

Symposium on the Health Effects of Gasoline: Panel Discussion on the State of the Science

by Andrew Sivak

Introduction

The purpose of this panel was to critically review the quality and magnitude of the scientific information on gasoline and certain of its primary chemical constituents with respect to both cancer and noncancer health end points. This evaluation was undertaken as a prelude to the risk characterization discussions to establish the scientific groundwork on which those discussions could be based. The discussions of the panel broke down into three reasonably well-defined subject areas. R. McClellan and P. Rombout discussed the broader issues of toxicology testing strategies and the ways in which data from experimental studies and epidemiology studies could be integrated to give a composite scientific basis for risk characterization. J. McLaughlin and P. Enterline considered the epidemiology data presented in connection with renal cell carcinoma and leukemia in occupationally exposed populations. P. Infante discussed the issues relating to benzene exposure and the associated hazards. McLaughlin, Enterline, and Infante have provided individual commentary papers for their areas of concern that are included elsewhere in these proceedings. This panel discussion report does not repeat their comments but focuses on the other areas discussed.

Research Strategy and Toxicology Study Design

A central question in the development of a research strategy to address the basic issue to limit adverse health effects in people from exposure to gasoline and its combustion products is what are the exposure-response relationships on a population basis for air toxics, individually, or in mixtures. In carrying out research to gain the necessary information to make risk assessments and ultimately to manage the risks, the policy issues must be kept in mind. The primary toxicological issues are *a*) establishing quantitative risk estimates from epidemiological data; *b*) integrating epidemiological and animal data; *c*) using animal

data in the absence of human data, which includes the relevance for extrapolation between species and extrapolation from high to low exposures; *d*) estimating risks to susceptible subpopulations; *e*) estimating risk of exposures to mixtures; and *f*) aggregating different kinds of risks.

A key component of environmental health studies is developing a strategy for evaluating mixtures such as gasoline. The factors that need to be addressed are *a*) the appropriate use of both experimental and theoretical approaches, *b*) balancing the use of integration (entire mixture) and reductionist (individual chemicals) approaches, and *c*) building on the growing body of information on gasoline and its components. The challenge is to be able to conduct risk assessments that meet both regulatory and research opportunity identification needs and create an atmosphere that recognizes risk assessment/research as a continuing process. This will require the development of approaches for planning, prioritizing, and managing large-scale endeavors with multiple investigators and institutions for an adequate interval.

A clear understanding of exposure in making judgments about health hazards and risk is of critical importance. Gasoline is a complex and highly variable material with respect to both location and time. In dealing with exposure, it is essential that closer ties be made among those studying exposure and effects and that increased communication among these constituencies would aid the risk assessment process considerably. With respect to exposure, several factors need increased attention. Among them are a better understanding of peak exposures (both frequency and level), a better understanding of the relationship between exposure and air quality data as usually collected by regulatory agencies, and the use of activity patterns of persons to obtain more realistic exposure information.

Concerning effects research, there seems to be inadequate attention to short-term exposures that might have effects on health. One of the most important avenues for research is to develop biomarkers for exposure in humans and test systems to tie the exposures to the effects more directly. Subtle and apparently not life-threatening effects, such as sensitivity, irritation, and discomfort, will very

likely be the effects experienced by the majority of a population, and consideration of quality of life issues will need attention in the future. Up to the present, these two areas of toxicology have received relatively little attention, but in the coming years they will, in all likelihood, become matters of major concern, especially as the measuring tools and end points become better established in the armamentarium of the environmental scientist.

Panel

Chair—

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