



Project Summary

Mini-Assessment: Total Exposure Assessment and Exposure-Dose Relationships

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This report briefly examines recent research in the areas of total exposure assessment and research concerning the relationship between patterns of exposure to environmental pollutants and dose levels received by exposed individuals and populations. This assessment is intended to provide policy makers with a concise discussion of important trends in recent research; it is not meant to be a comprehensive literature review.

This Project Summary was developed by EPA's Office of Exploratory Research, Washington, DC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

This mini-assessment is intended to provide a brief examination of recent research in the areas of total exposure assessment and research concerning the relationship between patterns of exposure to environmental pollutants and dose levels received by exposed individuals and populations. Because the major focus of the study is on the use of exposure assessment as a tool in the analysis of environmental policies, emphasis is placed on studies directly relevant to the assessment of such policies, rather than on more basic research. An annotated bibliography in the final report will enable the reader to obtain more in-depth information. Much of the research on which this assessment is based was completed in August, 1982.

The final report identifies areas where

further research on total exposure assessment and exposure-dose relationships is needed. This compilation of research priorities was developed from several sources, i.e., from the scientific literature and personnel directly involved in research in exposure and exposure-dose assessment. When discussing possible research priorities, the report emphasizes those areas of research most relevant to environmental policy assessments.

Discussion

Chapter 1 of the report develops a framework for evaluating research in exposure and dose assessment and explaining how the assessment of exposure and exposure-dose relationships influences the quality of environmental risk assessment and environmental policy. Often in the past, the relationship between exposure and dose has been neglected. Only in the relatively recent past have studies been made of total exposure; e.g., identification of important sources of pollutant exposure and assessment of the relative importance of different routes of exposure for individuals and populations.

Also briefly reviewed in Chapter 1 are the important distinctions between population and individual exposure. These distinctions, along with the framework for the use of exposure and dose assessment in environmental policy analysis, provide the structure for the remainder of the report.

Chapter 2 discusses techniques for the measurement and assessment of individual exposure to pollutants. Two different but complementary approaches to meas-

uring total exposure to air pollutants, i.e., personal exposure monitoring and micro-environmental characteristics, are described, as are recent advances in personal monitoring devices. Also discussed are the relative strengths and limitations of devices for measuring exposures to specific pollutants. Current knowledge about microenvironmental characterization of indoor air quality is presented.

Chapter 3 of the report addresses methods for assessing and measuring population exposures to environmental pollutants, both directly and by generalizing results from individual monitoring or microenvironmental characterization. A survey of exposure estimation techniques based on the use of ambient monitoring results reveals the need for better models of human behavior. Recent efforts to apply studies of population behavior (commuting or time use patterns, etc.) to the assessment of population exposures are discussed.

Chapter 4 deals with the determinants of relationships between exposure patterns and dose levels in individuals and populations exposed to pollutants. The chapter begins with a short review of recent studies of the properties of individual pollutants (solubility and particle size distribution, for example) which affect the dose absorbed by exposed individuals. This is followed by a discussion of how primary demographic variables, socioeconomic factors, and abnormal physiological states can affect exposure-dose relationships for environmental pollutants. The chapter also discusses mathematical models for absorption and transport of pollutants in the body, and models for integrating and comparing exposures by differing routes. Recent studies of physiologic indicators of pollutant exposure and dose and their potential applications in characterizing total exposures conclude this chapter.

At the end of each chapter of the final report is a brief discussion of recommendations for important research. A summary of these findings is presented below.

Recommendations and Research Needs

Individual Exposure

- Improved personal monitoring devices for a number of pollutants (NO_x, particulates) are required. Such devices need to be more sensitive, lighter, and capable of more or less continuous

recording of pollutant levels if personal exposures are to be characterized adequately.

- Characterization of trace organic contaminants in food and of metals and pesticides in individually prepared foods is needed.
- Characterization of aerosols such as asbestos and particle-bound polycyclic hydrocarbons should be improved.
- Studies to further characterize important pollutant microenvironments, when possible, validated by personal sampling procedures, should continue.

Population Exposure

- EPA should develop a consensus on its exposure assessment needs and develop procedures to allow the most efficient use of resources devoted to exposure assessment.
- Existing data sources on environmental exposure (emission inventories, monitoring network results) need to be improved and updated to facilitate better characterization of population exposures.
- Approaches to selection of population samples should be refined.
- Theoretical criteria for selection of microenvironments should be developed.
- Intercity and geographic variations in activity patterns should be analyzed and microenvironments defined.
- Pollutant concentrations in microenvironments and their variability over time should be characterized.
- Predictive exposure assessment models should be developed and validated.
- Alternatives for dealing with subjects about recording exposure dates, food intake, and activities during the day should be analyzed.

Exposure-Dose Relationships

- An understanding of the physiological variables affecting individual exposure-dose relationships should be refined in order to allow more accurate identification of high risk groups.

- Pharmacokinetic models of pollutant uptake and metabolism can be applied to the clarification of exposure-dose and dose-response relationships. More emphasis should be placed on assumptions regarding pollutant uptake as inputs to these models.
- Efforts must be continued to develop models which allow the assessment of contribution to total exposure from multiple sources and by multiple routes of exposure.



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The complete report, entitled "Mini-Assessment: Total Exposure Assessment and Exposure-Dose Relationships," (Order No. PB 84-128 032; Cost: \$16.00, subject to change) will be available only from:

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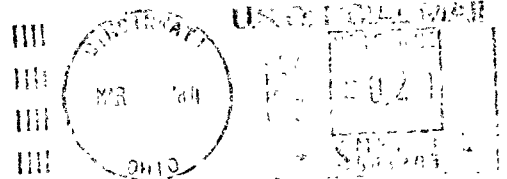
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