Annex A Experts and Reviewers

ANNEX A
EXPERTS AND REVIEWERS INVOLVED IN AFEAS

EXPERTS

R. Atkinson	University of California, Riverside
W.L. Chameides	Georgia Institute of Technology
P.S. Connell	Lawrence Livermore National Laboratory
R.A. Cox	Harwell Laboratory
R.G. Derwent	Harwell Laboratory
D.L. Filkin	E. 1. du Pont de Nemours & Co., Inc,
D.A. Fisher	E. 1. du Pont de Nemours & Co., Inc.
J.P. Friend	Drexel University
C.H. Hales	E. 1. du Pont de Nemours & Co., Inc.
R.F. Hampson	National Institute of Standards and Technology, Gaithersburg
I.S.A. Isaksen	Oslo University
L.S. Kaminsky	State University of New York at Albany
M.K.W. Ko	Atmospheric and Environmental Research, Inc
M.J. Kurylo	National Institute of Standards and Technology, Gaithersburg
R. Lesclaux	University of Bordeaux
D.C. McCune	Boyce Thompson Institute for Plant Research, Ithaca
M.O. McLinden	National Institute of Standards and Technology, Boulder
M.J. Molina	Jet Propulsion Laboratory
H. Niki	York University, Ontario
M.J. Prather	NASA Goddard Institute for Space Studies
V. Ramaswamy	Princeton University
S.P. Sander	Jet Propulsion Laboratory
F. Stordal	Oslo University
N.D. Sze	Atmospheric and Environmental Research, Inc.
A. Volz-Thomas	Kfa Julich
W-C Wang	Atmospheric and Environmental Research, Inc,
L.H. Weinstein	Boyce Thompson Institute for Plant Research, Ithaca
P.H. Wine	Georgia Institute of Technology
D.J. Wuebbles	Lawrence Livermore National Laboratory
R. Zellner	University of Hannover

REVIEWERS

D.L. Albritton	National Oceanic and Atmospheric Administration
J.G. Anderson	Harvard University
R.E. Banks	University of Manchester Institute of Science and Technology
J.J. Bufalini	US Environmental Protection Agency
A.W. Davison	Newcastle University
W.B. DeMore	Jet Propulsion Laboratory
D.D. Des Marteau	Clemson University
R.A. Duce	University of Rhode Island
A. Goldman	University of Denver

EXPERTS AND REVIEWERS INVOLVED IN AFEAS (Continued)

M.R. Hoffman	California Institute of Technology
C.J. Howard	National Oceanic and Atmospheric Administration
N. Ishikawa	F&F Research Centre, Tokyo
J.L. Moyers	National Science Foundation
V. Ramanathan	University of Chicago
A.R. Ravishankara	National Oceanic and Atmospheric Administration
F.S. Rowland	University of California, Irvine
P. Simon	Institut d'Aeronomie Spatiale de Belgique
H.O. Spauschus	Georgia Institute of Technology
S. Solomon	National Oceanic and Atmospheric Administration
A. Tuck	National Oceanic and Atmospheric Administration
R.T. Watson	National Aeronautics and Space Administration
S. Wofsy	Harvard University

Annex B Companies Sponsoring AFEAS

ANNEX B
COMPANIES SPONSORING AFEAS

Akzo Chemicals	Netherlands
Allied-Signal Corporation	USA
Asahi Glass Co., Ltd.	Japan
Atochem	France
Chemical Industries of Northern Greece, S.A.	Greece
Daikin Industries, Ltd,	Japan
E. I. du Pont de Nemours & Co., Inc.	USA
Hoechst AG	Germany
ICI Chemicals and Polymers Ltd.	UK
ISC Chemicals	UK
Kali-Chemie AG	Germany
LaRoche Chemicals	USA
Montefluos SpA	Italy
Pennwalt Corporation	USA
Racon (Atochem)	USA

Annex C Statement of Work

ANNEX C

STATEMENT OF WORK

Each reviewer should prepare a one page written review of each paper specified with their name in the following. The reviews should be sent to the chairman of the AFEAS science committee as early as possible and fifty copies of the reviews should be brought to the AFEAS conference.

