

Delusions, Illusions and Ongoing Neglect of Hazard Recognition, Regulation and Control of Industrial Carcinogens

President's Cancer Panel September 16, 2008

Jeanne Mager Stellman, PhD¹ and Steven D. Stellman, PhD MPH²

¹*Professor & Chair, Environmental and Occupational Health Sciences, SUNY-Downstate Medical Center, 450 Clarkson Avenue, Box 43, Brooklyn 11203, New York, and Professor Emeritus, Mailman School of Public Health;* ²*Professor, Department of Epidemiology, Mailman School of Public Health, Columbia University, NY, USA*

I wish to thank the President's Cancer Panel for this opportunity to address it on environmental cancers associated with industrial and manufacturing exposures. The Panel's day has been framed by a series of questions on the current state of governmental regulation, inspection, control and overall policy with regard to carcinogens; on resources allocated to recognition of cancer hazards, and on social and policy barriers to carrying out research and developing effective cancer control policy

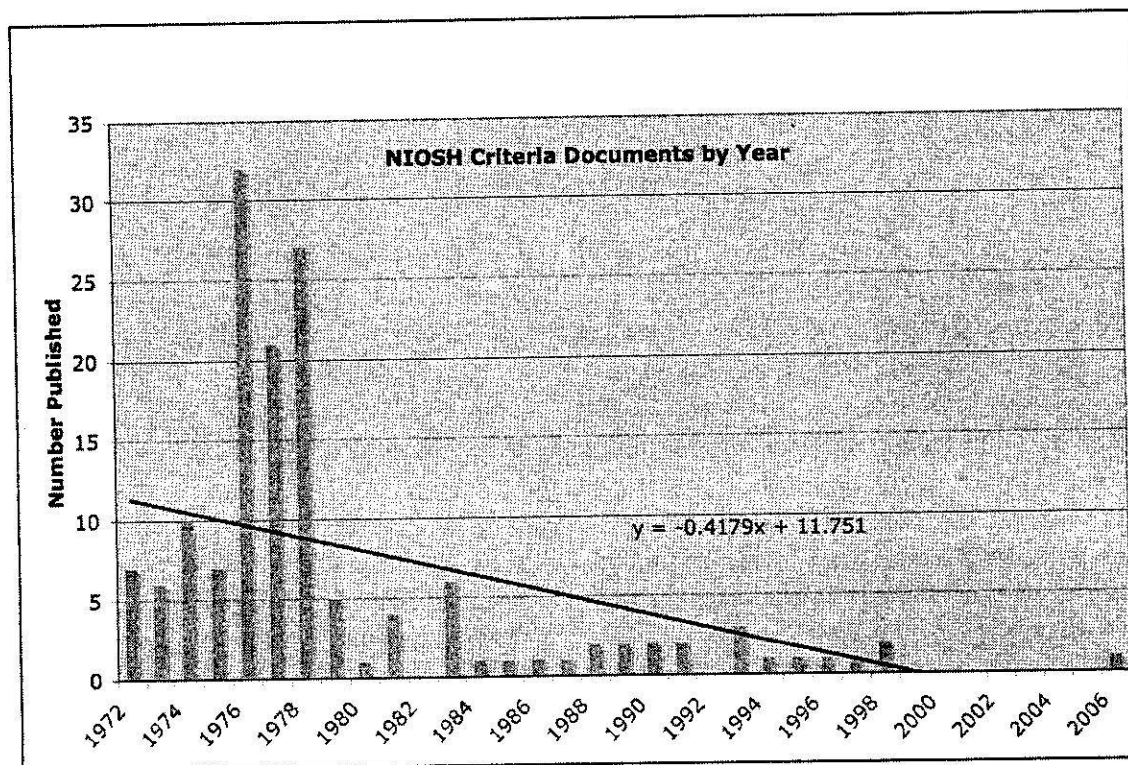
These questions are, of course, more or less rhetorical. Indeed, each of us on the day's panels can most probably reach into our file drawers and pull out papers and presentations we have given in the 1970s, 1980s, 1990s and 2000s addressing these very issues (see for example /1,2/. The only substantive differences in content would be that the number of potential chemical exposures has grown – as has the knowledge gap about the hazards associated with these chemicals and the dearth of appropriate standards to ensure that hazardous exposures are controlled.

REGULATION

The National Cancer Panel need not call upon outside experts to confirm the federal government's

own findings that fewer than 2% of chemicals on the market have been tested for carcinogenicity /3/ or that a significant number of agents that have been identified as carcinogens by the Environmental Protection Agency, the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP) are unregulated by the Occupational Safety and Health Administration (OSHA) /4/. My colleague Dr. Franklin Mirer will present some of these data on specific OSHA standards in more detail in today's panel presentations.

