

The Other Side of the Atom

By L. JACK WHITNEY

The Oregon journal for science teachers recently published an article by an "educational representative" of the Portland General Electric Co. (Loeffler, 1970). This private firm is building the Trojan nuclear plant—a million-kilowatt generator—on the Columbia River just across the border from Washington. The facility should be one of the better installations of its kind, and its virtues were well described in the February article. It was a one-sided account, however: none of the known or potential hazards was mentioned. These dangers are documented in a profuse literature, and an "educational" paper does not ignore them.

Population growth will continue for some years; and, unless we are willing to sacrifice the last free-running stream in the country, electrical power from nuclear plants will be required to "buy time." Control of population growth is clearly required, and very soon. Power needs—and electrical energy provides only a fraction of the total power we consume—cannot be permitted to double in a decade (Ehrlich and Holdren, 1969). Technology cannot, by any method now known, produce more electrical energy without causing environmental degradation in known forms and risking it in others.

Some Things Left Unsaid

A natural-draft cooling tower at the Trojan nuclear plant will obviate the need to return heated water directly to the Columbia River, where, the Oregon Fish Commission believes, "a rise of 5.4 degrees... could be disastrous for the eggs of the Chinook salmon" (Clark, 1969). Here one might consider the first words in John Clark's paper:

"Ecologists consider temperature the primary control of life on earth. . . ." Natural-draft cooling towers release great quantities of water vapor into the atmosphere, as they cool by evaporation. This can mean fog and ice in the vicinity of the plant, particularly in cool weather—which is what the Trojan site has, much of the year. Or, if consumer and producer would accept a cost per kilowatt that is more than doubled, a "dry tower," operating as a giant heat-exchanger, could be used, according to Clark; from it, heat alone is emitted. But local climatologic changes must be expected in either case. Heat is obviously not removed from the environment; there is, in fact, a significant problem generally with "the tremendous quantity of waste heat generated at nuclear installations" (Ehrlich and Holdren).

Trojan may well be the best answer available to part of Oregon now, but it presents ecologic and health hazards that must be recognized. To speak of "low emissions of radioactivity," as Loeffler did, is pertinent in an explanation of the Trojan plant, but when the purpose of an article is educational it is also necessary to admit that any radioactive emission is hazardous. Biologists have agreed for years that radiation from natural sources (cosmic rays, for example) probably accounts for many genetic mutations causing birth defects, leukemia, and other anomalies, and that some risk attends the addition of *any* radiation to the environment. Even the x-ray, as a routine screening procedure to detect pulmonary tuberculosis, is avoided by many medical people. In speaking of diagnostic x-ray procedures generally, Karl Z. Morgan, a health physicist at Oak Ridge National Laboratory, is quoted as saying that "many of the millions [x-rayed annually] are probably being dangerously overexposed to radiation" (Anon., 1967). And the disposal of radioactive

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waste is a problem of long standing, not yet solved and perhaps worsening (Curtis and Hogan, 1969).

Truth-Telling: Obstacles and Demands

Public schools are visited by speaker-demonstrators who present AEC and electrical-utility-company views of fission plants. These people, in my experience, can present the physics of the operation in fine style; however, associated health and ecological concerns are either unmentioned or unknown. An insistent questioner is likely to be assured that AEC standards are more than adequate.

Graham DuShane wrote an editorial for *Science* 13 years ago, and its message is still, alas, timely (DuShane, 1957). Addressing himself to the health hazard of radiation, he said: "...any amount of radiation takes its toll of the population and any increase takes a greater toll" and "the hazard from nuclear reactors for power production is a greater potential threat than that from weapons testing." Perhaps the most important point DuShane made was that "the question of the effects of radiation upon human health has become a subject for partisan political debate" and thus discussion of the effects of radiation "cannot readily be conducted in the dispassionate atmosphere of a scientific discussion." The ongoing dispute in Denver over health hazards purportedly resulting from operations of an atomic weapons plant by Dow Chemical Co. for the AEC illustrates the persistence of this unfortunate political situation (Ripley, 1970). We still have to contend with the vested interests of the AEC and its licensees; but the rules of the game are changing. An increasingly sophisticated citizenry is asking questions based on a realization that it, too, has a vested interest—in a healthy habitat.

Those of us whose primary concern is to educate for protection of the total environment are as much bound ethically to recognize the positive aspects of a particular nuclear power plant as are the facility's builders to present the negative. Objectivity and honesty are essential. Neither side can accomplish a worthwhile long-term goal with half truths or slanted public statements. Our youngsters, even in the middle grades, are informed and critical. They will accept the assertion that, for the present, a nuclear plant must be built to supply power demands of a growing population, but not if the reasons stated are fuzzy or incomplete and not without a discussion of the attendant risks and problems.

Many children know that there must eventually be alternatives to more power for more people. Today's youth is not inclined to accept such venerable goals as "growth" or "progress" without careful definitions of the terms. These are shibboleths of a time past. A significant number of young people already know enough of the complexity and fragility of ecosystems to be chary of any proposed manipulations.

