Recycling Plutonium: The NRC Proposes a Second Look

In a move that has brought praise from environmental groups and condemnation from industry, the federal Nuclear Regulatory Commission (NRC) is proposing to delay at least until 1978 a crucial decision on whether to approve the use of plutonium as a fuel in nuclear power plants. This reverses, at least tentatively, a decision taken a year ago by the now-disbanded Atomic Energy Commission to approve plutonium as a supplement for uranium fuel.

Expressing what it called a "provisional view," the 4-month old NRC said on 8 May that questions about the feasibility of safeguarding plutonium from theft in a new industry needed further study. Although the NRC made clear that it could still change its collective mind, the new commission seems willing to take a hard new look at the plutonium problem before channeling this controversial metal into the civilian nuclear economy.

Virtually from the beginning of the civilian atomic power program in the 1950's the AEC maintained that it would eventually be economical to reclaim plutonium from the spent uranium fuel removed from power plants and recycle the plutonium in fresh fuel rods. This, it was hoped, would reduce the demand for expensive enriched uranium by 10 to 20 percent and thereby would cut the cost of nuclear power generation. Whether, in fact, fuel reprocessing is economical now or will be in this decade is still under debate in the industry.

Nevertheless, the AEC decided last summer that the time was ripe to recycle plutonium. It formally proposed to start licensing the necessary chemical reprocessing and fuel fabrication facilities even though, as the AEC acknowledged, details and costs of an adequate safeguard program remained to be worked out.

A four-volume environmental impact statement published at the time discounted, out of hand, unresolved questions about plutonium's toxicity in humans and failed to mention an abysmal safety record chalked up by the four companies involved in producing experimental plutonium fuel rods (*Science*, 20 September and 11 October 1974).

The AEC's decision proved impolitic, coming as it did in the midst of rising congressional and public concern about the possibility of nuclear theft and terrorism. The Nixon Administration's proposal to sell reactors to Egypt and Israel, close behind India's first detonation of a plutonium bomb, only inflamed doubts about the government's prudence in commercializing plutonium, a metal equally adaptable as fuel for bombs or electric power plants.

By early this year, the Environmental Protection Agency and the President's Council on Environmental Quality (CEQ) were urging delay until safeguards questions could be resolved. On 20 January, for example, CEQ chairman Russell W. Peterson said in a letter to the NRC that the threat of terrorist diversion and use of plutonium in a civilian industry "is so grave that it could determine the acceptability of plutonium recycle as a viable component of this nation's nuclear electric power system."

The NRC, whose staff was formed from the AEC's regulatory branch in January, seems to have taken this caution to heart.

Opposing sides in the nuclear controversy have been quick to comment on the decision, tentative though it is. Environmentalists, among them Anthony Z. Roisman, a Washington lawyer long involved in nuclear power battles, said that the agency's decision seemed to impose a "moratorium on plutonium recycle," and indicated independence on the part of the NRC. The Atomic Industrial Forum, on the other hand, termed the move "deplorable." From the corporate point of view, further delay in plutonium recycling only adds to the muddle currently afflicting the nuclear fuel industry.

The waste disposal end of the nuclear fuel cycle is unquestionably in disarray. Unexpected technical problems have left the United States without a single commercial nuclear fuel reprocessing plant in working order; as a result, spent fuel is piling up to a point where some utilities may be forced to shut down their reactors temporarily.

Of the three commercial plants that have been built, one, near Buffalo, New York, closed in 1972 for remodeling and won't reopen until 1979 if at all; a second, near Chicago, built by General Electric at a cost of $64 million, failed to work properly and seems destined for abandonment (*Science*, 30 August 1974). The third, being built by Allied General Nuclear Services at Barnwell, South Carolina, is scheduled to start up next year, but its operating license could be delayed by the NRC's postponement of recycling; certainly nuclear critics will be arguing that it ought to be delayed, on the ground that, without recycling, there's no need for chemical plants to chop up the spent fuel and extract the plutonium.

