REGULATORY TOXICOLOGY AND PHARMACOLOGY 15, 73–82 (1992)

not copied

Workshop on the Health Effects of HCl in Ambient Air

MICHAEL A. KAMRIN

Institute for Environmental Toxicology, C-231 Holden Hall, Michigan State University, East Lansing, Michigan 48824

Received April 3, 1991

This article presents a summary of the proceedings of the Workshop on the Health Effects of HCl in Ambient Air, held in Detroit, Michigan, on October 15, 1990. Participants addressed three topic areas: sources, levels, and chemistry of HCl in ambient air; toxicity of atmospheric HCl to humans and animals; and the need for future research on toxicity and exposure. Consensus conclusions related to each of these topic areas, arising form the deliberations of the workshop participants, are presented. These include: (1) atmospheric HCl will most commonly exist in the gaseous form; (2) long-range transport of HCl is probably of limited importance; (3) ambient HCl levels are in the low parts per billion range; (4) irritation of the upper airways appears to be the most sensitive indicator of exposure; (5) such effects are likely to occur only at exposure levels much greater than those measured in ambient air; and (6) future health research should focus on occupationally exposed populations and potentially sensitive subgroups, e.g., asthmatics.

INTRODUCTION

The objectives of the Workshop on the Health Effects of HCl in Ambient Air were to evaluate (1) available information about sources, levels, and chemistry of hydrogen chloride in ambient air; (2) current knowledge about the toxicity of atmospheric hydrogen chloride to humans and animals; and (3) the need for future research on the toxicity of and exposure to hydrogen chloride in ambient air. To accomplish this, a group of 32 scientists representing a variety of disciplines and sectors met for a full day of intensive work on October 15, 1990, in Detroit, Michigan. The Workshop was coordinated by the Institute for Environmental Toxicology, Michigan State University.

In preparation for the meeting, participants were provided with a number of materials. Included were six articles describing experiments on the health effects of HCl (Malek and Alarie, 1989; Burleigh-Flayer *et al.*, 1985; Hartzell *et al.*, 1988; Kaplan *et al.*, 1988; Albert *et al.*, 1982; Sellakumar *et al.*, 1985); a summary of the National Research Council (1987) evaluation of HCl; and two review articles on the health effects of acid aerosols (Spengler *et al.*, 1990; Soskolne *et al.*, 1989a). One additional article describing a risk assessment of sulfuric acid (H_2SO_4) was distributed at the time of the meeting (Rao and Brown, 1989).

0273-2300/92 $3.00

The Workshop began with three presentations to delineate the important health and environmental issues. Participants then were divided into smaller groups to facilitate discussion of the major questions. These breakout sessions were structured to identify areas of consensus and those requiring further study. All participants then met as a group to hear summaries of the breakout sessions and discuss the conclusions that were reached. The implications of the group conclusions for assessing human risk were also addressed during this final segment of the meeting.

This report contains summaries of each of the formal presentations followed by discussions of the issues raised in the respective presentations. The discussion sections summarize the views of the participants as expressed in both the breakout and the plenary sessions. In addition, the report reflects comments provided by participants subsequent to the Workshop in response to a draft version of this manuscript. While it was not possible to incorporate all comments of all individuals, this meeting summary reflects the consensus of the participants.

HCl IN AMBIENT AIR

Sources and Levels

The first speaker, Gerald Keeler (University of Michigan) discussed sources of HCl, the nature of HCl emissions and their atmospheric distribution and fate, and concentrations of HCl in ambient air. The two major sources of atmospheric HCl are fossil fuel burning and incineration of domestic and industrial waste (Sturges and Harrison, 1989; Lightowlers and Cape, 1988). The fossil fuel of most concern is coal. The amount of HCl generated from burning of coal depends on its chloride content which varies from 0.0029 to 0.095% (Gladney *et al.*, 1984; Olmez, 1990). The chloride content of fuel oils is generally low, as is the concentration in gasoline, where chloride is used as a scavenger for lead (Lightowlers and Cape, 1988; Pierson and Brachazek, 1983). The major contributors to the chlorine content in municipal solid wastes are polyvinyl chloride and paper (Lightowlers and Cape, 1988; Michigan DNR, 1986).

The relative contributions of incineration and coal burning can be estimated using information from existing facilities. A high-capacity resource recovery facility, operating 24 hr a day, 5 days a week, and burning 650,000 tons of solid waste (containing 6.5 lb HCl/ton) per year is estimated to emit uncontrolled emissions of about 2000 tons of HCl/year (Michigan DNR, 1986; Brunner, 1985). A high-capacity coal-fired power plant, burning 2,000,000 tons/year of bituminous coal (with an HCl content of 0.0925%), emits an estimated 1700 tons of HCl/year. Thus, these two types of sources appear to emit roughly equivalent amounts of HCl into the air. However, the source type that is the largest contributor to HCl in a particular geographical region depends on the amount and type of fuel consumed and the control equipment utilized on each facility.

In addition to the combustion of coal and solid waste, there are a number of other sources that contribute to HCl in ambient air. These include glass manufacturing, iron–steel manufacturing, the ceramic industry, cement production, the chemical industry, rocket firing, and natural sources, e.g., volcanoes and sea salt (National Research Council, 1976; Fenton *et al.*, 1980; Clegg and Brimblecombe, 1985). In most areas, these secondary sources contribute 10% or less to the total HCl emissions (Lightowlers