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Letters

Move solar hydrogen up front

SIR: Your report from Kansas City in the Sept. 20 issue of C&EN, page 8, highlighted some experiments from Gabor Somorjai's research group at Berkeley which deserve much more attention from the chemical community, particularly in view of the recent report of the Department of Energy's Energy Research Advisory Board which "moves solar energy to the back burner" (ibid.).

Chemists are rarely presented with an opportunity where the development of a technology could help solve three major national problems simultaneously. While the conversion of solar energy to the fuel hydrogen is currently viewed as "visionary," such a substitution for our fossil and nuclear based energy futures would: (1) reduce the economic impact of a vanishing and largely monopolized fuel reserve, (2) reduce the environmental impacts of both the CO₂-caused greenhouse effect and acid rain, and (3) reduce the risk of war we put ourselves under by relying largely on petroleum to energize our society. Solar-hydrogen is thus a triple-edged sword and should instead be thrust to a "front burner" national priority.

Finally, may I respectively note that a solid state p/n photochemical diode, similar to the p/n Fe₂O₃ unit of Somorjai et al., but instead constructed of p-GaP and n-Fe₂O₃, was previously described by Howard Mettee, John Otvoe, and Melvin Calvin [Solar Energy Materials, 4, p. 493 (1981)]. The earlier heterodiode also split water when exposed only to solar illumination, so that the announcement that the p/n Fe₂O₃ diode was "the first electrochemical cell that can photo-dissociate water using only visible light" was in error.

Howard D. Mettee

Associate Professor of Chemistry, Youngstown State University

Ravaging our planet

SIR: I understand Gordon N. Walker's concern for destruction of our forests (C&EN, Aug. 23, page 4), but he must adopt another view. The "power- and profit-oriented madmen" can be slowed, but they will not be stopped.

The rape of Earth occurs simultaneously with research on space stations and communities and the conquest of other planets and their satellites. Discovering and populating exotic regions in spite of apparently insuperable obstacles will continue into the future as it has happened in the past.

Have you ever thought that the children and grandchildren for whom conservationists declare that they want to save Earth may not desire the old world? Nostalgia for a past home has psychological benefit, but present reality and future inevitability persist.

Yes, I am confident that our race will terminally ravage our planet. Develop a futuristic mental vista of the as-of-now unknown (except

in our arts) life beyond this sphere. The effort may be excruciating or the view impossible to maintain; nevertheless our survivors will be living there.

Waco, Tex.

Carol Lingle Mark

Selenium and arsenic

SIR: Gio B. Gori's science policy review on regulation of cancer-causing substances (C&EN, Sept. 6, page 25) excels in appealing for a realistic governmental approach to how little we know for sure about cancer. Unfortunately, it errs in stating, "Selenium can induce cancer in animals, and arsenic is a known human carcinogen."

Actually, selenium was never shown to cause cancer experimentally in animals. Largely because of its known toxicity, selenium was impugned in 1943 as a likely cause of cancer and the idea was promptly accepted as real by oncologists generally. It then took about 30 years to prove that selenium does not cause cancer. (Symposium: Selenium in Biomedicine, Eds., Muth, Oldfield, Weswig, AVI, Westport, 1967, and Selenium in Biology and Medicine, Eds., Spillholz, Martin, Ganther, AVI, Westport, 1981).

The question now, however, is quite the opposite. It is quite clear that selenium has value against both the induction of cancer in animals by known carcinogens and spontaneous cancer in some strains of mice, but its value against human cancer calls for more research.