In any case, the Barnwell plant is not nearly large enough to handle all the spent fuel pouring out of the nation's power plants, and the only easy answer is to increase storage space for the used and highly radioactive fuel rods.

Spent fuel is stored in concrete basins filled with cooling water and located on reactor sites and at the three reprocessing plants. But the basins are filling up. According to a recent survey by the Energy Research and Development Administration, 14 nuclear power plants will need expanded storage capacity by the end of this year and the number will grow to 28 by the end of 1976. Once storage space is no longer available to a utility, its reactor may be forced to shut down.

ERDA's fuel experts say that a cheap and safe answer to the problem is simply to put more fuel in existing basins than was originally intended. But environmental groups are already gearing up to block this solution, in court if necessary, on safety grounds. Weighing in their favor is a report put out by the General Accounting Office last November that said spent fuel storage basins at utilities were more vulnerable to sabotage than reactors themselves, and that growing quantities of the radioactive fuel "increased the potential consequences of successful sabotage."

ERDA's fuel experts disagree, but such disagreement sometimes makes for lengthy litigation.

In the meantime, some industry analysts are beginning to wonder whether fuel reprocessing is really worth all the trouble and expense. As the slim margin for profit in plutonium recycling has evaporated, pessimists have begun to talk about a "throwaway" fuel cycle in which spent fuel rods are stored indefinitely—perhaps permanently—in some government repository.

The only trouble here is that the government has just postponed its latest plan for a repository (*Science*, 25 April) and has still not arrived at a solution in the search for some acceptable final resting place for the nation's "high-level" nuclear detritus. Current plans are to accelerate development of a pilot storage vault carved out of a salt bed 3500 feet under the southeastern

(Continued on page 874)

Microscope Slide Incubator

Incu-Stage is designed for use with 1- by 3-inch slides to maintain microorganisms at 37°C. The slide is placed at the bottom of a compartment in contact with the substage condenser. The top of the incubator is covered with a mica sheet with a hole in the center through which the objective projects into the incubating chamber. A soft rubber washer serves as a seal. Incu-Stage has integral heating elements and a bimetallic thermostat. Lab-Line Instruments, Incorporated. Circle 737.

Literature

Water Technology Manual covers 14 methods and has a reference section of hints on spectrophotometry. Bausch & Lomb Analytical Systems Division. Circle 742.

Metro Disc describes a water sampler for heavy metal analysis. Data sheet 18 lists capabilities and applications. Environmental Devices Corporation. Circle 743.

p*H Meters* features the model 103—a precise, reliable model with sensitivity to 0.01 unit. Brinkmann Instruments Incorporated. Circle 744.

Solution Calorimeters are covered in bulletin 1451 for the measurement of heat of reaction from 2 to 2000 calories with an accuracy of 1 percent. Parr Instrument Company. Circle 745.

Catalog 750 features thermometers, hygrometers, and accessories for measurement of heat in research applications. Brooklyn Thermometer Company Incorporated. Circle 749.

1975 Research Products Catalog lists radiochemicals, standards, liquid scintillation and gamma counting supplies and accessories. Amersham/Searle Corporation. Circle 747.

Laboratory Products Catalog 750 describes reagents and specialty chemicals. J. T. Baker Chemical Company. Circle 748.

Model AR-2 Recording Vacuum Balance includes description of stability, features, accessories, and design specifications. Perkin-Elmer Corporation, Instrument Division. Circle 751.

NMR Deuterated Chemicals and Shift Reagents lists an expanded product line for this mode of chemical analysis. Pfaltz & Bauer Incorporated. Circle 752.

Laboratory Products Catalog describes apparatus for cell harvesting, solution pumping, air filtration in vacuum systems, and other scientific applications. Spectroderm International. Circle 753.

Demineralized Pure Water is devoted to the Osmo system of reverse osmosis. Osmonics, Incorporated. Circle 750.

