pants, Alexander D. Langmuir, a former CDC epidemiology chief and now a visiting professor at Harvard Medical School. "My gut reaction after an hour's conversation was that it was a coincidental phenomenon and no problem." The next day CDC publicly announced that it was investigating the Guillain-Barré phenomenon, but it stressed that "there was no evidence to link the reported cases to vaccination and that there did not appear to be an increased number of cases of Guillain-Barré syndrome occurring in the country."

Two days later, CDC, after another conference call with the outside experts, reversed itself and recommended that the program be halted pending further investigation of the Guillain-Barré phenomenon. What had happened to change everybody's mind? The most important factor, according to Sencer, was a sharp downward revision in the estimated annual incidence of Guillain-Barré disease in this country under normal circumstances—from 14,000 cases under the initial estimates to only 4,000 cases after the figures were refined. Against that smaller background, the cases of Guillain-Barré disease found in conjunction with the immunization campaign began to look more significant.

Not all of CDC's own staff experts were in favor of halting the whole program. At least two are said to have recommended continuing the program for "high risk" individuals deemed likely to die from flu, namely the elderly and chronically ill. But the majority of CDC's staff preferred to stop all vaccinations pending completion of the investigation of Guillain-Barré cases. According to one participant, the majority was tired of getting hit on the head for the flu campaign and felt that, unless they could prove the campaign was not causing harm, they wanted time out for a breathing spell.

CDC's recommendation for a temporary halt was communicated to Theodore Cooper, assistant secretary for health in the Department of Health, Education, and Welfare (HEW), in a telephone call on 16 December. Although Cooper was technically the official who had authority to continue or to suspend the program, he had little choice once he had received the authoritative recommendation. After briefing HEW Secretary David Mathews and President Ford, he held a late afternoon press conference to announce suspension of the campaign. The tone of the conference suggested an attempt to downplay the significance of the problem. Cooper stressed that "no association" had been found between vaccination and Guillain-Barré cases beyond the statistical suggestion of a possible relationship. And he apologized that some people might find the suspension "premature" or "alarming." But he called the suspension "the most prudent course to take at this time." Suspension, he stressed, "does not mean termination." Neither Cooper, in his oral comments,

Nuclear Moratorium: Study Claims That Effects Would Be

Alvin Weinberg, an articulate advocate of nuclear power for much of his career, has now challenged industry claims that a nuclear moratorium would wreak economic havoc in the United States. In a new report, Weinberg says that the country could afford to give up nuclear power for 30 years with only modest economic and environmental consequences, because future energy demand will grow much more slowly than had been anticipated. The consequences of a moratorium, he says, would include higher direct costs for electricity estimated to be no more than 1 percent of the yearly gross national product and the need to mine an additional 1 to 3 billion tons of coal per year by the end of the century.

The report's estimates of reduced energy growth will have implications beyond the nuclear arena, since energy demand forecasts are the starting point for broader policy questions. What is most striking about these estimates is the company they keep—the Weinberg projections are essentially identical to the 1974 low-growth scenarios of the Ford Foundation's Energy Policy Project (*Science*, 1 November 1974, p. 426), although arrived at independently and by a different method. The pioneering Ford Foundation's scenarios, especially the so-called "zero energy growth" case, were very controversial at the time and were as pointedly ignored by the government energy policy establishment as they were enthusiastically taken up by the environmentalists. But the tide now seems to have turned. The Weinberg study is evidence that low energy growth forecasts are well on their way to attaining the status of conventional wisdom. The incoming Carter Administration, moreover, appears to be aware of and receptive to such ideas. Weinberg gave Carter a preview of his study's conclusions earlier this year at one of the then-candidate's briefings in Plains, Georgia, and one of the principal members of the Carter energy transition staff is S. David Freeman, the director and principal architect of the Ford Foundation study.

For the nuclear industry, however, the Weinberg study is likely to prove anything but a welcome Christmas present, since it tends to undercut many of the claims made, for example, during the California nuclear referendum campaign of last year. The three-volume report* marks the first major project of the Oak Ridge–based Institute for Energy Analysis since Weinberg assumed its directorship in mid-1975. Weinberg headed the Oak Ridge National Laboratories for many years and later served a stint as energy policy adviser to the Nixon Administration. The report is one of several background studies commissioned by the National Academy of Sciences in connection with its ongoing massive study of nuclear power and alternative energy systems. It also marks Weinberg's re-emergence in a role that he has played from time to time, that of iconoclast-in-residence for the nuclear community.

The report concludes that, under most assumptions about future interest rates and fuel costs, nuclear plants will be a cheaper source of electricity than coal-burning plants. The difference, however, is small enough that the cost of a moratorium on the construction of new nuclear plants from 1980 to 2010 would not represent a major perturbation to the national economy, even though it might total $300 billion to $400 billion by the year 2010. Regionally, for example in New England, the impact might be more severe. But the report asserts that a moratorium would eliminate only about 50,000 jobs in the nuclear industry, most of these only temporarily. Environmentally, it is judged that a U.S. nuclear moratorium would have little effect on worldwide CO_2 levels unless it led to the abandon-

**Economic and Environmental Implications of a U.S. Nuclear Moratorium* (Institute for Energy Analysis, Oak Ridge Associated Universities, Oak Ridge, Tenn., 1976).

nor a press release issued by CDC that same day mentioned that several of the Guillain-Barré victims had died. When an angry reporter who knew of the deaths challenged Cooper on that point, he replied lamely that it had been "an omission on my part."

