbell said. Most promising absorbent being investigated is silver-coated sand, an interesting reversal of the old silver-mining method in which mercury was used to draw out the silver.

Another project occupying two new staff members in the Analytical and Chemical Section is a $100,000 study for the development of a gas and vapor sampling tube and a method of analyzing the gases and vapors after sampling.

From NIOSH's list of 25 top priority toxic substances that must be studied, Gerry Wood and Robert Anderson are looking at five, and for each of these, they must produce an air sampler that will meet a number of practical requirements and an analytical method that will be simple, fast and reliable.

"The need for simplicity and speed can't be

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A personal sampling device for formaldahyde, developed in H-5, is demonstrated by Bob Anderson with help from Gerry Wood. Device includes a sampling pump worn at the waist with a solid absorbent tube which collects air from the breathing area. Tube retains material throughout the working day and until sampler can be analyzed.

overemphasized," Campbell said, explaining that this analysis is being done at two laboratories in the United States and by many senior industrial hygienists and their surveyors in each of the 10 regions covering the United States. "If each man takes several samples a day, that adds up to a tremendous number of samples of a tremendous variety of materials that will have to be analyzed."

In the past six months, Wood and Anderson have concentrated on formaldahyde, NIOSH's first priority material, and have just about decided on alumina as the best absorbent for the sampler which must absorb and retain materials from the worker's breathing area through an eight-hour day and then release them for analysis only after the sampler has been mailed to the laboratory.

Reclaiming 100 per cent of the materials absorbed by alumina proved to be a tougher problem but was eventually solved by a heating process. Analysis was done by gas chromatography but the investigators point out that other techniques will be tried such as ultraviolet and infrared.

About one-third of the work of Harry Ettinger's Aerosol Studies Section is funded by NIOSH and is primarily concerned with the hazards to workers due to coal dust and asbestos fibers. NIOSH provided $110,000 for this work this year and is expected to contribute $155,000 next year for work which has resulted in the addition of two staff members and two technicians to the section. Working with Ettinger, who is also alternate group leader, are Charles Fairchild, Owen Moss, Lawrence Ortiz, Bonnie Isom, Donald Gettemy and George Royer.

The project is aimed specifically at respirable dust, Ettinger said. These are the small particles, less than two microns in diameter, which deposit in the lower portions of the lung for long-term retention and are responsible for lung diseases such as miner's lung or pneumoconiosis and asbestosis. Larger particles deposit in the nose, throat and upper lung and are eliminated by the nose and GI tract leaving no long-term effects.

"Our job," Ettinger said, "is to evaluate the hazards due to these materials and to develop methods of air sampling that will break down the quantities of materials by size."

One aspect of the program, now completed, is the design, testing and fabrication of a prototype calibration test system that will check personal air samplers for their ability to measure the con-

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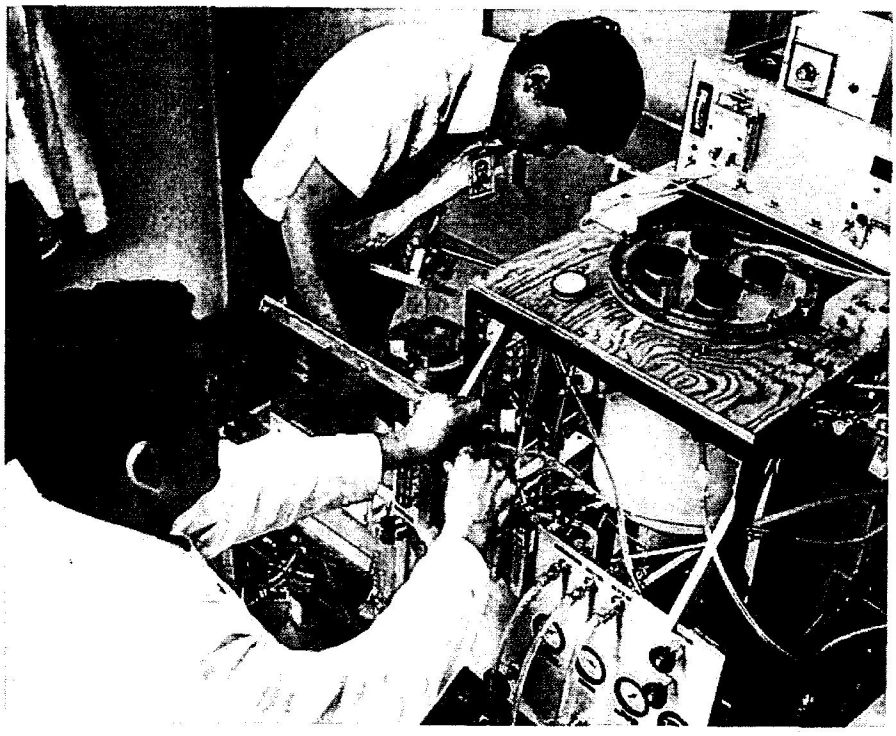


