FIRE TOXICOLOGY FROM THE NATIONAL ACADEMY OF SCIENCES (NAS) POINT OF VIEW

David L. Winter
NASA Headquarters
Washington, D.C.

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The Subcommittee on Fire Toxicology of the Committee on Toxicology is now an element of the recently established Board on Toxicology and Environmental Health Hazards of the National Academy of Sciences. At the request of NASA, the Subcommittee on Fire Toxicology undertook the tasks of evaluating the state-of-knowledge in fire toxicology and recommending guidelines for establishing standard approaches for testing the toxicity of polymeric materials in fires.

The Subcommittee published its recommendations in the August 1977 NRC report, Fire Toxicology: Methods for Evaluation of Toxicity of Pyrolysis and Combustion Products, Report No. 2. Method guidelines included recommended pyrolysis/combustion conditions, animal exposure conditions, and end points to be measured. The subcommittee concluded that acceptable screening tests to evaluate the relative toxicities of the pyrolysis/combustion products of materials are not currently available, and more research is needed in this area. It did, however, recommend the following guidelines for developing the needed methodology.

"A. Materials should be evaluated under both pyrolysis and flaming conditions. Both gaseous and particulate combustion products should be mixed uniformly in the chamber atmosphere without being unduly subjected to surface condensation. Therefore, it is highly desirable to use one chamber for both pyrolysis and animal exposure.

B. Small rodent species such as rats or mice should be used as the animal model. Enough animals to give statistically valid results must be used at each exposure condition. The time of exposure should be in the range of 15 to 30 minutes, preferably 30 minutes. The temperature in the animal exposure chamber should not exceed 35^{o}C and the oxygen level should be maintained above 16%.

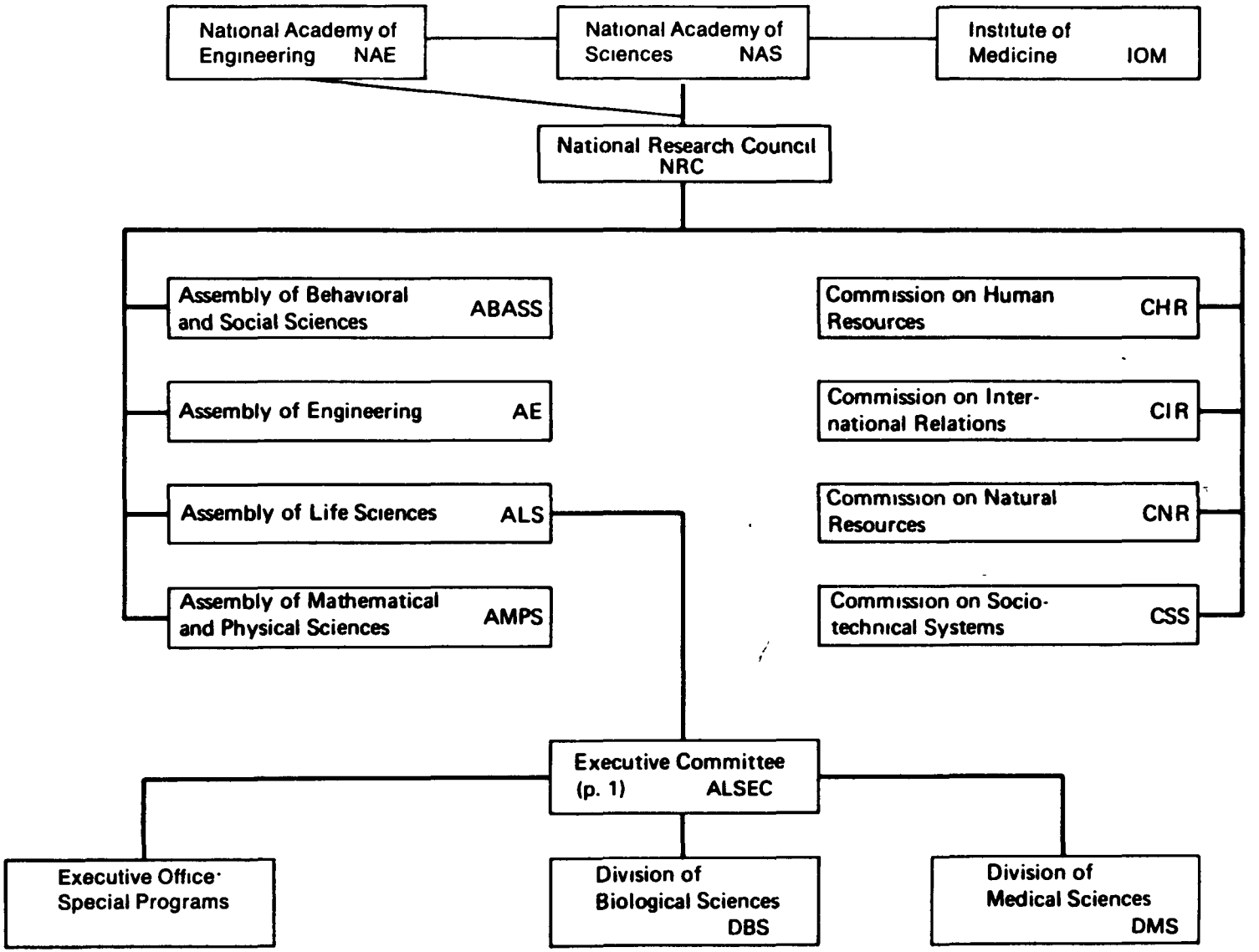
C. Incapacitation is considered to be the most important end point since it should be directly related to escape capability. Laboratory animals should be held for 2 weeks postexposure and observed for behavioral and physical changes as a measure of latent effects.

