In 1974, the same year Congress was breaking up the AEC and beginning to look with a fishy eye at its Joint Committee on Atomic Energy, a step toward a more general cleanup was taken with the authorization of an engineering survey of inactive piles. Senator Frank Moss, from Salt Lake City, was a prime mover behind this legislation.

That the NRC began taking hold of the tailings problem shortly after it was created was, as commissioner Gilinsky has acknowledged, partly due to prodding from the Natural Resources Defense Council (NRDC), an environmental law group. The NRDC filed a petition with the new agency asking that a generic environmental impact statement (GEIS) on tailings disposal be prepared and that uranium mill operators be required to post a performance bond that would cover the cost of such improved practices as might ultimately be required.

The NRC agreed to prepare the GEIS (to be issued later this year), and while it did not immediately adopt the proposal for performance bonds it eventually did so. Also, by the spring of 1977, the agency had adopted a set of performance objectives for tailings management and was insisting that companies applying for NRC licenses or license renewals observe them.

One prime objective is to have all new uranium mills sited remote from centers of population, and to have all tailings disposal sites so situated as to avoid or minimize "disruption and dispersal by natural forces." Another is to reduce, for tailings disposal sites new and old, gamma radiation to essentially background levels and radon emanations to about twice such levels. In addition, any need for continued monitoring and maintenance following tailings disposal and site reclamation would be eliminated.

An early practical test of these objectives came with a license application by the Rocky Mountain Energy Company of Denver, the mining subsidiary of the Union Pacific Corporation, to build a uranium mill in Wyoming in a joint venture with the Southern California Edison Company. This Bear Creek mill, already in operation on a company claim 70 miles northeast of Casper, is now disposing of its tailings in a carefully designed and engineered surface disposal facility but will eventually switch largely to subsurface disposal. All dry tailings will be backfilled into deep, specially prepared surface mining pits created in extracting the uranium ore; this disposal method will be similar to the United Nuclear Corporation's proposed Morton Ranch operation (near Douglas, Wyoming) which the NRC regards as a model.

The NRC is not insisting that its licensees go to the large expense of removing existing tailings piles and burying them. Instead, it is requiring that these piles be regraded to resist erosion and then covered with clay and other soil to a depth (usually of 8 to 12 feet) sufficient to meet the objective of reducing radon emanations to twice background levels. Agency staff people say that such "above-grade burial" can be adequate, especially if the pile is nestled among terrain features and is not on an exposed site.

How disposal plans of the kind described above square with the new awareness of the hazards that mill tailings pose for the long term will no doubt be fully discussed at public hearings next year on the GEIS. Tailings quite obviously cannot be disposed of in geologic repositories in the manner proposed for high level and transuranic wastes; they are far too voluminous for that even if, from the standpoint of minimizing radiation exposure over the millennia, a case could be made for it. But there clearly is a question as to how far federal and state regulatory authorities should go in making concessions to economic expediency.

However such questions may be resolved, it is clear that the NRC and Congress have now begun in earnest to address the tailings disposal problem with the seriousness it deserves.

—LUTHER J. CARTER

Fermilab in Transition: The Wilson Era Ends

Fermilab—the 2-kilometer-diameter accelerator laboratory on the plains of northern Illinois—was the unique creation of Robert R. Wilson, an extraordinary builder, technical visionary, and architect who controlled almost every detail of his organization and forcefully directed the company's largest accelerator for 11 years.

When he resigned last February in an effort—ultimately unsuccessful—to get more money for his laboratory, the circumstances were unusual. There was the hint that he might be persuaded to return if more money somehow came along, and in any event, he requested that the board of trustees keep him on in a subordinate capacity while his erstwhile deputy was promoted to be the new director. Indeed, the circumstances were unusual enough to raise questions about whether the old era of Wilson would be followed by a new era of Wilson, or whether his dominant influence on the laboratory—a controversial issue through much of his tenure—was ending.