Somewhat similarly, selenium's sister element, arsenic, has been repeatedly shown incapable of causing cancer experimentally in animals, and there is still no proof that arsenic causes cancer in humans (C&EN, Oct. 5, 1981, page 4, and April 12, 1982, page 4). Alternative causes for the human cancers for which arsenic was routinely blamed for over a century continue to be found. Furthermore, it has become clear that, if anything, the human cancer rate may be lower in areas in the U.S. where the level of arsenic in drinking water is somewhat above the WHO-EPA limit. This situation applies for Fallon, Nev., and has been documented for towns in Utah. Much evidence in animals has indicated that arsenic, like selenium, has value against known carcinogens; also that a high but well-tolerated intake of certain arsenicals decreased spontaneous cancer incidence. As Gori noted, both elements are essential and have roles in metabolism. The facts that both arsenic and selenium have much to do with sulfur metabolism is well established; also that aberrations in sulfur metabolism and DNA repair mechanisms may lead to cancer.

This letter is written not to criticize Gori's otherwise realistic appeal, but to direct attention to the basic need to be right about the toxic trace elements, particularly arsenic, traditionally the most misunderstood. The truly remarkable situation now exists that all safe uses of organic arsenicals in animal production will be banned in the European Economic Community countries

as of December 1982. This action stems from belief in the "arsenic cancer in humans association," a dogma that cannot be proven, disproven, or even tested. It should be recognized that this association grew by reiteration of an idea that seemed to make sense. But so did the belief in selenium cancer.

Compounds of arsenic are the best antidotes to selenium toxicity, and arsenicals were the first magic bullets in human medicine. It is becoming ever more clear that selenium has remarkable value against cardiovascular diseases of humans [Lancet, Oct. 27, 1979, p. 889, and July 24, 1982, p. 175]. The critical need is to learn how trace elements, particularly selenium and arsenic, function to minimize susceptibility to human diseases of aging, including cancer. Schenectady, N.Y. Douglas V. Frost

Nuclear/electrical energy

SIR: "Troubled nuclear power tries to recover" (C&EN, Sept. 20, page 11) is an excellent and objective analysis of a difficult subject. It correctly identifies the need for and the various problems associated with developing a strong nuclear power industry.

One flaw mars the discussion: the assumption that the gross national product is dependent upon growth in electricity demand. In the early seventies, it was widely assumed that the GNP was dependent on increasing total energy consumption. At the time it was easy to believe that, since the GNP did suffer as a result of the abrupt reduction in oil supply, and because U.S. energy use was built on cheap, subsidized energy.

That basic assumption was proven false after legislative policies—notably the Energy Policy and Conservation Act (1975) and the Energy Conservation Policy Act (1978)—established fiscal incentives for energy efficiency and, through deregulation, reduced fiscal subsidies for production. The resulting improvement in energy efficiency is probably why, in 1979, we see a sharp reduction in energy consumption while the GNP remains steady or slowly rises.

Electricity demand, however, is not so easily correlated with either energy consumption or GNP. In 1975, for example, electricity demand went up while GNP (and total energy consumption) went down; and after 1978, while electricity demand remained essentially constant, energy consumption dropped sharply. One could infer from these data that electricity (and nuclear power) is making significant penetration into the total energy market during a period of sharply increasing efficiency, but even that is probably too simple an assumption.

The kernel of the problem seems to be a three-tiered exaggerated importance of (1) the dependence of the GNP on energy consumption; (2) the dependence of energy consumption on electricity demand; and (3) the dependence of electricity demand on nuclear power. The result is an unrealistic link between nuclear power and GNP, which strains credibility and, curiously,

tends to weaken the industry's argument with public critics. Correlations among such complex values as GNP, energy consumption, and electricity sales are exquisitely arcane if, indeed, they can be made at all. In the present case, however, there are many, better, arguments for an improved nuclear power industry than to allege that the GNP is dependent upon increasing electricity demand.

J. C. Kellett Jr.
Formerly Director, Education Division, and
Deputy Director, Office Consumer Affairs,
U.S. Department of Energy

Correcting the record

SIR: This letter is submitted in order to correct what we can consider factual errors in the recent article by Gio B. Gori, "Regulation of Cancer-Causing Substances: Utopia or Reality" (C&EN, Sept. 6, page 25).