D. As a minimum set of parameters, temperature, carbon monoxide, carbon dioxide, and humidity should be monitored in the chamber during exposure of animals. Other toxic degradation

products such as hydrogen chloride or hydrogen cyanide, which could be anticipated because of the type of polymer under test, should also be monitored. Further, the smoke density in the animal chamber should be measured as a function of time following initiation of pyrolysis/combustion of the material.

E. Relative toxicity of material should be determined by comparing test materials with reference materials, either those currently in use or candidate materials, rather than attempting to make absolute toxicity evaluations."

1977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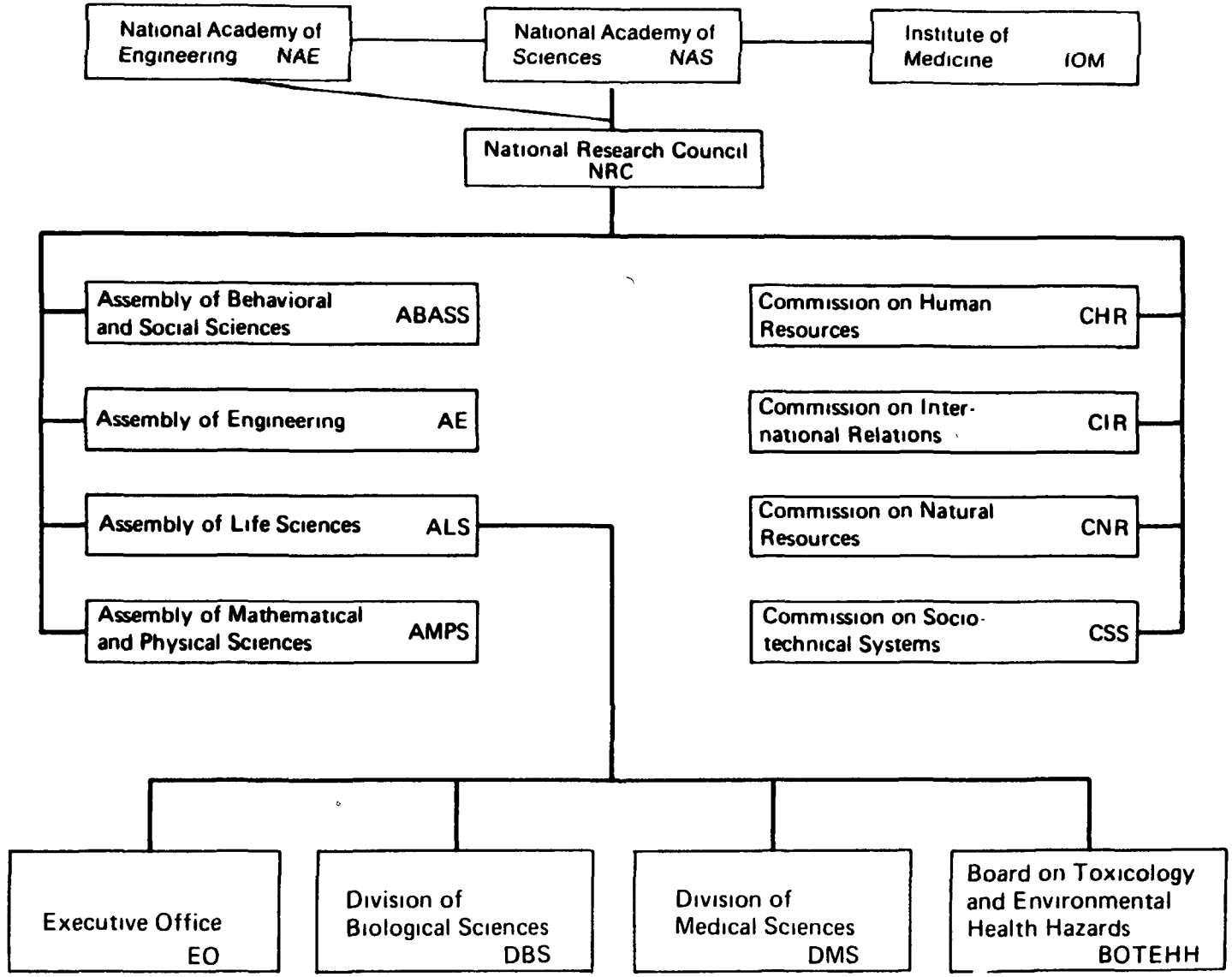
