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THE RELATIONSHIP OF NASA OCCUPATIONAL MEDICINE
AND ENVIRONMENTAL HEALTH WITH THE ADVISORY CENTER
ON TOXICOLOGY

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The Advisory Center on Toxicology is a part of the National Academy of Sciences. The Academy was organized in 1863 under a Congressional Charter which was signed by President Lincoln, and one of the main functions of the Academy was to provide a pool of the nation's scientific and technical manpower that would be available on request to provide consultation to the Federal government. This is still one of the major roles of the Academy and over the years the organization has been expanded to provide for an increasing involvement in Federal scientific and technical problems. In 1947 the Academy established a Committee on Toxicology which primarily served the Armed Forces and the Atomic Energy Commission. After ten years of operation the workload on this Committee had grown to such an extent that they needed full-time professional staff support which resulted in the formation of the Advisory Center on Toxicology in 1957. Administratively, the Center is placed under the Division of Chemistry and Chemical Technology of the National Research Council; however, it also operates in close consultation with the Division of Biology and Agriculture and the Division of Medical Sciences.

The Advisory Center on Toxicology maintains thorough coverage of the technical literature in toxicology and allied subjects. Its present holdings include approximately 2,000 textbooks, 12,000 reprints, and many years' collection of technical journals and abstract bulletins. In addition, there is an extensive collection of government bulletins and laboratory reports as well as unpublished information supplied by private industry. All of the pertinent information in this collection is thoroughly cross-indexed so that it may be rapidly retrieved when needed. There are approximately 200,000 index cards in the collection and it is estimated that there are entries on nearly 50,000 chemical compounds. The staff of the Center consists of less than 10 people including two professional scientists. They are able to call upon the Committee on Toxicology for any necessary help in providing service to the sponsors. The membership of the Committee changes from time to time and its members are always appointed from the best people in the field from government, academic institutions, and private industry. The present membership of the Committee is shown in the accompanying list and represents a variety of professional specialties and an impressive collection of experience. Each of these members serve out of a sense of professional responsibility and patriotic duty, and they serve without any fees or

honoraria, but are reimbursed for their out-of-pocket travel expenses associated with the work of the Committee.

The list of Committee members also shows the various federal agencies who are fiscal sponsors of the Center and Committee, and for whom the bulk of the work is accomplished. Within the NASA organization funds are annually appropriated in support of the Center by the Office of Research and Technology under Dr. Walton L. Jones. The Center maintains technical liaison not only with Dr. Jones' office, but also with the Division of Occupational Medicine and Environmental Health under Dr. Arnoldi and Mr. Marrazzo. In addition, technical liaison has recently been established with General Humphrey's office and with Dr. Orr Reynolds' group on space biology. The services of the Center and the Committee are available to the entire NASA organization including their contractors by communication to and from these technical liaison representatives. Mr. Marrazzo has been serving as the Liaison Representative for the Division of Occupational Medicine and Environmental Health, and requests for assistance from the various field operations under this Division should be routed through him. Mr. Marrazzo and the Center fully recognize that occasionally it is necessary to obtain information and guidance rapidly, in which case, we are quite willing to receive requests by telephone, and ask only that the communication be confirmed later in writing in order that the records may be kept straight.

The actual services of the Center and Committee are perhaps best described by identifying things which are excluded and by giving some examples of things which are included. The Center does not concern itself with problems of the toxicity or adverse reactions of drugs and other pharmaceuticals. When such problems do come to the Center, the advice and assistance of the Food and Drug Administration is obtained. The general business of forensic toxicology is not covered by the Center, nor is much attention given to analytical procedures associated with toxicity studies. The Center is becoming increasingly involved in the toxicity of pesticides; however, it is not deeply involved in the current questions of contamination of our environment and food supplies by pesticides. At the same time, there is a fairly extensive involvement in matters of air pollution arising from the sponsorship by the National Air Pollution Control Administration. The Center has only occasionally dealt with questions of water quality

and these have always had direct relationship to the interests of the sponsors. For example, assistance was given NASA in establishing criteria for the quality of the drinking water of the astronauts during the Gemini and Apollo programs.

The main area of coverage by the Center might thus be identified as the toxicology of commercial products. For example, there has been a continuing and close relationship with Dr. Harris of Houston on the off-gassing of materials of construction of spacecraft with the resulting contamination of the atmosphere within the craft. A recent example of this type of activity was the assistance provided to the Biosattelite III program. During the course of a pre-flight check, the highly instrumented monkey in the craft became seriously ill and later died before the pre-flight check could be completed. The Center was able to identify the toxic component being generated in the spacecraft and to suggest its source. The contaminant was dichloroacetylene which is an extremely toxic gas that has been encountered in a variety of closed environments. This gas is formed by the chemical decomposition of chlorinated hydrocarbon solvents passing over alkaline carbon dioxide scrubbers. There have been some human fatalities attributed to this gas and it can produce serious symptomatology upon prolonged exposure to just a few parts per million. If chlorinated hydrocarbons have been used as cleaning solvents or non-flammable solvents in adhesives during the construction of the closed environment, there may be sufficient off-gassing to be converted to a dangerous atmosphere.

