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MEMORANDUM

TO: Robert F. Gertenbach
FROM: Leonard S. Zahn
SUBJECT: International Specialty Conference on Combustion Processes and the Quality of the Indoor Environment
Niagara Falls, NY, Sept. 27-29, 1988
CC: WDH
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It was a small meeting both in the number of papers and those attending: there were about 35 of the former and 75 of the latter. The gathering was sponsored by Air Pollution Control Association committees dealing with building factors and ventilation, monitoring and modeling, and residential and commercial fuel combustion.

The subject of environmental tobacco smoke (ETS) seemed to have been uppermost in the minds of the planners; it was the central focus, or drew considerable attention, in 40% of the presentations. One session was devoted to ETS characterization and exposure; another was on ETS policies. Also emphasized by several speakers was the use of biomarkers to help determine exposure to ETS, especially among children and infants.

Some interesting comments were heard during the meeting, but only few of the data reported appeared to be new. One paper offering data about problems related to ETS measurements came from a New Mexico scientist. Several reports were repetitions or re-writes of material presented in recent years. Other papers, dealing with ongoing studies, provided up-to-date information.

Perhaps the most significant disclosure at the meeting was that the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) would soon recommend new ventilation standards for buildings in order to deal with any problems related to ETS. It was made clear that questions had been raised about tobacco industry pressure regarding ETS in buildings.

JAMES REPACE of the Environmental Protection Agency (EPA) was on the program with a review of data that he said justified restrictive legislation for ETS. He criticized nearly all the reports at the meeting which sought to portray ETS exposure as less of a health hazard, or no hazard at all in a practical sense. Joining him in this effort, but to a far lesser degree, was A. JUDSON WELLS, a consultant to the American Lung Association.

Another speaker from the EPA reported that mutagenic compounds had recently been detected in emissions from kerosene heaters, devices whose usage is most marked in the South and Northeast.

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The highlights:

1. DOUGLAS WALKINSHAW, of Canada's National Research Council and a faculty member at the University of Toronto, was the one who reported to the meeting on ASHRAE's forthcoming standard. (ASHRAE, an organization of people in industry, government and academia, develops consensus standards for building ventilation that generally are accepted throughout the United States and Canada.)

ASHRAE's previous ventilation standard, approved in 1981 (and known as 62-81), called for a dual rate of ventilation, or two different figures, for buildings: 5 cubic feet (of outside air) per minute (CFM) per person in nonsmoking spaces, 15 CFM per person in smoking spaces. The latter was raised to 20 CFM in office situations. The figure for houses was 10 CFM per room. This dual rate confused many people, Walkinshaw said.

The proposed new standard (actually a revision called 62-81R) recommends 15 CFM per person in any space, or at least a one-third air change every hour, "whichever governs," he said. This applies both to residential and nonresidential structures.

Walkinshaw said the revised standard, by eliminating the dual rate of the 62-81 standard, should not be construed as an example of submission to tobacco industry pressure. The standard does not "void or downplay" the ETS-indoor air quality issue. The most important element is that if buildings are properly operated and maintained, there will be few problems regarding ventilation.

He said that ASHRAE has not and will not provide health-based indoor air criteria but will provide such criteria on the basis of comfort of building inhabitants.

(The new standard also contains proposed air quality criteria for radon, chlordane, ozone, and carbon dioxide.)

2. Repace, describing smoking as a practice that was "quite deadly and not connected with long life," offered nothing new as he repeated his claim about the lethal effects of ETS.

Repase gained widespread attention several years ago when he said ETS was responsible for at least 5,000 lung cancer deaths annually in the U.S. At Niagara Falls, he said at least seven other studies have produced figures that were in "remarkable" agreement with his.

Much of his talk consisted of citations from the work of others in the ETS area. One such source was a 1984 paper by S. MATSUKURA of Japan on ETS and urinary cotinine levels in non-smokers. Later in the meeting, NANCY HALLEY of the American Health Foundation urged Repase -- "I cannot caution you strongly enough" -- not to use Matsukura's data, saying they were suspect

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and unduplicated. Repace agreed.

Repac raised what seemed to be a new aspect for him when he said a number of reports have linked ETS to heart disease. While saying that these reports weren't conclusive "at the present time," he noted that it's plausible from an epidemiological and biological standpoint to relate ETS exposure to heart disease. Nicotine and other substances in tobacco have been associated with increased cholesterol deposition in arteries, he said, adding that he'd gotten his information on smoking and the heart from something called "A Physician Looks at Smoking."

