Beryllium Report Disputed by Listed Author

A standing controversy over a NIOSH study is revived by one of the scientists involved

A coauthor of a recent report claiming that beryllium is a human carcinogen has taken the extraordinary action of disavowing it and charging that his colleagues used inappropriate statistics, despite his objections. David Bayliss, an epidemiologist who worked on the study while an employee of the National Institute for Occupational Safety and Health (NIOSH), made these charges in a recent letter to the director of the Center for Disease Control (CDC), which oversees NIOSH activities.

Referring to an article in the February 1980 *Journal of Environmental Health*,* Bayliss wrote that "there is now in the public domain a report attributed in part to me and bearing the imprimatur of the United States government, which is at best misleading and . . . should not be permitted to stand unchallenged in its present form." Bayliss claims that the report is flawed on a number of statistical grounds and that it should be retracted and redone by a group outside of NIOSH.

The report describes the results of an epidemiological survey of workers at a beryllium plant in Reading, Pennsylvania, one of only two plants in the United States where the light, heat-resistant metal is produced. Controversy over the study and NIOSH's conduct had arisen before (see *Science*, 2 December 1977), but mostly as the result of industry complaints. Officials of the two beryllium manufacturers, Brush Wellman of Cleveland, Ohio, and Kawekci Berylco Industries, Inc., of Reading, are delighted to find that one of the study's authors agrees with many of their criticisms. "The position of Mr. Bayliss confirms a great deal of painstaking work done by industry consultants," says Martin Powers, vice president of Brush Wellman.

The significance of the report lies in a 5-year-old proposal by the Occupational Safety and Health Administration (OSHA) to cut in half the permissible level of exposure to beryllium in the workplace. The present exposure limit was set voluntarily in 1959 in order to prevent berylliosis, a debilitating nonneoplastic lung disease. Since then, a series of tests have shown that beryllium causes cancer in animals, prompting OSHA to press for an even lower limit. A review panel established by former Secretary of Health, Education, and Welfare Joseph Califano affirmed the overall conclusions of these tests in 1978 but remarked that many of them were flawed. The panel also said the data were insufficient to determine whether the most commonly used form of beryllium—a copper alloy—causes cancer. Both the industry and the government apparently believe as a result that the conclusions of the epidemiological survey are critical to the regulatory dispute.

The study uncovered 47 cases of lung cancer among workers exposed at the Kawecki plant between 1940 and 1975, an amount the authors say is significantly more than the expected incidence of 34 lung cancers. The authors calculated the expected incidence by extrapolating from cancer statistics covering 1940 to 1968. Bayliss now claims that these statistics are invalid because they fail to reflect a lung cancer increase that occurred between 1968 and 1975. Had the statistics been updated to include this period, the expected incidence at the plant would be 38 cancers, a number that is not significantly different from 47, according to traditional statistical measures. As a result, Bayliss says, NIOSH and OSHA cannot properly be certain that the excess is not an artifact.

Peter Infante, a coauthor who now works at OSHA, defends the report's accuracy and describes Bayliss' letter as "totally absurd." He says that NIOSH had not added the updated cancer statistics to its standard reference tables in time for their use in the study. Publication of the report might have been delayed to accommodate the newer information, Infante says, but a NIOSH and CDC review panel decided against this approach, apparently out of eagerness to get the study in print. (The article itself says only that "published vital statistics were not readily available for the period 1968–75.") Infante says in addition that even with the updating, the lung cancer excess among a subgroup of those with 15 or more years of latency is statistically significant.

Officials at NIOSH agree. As to Bayliss' claim that publication would have been delayed only briefly for the updating, a NIOSH official says Bayliss is correct on the timing but wrong on the ease with which it could have been done. The official goes on to say that because of the positive tests in animals and the excess of cancers in the subgroup, "we still hold to the conclusion that beryllium is a human carcinogen—though it is clear that the statistical significance of the study is not overwhelming and can be fully resolved only by further analysis." The agency plans to investigate the incidence of cancer occurring since 1975, the end of the original survey period—an idea that Infante first proposed last year. Officials at NIOSH have every expectation that additional excess cases will be found. They add that CDC director William Foege agrees, and that Foege sent Bayliss a letter on 8 January rebutting some of his technical criticisms.

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Bayliss had also charged that insufficient attempt was made to determine if the lung cancer victims were smokers. The industry had claimed, on the basis of sketchy interviews with the victims' relatives or friends, that as many as 30 may have smoked. The article discounts the

*J. Wagoner, P. Infante, D. Bayliss, "Beryllium: An Etiologic Agent in the Induction of Lung Cancer, Nonneoplastic Respiratory Disease, and Heart Disease Among Industrially Exposed Workers."

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potential influence of smoking on the survey results by noting that many of the tumors found in the 47 workers were adenocarcinomas, in lieu of more common smoking-induced bronchogenic carcinomas.