Six months after Wilson's resignation, the delicate task of choosing new leadership has apparently come to a conclusion. As evidenced by the time required, resolution of the laboratory's quandary was not simple. Even after the board of trustees of the independent organization that directs Fermilab, University Research Associates, settled on a new director, difficulties with the funding agency, the Department of Energy (DOE), delayed final approval. The department apparently had no objection to the person chosen by the board, but bureaucratic hurdles nevertheless held up the choice from mid-August to the present. Officials at the DOE say the last hurdles have been overcome and an announcement is due in a matter of weeks.

The new director is expected to be Columbia University physicist Leon Lederman, a talented and self-effacing experimentalist who has been closely connected with the laboratory from its beginnings in 1964. Having spent his research career working on a broad range of experiments performed in many different laboratories, and much of his time at Fermilab sparring with Wilson in a friendly fashion, Lederman is expected to bring a distinctive style to the laboratory. Well known as a charming humorist, Lederman is also rated high by his colleagues for his "taste in science," energy, toughness, and understanding of the factors that can bring a loss of vitality to a laboratory. If—as seems virtually

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Upton OK's Laetrile Test on Humans

In an attempt to clear up the 20-year-old Laetrile controversy "once and for all," National Cancer Institute (NCI) director Arthur C. Upton on 27 September called for an NCI clinical trial of the apricot pit derivative. Between 150 and 300 terminal cancer patients are expected to begin receiving the drug before January, with the first results coming in by next spring. The decision comes after a long and bitter dispute between Laetrile advocates who claim that some 70,000 American cancer patients have benefited from the drug and a scientific establishment that for the most part feels Laetrile is a hoax. Said Upton in announcing the decision: "It's an issue that begs resolution."

The decision comes 15 years after NCI was first asked to conduct a clinical trial of Laetrile. But repeated tests in animals never showed evidence that Laetrile could combat cancer, and testing never proceeded to humans.

Upton's quick decision came 2 days after NCI's Decision Network Committee, a group of NCI physicians and scientists, made a half-hearted recommendation calling for a clinical trial of Laetrile (*Science*, 6 October). The vote was 14 in favor of a trial, 11 against. Their recommendation was based on a $152,000 inconclusive review of the medical records of cancer patients who used Laetrile. Of the 22 cases where all the necessary records could be obtained, six patients showed improvement, nine stayed the same, and seven got worse.

Asked by a wire service reporter whether he had been disappointed with the ambiguous results of the retrospective study, Upton said: "Yes. I would have hoped for either no cases or a couple of hundred good ones. As it was, the results fell in a gray area where you can either argue you have proof or that you have nothing."

But Upton also told the group of 200 workers and reporters at the announcement: "By virtue of the fact that thousands of people are now receiving Laetrile and the fact that we have this evidence, inconclusive as it may be in humans, we can justify a trial to resolve the matter once and for all." Since that decision, 150 cancer patients have called NCI to volunteer.

The Institute will propose a "phase two" trial, which will determine whether Laetrile can produce shrinkage of tumors in patients with advanced cancers. If successful, testing would then move to a "phase three" study where Laetrile's effectiveness would be compared with standard anticancer drugs. Upton said he hoped the protocol "would not rule out" the use of Laetrile in conjunction with what its proponents call a program of total metabolic therapy—including a vegetarian diet, supplemental vitamins and enzymes, and chelated minerals—which they insist is crucial to the drug's success.

Objections are already being raised. As with the case-review study, some researchers argue that "total metabolic therapy" masks the effect of the drug, that metabolic therapy rather than Laetrile may be responsible for a stimulation of the immune system that brings patient improvement.

But Upton acknowledged in response to a question that Laetrile advocates would reject the NCI findings as out of hand if the metabolic program was not included. Robert W. Bradford, chairman of the country's largest pro-Laetrile group, the Committee for Freedom of Choice in Cancer Therapy, said in a telephone interview that he was pleased with Upton's decision. He also noted that unless the total metabolic program was used, his group would not endorse the findings.

