workplace of a potentially toxic chemical every 20 minutes." The quotation, which appears on p 1142 of my article, also comes from this testimony.

Earlier, on May 23, 1977, Dr. Bingham testified before the Subcomittee on Compensation, Health and Safety of the House Education and Labor Committee. There she stated: "The extent of workplace health tragedy in America is appalling. The NIOSH has estimated that there are approximately 100 000 deaths each year from occupational disease; many of us in the environment medical community believe this to be an extremely conservative estimate. Numerous chemicals and substances used in the workplace cause cancer in those exposed; others often result in irreversible disease."

I could cite more of her remarks, but those above indicate the intensity of Dr. Bingham's commitment to thwart occupational disease; I was merely attempting to convey the tenor of her commitmeat in my article.

I believe that a responsible case can be made for a *correlation* between industrialization and cancer. The National Cancer Institute's environmental epidemiological branch has some convincing, if not absolute, evidence in the form of cancer maps (see *ES&T*, December 1975, p 1116), and published reports [Hoover, R., and Fraumeni, Jr., J. F., *Environ. Res.*, 9, 196-207 (1975); Blot, W. J., and Fraumeni, Jr., J. F., *Lancet*, p 142 (1975); and Blot, W. J., et al., *Science*, 198, 51-53 (1977)].

Industry is also increasing its epidemiological efforts. Du Pont, for example, alerted to a possible problem with acrylonitrile from animal studies, immediately reduced worker exposure to that chemical. Then, from an epidemiological study, Du Pont found a 1.5 times higher than normal cancer rate among its acrylonitrile workers.

New Jersey, which touts its status as the No. 1 chemical state, is concerned that all of its 21 counties exceed the national cancer mortality average. Glenn Paulson, assistant commissioner of N.J.'s Dept. of Environmental Protection has stated: "It's clear that industrial development is linked to cancer. But it's not a simple picture; it's a complexity of many clues." Using NIH's computer and CEQ's UPGRADE program, N.J. is now surveying, monitoring and analyzing data to unravel that complexity. Do New Jerseyans eat an exorbitant amount of avocados?

While it is undeniable that smoking and diet are principal causes of environmental cancers (*ES&T*, December 1975, p 1116), Dr. Irving Selikoff's (director of Mt. Sinai School of Medicine's Environmental Sciences Laboratory, N.Y.) body of research on asbestos workers clearly demonstrates that workers exposed to carcinogens, who also smoke, have a greater chance of contracting cancer than exposed nonsmoking workers.

According to the American Cancer Society's (ACS) 1978 "Cancer Facts & Figures": "Except for cancer of the lung, age-adjusted cancer death rates in general are leveling off and in some cases dropping off." But there have been some unexplained increases in certain cancers, notably those of the pancreas, bladder and lung. This downward trend in cancer death rates is not, however, the result of better preventive measures, but stems from better medical/surgical care and treatment, a fact often overlooked by those citing ACS figures.

Finally, I will allow the experts to speak to the question of occupational cancers. A survey of 300 members of the newly formed American Society of Preventive Oncology found that 60% felt that there is "substantial" scientific evidence that large numbers of workers are now being exposed to significant levels of known carcinogens. Only 20% of the 60%, however, felt that there is "substantial evidence" that reduction of these exposures to very low (trivial) levels is worth the inherent expense. Another 20% thought the costs too expensive and the remaining 20% had no opinion. Nearly 50% of the respondents felt that there is a "large burden" of occupationally-caused cancer that has yet to be identified.

Lois R. Ember
ES&T
Washington, D.C.

OSHA

Dear Sir: The Special Report, "OSHA on the Move" (*ES&T*, December 1977, p 1142), contains unproven assertions, undocumented numbers, factual errors, and misleading statements.

On page 1142: "... NIOSH's conservative estimate of approximately 100 000 deaths each year from occupation-related diseases." The number first appeared on page 111 of the "President's Report on Occupational Safety and Health", October 1972.

