LETTERS

Computer Security and the Bell System

Gina Bari Kolata, in her article on computer encryption (News and Comment, 29 July, p. 438), incorrectly attributes to me a statement "that officials of the Bell Telephone Company have decided that the DES [Data Encryption Standard] is too insecure to be used in the Bell System." To the best of my knowledge, the Bell System has taken no official position concerning the security of the DES. I also would like to clarify my personal views about the DES.

I was certainly a critic of the DES during the discussions which preceded its adoption, and I recommended that it not be adopted. I was bothered by the secrecy surrounding the design of the crucial "S-boxes," because this secrecy makes it all but impossible for an outsider to evaluate the overall security of the system. I was also disappointed that a key size was chosen so small that it was left open to the sort of attack suggested by Hellman and Diffie. Their approach would have been rendered utterly useless by a modest increase in key size. Each increase of 1 bit of key size doubles the expense of exhaustive search while adding only a small cost to encryption. During those early discussions, I urged that the key size be increased and that the design principles of the S-boxes be revealed.

Now the standard has been adopted and I welcome it. It is plainly superior to any commercially available encryption device I have seen. I believe it will serve any ordinary commercial purpose for a good many years to come. I know of no way to read messages encrypted by the DES that does not involve knowledge of the key, and I know of no one who claims to be able to do so. Double encryption, with two different keys, rules out any possibility of exhaustive key search in the foreseeable future.

Despite the controversy surrounding its adoption, the DES is a substantial contribution to the security of data.

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Asbestos Pollution

The report "Environmental asbestos pollution related to use of quarried serpentine rock" by Rohl, Langer, and Selikoff (17 June, p. 1319) appears to be an example of sensational writing. The substance of the report has already been published in many newspapers. It contains little information of scientific value that is new and calls attention to an environmental danger without backing it with relevant facts.

It has been known since the 1940's that at least some fibrous silicate minerals might be associated in some way with lung diseases. The metamorphic terrains of the eastern United States, of course, contain an abundance of such minerals. One might say that they are a part of the ambience. A large amount of mineralogic and geologic data exists about their occurrence, both in the region as a whole and at the quarry site near Rockville, Maryland. It appears, however, that little information is available about any actual danger that results from exposure to airborne dust containing such minerals in the kind of environment described. Even the authors of the report say only that there is a possibility of danger.

The medical aspect of the problem is more to the point than the mineralogy of the quarry. If some medical research group would come up with some hard data that relate illnesses or mortalities to degree of exposure to the mineral dust then it might be possible to judge the hazard. The mineralogy of the quarry is irrelevant without relating it to medical data and calling it a hazard is irresponsible.

I do not know the reasons for the recent Environmental Protection Agency decision relating to this matter, but if that agency has forbidden the use of quarried material on the basis of the evidence described in the *Science* report, it is a disgrace.

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Hack tilts at the wrong windmills. The Rockville, Maryland, problem is not that the mineralogic and geologic status of the area is newly being described. That there are serpentinite ore bodies has been known for decades. What is new is the fact that these ores were being quarried, finely crushed, and then spread over roads, paths, playgrounds, driveways, and parking areas. In the process, the contained asbestos (chrysotile) was released and entered the air of the communities in which it was used. In Montgomery County, Maryland, it was found in concentrations sometimes 1000 times higher than those in the air of many U.S. cities.

Hack says there appears to be little information available about "any actual danger that results from exposure to airborne dust containing such minerals in the kind of environment described." Unhappily, there is much information available about asbestos-related deaths—from mesothelioma, lung cancer, cancer of the esophagus, stomach, colon, rectum, and other cancers. But most of these have been elsewhere, in other environments—mines and mills, factories, construction sites, shipyards, households of asbestos workers (contaminated by dust brought home on clothes and shoes), and neighborhoods around asbestos mines and factories. Do chrysotile ores have deadly potential when excavated and crushed in Quebec and not in Rockville? Should the state of Maryland, Montgomery County, and the Environmental Protection Agency (EPA) allow children in schoolyards to play on surfaces spread with gravel containing asbestos? Should "hard data"—sought after a 20- to 30-year latency period—from Bethesda, Silver Spring, Chevy Chase, Baltimore, Alexandria, College Park, and Washington be added to the experiences of Long Beach, Paterson, London, Dresden, Newark, Rochdale, Johannesburg, Thetford Mines, Barking, and Sverdlovsk before environmental asbestos air pollution is controlled?

Hack writes "It has been known since the 1940's that at least some fibrous silicate minerals might be associated in some way with lung diseases." This statement inadequately describes the dimensions and importance of the problem.