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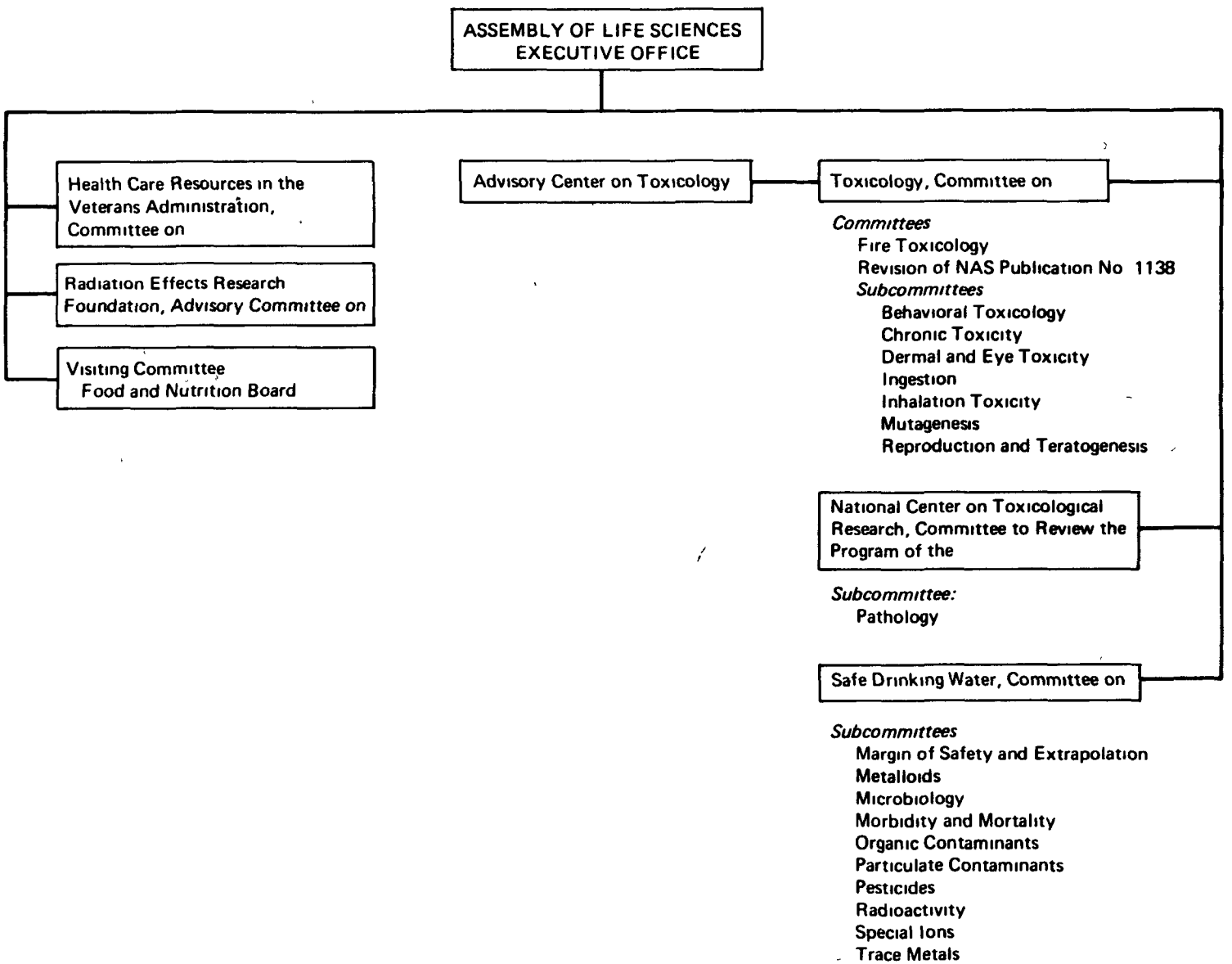
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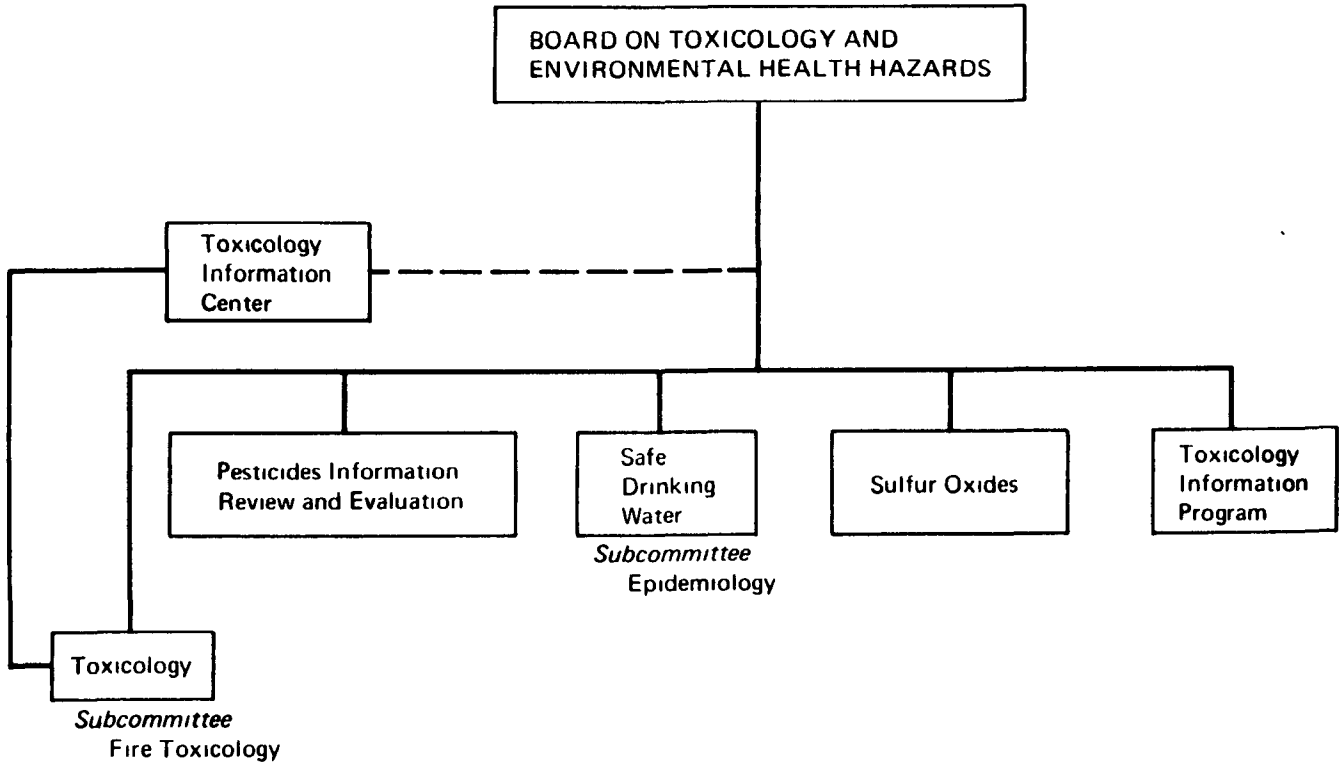
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DUBOIS, ARTHUR B., M.D.
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FRISTROM, ROBERT M., Ph.D.
APPLIED PHYSICS LABORATORY
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UNIVERSITY OF UTAH

