Letters

Uranium Enrichment

Colin Norman's article "Uranium enrichment: Heading for a cliff?" (22 May, p. 906) states that "[t]he Department of Energy . . . has managed to pull the [uranium enrichment] business back from the brink with some severe and painful cost cutting" but that Congress must resolve the dispute over some $8.8 billion in debt that the program has accumulated. Unfortunately, the Enrichment Program is far from stabilized, and the simplest "resolution" of the debt—which is acknowledged by all relevant government agencies—is repayment.

As Norman notes, Senators Ford and Johnston have introduced a bill to "forgive" approximately 95%, or all but $360 million, of the debt owed to the taxpayers. One of the reasons for this enormous subsidy is ostensibly to prevent U.S. utilities from going abroad for cheaper enrichment services furnished by foreign government-owned suppliers. There are ways to accomplish the same goal without costing the taxpayers more than $8 billion. For example, DOE's domestic market (about two-thirds of DOE's business) can be maintained through use of existing authority in the Atomic Energy Act to require domestic utilities to purchase enrichment services from DOE.

Another objective of the $8.4-billion "write-off" is to hold on to foreign sales of approximately $400 million per year. But many of these sales would remain with DOE regardless of price because of political considerations in the foreign trade area. The $400 million is not all, and may not represent any, profit. Therefore, the cost of the subsidy grossly overshadows the value of retaining a market that costs more to serve than can be recovered.

Furthermore, most of DOE's foreign sales are lost, not to higher prices, but to foreign utilities (which are generally government-owned) patronizing their home countries' new enrichment services.

Booz-Allen & Hamilton, the consulting firm that reviewed the situation for Martin Marietta (DOE's enrichment plant operator), recently testified before Congress that DOE's foreign competitors lack the capacity to service defecting DOE customers until the mid-1990s. Therefore, DOE could maximize the value of the enterprise and in the process recover most if not all of the debt by simply raising its prices with no fear of lost sales. While we do not agree with all of the policy recommendations made by Booz-Allen, we do agree with their conclusion that DOE's current strategy of cutting prices without much attention to the future is "not viable."

There are two additional matters that Norman does not mention in his article. First, DOE has a legal obligation to recover all the costs of its civilian enrichment program under section 161v. of the Atomic Energy Act. This requirement, which has been in the law since the federal government began providing enrichment services to civilian customers in 1969, is designed to prevent exactly the type of taxpayer subsidy now advocated by Senators Ford and Johnston, DOE, and the nuclear utility industry.

Second, DOE ran up the $8.8-billion debt in question by investing in unnecessary capacity (diffusion plant upgrades and the gas centrifuge) rather than repaying the Treasury. DOE took these actions at the insistence of the nuclear utility industry, as evidenced by congressional testimony of the Edison Electric Institute and others. The utilities testified that they would pay for the capacity and that the risks of not having it available outweighed the risks of having too much. They are now reneging on their own commitment by threatening to turn to other suppliers unless DOE or Congress "forgives" their $8-billion debt.

Contrary to Norman's assumptions, the Ford-Johnston approach would not result in a more "businesslike" enrichment program, would write-off a debt that *can* be recovered and would not protect against the accumulation of additional debt to taxpayers requiring additional write-offs in the future. Also, payback to the Treasury can be made without harm to DOE or to the nuclear industry or its ratepayers. Full recovery of the debt would add less than one-tenth of a cent to the cost of each nuclear-generated kilowatt-hour. Such a payback would be in accordance with existing law and more than 20 years worth of commitments by the federal government and the nuclear utility industry.

John Longnecker, the DOE official in charge of the enrichment program, is quoted as proposing that the enrichment business "is a profitable niche of the nuclear business internationally" and that "[t]he only way we can be beaten is for the United States to choose not to compete." He has proved that the only way the program is "profitable" is by gargantuan taxpayer support. The cost to the United States for increasing DOE's market share as suggested by Longnecker and as proposed by Senators Ford and Johnston is $8 billion now and more later out of the pockets of U.S. taxpayers. Even this negative "profit" would result in only marginal expansion of DOE's mar-

ket share. The United States can meet its domestic and national security uranium enrichment needs now and in the future without any taxpayer bailout. Moreover, it can continue to be a reliable supplier to such foreign customers as desire its services without cost to the taxpayer. Why should Congress and the American people support the Senate approach, or DOE's current policies?

B. JEANINE HULL
National Taxpayers Union, c/o Kirkpatrick & Lockhart, 1800 M Street, NW, Washington, DC 20036-5891

Indictment of Soviet Physicist

I am writing in response to the Research News article "*Glasnost* comes to Soviet physics" by Arthur L. Robinson (8 May, p. 671).

I believe the article that appeared in the Soviet magazine *Literaturnaya Gazeta* is an unfair and incorrect indictment of Soviet physicist Evgenii N. Yakovlev, the acting director of the famous Institute of High-Pressure Physics located just outside Moscow. The thesis of the Soviet accusations against Yakovlev is an unequivocal allegation that Yakovlev's work on the pressure-induced metallization of hydrogen diluted, diverted, and stagnated the efforts of the institute for a 10-year period and, furthermore, that Yakovlev's announcements that he had achieved the metallic state of hydrogen were blatantly incorrect. Perhaps the Soviets are trying to find excuses for failing to first report the pressure-induced high-transition-temperature ceramic oxides.