Asbestosis, the progressive and often fatal lung scarring caused by the inhalation of asbestos fiber, was first described 70 years ago in the United Kingdom and some 60 years ago in the United States (*1*). In 1935, suspicion that malignant lung disease was also associated with asbestos exposure was reported in both the United Kingdom and the United States (*2*). An epidemiological study in 1955 of asbestos workers in Great Britain demonstrated a tenfold excess risk of lung cancer in asbestos workers (*3*). Similar findings were soon reported in the United States (*4, 5*). In the mid-1950's, pleural and peritoneal mesothelioma were found associated with asbestos exposure (*6*). Since the mid-1960's, a number of other epidemiological studies in the United States, the United Kingdom, the Federal Republic of Germany, Italy, the Netherlands, and elsewhere have clearly established an irrefutable statistical basis for the association of asbestos fiber exposure in the workplace and excess risk of various kinds of cancer. In some studies, it was found that 40 percent of those exposed to asbestos fibers died of asbestos-related disease (*5, 7*).

Once mineral fibers are inhaled, they are usually retained in the lungs. Fibers have been found in lung parenchyma and pleura many decades after cessation of exposure (*8*). Most of the fibers found in human tissue are submicroscopic in size, and transmission electron microscopic techniques are required for resolution (*9*). Of importance are the observations which demonstrate the ability of fibers to migrate from their sites of entry to many extrapulmonary organs (*10*).

Moreover, the fibers interact with other carcinogenic agents. Asbestos exposure greatly increases the risk of lung cancer from cigarette smoking; asbestos workers who smoke have approximately eight times the lung cancer risk of other smokers and 90 times the risk of individuals who neither smoke nor work with asbestos (*11*). (Montgomery County children who have inhaled asbestos have good reason never to smoke cigarettes.)

Concentrations of airborne asbestos have been measured in a range of environments. Urban atmospheres usually contain less than 10 nanograms per cubic meter (often in the 0.1- to 1.0-nanogram range) and do not exceed 100 nanograms per cubic meter except near point source emissions. These values have been determined in the United States, the United Kingdom, and France (*12*). Concentrations of 10 to 5000 nanograms per cubic meter have been reported near emission sources, including factories, using asbestos (*12*). In contaminated households, concentrations well below 1000 nanograms per cubic meter are usually found. Yet, mesothelioma is found in these neighborhood and household environments (*13*). The concentration of asbestos fiber measured in the Rockville area is within the range in which asbestos disease has been observed. Indeed, Wagner *et al.* (*13*) have suggested that crushed tailings, containing asbestos fiber, used to surface roads in the Kuruman area of South Africa, may have been a factor in the etiology of the environmental mesotheliomas observed there.

Hack writes "The metamorphic terrains of the eastern United States, of course, contain an abundance of such minerals. One might say that they are a part of the ambience." The author does not use the term "asbestos," but we conclude that he means asbestos from the juxtaposition with statements concerning biologically active fibrous silicates. We take serious issue with this concept. The fibrous silicates that are linked with malignant disease in humans are the commercial varieties of asbestos—crocidolite, amosite, anthophyllite, and tremolite. The rock-forming analogs, for example, asbestiform amphiboles, not asbestos per se, are currently under investigation. These mineral fibers occur in the environment in a range of forms and concentrations and are not germane to the present discussion. Rather, chrysotile asbestos, the fiber of concern in the present instance, appears to be the only known common pollutant but even then usually occurs only as a trace constituent in air and water. The road dust situation in Rockville, on the other hand, constitutes an extraordinary point source emission of chrysotile fiber. Hack's statement suggests that asbestos has been a part of the natural ambience since crustal evolution. This may be so, but the "natural" measured concentrations are many orders of magnitude less than one finds in Rockville air. Background levels and Rockville levels are worlds apart.

We suggest that the EPA asked for the immediate abandonment of this use of quarry materials because of a historical skein of data and reports, and not as the result of a single report, even one citing extraordinary concentrations of airborne asbestos. The agency is to be applauded, and its scientists commended, for their judgment and prudent action taken on this important public health matter. Critics might direct their energies at the causes of such problems and not at those who bear the unhappy news.

In retrospect, the Rockville findings were indeed sensational. They referred to information and data that indicated a source of asbestos pollution in the environment at concentrations which have rarely been encountered before.

Unpleasant things are being found in our environment. Scientists have the obligation and responsibility to report them, and to allow their evaluation, as a guide to appropriate control measures. In this regard, we concur with the judgment of Luther J. Carter (News and Comment, 15 July, p. 237): "In any event, the Rockville quarry is likely to become another landmark for environmental policy-makers in their long and seemingly ever-broadening effort to identify and control the sources of possible carcinogenic substances."

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