NEWS AND COMMENT

(Continued from page 818)

New Mexico desert, but that won't be ready until the early or mid-1980's.

In spite of these continuing difficulties, the prevailing view of nuclear engineers seems to be that no real technological barriers exist to the safe and economical disposal of nuclear waste. But the continuing muddle over what to do with spent fuel and what to do with the final radioactive dregs of nuclear power generation are doing nothing for the technology's image.

—ROBERT GILLETTE

RECENT DEATHS

Frederick B. Davis, 65; professor of education, University of Pennsylvania; 2 March.

Richard F. DeMar, 50; professor of mathematics, University of Cincinnati; 11 February.

Donald W. Denna, 44; associate professor of horticulture, Colorado State University; 15 January.

Alden H. Emery, 73; chemist and former executive secretary, American Chemical Society; 14 March.

Paul H. Margolf, 78; professor emeritus of poultry science, Pennsylvania State University; 13 February.

Bernard D. Tebbens, 65; professor of public health and engineering; University of California, Berkeley; 10 February.

C. Mildred Thompson, 93; dean emeritus, Vassar College; 16 February.

Adolph E. Waller, 82; professor emeritus of botany, Ohio State University; 28 January.

Edward H. Watson, 72; retired chairman, geology department, Bryn Mawr College; 21 February.

Arnold V. Wolf, 58; dean, Graduate College, University of Illinois Medical Center Campus; 27 February.

Nathan A. Womack, 73; first chairman, surgery department, University of North Carolina School of Medicine; 2 February.

George M. Worrilow, 70; former dean, College of Agriculture, University of Delaware; 27 February.

Bernice M. Wright, 66; former dean, College for Human Development. Syracuse University; 17 February.

Erratum: Excerpts of an address by Benno C. Schmidt (16 May, p. 716), chairman of the President's Cancer Panel, erroneously implied that the Cold Spring Harbor Laboratory is an officially designated "comprehensive cancer center." Although the laboratory receives support from the National Cancer Program, it is not a "comprehensive center."—B.J.C.

RESEARCH NEWS

(Continued from page 823)

ized and separated with flow systems, but the Livermore group is finding that chromosomes are also distinguishable. The investigators stained chromosomes isolated from cultured Chinese hamster cells with ethidium bromide. This dye combines specifically with DNA so that the chromosomes are separated on the basis of differences in their DNA content. The technique does not completely resolve the chromosomes but the resolution was sufficient to detect a chromosomal rearrangement in a mutant line of hamster cells.

Van Dilla thinks that the method is a highly promising approach to karyotyping and to purifying individual chromosomes for biochemical and biological characterization. The Livermore investigators are now attempting to apply the same procedures to human chromosomes. This will obviously be more difficult since humans have roughly twice the number of chromosomes as hamsters. In an early experiment, the investigators resolved chromosomes prepared from cultured cells from a human male (24 different chromosomes) into 7 groups. Again, karyotyping appears to be more limited by availability of suitable methods for preparing chromosomes than it is by the instrumentation.

Numerous additional applications of flow systems are being investigated. For example, the techniques provide a rapid, quantitative means of determining the amount of antigen or antibody on individual cells and thus for studying immune responses. Flow techniques should also prove valuable for studying lectin binding by cells. Lectins are widely used to probe the differences between normal and malignant cells.

The availability of commercial instruments will no doubt accelerate the applications of flow systems to biomedical research. Becton, Dickinson Electronics Laboratory (Mountain View, California) is now producing the FACS-1 after the prototype developed at Stanford. Bio/Physics Systems manufactures a series of systems with capabilities ranging from simple cell counting to multiparameter analysis with sorting. And Particle Technology, Inc. (Los Alamos) is also starting to produce flow instruments. Developments that will further stimulate research include incorporation into the instruments of lasers tunable over a wide range of wavelengths and of lasers emitting infrared or ultraviolet light. The potential impact of flow systems on biology, according to Mullaney, equals that of the electron microscope.—JEAN L. MARX