The 1972 Report referenced three scientific papers that examined mortality among 14 000 workers at high risk (underground metal miners, uranium miners, smelter workers). These are fine papers, but what NIOSH did next was inexcusable: by some calculation never made public they extrapolated mortality in this 14 000 worker sample to the entire U.S. work force. When asked later about the number, Dr. J. W. Lloyd of NIOSH said, "As you know, there is no way to enumerate deaths due to or related to occupational exposure because of failure by attending physicians to recognize occupation as an etiological factor for many diseases". In short, "100 000 deaths" is pure guesswork; nobody knows what the real number is. It does not belong in a scientific journal.

More undocumented numbers appear on page 1144 in a discussion of the National Occupational Hazard Survey (NOHS). For example: "one in every four workers may be exposed to an OSHA regulated substance that can cause disease or death, and up to 40-50 million Americans may have been exposed to an OSHA-regulated carcinogen ... during their working lifetime". The NOHS report is not yet published and has yet to receive the scrutiny of the scientific community. Repeated efforts by this office to obtain a copy have met with repeated deferrals of the publication date—currently set for March 1978. Quoting from an unpublished report is not limited to the lay press; Dr. John Finklea of NIOSH used some of the results in Congressional testimony last May. However, such prior "disclosures" are not a justification for their use in a scientific journal.

On page 1146 a paragraph starts with the headline: "Chemicals: presumptive guilt." Here the author misleads by citing crude (not age-adjusted) cancer death rates for the years 1900 and 1975, "The seventy-five years of U.S. industrialization." Of course there's a big increase. But no mention of the conquest of infectious disease such as typhoid and tuberculosis, a conquest made possibly by post-1900 industrialization. This caused a marked increase in average life span, resulting in a large increase in the death rates from diseases of old age, among them cancer.

The death rate for tuberculosis is now negligible. Yet the rate in 1900 for TB (194 per 100 000) was greater than the crude cancer death rate in 1975, which was 172 per 100 000. No mention of the skyrocketing rates for lung cancer—widely believed by many au-

thorities to be associated with cigarette smoking, a form of personal pollution. No mention of the fact that the age-adjusted rate for all sites has been increasing by only 0.2% for the past 20 years and went down 0.7% in 1975.

The article overstates cancer death rates by a factor of 100 ("65 per 1000 in 1900 vs. 171.5 per 1000 in 1975"). The crude rates cited are per 100 000 people, not per 1000. The total death rate in the U.S. was slightly under 9 per 1000 in 1975 for all causes of death.

Most misleading of all is the statement following the words "presumptive guilt" and the report of crude cancer rates: "Many of the environmental factors now believed to cause cancer are substances generated in workplaces regulated by OSHA," followed by a cartoon saying "Warning—this job may be hazardous to your health." No mention of the National Cancer Institute estimate (Dr. Guy Newell, 6/15/77) that "five percent (of all cancer) is related to occupational exposures such as asbestos, vinyl chloride . . .".

The problem of occupational cancer is a serious one, and the chemical industry is making great strides in controlling risk and preventing worker exposure to carcinogenic substances. Knowledge is the limiting factor; as scientific knowledge accumulates the 5% figure quoted above will decrease. However, scare tactics in a scientific publication hurt the preventive efforts by diverting scientific effort from prevention to rebuttal.

Donald W. Smith
Du Pont
Wilmington, Del. 19898

Jan 1978

In reply to Mr. Smith's letter

The long latency period from first exposure to a chemical or physical irritant and the first manifestation of disease, especially for cancers, makes estimating the number of deaths from occupational exposures very difficult and approximate at best. Nevertheless, Dr. J. W. Lloyd and his group at NIOSH made an attempt at developing "rigorous" methodology to estimate this number.

In a conversation, Dr. Lloyd (who is now at OSHA) told me that a one-page explanation of the methodology used, entitled "Method Utilized by the Office of Occupational Health Surveillance and Biometrics to Estimate the Annual Number of Deaths from Occupational Disease," was sent to those requesting an explanation of the figure's derivation.

