

## Crisis threatens most university reactors

The Nuclear Regulatory Commission (NRC) in late July billed 33 universities that operate 37 research and training reactors \$62,100 for each reactor — due Sept. 20. The bills represent a new and unbudgeted expense: a flat annual fee to cover the cost of NRC licensing and inspections.

And shortly after Oct. 1, NRC plans to bill each university reactor yet again, this time for the estimated cost of regulating them in fiscal year 1994.

Over roughly three months, then, the commission will have assessed each reactor more than \$124,000. Schools with two reactors will receive two such bills. Yet a number of these institutions maintain annual reactor budgets of less than \$150,000 — some well under \$50,000. For many, it isn't a question of whether they want to pay — the money isn't there, notes William G. Vernetson, director of the University of Florida's reactor in Gainesville.

"More than anything else, this whole thing is really an invitation to shut down every [university] reactor in the country," says John A. Mayer, who directs the nuclear engineering program at Worcester (Mass.) Polytechnic Institute.

Adds Vernetson, who chairs the National Organization of Test, Research, and Training Reactors (TRTR), "I don't think we're crying wolf when we estimate that within three years we'll lose 15 to 20 of these reactors from closings," his own among them. John A. Bernard Jr., operations director at the Massachusetts Institute of Technology's research reactor, suspects the total could reach 30.

"This is really going to affect the science community," argues Terry Tehan, who directs the University of Rhode Island Nuclear Science Center in Narragansett. Researchers use many of the reactors in a broad range of non-nuclear applications, from environmental monitoring of air-pollutant plumes to cancer therapy, he notes. Many of the reactors also are used widely by educational institutions outside the universities.

The fiscal bombshell that NRC dropped this month stems from the Omnibus Budget Reconciliation Act of 1990 (OBRA-90). The law orders NRC to recover "approximately" 100 percent of its budget by assessing fees on those it regulates. NRC initially exempted university research and training reactors, on grounds that such educational institutions could not reasonably pass these new costs to their customers, usually students.

But Allied-Signal, Inc., sued NRC, arguing that it also could not pass through the agency's new fees. On March 16, the U.S. Court of Appeals for the District of Columbia ruled that an inability to pass costs along was not sufficient grounds for an exemption from fees.

NRC immediately solicited public com-

ments on whether it should continue to exempt the university reactors. While academic institutions argued for continuing the exemptions, many other groups — including some nonprofit hospitals that use materials and equipment regulated by NRC — argued that universities should pay their fair share.

In a July 20 notice in the Federal Register, NRC said it "is reluctant . . . to impose fees that could result in diminishing the already dwindling number of university programs devoted to the nuclear sciences. But the Commission is not in a position to analyze with any confidence the potential burden on educational benefits in comparison with the burdens that fees will impose on the beneficial activities of other licensees." As a result, NRC said it would "reluctantly" withdraw its exemption from licensing fees for universities.

NRC noted that the court ruling left open the possibility that such exemptions might be justified on grounds that educational institutions offer "exceptionally large externalized benefits," which "cannot be captured in tuition or other market prices." However, none of the submitted comments made a compelling case that universities offer such benefits, the NRC said.

Ten days later, Cornell University — billed \$124,200 for its two small reactors — filed a 13-page petition with the NRC formally making the case for the reactors' external benefits. It argued that knowledge derived from education and research is "the archetypical public good — once produced, it can be distributed widely at no incremental cost." Eleven other institutions with research or training reactors signed the Cornell petition.

Most affected institutions are now submitting exemption requests, Vernetson says. He and other TRTR members asked NRC last week to at least let universities pay their bills over an extended period.

To date, the only encouragement TRTR has received came Aug. 6 in a notice from James M. Taylor, NRC's executive director for operations. He noted that university reactors that shut down can avoid paying even the current bill if they file for a "possession-only" license by Aug. 19. Those wishing to file for an exemption will get an extension on paying their 1993 charges. If such a filing arrives by Nov. 17, late penalties or interest will not accrue until NRC resolves the case.