Above, a method for calibrating distribution of coal dust particles includes a Lovelace aerosol particle separator, being operated by Jose Martinez and Don Gettemy. From the coal dust atmosphere, particles are impregnated on foil in a spiral separator according to size. Foil is then removed, far right, by Marvin Tillery, and cut by George Royer, right, for measurements.

Tricky problem of standardizing asbestos particle counting is being tackled by H-5's aerosol section. Larry Ortiz examines a collection of asbestos particles and discusses the count with Charles Fairchild.

centration of dust particles in proportion to their respirability.

The instrument, which includes an aerosol chamber, generator and aerosol distribution system, was delivered to NIOSH in July for use in its Testing and Calibration Laboratory in West Virginia.

Still under way in the aerosol program is the development of a standard coal dust for use in research and in the testing and calibration of instruments and samplers. With bulk coal, mined by NIOSH from a special vein, H-5 workers are using jaw crushing, ball milling and micronizing techniques in an attempt to produce coal dust in appropriate sizes.

But physical size of particles is not the whole story, according to Ettinger. Because the lung judges a particle by its aerodynamic size, determined by such factors as size, shape, and density, Ettinger's group is studying the aerodynamic properties of particles, particularly under high and low humidity conditions to determine the effects of moisture.

A tougher problem than coal dust has been the program to prepare asbestos standards for state agencies measuring airborne asbestos.

"The law requires all states to sample airborne asbestos by counting the fibers," Ettinger explained, "but the trick is to get everyone to do it the same way." To solve the problem, H-5 has been asked to provide samples with identical and predictable concentrations of fibers so that counting systems can be standardized.

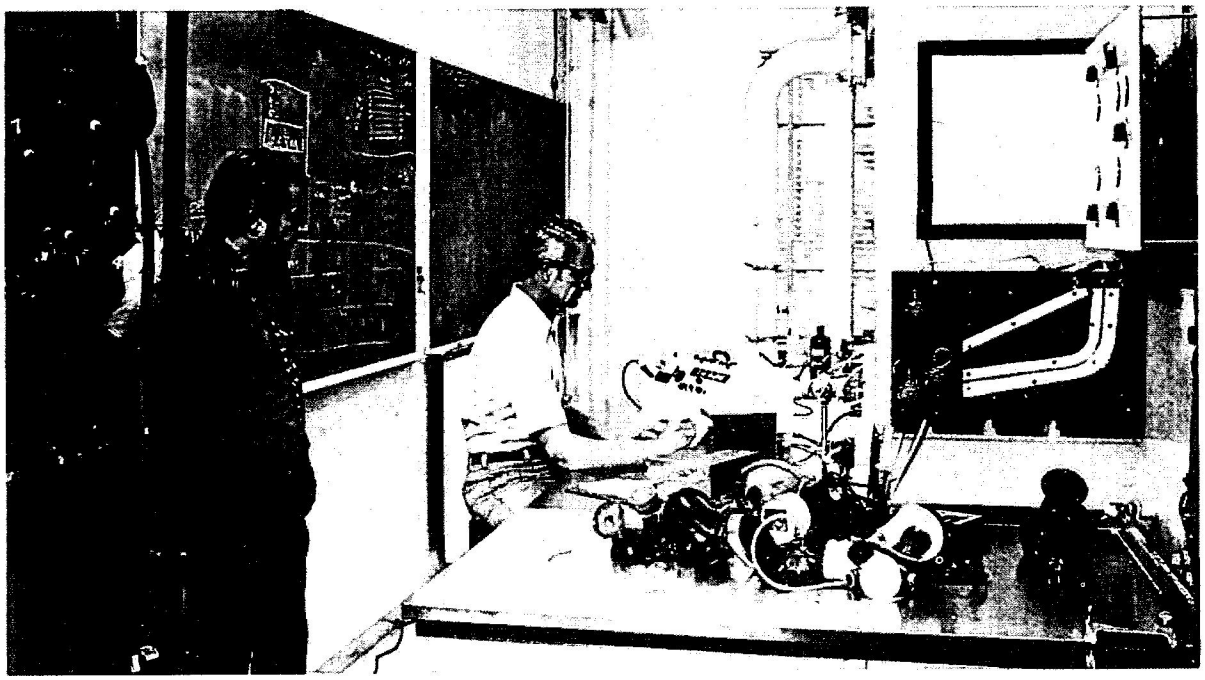
Ettinger's section is also attempting to develop efficient respirable samples for asbestos, "but with the odd fiber shapes," Ettinger said, "the problem is how to determine which sizes and shapes go down into the lung and which do not."