Happily, environmental education is developing rapidly in our public schools. Oregon's state department of education last summer began to design an interdisciplinary curriculum for grades 1-14. As a member of the teacher group working on the project, I share the belief of its coordinator that complete and honest cooperation with government and industry is essential. Just as whole societies pollute through individual and collective activities, whole societies must find the best means to stop or minimize pollution. It cannot simply be dismissed as private industry's problem; nor, obviously, can one assume that a governmental agency will always provide and enforce the requisite safety standards.

An Awakening Generation

George Wald probably analyzed correctly the worldwide restlessness of college students—many of whom, he believed, were behaving as though they could foresee no future (Wald, 1969). Crises of war, pollution, population growth, and kindred problems seemed overwhelming to them. That same restlessness (with qualifications as to ill-advised dissent) gave R. T. Tanner cause for a hopeful view: "I am encouraged by the unrest of today's youth. Among their rallies for human rights, freedom of speech, peace, and love, there has been little mention [at the time of writing] of the conservation of a varied environment; however, their very concern for the aforementioned concepts argues for their potential as a generation of conservationists, even if it grows from a respect for mankind rather than from a love of nature. They need only understand the relation between a varied environment and the freedom of man" (Tanner, 1969).

My own experience is mostly with younger students—those who will be the college students of the middle 1970's. Current explosive concern with environmental problems—involving, as it does, a massive cross-section of our citizens—has reached many of these junior high youngsters. Unless I seriously misperceive, these people are developing both the awareness of what is wrong—the awareness Wald found lacking only a short while ago—and the kind of commitment to a wholesome environment that Tanner hoped to see. It is interesting to recognize that last April's environmental "teach-in," involving students on college campuses across the nation, came almost on the first anniversary of Wald's address and Tanner's article.

I am firmly convinced that by 1975 college students will be so well informed, so determined and capable, that their activities will be effective. With less heat and more light, they will be a very powerful force in the effort to restore and preserve quality in man's habitat.

REFERENCES

ANON. 1967. X-ray excess. *Time* 90 (10): 69.

ANNOUNCEMENT

1970-71 OBTA Program

In 1970-71 NABT is again sponsoring the Outstanding Biology Teacher Award. For over a decade this program has recognized outstanding performance in the classroom and has brought it to the attention of the general public. Four years ago American Optical Corp., a charter sustaining member of NABT, indicated its interest in biology education in a very positive manner by providing each state OBTA recipient with a Series-50 binocular microscope. Therefore, each biology teacher selected as an outstanding representative of good secondary biology teaching in his state has received a microscope with engraved citation and the appropriate honor due him.

Any biology teacher may be nominated for an OBTA award by an administrator, colleague, student, or other person who is competent to judge the teaching effectiveness of the candidate. On being nominated, the candidate is required to complete a form detailing his experience, academic training, honors, and teaching philosophy. Two recommendation forms are also completed by acquaintances who can best describe the candidate's teaching effectiveness, methods, and philosophy. The three forms are sent for review to the state OBTA director and his committee, which is composed of biologists and educators.

With a large population of exceptional teachers in biology, selection of the "best" teacher is impossible. Therefore, NABT honors an outstanding teacher in each state each year.

If you know of a teacher deserving of this recognition, please complete the following form and mail it before Dec. 1.

OBTA NOMINATION FORM

NABT, 1420 N Street, N.W., Washington, D.C. 20005

I wish to nominate the following high school teacher as a representative of outstanding biology teaching in our state:

Name of candidate _____

School _____

School Address _____

City _____

State _____ Zip _____

CLARK, J. R. 1969. Thermal pollution and aquatic life. *Scientific American* 220: 19-27.

CURTIS, R., and E. Hogan. 1969. *Perils of the peaceful atom*.

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RIPLEY, A. 1970. Scientists say Denver in peril from radiation. *San Francisco Chronicle* 12 February: 1, 28.

TANNER, R. T. 1969. Freedom and a varied environment. *Science Teacher* 36: 32-34.

WALD, G. 1969. A generation in search of a future. *Sunday Oregonian* 13 April: "Forum" section. (Address delivered at Massachusetts Institute of Technology on 4 March.)

Those Places They Call Schools

When children were asked what they would do to make school better they gave the following suggestions:

"A lot of the time, I think, if they put on the radio, like we have at home, it would be a lot better than not hearing anything but yourself and the clock. The teacher, she always coughs and says it's time to do the next thing, and you can tell when she gets angry, because her chair squeaks a lot, because she moves around more. They should get rid of that chair. And they shouldn't have us go to the bathroom way down the hall, and they told us that the lunchroom, it's too big and everyone gets lost in it. My mother says we could have little sun-rooms, with plants in them, and we could go and eat there, a few of us in each one, and it would be cozy. And I think we could have places to play, not just the halls and the classrooms and nothing else. Yes, we have the gym, but that's for games, and it's too big, and I mean a room like we have at home, a play-room, for our class; and other classes, they could have theirs too."

Among suggestions for making a classroom more friendly one child spoke of having a room in which there were plants and flowers and "most of all, really most of all" a window roof so you could just look up and see the sky and the clouds and the sun and when the rain falls you could see it falling and you'd like it better, being in school.

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