Reed Robert Burn, who manages the University of Michigan's Ford Nuclear Reactor in Ann Arbor, says his institution will pay NRC's bill. Indeed, he adds, while he hopes the university will not tap his budget for the funds, doing so "would not terribly disrupt our operation."

However, he argues, even the large amount of contract work his reactor does offers large external benefits. For instance, while the facility performs neutron radiography for NASA and local automakers — such as imaging where carbon deposits build up in a car's fuel injectors — Burn says, "we only provide such unique services when you can't get them any other way." He says his department never competes with companies offering the same service commercially.

Bernard says MIT also can handle NRC's new fees, "probably through staff attrition." However, he expresses concern about the precedent they set. Once Congress divests itself of funding NRC, there will be "no check on the amount of regulation that NRC can impose . . . [and]

ANNUAL FEE - FY 1993

Period: 10/01/92 - 09/30/93

FY 1993 Annual Fee \$	62,100
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In order to avoid the assessment of interest and administrative charges, payment must be received by the NRC no later than September 20, 1993.

Amount Due Now \$	62,100
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Portion of NRC bill sent to University of Rhode Island.

no incentive to regulate only those aspects of reactor operation that truly require regulation."

Mandatory fees could soon proliferate, Bernard says. "This is making university administrators very nervous." If other regulatory bodies attempt to recover similar charges, "it's going to suffocate research" because the money for it will just be diverted to paying fees, he says.

John W. Poston Sr., head of nuclear engineering at Texas A&M University in College Station, argues that in setting the new fees, NRC "took the dumb approach: It took what it claimed to be the cost of inspections, divided it by the number of reactors [it regulates], and then charged everybody that same amount."

This might be justified if NRC expended the same time and effort inspecting each facility, regardless of the reactor's size and activities, he says, but it doesn't. The agency spends a week two or three times a year inspecting Rhode Island's 2-megawatt reactor, which has a \$140,000 annual budget, notes Tehan. By contrast, NRC inspectors visit Texas A&M's 5-watt reactor once every three years.

"How can [NRC] justify \$186,300—which is what my bill would be for three years—for just one week of inspector time on my site?" Poston asks.

NRC spokesman Frank Ingram responds that the fee is not meant to represent actual inspection costs. Commercial power reactors pay additional inspection fees on top of an annual fee, he notes. Why do all university reactors pay the same fee? "That seems to be the most equitable way to do it, because there isn't that much difference in size among [university reactors]," Ingram says.

With a budget of less than \$15,000 a year, Poston's reactor will not survive NRC's new fee schedule. But shutting it down will not come cheap. While Poston can avoid NRC's bills by shutting down the reactor and taking a possession-only license on it, he notes that "you can only stay in this mode for two years before NRC forces you to [dismantle] it." And that, he estimates, will probably cost between \$500,000 and \$1 million.

Finally, NRC's new fees aren't restricted to university reactors. Last week, many

universities got bills for licenses on "special nuclear material"—neutron sources and uranium—and for "by-product materials," the radioisotopes used in biology, medicine, and other fields.

MIT's bill for special nuclear materials totaled \$187,000—almost entirely for material in dead storage. "The irony," Bernard says, "is that we have been trying to return most of this material to its owner—the U.S. Department of Energy—for over a decade, but have been unable to do so because of various regulations." Even MIT's bill for by-product materials is high: \$28,500.

These additional fees will hit a host of universities without reactors, Bernard notes. For instance, any using uranium foils or neutron sources in physics laboratories will be subject to a fee.

Hoping to eliminate the new fees altogether, TRTR members are seeking support from a number of scientific groups. But "the real source of relief here must come from congressional action," Mayer says, "because NRC is after all responding to a congressional mandate." —*J. Raloff*

## Weighing the causes of severe depression

Scientists have taken an initial step toward identifying the ways in which genes and specific personal experiences jointly act to produce severe depression in women.

