a chapter to a constitutional law inquiry, which concludes that the federal civilian nuclear program and the safety decisions under it are unconstitutional; not because the framers did not foresee and "mandate" nuclear energy, as Lewis interprets the chapter, but because they limited the federal powers to those which were not to be, and cannot reasonably be, construed as powers "to promote manufactures" by spending and granting immunities, or to provide for "the advancement of useful knowledge and discoveries" (that is, civilian research and development). Such powers were expressly proposed but rejected in the federal Convention of 1787. New powers can only be granted by constitutional amendment—a process that was to enable the people to control their government and best pursue their safety and happiness (way of life).

Lewis asserts that on this issue I am "furthest out" and that the book "is short on practical suggestions for ascertaining" the judgment of "will of the people" on nuclear safety. However, he ignores the legal brief in the chapter. As for practical suggestions, the book does indeed specify one; namely, the constitutional method. Drawing on the amendment procedure of Article V of the US Constitution, the book explains that Congress should review civilian nuclear energy for its necessity and safety; and if they then want to continue with the federal program, they would have to request the authority to do so by an amendment proposition submitted to the States for ratification (preferably by the mode of state conventions, for which the people would elect delegates). To say that constitutional methods are not practical is to turn away from self-government. It is noteworthy that our cherished Bill of Rights was enacted by the amendment process.

In a "personal note" Lewis resents the assertion—made in my chapter on the American Physical Society reactor safety study—that there is a "reluctance of the . . . physics community to discuss" certain issues, which he does not identify, nor mention anywhere else in his review, though my book does. These are the safety issues of power excursions and power-cooling mismatch accidents—both worse than the loss-of-coolant accident. As the book shows, such accidents appear to have the potential for causing agricultural restrictions over 500 000 square miles, due to strontium-90 fallout, and other huge consequences. Extensive efforts on my part to persuade the physics community to pursue these issues in funded research were unsuccessful. Also, the APS study group, of which Lewis was chairman, disregarded a key power-excursion analysis I sent them. Specifically, during their working session in 1974, I sent the group excerpts of an internal report of the National Reactor Testing Station (1964–65) on power-excursion accidents in light-water reactors. The report calculates a catastrophic explosion potential, and proposed a massive research program, which was disregarded by the AEC. That document, which is treated in my book, contains the only analysis ever prepared on the full excursion potential of present-day reactors; but it was kept secret until 1974. Lewis's group did not pursue the matter with me; nor did they even mention the document or the power excursion phenomenon and accident possibility in their report (*Reviews of Modern Physics*, July 1975). Instead, they reported that they had "not uncovered reasons for substantial short-range concern regarding risk of accidents." Was it not correct, therefore, to say that there is a reluctance to discuss such issues?

Finally, Lewis interprets the Preface as promising "a balanced account" of safety issues, but finds the text "an unremitting litany of accident hazards." However, as the book states at the outset, I sought to investigate the essential reactor hazards (not to justify safety). Moreover, I presented my findings of extensive and fundamental shortcomings in official safety analyses and experimental programs, and extremely disastrous accident potentials, not unremittingly, but with the basic mitigating facts.

RICHARD E. WEBB
5/18/77 *Toledo, Ohio*

THE AUTHOR RESPONDS: Richard Webb's letter is full of falsifications about what he has written, what I have written, and, above all, about facts. I was aware that selfrighteousness had blurred his perception of true and false, but hadn't expected him to give the rest of the game away as completely as he did in the next-to-last paragraph:

- "Extensive efforts on my part to persuade the physics community to pursue these issues in funded research were unsuccessful."
- "The report . . . proposed a massive research program, which was disregarded by the AEC."

Apparently, Hell hath no fury like an engineer scorned.

H. W. LEWIS
University of California
Santa Barbara, California

Kirkhoff versus Kirchhoff

William Dean's letter (May, page 11) is headed "Kirkhoff pairs" and the text makes reference to "Kirkhoff's laws." In a physics journal, one would expect to find the correct spelling of the name of a well known physicist, Gustav Robert Kirchhoff (1824–87), FRS, professor of physics

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letters

at Breslau, Heidelberg and Berlin, one of the founders of spectrum analysis, discoverer of cesium and rubidium, originator of Kirchhoff's laws of electricity and contributor to the theory of partial differential equations. The name is frequently mispronounced to sound like "Kerchof" in English, which at least has the virtue of being related to the spelling.

