LETTERS

Chrysotile Asbestos: Effects of Human Exposure

In his letter of 23 September (p. 1232), John T. Hack correctly indicates that the environmental asbestos pollution in Rockville, Maryland, is primarily from chrysotile, since that type of asbestos is found in the Rockville quarry. However, Hack is incorrect in suggesting that studies (*1*, *2*) of the health and mortality rates of workers in the chrysotile-producing mines of Quebec, Canada, exonerate the crushed rock from the Rockville quarry as a carcinogen and that the general health of Quebec chrysotile miners and millers "is comparable to that of Quebec Province as a whole."

Many studies have been made of the effects of human exposure to chrysotile (*3*, *4*). These studies take into account a long period of clinical latency which occurs between the onset of exposure to mineral fiber and the clinical appearance of malignant disease. For asbestos fiber, the latent periods appear to extend from 20 to 40 years or more from the onset of exposure (*4*). Exposure intensity is another factor in that it determines the competitive risk of contracting asbestosis or malignant disease and also influences the length of the latency period.

McDonald and Becklake state in their 1976 study (*2*, p. 521), "In Canada, as elsewhere, diseases recognized to have an association with asbestos exposure include pulmonary fibrosis which may affect the lungs (giving rise to asbestosis) and/or the pleura (giving rise to pleural thickening and calcification) and malignant tumors, which may be respiratory, mesothelial, or gastrointestinal in origin." The only variance with other studies is the calculated relative risk of each disease. This variance may be explained in part by their study design.

In the Quebec studies to which Hack refers (*1*, *2*), the authors assessed the relationship between the intensity of dust exposure and the resultant mortality rates, x-ray changes, pulmonary function changes, respiratory symptoms, and other effects among workers in the Quebec asbestos mining and milling industry. They estimated dust exposure on the basis of the job type in the mine or mill and the number of years a worker spent at each job site. They calculated an exposure index for each worker based on "million particles per cubic foot" (MPCF) multiplied by the number of years exposed at that level, which yielded a hybrid dubbed "total MPCF-years" for each worker. More important, they grouped 4000 individuals whose "exposure histories" were determined by this method, and for whom mortality data existed, on the basis of total exposure (based on "MPCF-years"), not by years from the onset of exposure. What this meant was that individuals with 400 MPCF-years exposure could be those exposed to 40 MPCF for 10 years, 80 MPCF for 5 years, or 10 MPCF for 40 years. Years from onset of exposure were not separately evaluated. Individuals included in this study were those with both short and long latency periods. The authors of one of the Quebec studies state that ". . . the length of exposure may be related to length of survival and thus might tend to obscure differences in mortality between exposure groups . . . . deaths accumulated over many years were used in a single calculation of mortality" (*1*, p. 63). Even so, among those considered to be most heavily exposed, individuals with 400 to 800 MPCF-years exposure have a 2.1 elevated risk of developing respiratory cancer, and those with greater than 800 MPCF-years exposure have a 3.6 times elevated risk (*2*, p. 525). These calculated risks should be considered conservative, as each data group may include individuals who have not completed the long clinical latency period required for "elevated risk."

The Beaudry Commission has reported similar data in its study of the chrysotile miners in Thetford, Quebec (*5*). It found that the Quebec asbestos industry had failed to educate the workers to the dangers associated with mining and milling of chrysotile; that outdated, dangerous methods were being used in the production of fiber; that the government inspectors had been negligent; that there was a lack of medical surveillance and protection for the workers; and that no proper controls had been installed, even in new plants and mills.

Chrysotile mining and milling has thus been established as hazardous. Reviewing available data, an agency of the World Health Organization recently concluded, "Uncontrolled exposure to chrysotile asbestos, as to other types of asbestos, has the potential for serious human disease. Reassurance is unwarranted as experiences with asbestos cancer in the United States, Canada, Great Britain, the U.S.S.R. and other countries have shown. Unnecessary exposure should be avoided" (*6*).

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Outer Continental Shelf Operating Regulations

The Secretary of the Interior has proposed controversial revisions (*1*) of existing outer continental shelf (OCS) oil and gas operating regulations (*2*) governing postlease sale activities by lease owners. Despite potentially significant and far-reaching adverse environmental consequences that could result if the revisions are adopted, the Interior Department has decided not to prepare an environmental impact statement addressing such consequences. If there is no major opposition from other Executive departments or from Congress, the revisions may become law as early as January 1978.

The stated intent of the revisions is to provide states affected by OCS oil and gas activities with (i) timely access to information regarding planned exploration, development, and production operations and (ii) opportunity to review and comment on federal decisions relating to such operations. Although the objectives may be worthy, the proposed procedures by which they would be achieved appear unnecessarily intricate, cumbersome, and duplicative.

The revisions require that (i) before any exploration activities, each lease owner must prepare and submit a series of elaborately detailed plans and environmental reports for review and acceptance by cognizant federal agencies and affected states and subsequently (ii) a second series of detailed plans and reports must be submitted for comparable review and acceptance before any development and production work. These stipulations would supplement existing federal regulations requiring preparation

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of a comprehensive environmental impact statement before any OCS lease sale.

We believe that these additional requirements for serial plans, reports, and interlocking federal and state reviews would result in major delays in bringing OCS oil and gas resources into production—delays that could amount to years.

Significant adverse environmental effects that could result from these delays include (i) degradation of air quality (caused by burning less clean fuels because of delays in obtaining oil and gas from OCS tracts) and (ii) greater potential for oil spills associated with increased tanker activities (resulting from the need to import larger volumes of foreign oil). In view of these and other possible environmental effects, the decision of the Department of the Interior not to prepare an impact statement seems questionable.

We urge concerned fellow scientists to write or wire Secretary of the Interior Cecil D. Andrus calling for the preparation of an environmental impact statement on the proposed revisions; copies may be sent to appropriate senators and congressmen.

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Prigogine at the University of Texas

Procaccia and Ross, in their article (Research News, 18 Nov., p. 716) on Ilya Prigogine's work in the field of nonequilibrium thermodynamics that led to his receiving the 1977 Nobel Prize in Chemistry, identify him as a professor of the Free University of Brussels, Belgium. He is also professor of physics and of chemical engineering and director of the Center for Statistical Mechanics and Thermodynamics (which he founded in 1967) at the University of Texas at Austin, and currently divides his time between the two universities.

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