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 Cautions as to the use of outdated statistics are contained in the fine print of the report, but such caveats are easily lost in a conclusion that yet one more substance causes cancer in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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problem, and whether it is willing to require anything less than a permanent solution.

Safety experts say there are two ways to look at the problem of cabin fires. One is that the most serious threat is posed by fuel fires outside the cabin started by a crash. Such fires can migrate to the passenger compartment when heat causes acrylic airplane windows to shrink and fall inward. To diminish this problem, the FAA has been investigating chemical additives to aircraft fuel that would prevent jet fuel from misting when its tank ruptures. It is also testing models of a heat-resistant window invented by the National Aeronautics and Space Administration (NASA) in 1973.

The alternative view of the cabin fire problem holds that cabin fires caused while a plane is in flight or on the ground—not involving aircraft fuel—are more hazardous. This is a view that the FAA has been reluctant to accept, partly because most of the early incidents in which passengers were killed by smoke and flame were of the type involving fuel. Unlike the FAA, Congress fastened onto this type of crash early on, and much of its ire over the agency's inactivity is caused by its failure at getting the agency to agree in full. Critics of the agency in Congress and elsewhere are not uninterested in the antimisting additives or the invention of new aircraft windows; they argue only that the FAA has focused on the long-term fuel additive problem at the expense of things that can be done immediately inside the passenger compartment. These improvements, many of them recommended years ago by the NTSB, include adoption of a more rigorous flammability test, use of less flammable seat cushions, and use of better lighting. The NAS has recommended such painless improvements as the elimination of carpets as vertical decoration and the wearing of flame-retardant uniforms by the crew. The agency's ambivalence about interior cabin hazards has apparently kept it from acting.

> "This may be the most neglected area of air safety."

The General Accounting Office examined the FAA's record on air safety and concluded, for example, that the FAA overlooks short-term improvements in search of an elusive perfect solution. The agency's record on cabin materials is typified by miscarried attempts to restrict smoke emissions, the GAO said. The agency circulated an advance notice of smoke emission regulation in 1969, and followed it with a formal proposal 6 years later, only to withdraw it altogether after another 4 years. A similar advance notice of toxic gases regulation was circulated in 1974 but withdrawn in 1979. The agency said that the industry's reaction to its proposals forced it to return to the drawing boards—that it was persuaded the issues of smoke and toxicity must be joined in a single rule, but only after more study and new discoveries. King, of NTSB, disputes this conclusion. "It is simply not true that any improvements in postcrash survivability must await some future technological breakthrough. Today, we have products on the shelf that if put into the planes will start saving lives. All that is lacking is the will to make changes occur."

At the time the regulations were withdrawn, the FAA appointed a committee to advise it as to where to turn in the search for a safer cabin—a development that some congressmen expected to lead to additional regulatory delay. The Special Aviation, Fire, and Explosion Reduction (SAFER) committee was billed by its chairman, John Enders, a former NASA official, as a collection of "approximately 150 of the world's top experts in aircraft fire safety." About two-thirds of these experts came from the aircraft industry and the FAA itself. The committee's final report, issued last September, concluded, in the words of FAA director Langhorne Bond, that "in general . . . the FAA is doing the right things in the area of postcrash and explosion reduction"—a conclusion he found "personally encouraging." Representative Norman Mineta (D-Calif.), who is frequently critical of the FAA's approach, was skeptical that the 2-year wait was worth this conclusion. He pointedly asked John Harrison, the agency's director of aviation safety, if the agency would be doing anything different as a consequence of the committee's existence. Harrison replied, "That's difficult to say. . . . It is kind of a hard question to answer."

In addition to appointing the committee when its regulations were withdrawn, the FAA contracted with a subsidiary of the McDonnell-Douglas Corporation to develop a sophisticated fire chamber for testing potential hazards to passengers from smoke, heat, and flame.

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Fredrickson Asked to Be a Holdover Again at NIH

Donald S. Fredrickson is likely to continue as director of the National Institutes of Health under the Reagan Administration. His new boss, Secretary of Health and Human Services Richard S. Schweiker, unofficially has asked Fredrickson to stay on, according to a Schweiker aide. Fredrickson told *Science* that he had accepted. Formal approval of the reappointment has to come from President Reagan. Both the aide and Fredrickson said it was unclear whether he would stay for the full Reagan term. Formal approval of the reappointment has to come from President Reagan.

Fredrickson would be serving as NIH director in his third administration. He was named NIH director in July 1975 by President Gerald Ford and was reappointed by President Jimmy Carter.

Fredrickson's retention by Carter was welcomed by an NIH constituency which believes that the NIH directorship should be apolitical even though it is filled by presidential appointment. A decision by Reagan to keep Fredrickson on would doubtless meet the same sort of approval in the biomedical research community.

Senate Westerners Stake a Claim

The realignments and reassignments in the Senate caused by Republican gains in the November election resulted in a strong east to west shift in power over science and technology affairs, at least as determined by committee chairmanships.

Along with their new majority status Republicans won the right to organize the Senate and appoint committee and subcommittee chairman. As it happens, westerners rounded up virtually all the chairmanships associated with science.