The reviews should address the following questions:

1. Is there significant information relevant to the subject that is not included in the review paper?

2. Are the conclusions supported by the information presented in the review paper?

3. Are the findings reported in the executive summary supported by the information in the body of the paper? Are all of the important points covered in the executive summary? Does the summary provide the correct level of detail or is information included that should be removed?

I. Physical and Chemical Properties:

Since model calculations and evaluations of potential biological and health effects will require the information developed in these reviews as input, Experts answering these questions will be required to submit their review papers by not later than 28 February, 1989.

A. Solubility in Water, Vapor Pressure, Hydrolysis Rates

Based on information in the literature, supplied by AFEAS member companies and available from other sources, what are the recommended temperature dependent values of the solubility in pure water, solubility in sea water, vapor pressure, and hydrolysis rates for each of the HCFCs and HFCs? Expert - Mark McLinden

Reviewer - H.O. Spauschus

B. Reaction Rate Constants

Based on available information, what is the recommended temperature dependent rate constant for reaction of each of the HCFCs and HFCs with hydroxyl and $O(^1D)$? What are the error limits on these rate constants? Experts - Bob Hampson, Mike Kurylo and Stan Sander working together.

Reviewers - W. B. DeMore and A. R. Ravishankara

C. Absorption Cross-Sections

Based on available information, what are the recommended ultraviolet (190-400 nm) and infra-red (primarily in the 8 - 13 m range) cross-sections for each of the HCFCs and HFCs? What are the error limits on these cross-sections? Expert - Mario Molina

Reviewers - P. Simon and A. Goldman

D. Degradation Mechanisms

Based on available information, how will the HCFCs and HFCs degrade in the troposphere after

the initial hydrogen atom abstraction by hydroxyl, what are the intermediate and final products and what is the most likely atmospheric lifetime of each of these products? Is it likely that relatively stable fluorine-containing intermediates would be formed? How would the products be removed from the atmosphere? As this is one of the more important set of questions, four experts, or teams of experts, are being asked to address these questions. Experts - Tony Cox and R. Lesclaux working together; Roger Atkinson; Hiromi Niki; and Reinhardt Zellner.

Reviewers - All reviewers should compare the papers to identify inconsistencies and determine if they are due to uncertainties that cannot be resolved without further research or if they are due to errors in one or more of the papers. Specific responsibilities for more extensive reviews are:

J. G. Anderson - papers prepared by R. A. Cox and R. Lesclaux and R. Zellner

J. Bufalini - papers prepared by R. Atkinson and H. Niki

W. B .DeMore - papers prepared by H. Niki and R. Zellner

A.R. Ravishankara - papers prepared by R. Atkinson and R. A. Cox and R. Lesclaux

Each of the following reviewers should prepare a single review of the group of four papers. The group should be reviewed for completeness and consistency. Causes of any inconsistencies should be discussed. Each of these reviewers should suggest a single executive summary based on the four executive summaries.

F. S. Rowland

R. E. Banks

N. Ishikawa

II. Uncertainties in Atmospheric Lifetimes

Experts answering these questions will be required to submit their review papers by not later than 1 April, 1989.

A. Tropospheric Hydroxyl Concentrations

Based on measurements of the isotopic ratio of carbon in atmospheric carbon monoxide, what is the average tropospheric hydroxyl radical concentration and what are the uncertainties in the derived concentration? Given that the rate constant of the reactions of HCFCs and HFCs with hydroxyl are temperature dependent, what is your best estimate of lifetime (with uncertainty limits) of each of the HCFCs and HFCs? Experts - Andreas Volz-Thomas and R. G. Derwent working together.

Given the available data base on methyl chloroform and HCFC-22 (measured atmospheric concentrations and estimated global emissions), what are the calculated atmospheric lifetimes of these compounds and how sensitive are the lifetime to variations in these data, e.g. latitudinal, seasonal,

vertical profile? Calculate the effect of a reasonable variation in each of these parameters in turn. Assuming that reaction with OH is the only sink for methyl chloroform and HCFC-22, how do uncertainties in the data base for these compounds extrapolate to influence the derived OH concentration? Extend the sensitivity calculation from effect on lifetime to effect on *OH* and hence on the lifetimes of alternative fluorocarbons. Based on this analysis, what is your best estimate of lifetime (with uncertainty limits) of each of the HCFCs and HFCs.

