counsel ruled that he had to comply with the subpoena. The government mounted a vigorous assault on his conclusions at the hearing. Lynn Anspaugh, a scientist at Los Alamos, testified that he thought the sheep received a dose of only 1.4 rads to their intestinal tracts, and only 100 to 400 rads to their thyroids, a factor of 100 lower than Knapp's estimates.

The topic on which the calculations diverge, and on which the sheepmen's claims may ultimately depend, is the quantity of soil that a sheep ingests while eating. Knapp says that sheep foraging on a dry range, such as the one in Utah in 1953, ingest a good amount of soil, and so ingest a good amount of radiation. Anspaugh says they don't. Neither side can really prove its case, given the paucity of reliable research data, and the lack of any measurements at the time.

In congressional documents, Knapp admits that he did not rigorously prove that "fallout was the sole cause of death, or the primary cause of death . . . only that fallout is the simplest explanation of the primary cause of death." It is up to the government, he said, "to show that certain things did not happen. This is especially true if there is good reason to suspect that the government was deliberately deceptive or incompetent, or both, in presenting the facts of the case."

Shortly after giving his testimony, Knapp left the Joint Program Office and moved to his new position at the Defense Communications Agency. When the latest subpoena came around, Knapp was mindful of the Pentagon code on conduct, which says that employees will avoid any action that affects "adversely the confidence of the public in the integrity of the government." This time, he turned the subpoena down, with support from the Pentagon legal counsel. Subsequently, the judge told the Justice Department to arrange for his participation anyway.

America's nuclear weapons establishment has not been kind to those who dissent from its official positions. Gofman and Tamplin, whose work supported Knapp's initial study of radiation in milk, were eventually drummed out of weapons-related work, according to their own accounts. But Knapp's situation is different. He has on his side the passage of time: his allegations have been carefully confined to events of 20 to 30 years ago. His intention is obviously not to generate ferment, but to correct history.—R. JEFFREY SMITH

Next week: Did federal scientists deliberately conceal information that might have forced a halt to the testing?

New Slant on Engineer Training

A quartet of senior electrical engineering professors at MIT argue in a new report that an effective way to deal with the much-publicized crisis in engineering education is to pay more attention to working engineers now prey to "creeping obsolescence."

The authors shift the discussion from its usual focus on overcrowded undergraduate programs and a shortage of engineering and computer science faculty by advocating education for postgraduate engineers through a new structure linking universities, industry, and professional organizations.

Under its rubric of "Lifelong Cooperative Education," the report calls for a "new pattern of engineering education intended to meet the needs of a world characterized by rapid technological change and by engineering systems of growing complexity. In such a world, creative, responsible, and broadly knowledgeable engineers are a most precious resource whose quality cannot be replaced by quantity."

The report was prepared as part of the celebration of the 100th anniversary of the MIT electrical engineering department and was released on 2 October at a symposium marking the centenary. Members of the centennial study committee are professors Robert S. Fano (chairman), Louis D. Smullin, William M. Siebert, and James D. Bruce.

Created because the centennial seemed an appropriate occasion for a critical look at electrical engineering education, the committee decided in its early discussions that the rapid pace of innovation in the field made postgraduate education and professional development a problem area needing attention.

The subject was discussed in workshops in January and April attended by people from industry, MIT, and other universities. The committee completed its drafting work this summer. The report's major conclusion is that the demand for electrical engineers "cannot be met by replacing 'obsolescent' engineers with new graduates (and the human costs of such a replacement policy would be unacceptable even if it were feasible).

"The only apparent alternative is better utilization of the presently available engineering workforce through continuing education at the workplace with the active encouragement and support of employers."

Engineering schools and neighboring industries are urged to collaborate in making off-campus graduate programs available to working engineers. The report recommends that MIT and other engineering schools establish special master's degree programs for working engineers but not limit enrollment to degree candidates.

As a model for course instruction the report urges adoption of a method of "tutored video instruction" developed at Stanford over more than a decade. Television recordings of regular Stanford classes are used in off-campus sessions in small classes guided by tutors. The technique stresses frequent playback and discussion of material during the session; questions can be referred to a lecturer at Stanford by phone for discussion at the next meeting of the class.

While recognizing that continuing education programs in engineering already exist, the report argues that a much more widespread and effective system is required. The approach should strike a responsive note with critics who complain that industry prefers to pay lower wages to successive crops of recent graduates trained here and abroad, while shedding older, more highly paid engineers whose professional training is in many cases outmoded.

The report's authors concede that the major obstacle to implementation of their proposal is the current shortage of engineering faculty. As one answer, they say, "The help of industry is urgently needed in the form of sabbatical leaves for senior engineers so that they may join us as visiting faculty."

The report is addressed specifically to the MIT electrical engineering department, but the hope is that its proposals will attract broader interest at MIT and at other institutions.—JOHN WALSH

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