3. Haley said research at the American Health Foundation on biomarkers of smoke exposure has expanded to include DNA adducts and is concentrating on such substances as benzo(a)pyrene, 4-aminobiphenyl and nicotine-derived compounds.

Few good agents exist as suitable biomarkers, she said. Among those she called "direct" biomarkers were carbon monoxide, carboxyhemoglobin, thiocyanata, nicotine, and cotinine, the major metabolite of nicotine.

"Indirect" metabolites she listed were hydroxyproline (increased excretion of this amino acid in the urine is an indication of lung injury), thioethers, aromatic amines, and urinary mutagens.

Haley said a study (in which she apparently participated) looked at persons who recently had stopped smoking and never-smokers. Both groups were given chewing gum that contained nicotine, and the findings suggested that the mode of uptake of nicotine may be related to elimination of the substance from the body.

Another study of municipal workers in a southern community examined ETS exposure at home and at work. It was found that female nonsmokers were more likely to be wed to smokers than to nonsmokers.

Urinary cotinine measurements of these subjects were made, Haley said, adding that such measurements can be used to estimate ETS exposure, but not exposure to carcinogens. Other potential markers for disease risk have to be examined, such as hydroxyproline, N-nitrosoproline, thioethers, and mutagenicity.

4. DAVID COULTAS of the University of New Mexico, Albuquerque, said many questions remain about ETS, especially in regard to exposure-response relationships in children and about lung cancer in adults. He made the comment during a talk on the variability of measures of ETS exposure in the home. (Coauthors included JONATHAN SAMET of New Mexico and two men from the Harvard School of Public Health, JOHN McCARTHY and JOHN SPENGLER.)

He described a study of residents of 10 homes where ETS exposure was measured by an air sampling device (developed at Harvard), questionnaires were used, and urinary cotinine concentrations were examined. Inhabitants of the houses (which included one apartment and one mobile home) included both smokers and non-smokers.

Basically, the study turned up these findings, none of which was statistically significant: an increase in respirable suspended particulate matter was associated with one or more smokers in the home and with the colder months of the year. Nicotine levels also were increased in the presence of smoking, but were not associated with any season of the year.

Many factors that could not be measured may contribute to the variability of ETS levels in a dwelling, Coultas said. For atmospheric measurements of ETS, concentrations depend on the intensity and duration of smoking, room size, ventilation, absorption of smoke components, and methods of collection. Particle concentration also is affected by sources other than tobacco smoke. Furthermore, at a given level of nicotine exposure, urinary cotinine levels are also influenced by uptake, metabolism and excretion, and these are likely to vary among individuals.

The ability to predict levels of these markers is also limited by the subjects' inability to describe, conclusively and adequately, each kind of exposure.

Coultas said scientists are able to categorize and sort out groups of people, but don't do too well when it comes to individuals. Future studies of methods of ETS measurement will have to realize the importance of other factors that may contribute to atmospheric and biologic markers.

5. DOUGLAS DOCKERY of the Harvard School of Public Health gave data from the most recent followup of children in the the Six Cities Study in which his institution has been engaged for many years.

A total of 5,338 white children aged 7-11 years were last examined in the spring of 1986; the previous examination was in the fall of 1983. Their parents answered questionnaires that sought information about household smoking practices, cooking stoves, kerosene heaters, and wood-burning stoves.

About 50% of the children are now exposed to ETS at home as compared to about 66% ten years ago, Dockery said. Prior to age 2, the incidence of respiratory ills (cough, chest ailments) was consistently found to be increased in the children in direct relation to increases in the amount of smoking in the home. No association with ETS exposure at home was found for nonrespiratory ailments in the children.

The researchers initially found a protective effect of ETS on a subgroup of children with asthma or asthma-related symptoms. However, they found the effect resulted from the fact that smoking parents either stopped or reduced their smoking because of the children's illness. Small declines in pulmonary function were found among these children, but these weren't statistically significant.

Gas stoves used for cooking seemed to have a minor effect on respiratory symptoms in the children overall. More of an effect was seen in children from homes where the stoves had pilot lights than in those without lights, indicating a socioeconomic effect. (Stoves without pilot lights are newer and usually have electric starters.)

When gas and electric stoves were used to provide heat, a stronger association was seen in regard to pulmonary ailments. Again, socioeconomic factors seem to be involved, and this must be studied further.

Space heaters (kerosene, wood-burning stoves) were related to elevated rates of chest illness in nonasthmatics and "nonwheezers," but only in the last year of the study period. No adverse effect on pulmonary function was seen.