Are the inferred lifetimes for methyl chloroform and HCFC-22 consistent with the assumption that reaction with OH is the only sink? Is it possible that there is another sink for one or other compound, e.g. hydrolysis of methyl chloroform? Expert - Michael Prather

Reviewer - S. Wofsy

Individual reviews should be prepared for each paper and the conclusions of the papers should be compared. If there are inconsistencies the reviewer should determine if they are due to uncertainties that cannot be resolved without further research or if one or both of the papers contain errors.

B. Hydrolysis

Based on available information on hydrolysis rates, what are the most likely atmospheric lifetimes of methyl chloroform, HCFC-22 and the other HCFCs and HFCs against hydrolysis? (Estimates of average hydroxyl concentrations derived using measurements of methyl chloroform are based on the assumption that there are no other significant atmospheric sinks of methyl chloroform. This question is being asked to determine if that is a valid assumption.) Experts - Paul Wine and Bill Chameides working together.

What are the atmospheric lifetimes of the compounds identified in I.D. against hydrolysis? What are the ultimate products that would be formed in solution? Experts - Paul Wine and Bill Chameides working together.

Reviewers - M. R. Hoffmann and D. D. Des Marteau

In addition to preparing reviews of the papers the reviewers should prepare brief summaries of other potentially important liquid phase reactions involving compounds identified in I.D. and not addressed by AFEAS.

III. Natural Sources

Experts answering these questions will be required to submit their review paper by not later than 1 May, 1989.

What are the source strengths and atmospheric concentrations of compounds containing chlorine and/or fluorine due to natural sources? What are natural concentrations of fluoride in ground water? What are the concentrations of fluoride from natural sources in rain water and surface waters (oceans, rivers, lakes)? What concentrations are found in metropolitan water supplies before and after fluoridation? What are the source strengths of other inorganic compounds that would be converted to acidic compounds in the atmosphere? Expert - J. Friend

Reviewers - J. L. Moyers and R. A. Duce

IV. Model Calculations

Experts answering these questions will be required to submit their review papers by not later than 1 May, 1989.

A. Stratospheric Ozone

Given the information supplied by the experts answering I.B., I.C. and II., what are the calculated ozone depletion potentials (including uncertainties) of the HCFCs? Based on available information, could HFCs contribute to ozone depletion? Experts - Don Fisher, Ivar Isaksen, Dak Sze and Don Wuebbles working together.

Reviewers - S. Solomon and A. F. Tuck

B. Tropospheric Ozone

Given the information supplied by the experts answering I.B., is it likely that the HFCs and HCFCs would contribute to production of photochemical oxidants in the vicinity of release? on a global basis, how would emissions of HCFCs and HFCs (currently, emissions of CFCs are about one billion kilograms per year) compare to natural sources of ozone precursors? Expert - Hiromi Niki.

Reviewer - J. Bufalini

C. Global Warming

Given the information supplied by the experts answering I.B., I.C. and II., what are the halocarbon global warming potentials (including uncertainty limits) of the HCFCs and HFCs? Experts - Don Fisher, Dak Sze, and one other climate modeler, working together.

Reviewer - V. Ramanathan

V. Biological and Health Effects

Experts answering these questions will be required to submit their review papers by not later than I May, 1989.

Based on the answers to these questions in sections I. and II., is it likely that the decomposition products from annual emissions of one billion kg. (an amount that is approximately equal to current emissions of CFCs) could contribute to biological or health effects? The organisms to be considered should range from humans all the way down to microorganisms. The review should address the following topics for each of the classes of degradation compounds on the list:

1. Known acute and chronic affects to all concentrations, but with emphasis on the lowest concentrations for which data are available.

2. Existence of a dose-response threshold.

3. Availability of data on quantitative dose-response relationships.

4. Biochemists reaction mechanisms, if known.

5. Repair mechanisms and/or ability of the organism to adapt.

6. Potential effects at projected concentrations corresponding to hypothetical emissions for a given parent compound of 1 billion kg/year at steady state.

7. Most important research needed to resolve uncertainties relevant to the above items.

Experts - L. S. Kaminsky; and L. H. Weinstein and D. C McCune working together.

Reviewer - A. Davison

Individual reviews should be prepared for each paper and the conclusion of the papers should be compared. If there are inconsistencies the reviewer should determine if they are due to uncertainties that cannot be resolved without further research or if one or both of the papers contain errors.