One of the unique services provided by the Committee on Toxicology with the assistance of the Center is the recommendation of Emergency Exposure Limits for military and space chemicals. Accidental spills and exposures to materials having a high acute toxicity can always occur, and the Committee provides guidance to medical and engineering management personnel in the form of these EEL's which permits planning to minimize the injury potential of such emergencies. A list of the Committee's present recommendations is attached and each of these has been developed by the Committee in response to a specific request from one of the sponsoring agencies, frequently for a very special set of circumstances. These recommendations should not be applied to other circumstances without first checking to be sure that they are indeed applicable. In recommending these levels the Committee has made several assumptions including the following:

a. Since these are emergencies, an individual is only likely to be exposed once during a lifetime.

b. During the emergency an exposed individual will have to take some immediate action which may include control of the emergency or personal escape.

c. Under such circumstances, some degree of injury or effect upon the individual may be tolerated provided such effect does not interfere with the required action during the emergency and does not produce irreversible injury to the individual. It is hoped that personnel will never be exposed to these limits and certainly operations should be conducted in such a way that only essential personnel will be placed where such emergencies can arise. In particular, these limits are not to be applied to exposures of the general public to atmospheric contaminants. It will be noted that some of the recommended limits are tentative, and this situation arises from the fact that there are not sufficient data upon which to make a firm recommendation; however, in view of the pressing need of the requesting agency, the Committee has exerted its best judgment and made these tentative recommendations pending the collection of adequate data from research.

It can be concluded from these examples that the main efforts of the Committee and of the Center are oriented toward preventive measures of occupational medicine and industrial hygiene rather than post facto treatment. An additional function is that of research coordination among the various sponsoring agencies in order to promote efficient attack upon common problems and rapid distribution of information of common interest.

ADVISORY CENTER ON TOXICOLOGY

Operates jointly under the Divisions of Chemistry and Chemical Technology, Biology and Agriculture, and Medical Sciences.

Director of Center, Ralph C. Wands, National Research Council.

COMMITTEE ON TOXICOLOGY

Chairman, Dr. Herbert E. Stokinger, Chief, Laboratory of Toxicology and Pathology, Bureau of Occupational Safety and Health, Consumer Protection and Environmental Health Service, Environmental Control Administration, Cincinnati, Ohio (1971)

Vice-Chairman, Seymour L. Friess, Director, Physiological Sciences Dept., Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md. (1971)

Bertram D. Dinman, M. D., D. Sc., Acting Director, Institute of Industrial Health, The Medical Center, University of Michigan, Ann Arbor, Mich. (1971)

Arthur B. DuBois, M. D., Department of Physiology, Division of Graduate Medicine, University of Pennsylvania, Philadelphia, Pennsylvania (1971)

R. E. Eckardt, Director, Medical Research Division, Esso Research and Engineering Company, Linden, New Jersey (1971)

Arnold J. Lehman, M. D., Pharmacological Research Advisor, Bureau of Scientific Research, Food and Drug Administration, Washington (1970)

Harold M. Peck, M. D., Senior Director of Safety Assessment, Merck Institute for Therapeutic Research, West Point, Pennsylvania (1971)

V. K. Rowe, Biochemical Research Laboratory, The Dow Chemical Company, Midland, Michigan (1970)

C. Boyd Shaffer, Director of Toxicology, American Cyanamid Company, Wayne, New Jersey (1971)

Henry F. Smyth, Jr., Ph. D., Professor of Applied Toxicology, University of Pittsburgh Graduate School of Public Health, Pittsburgh, Pennsylvania (1970)

SPONSORS

Departments of the Air Force, Army, Coast Guard, and Navy, the Atomic Energy Commission, Federal Aviation Administration, Department of Agriculture, National Air Pollution Control Administration, and the National Aeronautics and Space Administration.

October 1969

EEL's RECOMMENDED BY NAS-NAE/NRC COMMITTEE ON TOXICOLOGY

	<u>10 Min.</u>	<u>30 Min.</u>	<u>60 Min.</u>
Acrolein			0.2 ppm
Aluminum fluoride	25 mg/m ³	10 mg/m ³	7 mg/m ³
Aluminum oxide	50 "	25 "	15 "
Ammonia (anhydrous)	500 ppm	300 ppm	300 ppm
Boron trifluoride	10	5	2
*Bromine pentafluoride	3	1.5	0.5
Carbon disulfide	200	100	50
Carbon monoxide (normal activity)	1500	800	400
(mental acuity)	1000	500	200
*Chlorine pentafluoride	3	1.5	0.5
Chlorine trifluoride	7	3	1
Diborane	10	5	2
1,1-Dimethylhydrazine	100	50	30
Ethylene oxide	650	400	250
Fluorine	15	10	5
*Formaldehyde			3
Hydrazine	30	20	10
Hydrogen chloride	30	20	10
Hydrogen fluoride	20	10	8
Hydrogen sulfide	200	100	50
*JP-5	5 mg/L.	5 mg/L.	2.5 mg/L.
*Monomethylhydrazine(MMH)	90 ppm	30 ppm	15 ppm
Nitrogen dioxide	30	20	10
Oxygen difluoride	0.5	0.2	0.1
Perchloryl fluoride	50	20	10
Sulfur dioxide	30	20	10
Sulfuric acid	5 mg/m ³	2 mg/m ³	1 mg/m ³
Tellurium hexafluoride	1 ppm	0.4 ppm	0.2 ppm
1,1,2-Trichloro-1,2,2-trifluoroethane (Refrigerant 113)			1500 ppm

*Tentative