NCI now must apply for an Investigational New Drug (IND) permit from the Food and Drug Administration (FDA). According to an NCI spokesperson, it will take 3 months to review the possible protocols and to submit the application to the FDA. Although commissioner Donald Kennedy has repeatedly come out against a clinical trial of Laetrile, he said the FDA would make an "objective evaluation" of NCI's request and decide "as quickly as possible." Says Kennedy: "We don't believe the restrospective review done by NCI demonstrates any effectiveness of Laetrile. But there are other reasons that we all recognize that a controlled clinical trial might be desirable and NCI has been persuaded by them."—WILLIAM J. BROAD

certain—his selection is ultimately approved by the Department of Energy, he will be in a position, at age 56, to bring up to a decade of new leadership to the laboratory.

While the torch has not quite been passed into the hands of the new leadership, it has clearly passed out of the hands of the old. Wilson has stepped down as director of the laboratory and accepted a faculty position at the University of Chicago. He is still tenuously connected with the laboratory as a consultant for its $38 million project to double the accelerator's energy, but he was apparently not asked to head the so-called doubler project as he requested on resigning (*Science*, 10 March). In keeping with his reputation as a sculptor, Wilson's new position at Chicago is an endowed chair in the undergraduate humanities department, where he will teach, among other things, art and design.

Wilson's deputy director since 1967, apparently passed over by the board of trustees, has also left the laboratory. Widely praised by those who have worked with him as an outstanding administrator, Edwin L. Goldwasser has returned to the school where he previously taught, the University of Illinois, Urbana-Champaign, to become dean of the graduate school and vice-chancellor for research. Since 17 July, the man who had been head of the doubler project and in some sense the number three administrator of the laboratory, Philip Livdahl, has been serving as acting director until Wilson's successor is named.

As practitioners of big science for many years, high-energy physicists have learned to be very politic. Although word of administrative disarray at Fermilab has circulated privately for years, physicists have been hesitant to criticize Wilson's organization publicly, not only because it would be impolitic but also because there is great respect for his achievements through a career of accelerator building that started in the Berkeley laboratory of E. O. Lawrence. Nevertheless, many think there were problems at Fermilab. Department heads were rotated at least every 18 months, physicists were put in nonscientific administrative posts and then soon removed, and few people stayed in their jobs long after they learned them. A tremendous effort was put into developing accelerator technology, and many thought it was at the expense of the funding for research. The laboratory had started life with a shotgun approach to particle research, mounting many small experiments, and critics think Wilson waited too long to consolidate the experimental program

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and build fewer large selected experiments with greater detecting power. "The director paid almost no attention to the physics there," says one physicist familiar with the laboratory, "He let the technical development fly off unrestricted."

Whatever the reasons, Fermilab did have its setbacks. For the first 2 years after the accelerator started up in 1971 it produced very little data, because virtually all the magnets in the accelerator ring had to be overhauled to correct an electrical shorting problem (*Science*, 17 December 1971). After the "November revolution" in 1974 that changed the course of particle research drastically and made quarks a household term, Fermilab was consuming the largest share of high-energy physics research funding, and yet the new physics, elaborating on charmed quarks, was being found in other, older laboratories. (Primarily as a result of Lederman's research, Fermilab's position may have improved in this respect.)

Robert Wilson, contacted by *Science*, says he would not make any apologies for the laboratory's record in bringing the first 400-billion-electron-volt (Gev) accelerator on line. The policy of 18-month rotations was a "deliberate attempt to develop a group of young physicists who knew the entire laboratory," and the shotgun experimental approach was "good and appropriate to a new machine working in a new area of physics, with a large constituency," he says. The point about 2 years of accelerator difficulties is "quite right, but we were coming on at 300 rather than 200 Gev," says Wilson. Even with the delay, Fermilab was operating in less time than the 7- to 8-year period projected in early planning studies at Berkeley, he says. Finally, Wilson observes that the November revolution consisted of "low energy physics" that other labs, which operate at lower energy, "could have found 10 years earlier."

