

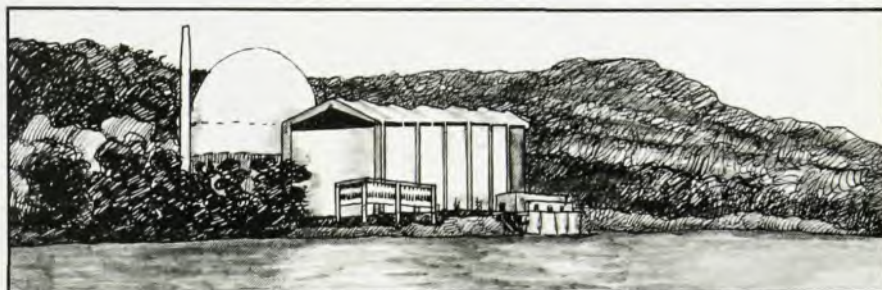
In defense of Gofman and Tamplin

As a member of the American Physical Society Council I have become aware that many of our members mistakenly consider *PHYSICS TODAY* editorials to be the council's mouthpiece. For this reason, and in the interest of truth, I wish to correct a serious misstatement in the editorial of the May issue (page 104), which is entitled "Clean Air Misunderstanding." The editorial attacks the congressional testimony of John Gofman and Arthur Tamplin, who have argued that the AEC's allowable radiation dose to population ought to be reduced below its present level of 0.17 rad per year by a factor of ten. The editorial states "Their testimony before the Joint Committee on Atomic Energy and elsewhere has failed to make clear to the public that: . . . the 0.17-rad dose itself corresponds only to about what the general public already receives annually from natural sources and also from medical x rays, and no one has been able to produce evidence demonstrating that a case of serious injury or death has resulted from radiation from these sources at these levels." It is difficult to believe that the writer of this statement has read Gofman and Tamplin's testimony before the Senate Public Works Committee (18 November, 1969), a large part of which is concerned precisely with the statistical impossibility of proving damage in a large population exposed to low-level radiation. Gofman and Tamplin correctly point out that the damage may be real and serious even when it is not statistically demonstrable.

It seems worthwhile for me to summarize briefly the issues that the May editorial obscured. From experience with high radiation doses (in the range 10–1000 rads) it has been found that these increase the natural rate of incidence of many forms of cancer by about 1% per rad of exposure. If the same rate of increase applies to low doses and to all forms of cancer (this is the "linear hypothesis") then the natural background dose of 0.1 rad per year is producing about 3% of all cases of cancer, or about 10^4 deaths per year in the US. The

linear hypothesis also implies that exposure of the entire population of the US to the present AEC allowable dose of 0.17 rad per year would produce an additional 10^4 cancer deaths per year.

The main point that Gofman and Tamplin are making is that all epidemiological studies of cancer so far conducted give results consistent with the linear hypothesis. This is true, even though not a single case of cancer can be demonstrated to be caused by radiation doses in the range below 1 rad. It is in the nature of the prob-



lem that the truth or falsity of the linear hypothesis is extraordinarily difficult to decide. Gofman and Tamplin argue that in setting safety standards we should be conservative, which means that we should assume the linear hypothesis to be true until we have good evidence against it.

I urge all readers of *PHYSICS TODAY* to read the Gofman-Tamplin testimony and to form their own opinions on the merits of the case.

FREEMAN J. DYSON

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THE EDITOR COMMENTS: I would like to join Dyson in emphasizing the point that the views expressed in the editorials are my own personal ones and do not necessarily represent the views of either the American Physical Society or the American Institute of Physics (which actually publishes *PHYSICS TODAY*).

Regarding his complaints about my editorial, it seems to me he has misinterpreted my position on Gofman and Tamplin's testimony and has failed

to respond at all to the main thesis of the editorial. I specifically stated that Gofman and Tamplin have every "right to challenge . . . the AEC." The main point of the editorial is that it is extremely unfortunate that, because of the manner in which Gofman and Tamplin have presented their arguments in public, too many people are getting the erroneous impression that nuclear plants are much more hazardous than coal plants. Actually the reverse situation is true. We are *certain* that chemical pollutants from coal plants now are contributing to

sickness and death. We are *not certain* that the AEC's permissible dose causes cancer. And in any case, since operating nuclear plants now give rise to levels 100 times smaller than the AEC's limit, we can all agree that radioactive pollutants from nuclear plants do not now present a hazard. The potential hazard that concerns Gofman and Tamplin could only arise if at some future time nuclear systems (for reasons now unforeseen) drastically increased their emissions of radioactive material over present levels. Currently, the rate of release from a nuclear plant is easily kept to about the same level as the rate at which naturally radioactive radon is emitted from the stack of an equivalent size coal-burning plant. Thus there is no reason to believe that nuclear plants, as we know them now, present any significant hazard to the population; there is every reason to believe they would avoid misery and death by eliminating chemical pollution.