Requested 1975, not received by 1/1/78

Citing several sources of evidence, including NCI's cancer maps, morbidity/mortality studies of American and Swedish chemists and the relationship of air pollutants to respiratory diseases, Dr. Nicholas Ashford of MIT's Center for Policy Alternatives came up with what he terms "a back of the envelope calculation" to substantiate the *reasonableness* of the 100 000 figure.

Dr. Ashford's reasoning can be found in his testimony before the Senate Subcommittee on Labor of the Committee on Labor and Public Welfare and the House Committee on Education and Labor (February 10–12, 1976). I quote from his testimony: "Cancer is the second leading cause of death in the U.S. today with an annual toll of 365 000 [actually 382 000 in 1977]. The incidence of cancer has risen rapidly with industrialization: in 1900, 3.7% of deaths were due to cancer, but by 1968 the proportion of deaths from this cause was 16.5%. In part, improved diagnosis and longer life expectancy due to decreasing prevalence of previous health scourges are responsible for this dramatic increase. Nevertheless, there are indications that the true incidence of cancer has in fact been on the upswing."

Dr. Ashford states at a later point in his testimony: "Of the 80 or 90% of cancer which could be environmentally caused, it is not presently known how much is occupationally related. There seems to be a general consensus among cancer researchers and environmentalists that one-quarter to one-half of this figure is complicated by occupational factors."

He ends his testimony by stating: "But let me come to this point: even if only 5% of heart disease, cancer, and respiratory disease were in fact occupationally related, the annual number of occupationally caused deaths would be 60 000. Thus, the public health service estimate of as many as 100 000 may not be unreasonable."

Dr. Lloyd's remarks, as quoted by Mr. Smith, appear flippant, but read what Dr. John Peters, writing on the Virginia Kepone episode (*ES&T*, December 1977, p 1190) in the *New England Journal of Medicine* [298, 277 (1978)] had to say: "Because the body has a limited number of physiopathologic responses the occupational diseases are frequently difficult to differentiate from naturally occurring disease. This situation, of course, complicates isolating the occupational cause, so that epidemiologic studies of working populations are frequently needed to determine the presence of occupational factors."

Dr. Peters asks whether a clinician, on a case-by-case basis, is likely to recognize a work-related cause of disease. He answers: "Too often, the answer is, no. Our medical training does not prepare us to recognize diseases of occupational origin."

Concerning the National Occupational Hazard Survey: I worked from this multivolume report, which was sent to me in November. A copy of the report was not sent to Mr. Smith or to others requesting it, simply because the survey was not in bound form and NIOSH did not have the wherewithal to reproduce the voluminous survey for each inquirer.

However, NIOSH told me that a copy of the survey was at the Washington office and was available for critical review, study and reproduction by Mr. Smith or anyone else. The survey was unpublished only in the sense that a copy could not be obtained from NTIS; the information contained in it was freely available.

The cancer death rates should have read per 100 000 population; that was an error in the copy that never was corrected.

For Mr. Smith's information, my 1975 special report mentions the conquest of infectious diseases, especially through the chlorination of public drinking water supplies. While chlorination, plus a sophisticated array of antibiotics, has virtually eliminated waterborne infectious diseases, chlorination also leads to an increased formation of trihalomethanes, including the known carcinogen chloroform. Does our technological wizardry merely substitute one risk for another?

Mr. Smith does not hesitate to use the best-guess estimate of 5% for that share of cancers related to occupational exposure, while he, at the same time, deplores the use of the 100 000 figure. Be that as it may. Let us assume that the 5% figure is correct. Five percent of 365 000 cancer deaths in 1975 amounts to 17 250 deaths (the comparable figure for 1977 is 19 100). In unhysterical tones, that is a significant number of preventable deaths. And, unfortunately, for the foreseeable future the number of deaths will rise as a result of occupational exposure 15–30 years ago.

Lois R. Ember
ES&T
Washington, D.C.