Or consider another example. The National Institute for Occupational Safety and Health (NIOSH) is mandated to provide technical assistance to OSHA and the Mine Safety and Health Administration in developing its standards. The National Cancer Panel does not need independent scientists to report back NIOSH's own performance in this regard. The graph on the following page shows the publication rate for criteria documents, special hazard reviews and joint occupational health documents produced with other countries. Criteria Documents are developed to provide the basis for comprehensive occupational safety and health standards. These documents generally contain a critical review of the scientific and technical information available on the prevalence of hazards,



the existence of safety and health risks, and the adequacy of methods to identify and control hazards. The downward trend of publication and dismal production rate needs no advanced statistical interpretation: neither OSHA standards-setting nor NIOSH advice-giving is occurring. These data are complemented by an ever shrinking number of papers on cancer regulation and carcinogen policies, as I easily observed in a straightforward recent Medline search on the topic.

PREVALENCE OF PROBLEM

Continuing in the same vein of "Why are we still asking these questions?" we would respectfully suggest that further erudite discussions as to the precise percentage of cancer deaths

attributable to exposures to carcinogens found in industrial and manufacturing situations are simply not needed. These arguments have been raging for decades now, following the publication of Doll and Peto's provocative assessment of attributable risk, which many considered a serious undercount /4/. The fact is that a significant number of annual deaths in the United States – and of course around the world as we export our hazards to developing nations—are caused by environmental pollutants and industrial chemicals (see ACS Facts and Figures, 2006 /5/ for example) and these cancers (and associated diseases) are, for the most part, completely preventable.

Furthermore, our technical ability to actually resolve the question of the exact percentage of deaths attributable to industrial and environmental chemicals is extremely limited. Following is a brief

summary of factors limiting our ability to estimate true risk ratios and even to identify all industrial carcinogens:

1. Latency between exposure and onset poses a daunting challenge to associating cause and effect. It is the rare workplace/industrial situation in which exposures do not change over time; where sufficiently accurate data on exposure scenarios are available to calculate a dose-response relationship; or even where the population at risk can be completely identified. Even in situations in which there is complete cooperation from the relevant employers assembling and following up on the study populations is extremely difficult.
2. The statistical power to observe an effect is limited. The expected rates of cancer require many person-years of observation and the exposures need to be sufficiently high to elicit a statistically observable effect. Without super-exposures of large populations, most occupational and environmental cancers will go undetected (particularly if they are never the subject of studies).
3. Competitive risk also limits the ability to identify—and hence control and regulate—carcinogens in the workplace or the general environment. Most carcinogens are associated with other toxic effects, many of which may manifest themselves many years before cancer develops, and many of these illnesses are themselves fatal. Silica is a prime example of such an agent.
4. Complex mixtures and exposures: Workplace environments are characterized by complex mixtures making substance-by-substance studies and regulations impractical. IARC has recognized this for many years and its monograph series and studies in general have evolved into monographs that deal with exposure situations and scenarios rather than

single substances. Such an approach is incommensurate with the standards-making approach as it has been practiced in the past. (It is difficult to generalize about recent standards-making as it doesn't seem to happen any more.)

5. The heterogeneity of the workforce further complicates studies. The development of cancer is assuredly attributable to both individual susceptibilities and exposures to industrial carcinogens and various behavioral factors. This multiple causation further limits the statistical power to observe an effect.

As a result of these methodological constraints, very few chemical carcinogens are actually "known" and classified as such. Many of the "known" carcinogens arise from peculiar circumstances that made their "discovery" possible. For example, asbestos is associated with a rare tumor, mesothelioma. Asbestos is used by specialized workers, insulators, where it is their major exposure. Also, by good chance, many insulators belonged to a trade union and that union maintained records whereby they could identify their members over many years. The extreme rates of lung cancer observed among cigarette smoking workers also improved statistical power immensely. But these factors alone would not have been sufficient to lead to our understanding about the cancer risks associated with asbestos and to the widespread control of asbestos that now exists.

The dedication and skill of E. Cuyler Hammond and his co-workers at the American Cancer Society (ACS), the power and wealth of the ACS and its interest in pursuing the research, and the extraordinary relationship between Irving J. Selikoff and the trade unions, coupled with his charismatic leadership qualities and tireless energy, combined to largely eradicate this blight on human health. By contrast, consider polychlorinated biphenyls (PCBs), which are classified by IARC and NTP as probable human carcinogens, but for

which few human studies are conclusive and OSHA does not regulate as a carcinogen. The paucity of human data is attributable to the complexity of the exposures, the ill-defined workgroups and undoubtedly to the sheer absence of will to carry out the appropriate studies. Not every substance or exposure circumstance is fortunate enough to have an Irving Selikoff, Cuyler Hammond or large organization interested in pursuing studies. Indeed, just the opposite in general occurs: there are often massive roadblocks to assembling study populations, obtaining accurate data on exposures and obtaining medical data. These roadblocks themselves require a separate and lengthy presentation, beyond the time and space allotted here.