Unlike other similar physics laboratories, Fermilab under Wilson had no "visiting committee" of prominent scientists to assess scientific progress and scientific policy questions each year and report such findings to the board. Knowledgeable Washington officials suggest that the laboratory could have benefited from more outside scientific review. Wilson reportedly disliked such review committees, and the board apparently never forced his hand on this issue according to these officials. The board did have a scientific subcommittee, which conducted extensive review, according to Norman Ramsey, head of the board of trustees who takes issue with the criticism. Nevertheless, he says that "there is virtue to the idea of an external visiting committee and one may well be established."

Leon Lederman

Whether or not the board of trustees of Fermilab caught wind of any critical sentiments, it conducted an inquiry of unprecedented magnitude as part of the search for a new director. "We interviewed many lab members, the outside users, and the user's executive committee," says Ramsey. The board interviewed each person at length, and the total number of people interviewed was "in the hundreds," says Ramsey. To reach those who were not interviewed, the trustees posted notices at the laboratory asking for candidates as well as suggested criteria for the new director's selection. Advertisements were even taken in the international magazine of particle physics, the *CERN Courier*. "It was a very vigorous examination of the whole question of the way the lab works by all parties," according to one observer at Fermilab.

The first name on the board's list of choices for the new director was Burton Richter of Stanford, who received the Nobel Prize along with Samuel Ting for the discovery of the J/Psi particle that started the November revolution, and who is largely responsible—by persistently advocating the merits of storage rings during the 1960's—for ushering in an era in which nearly every major accelerator is planning research with counterrotating colliding beams. According to those who know him, Richter turned the job down not because of rumors of difficulties at Fermilab but because Stanford's next storage ring, which supersedes the one on which he did his Nobel-winning work, is due to begin operation next year, and he gave greater priority to completing on the new ring the line of research that he began on the old one.

Lederman, who discovered a particle at Fermilab in 1977 (the upsilon) that appears to be a heavier version of Richter's J/Psi, was offered the directorship by the board of trustees in late July and soon accepted. Formal announcement was scheduled for 17 August. However, two difficulties arose immediately. First, because of previous research commitments at Cornell, he proposed to spend only 1 day per week at the laboratory until June 1979. Second, he asked for a handsome salary, which would match not only his Columbia salary but also Columbia's fringe benefits, which included college and graduate school tuition for three children.

At this point, of the Department of Energy began to get entangled in an affair which, on the face of it, would seem to have been between Lederman and the University Research Associates board. Both the choice of director and his salary, it turns out, had to be approved at the highest levels of the energy department. Lederman as a personality was approved in early August after he talked with the director of the DOE's Office of Energy Research, John Deutch, but Lederman's paperwork did not make it through so easily. According to one scientist at the DOE, there is a great deal of "salary sensitivity" in this year of fiscal restraint, and the bureaucracy held up approval because of the terms of the salary agreement.

Has the delay hurt Fermilab? "It is not as if we are losing time by this," says Deutch, who notes that the prospective drector (Lederman) is not due to show up until next June.

Yet critical questions face the laboratory. It must decide how to distribute its resources to compete wth a new European accelerator at CERN that started up last year with the same types of beams in the same energy range. The new director must decide among different options for the final configuration of the doubler project. While major research sections of the laboratory are being shut down for 6 months at a time, the distribution of funds among various laboratories is of crucial importance.

Some physicists think that Lederman is already being consulted informally on these questions. But until he is a formal full-time director, his ability to chart a new course may be limited.

In the meantime, Robert R. Wilson's $250 million monument to modern science and technology stands waiting on the prairie, sadly neglected until the new director moves west and Washington finishes its business.—WILLIAM D. METZ