Infante responds to Bayliss' criticism that "as is known to anybody familiar with the acquisition of such data, retrospective ascertainment of cigarette smoking habits is extremely unreliable"—a difficulty compounded by the fact that many of the victims' spouses are also deceased. Carl Shy, an epidemiologist at the University of North Carolina who served on the HEW review panel, adds that an absence of information about smoking is common to retrospective epidemiological studies, including some of those linking cancer with exposure to uranium, asbestos, and acrylonitrile. Yet the scientific community has accepted evidence for an association between lung cancer and these hazards, Shy says.

Finally, Bayliss charges that an insufficient attempt was made to determine whether the cancer victims actually had jobs that brought them into contact with the beryllium mist or fumes at the plant. One victim who was included apparently worked at the plant for only half a day. Deleting that case would not materially alter the survey results, but Bayliss suggests that similar mistakes could have been made. Infante responds that, "in spite of repeated requests for his comments in the past, Mr. Bayliss never raised this objection to me either in writing or verbally."

Bayliss, who now works at the Environmental Protection Agency, claims that most of his objections were ignored during the drafting of the article and that he was never permitted to review the report prior to its final submission for publication. Infante denies this, although it seems apparent that some revisions were made after Bayliss' last review.

Bayliss' essential charge is that NIOSH hurried the beryllium report into print instead of waiting a brief period of time for newer data. The charge ultimately boils down to the word of one against another. But NIOSH could reasonably foresee the availability of updated cancer statistics, and its explanation for not delaying the publication seems lame. As Bayliss aptly points out, "Studies of this kind, once published, tend to develop a life of their own and to have their conclusions accepted at face value and without critical independent examination." Cautions as to the use of outdated statistics are contained in the fine print of the report, but such caveats are easily lost in a conclusion that yet one more substance causes cancer in humans.—R. JEFFREY SMITH

FAA Is Cool to Cabin Safety Improvements

Twenty years after the first serious airplane cabin fire, the FAA remains reluctant to order a safer cabin design

Shortly after takeoff from Riyadh, the Saudi pilot of flight 163 saw a warning light flash on his instrument panel, suggesting that a fire had started in a luggage compartment. Although skeptical at first, he swiftly turned the Lockheed L1011 around when smoke began seeping into the passenger cabin. As the plane returned to the airport, flames appeared above the luggage compartment near the rear seats, causing fighting in the aisles as passengers scrambled toward the front. The plane touched down safely, but the cabin was by then filled with smoke and toxic fumes from smoldering or ignited cabin materials.

One of the toxic emissions of burning cabin materials is hydrogen cyanide, which causes hyperventilation and chest convulsions, making inhalation of smoke virtually unavoidable. Others are hydrogen chloride, which reacts with saliva to form a pool of hydrochloric acid in the throat, and phosgene, the nerve gas used in World War I. As rescuers approached, minutes after the plane had landed, gases such as these collecting in the cabin apparently erupted in a flash fire. The room temperature in such a fire typically peaks at 1800°F in about a second; virtually all available oxygen is consumed and replaced with carbon monoxide and other toxic or noxious fumes.

When rescuers finally opened a door, the inflow of air caused the remaining gases to burst into a flame that destroyed much of the plane—without any contribution from the fuel supply. But the passengers and crew were apparently already dead. Autopsies of cabin attendants and the flight engineer uncovered soot in their tracheas, confirming inhalation of smoke, but no searing from flame such as that occurring in the second fire. Official results of the crash investigation have yet to be announced, but those investigating the crash think that the 301 passengers on board died from breathing the smoke and toxic gases.

The incident, which occurred last 19 August, was the second worst single airplane disaster ever. On two previous occasions, in Boeing 707's flying over France and Saudi Arabia, 271 others died from the combination of smoke and toxic fumes of in-flight cabin fires. At least 100 other persons have survived airplane crashes only to die as a result of fires involving cabin materials. The first of these crashes was in 1961, yet today the Federal Aviation Administration (FAA) has done little to require the use of flame-resistant materials.

Numerous outside groups have found the FAA's activity in this area to be wanting. James King is chairman of the National Transportation Safety Board (NTSB), which investigates all airplane fires. "Ever since the 1961 crash . . . the FAA has promised action," he told the House subcommittee on transportation oversight last summer. "No action has been forthcoming." Congressman Newton Gingrich (R-Ga.) ventured that "this may be the most neglected area of air safety," to which King replied, "that is a most charitable summary."

The issue, according to a number of the agency's critics, is not whether less flammable materials are available. The National Research Council of the National Academy of Sciences (NAS), in a 1977 report, said that safer resins and foams are available now for use in cabin materials. Nor is the issue whether a perfectly safe airplane cabin can be created. Everyone agrees that it cannot. The issue is whether the FAA accepts the claim that cabin fire safety is a serious

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