P. M. PFALZNER
The Ontario Cancer Treatment & Research Foundation
Ottawa, Canada
6/10/77

•

Dean refers to somebody named "Kirkhoff." Is this by any chance the physicist Kirchhoff?

You may appreciate the following verses that have been circulating in the mathematics community:

Weep for the mathematicians
Posterity acclaims:
Although we know their theorems
We cannot spell their names.

Forget the things you thought you knew—
Henri Lebesgue has got no Q

The Schwarz of inequality
and lemma too, he has no T

The "distribution" Schwartz, you see
Is French, and so he has a T

Hermann Grassmann—please try to
Spell his names with 2 N's, too

Although it almost rhymes with Birkhoff
Two H's grace the name of Kirchhoff

Fejér, Turán, Cesàro, Fréchet—
Let's make the accents go that way,

And as for (Radon-) Nikodým,
Let's give his accent back to him.

But there is one I leave to you,
Whatever you may choose to do:
Put letters in or leave them out,
Dress them with accents round about,
Finish the name with -eff or -off,
There *is* no way to spell Чёбышев

R. P. BOAS
Editor
The American Mathematical Monthly
Northwestern University
Evanston, Illinois
5/27/77

More on fission vs. coal

The exchange between G. Eggermont and Joseph Devaney in April (page 13) on coal vs. fission was an interesting one. However, one major fact has apparently been overlooked. According to G. Eggermont "A 1000-MWe nuclear reactor releases practically no radioactivity . . ." and Joseph Devaney agrees " . . . even confining ourselves just to regular radioactive emissions, the coal-fired plant turns out to be much worse than a fission reactor . . ." The assumption of negligible gaseous radioactivity releases from nuclear power plants, especially BWR's, is not a good one.

The average annual noble-gas release for nine operating BWR's in 1974 was in excess of 613 000 curies per reactor, with an average of 203 effective full power days of operation per reactor.[1]

The gaseous I-131 release rate for nuclear reactors Dresden II and III was measured over a 2 ½ month period in 1973, and was found to lie in the range 0.01 μCi/sec to 0.1 μCi/sec.[2] Assuming 220 full-power days of operation, the total annual release of I-131 would lie in the range of 0.19 curies to 1.9 curies. The estimated annual airborne release of I-131 is given in the above reference to be 0.467 curies per year per reactor.

In addition, Joseph Devaney states that ". . . from fission plants the limitations (on emission of radioactivity) are extreme . . ." Actually there is no upper limit to the amount of radioactivity that can be released by a nuclear power plant provided that the utility can demonstrate that the requirements of 10 CFR 50, Appendix I are met for off-site doses.

References

1. NUREG-0016, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Boiling Water Reactors (BWR-GALE-CODE)," April 1976, pages 2–13.
2. T. R. Marrero, J. M. Smith, C. D. Wilkinson, "Airborne Iodine-131 Released from Boiling Water Reactor Plant," *Power Engineering*, Feb. 1977, pages 45, 46.

ROBERT SCULLY
West Orange, N.J.
4/19/77

THE AUTHOR COMMENTS: Robert Scully's letter is a sample-in-microcosm of what I am driving at. For, even to a reader of considerable knowledge, Scully's "613 000 curies" emitted per reactor-year appears to be a frightening number. (This number, by the way, is for older boiling water types—newer BWR's emit less, and pressurized water reactors emit substantially less. The average release of the important Kr-85 is about 500 curies per reactor-year.) It is my central thesis that because such isolated numbers, while of interest, are so misleading, one should compare *hazards*, indeed not just *radioactive* hazards, and not just for *part* of the fuel cycle, but for the whole cycle and for all hazards. Only in this way can the public and the Congress properly judge

continued on page 63