Commenting on the paper, THEODOR STERLING of Simon Fraser University, Burnaby, British Columbia, Canada, urged Dockery and his colleagues to recognize and include in their study the fact that the fathers of most of the children are blue collar workers who smoke and bring home industrial dusts and particles on their clothing, skin and hair. This recommendation was made not to remove the smoking factor, Sterling said, but to provide a chance to study the potential effects of occupation.

6. A survey of ETS in restaurants and offices in different cities was reported by WILLIAM CROUSE of the Lorillard Research Center, Goldsboro, NC. (Coauthors were two scientists at R.J. Reynolds Tobacco Co.)

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The survey was done under "real world conditions" and used a battery-powered monitor contained in a briefcase, Crouse said. The findings showed that ETS exposures in offices and restaurants were quite low.

Nicotine was the best indicator of the presence of ETS. Respirable suspended particle matter (RSP) isn't an appropriate marker for ETS. Offices and restaurants are different environmental categories with respect to RSP, but not for nicotine. Smoking behavior of patrons in the different restaurants surveyed was similar.

Repace criticized the report, saying the smoker density in restaurants wasn't described and, therefore, it was difficult to interpret the data. He also criticized Crouse's use of cigarette

equivalent data from the measurements. Further, while ETS exposure of nonsmokers in restaurants and offices may be low, the health risk still exists. He said Crouse had failed to prove that RSP was not a good marker for ETS.

Haley commented that monitors used in such studies should be placed in the breathing zone of the subjects. Also, it would be helpful to know how many smokers and nonsmokers were present at the sites where measurements were taken.

7. Particle phase nicotine, not gas phase nicotine, may be a suitable tracer for many indoor ETS components, said DELBERT EATOUGH of Brigham Young University, Provo, UT, in a paper on methods for assessing exposure to ETS. Carbon monoxide and nitrogen oxides are unsatisfactory tracers.

He said "unique, conservative" tracers for particulate phase ETS seem to be 3-ethenylpyridine, particle phase nicotine and solanesol. The first-named compound is easily measured indoors where smoking is present, he said, but few data are currently available. RSP and particulate mutagens may be suitable tracers of ETS in some, but not all, indoor environments.

Eatough said he expected a report to be published soon that isoprene might be a good marker for the particulate phase of ETS.

8. In a review of the formation and general characteristics of ETS, MICHAEL GUERIN of Oak Ridge National Laboratory, Oak Ridge, TN, said little research has been done on the chemical and physical dynamics of ETS. However, much has been done on sidestream and mainstream smoke.

Not much really is known about the general characteristics of ETS, he said, adding that most work in this area has dealt with epidemiological aspects.

There's evidence suggesting that sidestream smoke has virtually the same chemical makeup as mainstream smoke and that ETS is chemically stable, i.e., it does not undergo any major transformation. However, some recent work indicates otherwise, Guerin said.

9. Sterling, of Burnaby, reviewed his studies of contaminants in "regular," not "sick," buildings, saying he used methods that people can handle without difficulty.

He stressed ventilation factors, especially in regard to smoking rooms or areas in office buildings. Air from such rooms often is circulated into nonsmoking areas, he said.

His studies of four buildings -- three modern, sealed structures with mechanical ventilation, the other an older building with natural ventilation -- have led him to conclude that air

circulation is the most important factor in complaints about ETS.

RSP was found to be substantially higher in smoking areas and its presence in nonsmoking areas depended on air circulation patterns.

Repace criticized several aspects of the paper, including the fact that there was no information about the number of smokers involved. Sterling replied that the thrust of the work was about circulation and recirculation of air and the effect on ETS.

10. HARRIET AMMAN of the EPA, discussing health effects from unvented kerosene heaters, said there are unpublished data on mutagenic particles being emitted by such heaters. These particles have carcinogenic potential, she added.

About 17 million kerosene heaters have been sold in the U.S.; some 6 million are believed to be in use at present, mostly in the South and Northeast. About 35-40% of the heaters are found in mobile homes; another 15-20% in apartments.

The heaters emit sulfuric acid, ammonium sulfate, polycyclic aromatic hydrocarbons, sulfur dioxide, etc. Their use has been associated with reduced mucociliary clearance, pulmonary cell changes indicative of chronic bronchitis and pulmonary disease, decreased pulmonary function, and other pulmonary symptoms.

11. Also on the program was MATTHEW JACOBS of Covington and Burling, Washington, DC, legal counsel to the Tobacco Institute. Among the subjects he covered were: court cases aimed at banning smoking in workplaces; legislation to restrict smoking in public and private worksites; constitutional aspects of antismoking legislation, etc.

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