Perhaps the most conspicuous changes are those in the Labor and Human Resources Committee, which handles authorizations for the National Science Foundation and National Institutes of Health. Orrin Hatch of Utah has replaced Senator Harrison A. Williams of New Jersey as chair-

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Using a mathematical model developed at the University of Dayton and test instruments conceived at Ohio State University, the contractor created an index of cabin material hazards expressed as a function of evacuation time: the less hazardous the materials, the more time passengers have to escape. The $400,000 index was initially seen as a useful tool for requiring the use or invention of safer cabin materials. FAA technical officials, who received the aircraft company's report several weeks ago, now say it was a good effort but is not the final answer. Wayne Howell, the fire safety chief at FAA's technical center in Atlantic City, says that more work must be done to verify human survival limits used in the model. "Certain values were arbitrarily assumed, such as those relating to the effects of poisonous gas, and others have not even been looked at, such as those on the effects of irritant gases," he says. "The contractor used the best fire model available but it isn't good enough. We're going to have to run tests with primates exposed to these gases," an effort that will require at least another year.

The agency has no intention in the meantime of giving up its present method of testing cabin material flammability in favor of a method that many experts recommend as an interim solution. The current method, conceived over 30 years ago, consists of exposing cabin materials to the flame of a Bunsen burner for a brief period of time and seeing if they self-extinguish when the flame is removed (all materials in airplane cabins must pass this test). The NAS, among other groups, recommended several years ago that the Bunsen burner test be thrown over in favor of the radiant panel test, which heats the material indirectly, using the burner only as an ignition source. The NAS panel concluded that the radiant panel test more closely simulated real fire conditions, where materials frequently ignite from heat alone. Were the test to be adopted, cabin materials would be required to pass a more difficult hurdle. But the FAA says that because the panel test is also an imperfect fire simulation, no interim change should be made. "We all know that the Bunsen burner does not represent the conditions that exist in a postcrash fire condition," Howell told the House subcommittee last year. He cites the SAFER committee's recommendation that the test be retained with only minor modification as support for FAA's position. (A technical subgroup of the committee had recommended the change, but the full committee disagreed.)

The agency's critics in Congress say that analysis and testing has been done at the expense of practical regulation. The NTSB, for example, recommended in 1972 that aircraft manufacturers be required to place exit lights on or about the cabin floor, on the simple theory that smoke collects near the ceiling, thus obscuring exit markers in use now. The NTSB made this suggestion in the wake of accidents where this had happened. The FAA's response has been to seat test subjects in a cabin mock-up at its offices in Oklahoma City, subject them to smoke, and measure how quickly they flee, depending on whether the lights are at the ceiling or at the floor. Unsurprisingly, the tests recently revealed that floor lights cut evacuation time by 20 percent. Asked if the outcome seemed obvious, Gus Sarkos, an FAA program manager for cabin safety, says, "You can't use reasoning or what people might call apparent results. The industry might argue that it doesn't necessarily follow that floor lights would do the job. We have to prove what something is worth in terms of safety if it's going to cost the industry money."

FAA's testing occasionally lags behind that performed by industry. One example is its experimentation with alternatives to polyurethane seat cushions, the most flammable cabin item. The International Harvester Co., in cooperation with NASA and the FAA, developed a resilient foam of polyimide, which is lighter and more fire-resistant than polyurethane. Howell says that the material is currently being examined and tested in Atlantic City, and that the agency is also looking at an alternative urethane cushion with a thin fire-blocking layer of neoprene. International Harvester, in the meantime, has concluded its own tests and intends to begin marketing its invention this year.

Representative Elliot Levitas (D-Ga.), who is likely to chair the House transportation oversight subcommittee, says he gets "a sense that FAA has a deliberate policy of designing its regulations . . . either at or behind the state of the art." Delay on the adoption of an improved flammability test, for example, forced the Boeing Corporation to improvise its own during design of its new generation of 757 and 767 aircraft. Materials used in those planes have been required to meet a self-imposed flammability standard much more stringent than the FAA's current standard—a standard that other airlines can meet or not as they choose. According to another NAS panel, the agency has difficulty keeping pace with the state-of-the-art developments because the technical competence of the industry exceeds its own. As a result, the panel said, the agency's scrutiny is somewhat superficial.

Previous FAA officials apparently took little interest in the cabin safety issue, as Joseph Ferrarese, acting director of the office with cabin safety responsibility in 1978 and 1979, acknowledges. "You have just so much time and manpower," says Ferrarese, giving what he says is his opinion and the opinion of most of his former colleagues. "Cabin flammability should always be considered important, but not at the risk of more important things. There was talk about getting flame-resistant uniforms for cabin attendants [the proposal was made by NTSB in 1974]. It gets a little ridiculous—the next thing you know, people will be required to wear flame-resistant suits and dresses on board." Ferrarese, an engineer who is now with Eastern Airlines, says "this is a very sexy subject for congressmen. They're not technically qualified to investigate other areas of aircraft design, so they zero in on something they can relate to. It takes a lot of damn time to respond and distracts the FAA from its real missions."

"They have fed us a bunch of baloney over and over, and in an extremely patronizing manner," says Representative Gingrich.

But Congress remains just as determined as ever. Representative Gingrich says that "historically, the evidence is overwhelming that the FAA has had a deplorable record on this issue. They have fed us a bunch of baloney over and over, and in an extremely patronizing manner." He expects to bring up the issue quickly with whomever President Reagan appoints as the agency's new director. Last year, he told agency officials he would go on a witch hunt or attempt to disband the agency if cabin regulations were not forthcoming. Gingrich said recently it is a vow he intends to keep.—R. JEFFREY SMITH