While their colleagues study the problems of detecting and measuring pollutants, members of the Respirator Research and Development Section, headed by Ed Hyatt, are concentrating on protection with the nation's first comprehensive program for respirator quality control.

"The public is always shocked to learn that people have been using respirators on faith all these years," Hyatt said. "Industry has rated the efficiency of the filters but there has never been an effort to check fit, the breathing valves, or the overall efficiency of the respirator on a man under working conditions."

The NIOSH agreement, now in its second year, calls for H-5 to develop test equipment and methods for quantitative determination of the protection afforded wearers of dust, fume and mist respirators. By October, Hyatt expects to begin work on other types of respirators including chemical cartridge types, gas masks, supplied air respirators and self-contained breathing apparatus. Working with Hyatt on the project are John Pritchard, Charles Richards, Louis Geoffrion, Lloyd Wheat, Tom Moore, Paul Hesch, Alan Hack, Tom Davis and Anthony Sanchez.

To rate respirator efficiency, volunteers wear respirators in a dust or mist-filled exposure chamber while performing a variety of exercises and movements that can affect performance. A probe



Providing industry and testing agencies with information and training in the use and testing of respirators is a significant part of H-5's working agreements with NIOSH. Last month Jim DeField operated the instruments for testing respirators in a contaminated chamber while a team of photographers from Lawrence Livermore Laboratory filmed the operation.

in the respirator enables measurement, by scattered light or flame photometry, of the amount of contaminant entering the face mask.

Measurements are made while the man is facing forward, moving his head up and down and back and forth, smiling, talking, laughing, and frowning, all of which can affect the face mask seal. Effects of these activities on the respirator are averaged to provide the total respirator efficiency rating or "protection factor" expressed as a number representing the maximum probable protection afforded by the respirator.

Two aerosols are used. One is sodium chloride (salt) because it correlates well with the silica dust of concern to the mining industry. The other is polydisperse dioctyl phthalate, a non-toxic oily substance used in industry as a plasticizer.

Systems in which the aerosols are used are similar. Both systems include a plastic exposure chamber, an aerosol generator and light scattering or flame photometer, and both are being modified into compact, self-contained, portable machines that will be used in NIOSH's Testing and Calibration Laboratory.

To further define fit problems, Hack has undertaken a study of respirator fit on types and sizes of faces most representative of the U.S. working population.

With advice from physical anthropologists from the Aeromedical Laboratory at Wright Patterson Air Force Base and statistical assistance from LASL's C-Division, Hack has made a series of 21 specific measurements on the faces of more than 200 Los Alamos men and has selected a panel of 16 to serve as standards for new fitting tests to begin in the fall. The results of the anthropometric tests will enable scientists to rate respirators according to which ones fit most face types most efficiently.

"Up to now, manufacturers have been making only one size respirator and each manufacturer's size is different from the other," Hyatt said. "Consequently, even though a respirator might have a high efficiency rating, it usually fits only about 75 per cent of the wearers."

The respirator quality control program is a high point in H-5's 20 years of experience in respirator studies. The NIOSH agreements will permit more rapid growth of respirator technology of interest to all U.S. industry.