Although genes assume a high profile in much recent research on mental illness, the new study finds they exert "a substantial but not overwhelming" influence on episodes of severe depression, assert Kenneth S. Kendler, a psychiatrist at the Medical College of Virginia in Richmond, and his co-workers. Stressful personal events, such as getting divorced, losing a job, or developing a serious illness act as the strongest instigators of depression, the researchers contend.

Their results appear in the August AMERICAN JOURNAL OF PSYCHIATRY.

"Kendler and his colleagues have moved the field ahead by taking the time and care to study a large sample with prospective measurement of several putative risk factors [for depression]," writes C. Robert Cloninger, a psychiatrist at Washington University School of Medicine in St. Louis, in an accompanying editorial.

Kendler's team studied 416 identical and 264 fraternal female twin pairs located through a state twin registry in Virginia. Both members of each pair had lived in the same household through age 16. Participants averaged about 30 years of age.

At an initial assessment, each twin filled out questionnaires on the warmth and support offered by her parents, traumas she had endured during her life (such as sexual assault and life-threatening injury), neuroticism (a measure of anxiety and the quality of life), social support (from family, friends, and

others), and prior bouts of severe depression lasting two weeks or more.

At follow-up interviews conducted about 14 months later, each woman reported any instances of depression in the previous year, childhood separations from parents of more than one year, recent interpersonal, financial, and health difficulties, and stressful events in the past three months. Around 17 months later, the women again were asked to cite new episodes of depression and recent stressful events.

Nearly one-third of the sample reported an instance of severe depression at some time in their lives. In the more than two years of follow-up, about 16 percent of the women cited one or more new episodes of severe depression.

New instances of depression occurred more often among both identical twins, who share the same genes, than among both fraternal twins, who share about half the same genes. A woman's genetic risk for depression, signaled by a history of depression in a twin sibling, more strongly predicted future instances of depression than did the genetic risk combined with other factors studied.

This finding indicates that genes boosting the likelihood of getting depressed may largely do so through a direct effect on the brain that remains active during adulthood, rather than by fostering personality traits or behavioral tendencies that lead to depression, the researchers argue.

Recent stressful events showed the strongest direct association with new cases of severe depression. Genes may, to a small degree, influence personality

## Mars: Prelude to an orbit



NASA

*Coasting through space, the Mars Observer snapped this image of the Red Planet on July 28 to test its high-resolution, narrow-angle camera.*

*Despite dim light and an intervening distance of some 3.6 million miles, the photograph reveals glimmers of bright and dark markings etched by dust and sand. In the dark center, above the sunrise line, lie the volcanic plains and vast sand dunes of Syrtis Major. The bright area of the northern polar cap halos the top of the planet.*

*The Mars Observer will enter orbit, 248 miles above the Martian surface, on Aug. 24 (see p. 104). Once in orbit, the spacecraft will send back detailed pictures of geologic features such as the polar ice cap, where layers of dust surround icy deposits. These deposits "may reflect a much more arid period of Mars' past," says Bevan M. French, program scientist for the Mars Observer mission at NASA headquarters in Washington, D.C.*

*The new images will help scientists attain one of the mission's major objectives: an understanding of the climate of Mars, French says. The high-resolution camera will be able to discern objects as small as 1.4 meters across—about 20,000 times greater detail than that captured in the image shown here.*

characteristics that cause some people to encounter more traumatic events, according to Kendler and his co-workers.

Taken together, the various risk factors in the study accounted for half of each twin's susceptibility to severe depression, they conclude.

Further research must consider other possible influences, such as marital status and history of other mental disorders, the researchers maintain.

Untested assumptions by the researchers about cause and effect still muddy the meaning of the new data, Cloninger adds. For example, some recent stressful life events may result from, rather than contribute to, depression. —*B. Bower*