In discussing the ED₀₁ study conducted at the National Center for Toxicological Research, Gori states: "At the same time, low doses of AAF had the unexpected effect of increasing the life expectancy of the treated animals. These mice lived longer than the controls and predictably experienced a higher incidence of senile liver cancer hardly attributable to AAF."

The data from the ED₀₁ study do not support the above quote. From Saleburg [Saleburg, D., Adjusting for time on study, *Fund. Appl. Tox.*, 1, 67 (1981)], the mean time on study in the lifetime group was 737 days in the control animals and 738 days at 30 ppm, a difference of only two days. The average Kaplan-Meier estimates of median survival times were 753, 773, 754, 761, and 781 days for 0, 30, 35, 45, and 60 ppm AAF, respectively [Kaplan, E. L., Meir, P., Nonparametric estimation from incomplete observations, *J. Am. Statistical Assoc.*, 53, 457 (1958)].

Although these estimates indicate between a one- to 20-day difference in median survival for low-dose animals over that of controls, one-sided Cox tests (Thomas, Breslow, and Gart, 1977) of each low-dose group (30, 35, 45, and 60 ppm) against controls for each of six animal rooms do not show a statistically significant difference in survival time [Thomas, D. G., Breslow, N., Gart, J. J., Trend and homogeneity analyses of proportions and life table data, *Comput. Biomed. Res.*, 10, 373 (1977)]. Of 24 comparisons (4 doses X 6 rooms) only one test yielded a P-value less than 0.05, which is what one would expect by chance alone.

There is no strong evidence indicating that low doses of 2-acetylaminofluorene increased the lifetime of mice in the ED₀₁ study.

Further, tumor incidence rates were compared by NCTR using techniques given by Peto et al. [Peto, R., Pike, M. C., et al. Guidelines for simple, sensitive significance tests for carcinogenic effects in long-term animal experiments, p. 311. In: "Long-term and short-term screening assays for carcinogens: a critical appraisal,"

IARC Monographs, Supplement 2, (1980), Lyons, France]. These techniques essentially compare age specific tumor rates which remove the effects of differences in mortality, should they exist.

David W. Gaytor
Director, Division of Biometry
Lawrence Fishbein
Acting Deputy Director, National Center for
Toxicological Research, Jefferson, Ark.

Zeolite production patents

SIR: I have read the article on the expanding use of zeolites (C&EN, Sept. 27, page 10) with more than usual interest. Therefore, the statement that general and increased application for these materials was now developing as a result of the expiration of the zeolite production patents puzzled me.

The earliest patents describing manufacturing processes for these materials issued in a series of seven from 1950 to 1956. I was the inventor of six and the coinventor with A. E. Geesler of the seventh. Hence they were available for public use from 1967 to 1973.

These patents and an article by Kumins and Geesler [*Ind. & Eng. Chem.*, 45, 3 (1953)] which summarized five manufacturing processes, including supporting x-ray data were cited by the Federal Patent Court of West Germany in invalidating Union Carbide's German patent No. 1 038 017 as lacking novelty. The plaintiff in this case was the Farbenfabriken Bayer A.G. The decision was published on Oct. 24, 1967.

Further details of the processes disclosed in the seven patents and in our above mentioned article are described in D. W. Brack's excellent treatise entitled "Zeolite Molecular Sieves," John Wiley, 1974. However, no reference to the original publications is noted in an otherwise detailed and all-encompassing bibliography.

Perhaps the increased application efforts now being expended could have been started 10 to 15 years sooner if the public availability of the manufacturing processes for these aluminosilicates were better known.

I thought this little slice of history of these important compounds would be of interest to your readers.

Charles A. Kumins
Gates Mills, Ohio

Potential for litigative chaos

SIR: Your article on industry concerns relative to the Manville situation (C&EN, Sept. 6, page 5) is very much to the point, perhaps even more so than the article indicates. Contrary to the statement "The suits are being filed by workers exposed to asbestos when they worked for the company's Johns-Manville subsidiary," only a very small percentage of the suits fall into this category.

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