I take logical and forceful issue with the above Soviet position. As a professional Defense Department physicist working in the area of high-pressure for the past 22 years, I am very familiar with Yakovlev and with his work. I have met him on many occasions and have engaged in intensive discussions with him at conferences sponsored by the International Association for the Advancement of High Pressure Science and Technology (AIRAPT). I have discussed with him in detail recent work (including his own) on the pressure-induced insulator-to-metal transition in sulfur and in other insulators, as well as theoretical work in hydrogen. I have interacted with Yakovlev at conferences in Le Creusot, France, and in Uppsala, Sweden. I have found him to be knowledgeable and competent and to be far more cooperative and interactive than most Soviet physicists, especially those in the high-pressure field.

I have also become aware of Yakovlev as a humanistic and humanitarian scientist with characteristics that would clearly identify him as a sensitive, well-meaning member of the community of nations rather than a representative of a nation normally thought to be politically hostile. Yakovlev is, in my mind, a deeply sensitive and profound thinker and speaks better of the human quality of Soviet scientists, often thought to be unapproachably aloof from social and emotional values.

G. C. VEZZOLI
U.S. Army Materials Technology Laboratory, Watertown, MA 02172

Is Female Math Anxiety Real?

Constance Holden (News & Comment, 8 May, p. 660) reports that "Female math anxiety [is] on the wane." It may be that there never were many male-female differences in "math anxiety," at least insofar as secondary school and college-age populations are concerned. For college-age populations this was already suggested in a study of 1045 students at the University of Rochester in which there were no discernible differences between males and females in mathematical anxiety among students at the same level of ability (*1*). Already in the late 1970s Wesleyan University, which had one of the first "mathematical anxiety" clinics at the college level, reported proportionately as many males as females registered for its programs for the "math-anxious" (*2*).

What then explains the popular association of "math anxiety" with females (tacitly assumed to hold at all age levels)? It seems to stem from a 1976 article by John Ernest (*3*) later reprinted by the Ford Foundation, and an article by Sheila Tobias (*4*), followed by a book (*5*). Actually the Mathematical Anxiety Rating Scale (MARS) was developed by Richardson and Suinn around 1972 (*6*). Although 80% of the students in the Richardson-Suinn sample were female, no significant difference in mean scores or standard deviations was found between males and females. Rounds and Hendel (*7*), who used the MARS scale, actually studied older female college students who were enrolled in math anxiety programs, for whom an average of 16.5 years had elapsed since their last mathematics course and whose approximate average age was 35 years. No wonder they were "math-anxious"! In any case a good deal of caution is necessary in interpreting data based on the MARS scale (*1*, p. 44).

A recent study by Hallinan and Sørenson (*8*) indicated that female students (in fourth through seventh grades) ranking high in mathematics achievement were less likely to be assigned to high-ability groups by their teachers than were males with comparable scores. Even though the study also showed that "sex, *per se*, is not a determinant of assignment" (*8*, p. 67), the idiosyncratic assignment of *high-achieving* females (emphasis added) as influenced by sex is a major conclusion of the study. Furthermore (*8*, p. 71) girls "are more likely to be misassigned than boys." Although Hallinan and Sørensen do not believe that at the age level they studied the sex considerations in the assignment process affect mathematics achievement, this may happen for older children. The steady increase of the percentage of U.S. citizen female Ph.D.'s (in a declining total) each year (*9*) may be an indication that properly nurtured and encouraged at home and school, women are as capable as men in the upper levels of mathematics.

Finally, a distinction is frequently made in discussions of this sort between "verbal" and "mathematical" ability. In studies done as long ago as the 1960s, the Russian educational psychologist V. Krutetskii (*10, 11*) showed that while, on the one hand, ability to visualize abstract mathematical relationships and ability to visualize spatial geometric concepts were highly correlated, neither was a necessary component in the structure of mathematical abilities. Their strength or weakness determined the type of mathematical giftedness, rather than its extent. In addition, he found that the verbal-logical component of thinking is well developed in all mathematically able pupils, and one can therefore only talk about a greater or lesser development of the visual-pictorial component. Indeed students with "little capacity for mathematics" are primarily defective in the verbal-logical components of reasoning (*11*). Could it be that purported male-female differences in math anxiety have always been fictitious?

SANFORD L. SEGAL
Department of Mathematics, University of Rochester, Rochester, NY 14627

REFERENCES

1. H. Resnick, J. Viehe, S. Segal, *J. Counsel. Psychol.* **28**, 39 (1982).
2. R. A. Rosenbaum, personal communication.
3. J. Ernest, *Am. Math. Month.* **83**, 595 (1976).
4. S. Tobias, *Ms.* **5**, 56 (September 1976).
5. ———, *Overcoming Math Anxiety* (Norton, New York, 1978).
6. F. C. Richardson and R. M. Suinn, *J. Counsel. Psychol.* **19**, 551 (1972).
7. J. B. Rounds and D. D. Hendel, *ibid.* **27**, 138 (1980).
8. M. T. Hallinan and A. B. Sørensen, *Sociol. Educ.* **60**, 63 (1987).
9. *Not. Am. Math. Soc.* **33**, 922 (November 1986).
10. V. Krutetskii, *The Psychology of Mathematical Abilities in School Children* (Univ. of Chicago Press, Chicago, 1976).
11. V. Krutetskii, in *Educational Psychology in the USSR*, B. Simon and J. Simon, Eds. (Stanford Univ. Press, Stanford, CA, 1963), pp. 214–232.