Although Cooper had predicted at his 16 December press conference that it would take "every bit of a month" to complete the investigation, just a week and a half later he pressed CDC to convene a meeting of its top advisers to review the data and see if suspension was still warranted. Many CDC staffers considered this a premature effort to reinstate at least part of the program before its momentum was irretrievably lost (and before the lame-duck Ford Administration, which launched the immunization campaign, leaves office). They complained that their investigation was still under way, that data were incomplete, and that they had little time to prepare analyses. Nevertheless, on 29 December, the Advisory Committee on Immunization Practices and other consultants gathered at CDC headquarters in Atlanta to review what data there was. "I think it's a damn shame we've been forced to come to a conclusion before the data are as clean as they might be," grumbled Langmuir. Most of his colleagues apparently agreed. Except for two advisers who wanted to reinstate the program for individuals at high risk, they recommended continuing the suspension until further studies are completed. On 30 December, Cooper announced that he concurred.

The data that troubled the experts suggested—but did not prove—that the vaccinations might somehow be implicated in Guillain-Barré syndrome. As of 25 December, there had been 496 cases of Guillain-Barré disease reported in this country since the start of the immunization campaign on 1 October—with roughly equal numbers occurring among those who had received flu shots and those who had not. There were 11 deaths among the Guillain-Barré victims who had been vaccinated, 8 among those who had not. These totals were not particularly alarming in themselves. But an analysis of the attack rates in ten states where the data were most complete revealed that vaccinated individuals were 7.5 times more likely to develop Guillain-Barré disease than those who had not been vaccinated. That figure was high enough to cause concern.

Some of the scientists who reviewed the data are skeptical that this risk analysis will hold up. They cite a variety of factors that might skew the statistics. It is possible, for example, that the greater number of cases of Guillain-Barré syndrome found among vaccinees may simply reflect better case detection in that group. After all, some health officials note, the vaccinated persons have an incentive to report their illness so as to qualify for insurance payments under the immunization program. And the surveil-

Modest, Foresees Low Growth Rate for Total Energy Demand

ment of nuclear power throughout the world. Emissions of sulfur dioxide and other pollutants from coal-burning plants would be higher than without a moratorium, but would be less than at present—despite vastly increased coal consumption—if it is assumed that present pollution clean-up policies are continued and that many power plants will have scrubbers or other pollution control equipment. Coal mining accidents, however, are estimated to cause about twice as many injuries and deaths as would otherwise be the case. The land required for coal mining would increase substantially.

The principal reason for the modest impact of a nuclear ban as estimated by the report is its conclusion that the demand for additional supplies of energy in the 1980–2010 time period will also be modest. The report projects both a high and a low forecast (Table 1) that are both substantially

Table 1. Projected energy demand in quadrillion Btu's.

Year	Demand	
	Low	High
1975	71.1	71.1
2000	101.1	125.9
2010	118.3	158.8

lower than most previous predictions, and Weinberg says the consensus among those who participated in the study is that "we believe in the lower one more." The report also assumes that the U.S. energy economy will rapidly go electric, from 28 percent of the total energy supply in 1975 to about 50 percent in 2000—an assumption that is likely to be widely challenged. Nonetheless, the projected overall energy growth rate is so low, about 1.5 percent a year for the low-growth case, that a nuclear moratorium would not exert undue pressure on energy supplies. Economic growth for the same period is projected to be about 2.5 or 3.0 percent annually.

Most earlier studies, Weinberg says, used much higher estimates of population growth than those now accepted and assumed impossibly high increases in labor productivity. These studies, he asserts, also neglected to account for the effect of higher energy prices in inducing energy conservation. In essence, Weinberg's message is that the country is not growing as rapidly as it once did, and that even with growth rates for per capita energy consumption comparable to those that have prevailed for the past 35 years, total energy use will simply not rise nearly as rapidly as it has in the past.

All this is sweet music to the ears of those associated with the earlier—and in retrospect, almost prescient—Ford Foundation study. Freeman says that he has been gratified as well by recent favorable comments in industry newsletters that earlier were highly critical of his and his collegues efforts, and he sees the Weinberg study as an indication that what were once radical ideas are now becoming institutionalized. "All of us associated with the [Ford Foundation] study are feeling pretty good," he says. "You can't really expect more mileage for a piece of work than we got," adding that he is especially glad in retrospect that he sent a copy of the study to the governor of each state, including Georgia. Carter is said to have read the study carefully.

The specifics of a Carter energy policy are clearly still some way off, although Freeman is optimistic about the direction things are going. "It looks like we're going to have a real show here," he says. But it seems obvious that low energy growth projections will have a substantial effect on the framework within which new energy policies will be formed—if only to reduce the pressure for hasty commitments.—ALLEN L. HAMMOND