WHAT SORTS OF STANDARDS DO WE NEED?

The General Duty Clause of the United States Occupational Safety and Health Act states: 29 U.S.C. § 654, 5(a)1: Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." Thus we suggest that all carcinogens that currently are rated as known or probable by recognized agencies (e.g. IARC, NTP, EPA) are **already** regulated by OSHA under the General Duty Clause and exposure to them should be limited to the lowest detectable amount feasible. That the general duty clause is, in fact, virtually never applied to industrial carcinogen exposure is not a matter of science but of policy and lack of the will to prevent occupational disease, death and disability.

Next, since it is the job of OSHA to develop workplace guidance that assists employers and employees in fulfilling their obligations under the general duty to provide a workplace free from recognizable hazard, we suggest that OSHA, with the advice of NIOSH and other technical agencies,

undertake extensive process management standards-making similar to its Process Safety Management of Highly Hazardous Chemicals standard or its Hazardous Waste Operations and Emergency Response (HAZWOPER) standard or the OSHA Lab standard. These standards take into consideration the realities of complex working environments and seek to control processes rather than target individual bad actors. Control of a hazard at the source is a prime principle of industrial hygiene, as is substitution of less hazardous substances for known toxic agents. Mandating control of exposure situations and processes, rather than engaging in the long and clearly unsuccessful process of individual standards-making is consistent with the IARC approach of recent years, which has largely dealt with exposure situations and mixtures and not with individual substances. Indeed, the epidemiology and the industrial hygiene constraints described above mandate such an approach. In the case of vinyl chloride, OSHA adopted a stringent standard that led the chemical processing industry to develop scrubbing techniques for ridding product of unreacted monomer and of introducing mechanical cleaning mechanisms. These standard process techniques by and large led to vinyl chloride exposure levels below those mandated by OSHA and similar processing could be used to prevent exposure to other highly reactive monomers.

Indeed, the generalization of process controls to other chemically similar products makes scientific sense and is completely consistent with trends in the drug and chemical industries where structure-activity-relationships (SAR) are key to product development initiatives. Principles of SAR should be applied to untested chemical compounds and those chemicals with properties similar to known toxic agents should, by analogy, be considered potentially toxic and controlled through appropriate process management techniques. For

example, all alkylating agents, like ethylene oxide, should be considered carcinogenic until proven otherwise. Finally, it is fatuous to believe that regulatory decisions are based on science alone.

Advocacy is the key to regulation and control and to funding of scientific studies. It is not a coincidence that the decrease in carcinogen-control regulations, studies and government publications corresponds to the rapid shrinkage of the United States' industrial workforce and their representation by trade unions. Control of second-hand environmental tobacco smoke has come from public advocacy. Indeed, OSHA withdrew from its role of protecting workers from second-hand smoke and other serious problems of indoor air quality and has withdrawn its own indoor air quality regulatory proposals.

Thus, while we applaud the National Cancer Panel for directing its attention to this too long neglected topic and for framing the issues as insightfully as it has, we believe that the time for discussion is long past. While we as a society have been debating and delaying and have been occupying ourselves with setting up strawman arguments about incidence and attributable risk, more and more chemicals have been introduced into commerce and have remained largely unmonitored and unregulated. We hope that the resurgence of interest in this topic may be a harbinger to a new future in which we will not continue to remain bystanders to ongoing industrial manslaughter (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=TESTIMONIES&p_id=92.)

REFERENCES

1. Stellman, J. M. & Stellman, S. D. What Proportion of Cancer is Attributable to Occupation; Statistical and Social Consideration (American Society for Preventive Oncology, Chicago, 6 7 March, 1980).
2. Women's Occupational Health Resource Center News, Columbia University School of Public Health, 1979-1991.
3. National Safety and Health NIOSH. Occupational Cancer, 2007. <http://origin.cdc.gov/niosh/topics/cancer/>
4. Occupational Safety and Health Administration (OSHA). Appendix C Basis of OSHA Carcinogen Listing for Individual Chemicals. www.epa.gov/tri/tridata/tri99/pdr/appendixc.pdf
5. Doll R, Peto R. The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. *J Natl Cancer Inst* 1981; 66:1191-1308, republished as: Doll R, Peto R. The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. Oxford University Press, Oxford: 1981. Originally published as a "white paper" and disputed in Bridbord K, Decoufle P, Fraumeni JF, Hoel D, Hoover RN, Rall DP, Saffiotti V, Schneiderman MA, Upton AC: Estimates of the Fraction of Cancer in the United States Related to Occupational Factors. Report Prepared by National Cancer Institute. National Institute of Environmental Health Sciences, National Institute for Occupational Safety and Health, 15 September, 1978.
6. American Cancer Society ACS Facts and Figures, 2006. National Cancer Institute (NCI) SEER program Data, 2000-2003. Available at: <http://www.cancer.org>.