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HARVARD MEDICAL SCHOOL

WILLIAMSON, R. BRADY, Ph.D.
UNIVERSITY OF CALIFORNIA,
BERKELEY

CHARGE TO THE COMMITTEE ON FIRE TOXICOLOGY

1. REVIEW THE CURRENT STATE OF KNOWLEDGE AND METHODOLOGY FOR TESTING THE TOXICITY OF MATERIALS INVOLVED IN FIRES ON AIRCRAFT, SPACECRAFT, AND OTHER TRANSPORTATION SYSTEMS AND IDENTIFY ONE OR MORE "BEST AVAILABLE" TECHNIQUES.

2. TO CHARACTERIZE IDEAL TEST METHODS AND RECOMMEND RESEARCH TOWARD THEIR DEVELOPMENT.

3. EVALUATE CURRENT DATA ON SELECTED MATERIALS FOR THEIR TOXICOLOGICAL CHARACTERISTICS IN FIRE.

FIRE TOXICOLOGY

METHODS FOR EVALUATION OF TOXICITY OF PYROLYSIS AND COMBUSTION PRODUCTS

RECOMMENDED GUIDELINES ON METHODOLOGY

THE COMMITTEE HAS DEVELOPED GUIDELINES FOR A SCREENING PROCEDURE TO EVALUATE THE TOXICITY OF THE PYROLYSIS/COMBUSTION PRODUCTS OF POLYMERIC MATERIALS. ITS OBJECTIVES ARE TO SUGGEST A STANDARD METHOD FOR PYROLYZING OR BURNING SAMPLES THAT WILL SIMULATE THE NOXIOUS ATMOSPHERES THAT COULD BE ENCOUNTERED IN "REAL" FIRES AND TO SPECIFY STANDARDIZED EXPOSURE CONDITIONS AND END POINTS FOR FIRST-LEVEL SCREENING OF MATERIALS.

RECOMMENDED END POINTS

OBSERVATION

INCAPACITATION

MORTALITY

CARBOXYHEMOGLOBIN DETERMINATION

Attendees

Names	Phone #	Company
Ramon R. McNeil*	(206) 425-2150 x. 700	Weyerhaeuser Company
Rolf Hartung*	(813) 764-5430	University of Michigan
Thora W. Halstead	(801) 755-3734	NASA
J. Douglas McEwen	(513) 258-1261	University of California (Representing NAS)
Steve Peckham	(801) 533-2627	Research Consultant
Jean-Michel Jousny	660-45-18	University of South Parig
Yves Alaric	(412) 624-3047	University of Pittsburgh
William Satte	(301) 955-3029	Johns Hopkins University
Donald F. Draesler	(617) 8641570	Harvard University
E. O'Hara	(216) 933-6181 x. 531	B. F. Goodrich
Fred Clarke	(301) 921-3143	NBS
Warren E. Fitzgerald	(314) 694-8559	Monsanto
J. Wesley Clayton	(602) 834-4558	University of Arizona
J. B. Reid*	(412) 327-1020	Carnegie Mellon
Rita Ormel	(202) 492-6485	CPSC/EHST
Edward Podolak	(202) 426-3177	Federal Aviation Administration
Charles E. Crane	(405) 686-4866	FAA, CAMI
James Terrill	(302) 366-3379	E.I. DuPont/Haskell Lab
W. J. Pitts*	(517) 636-3689	Dow Chemical Co.
Gordon E. Hartzell	(801) 521-7660	University of Utah
Robert S. Levine	(302) 921-3845	NBS

FIRE TOXICOLOGY PROGRAM: JSC METHODOLOGY

H. Schneider and D. Bafus
Johnson Space Center
Houston, Texas 77058