Gofman and Tamplin have failed in their testimony to make it clear to the public that their disagreement with

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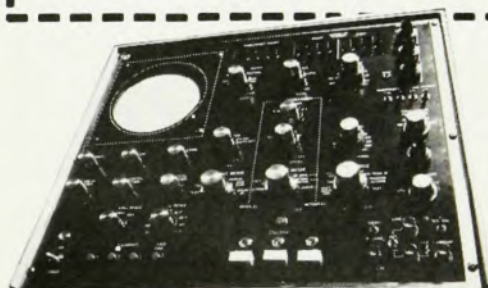
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the AEC does not challenge this conclusion and does not provide a valid reason for delaying the use of nuclear power.

In addition to befouling the environment, the burning of fossil fuel depletes atmospheric oxygen. Lamont C. Cole, physicist turned ecologist, stated in a recent address here in Rochester that in the continental US the consumption of oxygen by burning fossil fuels exceeds the amount produced by our plant life. The debt has to be made up by the marine flora of the Pacific Ocean.

I would suggest that the American Institute of Physics take on the task of educating the US public to the necessity of converting to nuclear power. Find out what the hang-ups are and address the educational program toward clearing them away.

Among the few people that I have talked with, the problem of thermal pollution looms large. Your editorial and Walter H. Jordan's article (May, page 32) did not really come to grips with this problem—it is not sufficient to say that this is also a problem in burning fossil fuels.

The public also must understand the risks and dangers involved in the mining and purifying of the reactor fuels. Finally, the products will exceed (in volume) the need for isotopes and some provision will have to be made to dispose of same.

The process of education will be slow, but it will pay dividends to all concerned.

HENRY A. KNOLL
Rochester, N. Y.

Comments on training funds

In my Navy days I had something to do with torpedoes. As I understood it, the torpedo with which we went into World War II was a copy of a German torpedo that had washed up on a beach in 1908. The distinguishing feature of that misbegotten weapon was its level-control mechanism. If the torpedo was traveling slightly upward, the response was full rudder down. On the other hand if the torpedo were aimed somewhat down, the response was full rudder up. The natural result was that our torpedoes zigzagged in a vertical plane with rather large amplitudes.

A further consequence was that our torpedoes frequently went under ships and on occasion they even went over them. When we obtained Japanese torpedoes for testing during the course of the war, we observed with a measure of disbelief that they actually ran level. Our first reaction was that our depth gauge was not functioning properly.

There is much about the American political and economic system that seems to operate like our early World War II torpedoes. In so many ways we seem incapable of a controlled differential response. At the moment we are faced with a surplus of PhD's in many areas of science and engineering. To deny this is unrealistic and even dangerous. There is no way in which this society or economy can continue forever to produce science PhD's at a rate six times faster than the population itself increases. It does not make academic, sociological, or economic sense to continue to grant our highest academic degree to students of marginal competence and promise. It does not make sense to proliferate mediocre degree programs in schools that can ill afford them.

The federal response to this problem has been FULL RUDDER DOWN. The NASA traineeships are a fading memory; the NDEA Title IV fellowships are plummeting. The decision has been made that there will be no new awards of NSF traineeships in fiscal year 1971. The rumor is current that NIH grants are to be decreased by the amount of money being awarded to students for research assistantships. All this represents a weird and frenzied over-reaction to a serious problem. To say the PhD surplus problem does not exist is cruel nonsense. To say that the observed federal response is a sensible solution to the problem is irresponsible madness.

This nation must not be denied its chance for scientific and technological advance through this shortsighted program of blindly eliminating graduate students. Rational estimates of our needs can be made. Continuous incremental adjustments can be made each year. Adjustments between the areas of graduate-student support and postdoctoral support can be made to provide sensible short term buffering to compensate for minor predictive errors.

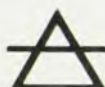
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