THE FIFTH ANNUAL

EPA CONFERENCE ON STATISTICS

March 6-9, 1989
Boar's Head Inn
Charlottesville, Virginia

WELCOME

The Fifth Annual U.S. Environmental Protection Agency (EPA) Conference on Statistics is sponsored by the Statistical Policy Advisory Committee (SPAC) and funded by the Statistical Policy Branch, Office of Policy, Planning, and Evaluation. The Conference is held solely for the benefit and participation of EPA personnel. Programming and arrangements for the Conference have been provided by the SPAC Conference Planning Committee, chaired by John Warren. Listed below are the members of the Conference Planning Committee for the 1989 EPA Conference on Statistics:

Ruth Allen, ORD
John Creason, HERL-RTP
Thomas Curran, OAQPS-RTP
Jim Daley, OPPE
Dennis Ann Daniel, WIC
George Flatman, EMSL-LV
Barnes Johnson, OPPE
Henry Kahn, OW
Kathleen Knox, OPP

Mel Kollander, OPPE
Herbert Lacayo, OPPE
Richard Levy, OPP
William Nelson, AREAL
Barry Nussbaum, OAR
Wayne Ott, ORD
Judy Stober, HERL-CI
John Warren, OPPE

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NOTES

AGENDA

MONDAY, MARCH 6

3:30pm - 5:30pm   Registration and Check-in
Lower Lobby

5:30pm - 6:30pm   **OPENING SESSION**
Ballroom

Introduction -- N. Phillip Ross, Chief, Statistical Policy Branch, OPPE

SPAC Annual Report -- N. Phillip Ross, Chair, Statistical Policy Advisory Committee, Chief, Statistical Policy Branch, OPPE

Welcoming Remarks: The Hidden Power of Statistics -- Timothy Titus, Director, Chemicals and Statistical Policy Division, OPPE

Overview of Conference -- John Warren, Chair, Conference Planning Committee, Statistical Policy Branch, OPPE

Conference Information -- Marcia Gardner and Lori Hidinger, SRA Technologies, Inc.

6:30pm - 7:30pm   Opening Reception
Lower Lobby

TUESDAY, MARCH 7

8:15am - 8:45am   Continental Coffee
Lower Lobby

8:45am - 10:00am   **ARE WE COMMUNICATING PROPERLY?: A VIEW FROM TWO UPPER MANAGERS**
Ballroom

Session Chair: **Barry Nussbaum**, Chief, Field Operations and Compliance Policy Branch, Office of Mobile Sources, OAR

Panel:
Don R. Clay, Acting Assistant Administrator, Office of Air and Radiation
Bob H. Robinson, Associate Administrator, Economic Research Service, U.S. Department of Agriculture

Discussant: **Barry Nussbaum**, Chief, Field Operations and Compliance Policy Branch, Office of Mobile Sources, OAR

10:00am - 10:15am   Break
Lower Lobby

10:15am - 11:30am   THE COST-EFFECTIVE STATISTICIAN
Ballroom

Session Chair: **Kathleen Knox**, Deputy Director, Biological Evaluation and
Analysis Division, OPP

Panel:
Tom Harris, Biological Analysis Branch, Biological Evaluation and Analysis
Al Jennings, Director, Biological Evaluation and Analysis Division, OPP
Kathleen Knox, Deputy Director, Biological Evaluation and Analysis Division,
Mel Kollander, Statistical Policy Branch, OPPE

11:30am - 1:15pm   Lunch Break

12:45pm - 1:15pm   POSTER SESSION Meeting and Set-up
Ednam Hall

1:15pm - 2:30pm   HAZARD EVALUATION AND RISK
ASSESSMENT
Albemarle Room

Session Co-Chairs:
Rich Levy, Hazard Evaluation Division, OPP, and
John Creason, Health Effects Research Laboratory, RTP

Risk Assessment in the Office of Pesticide Programs
Presenter: **C.J. Nelson**, Atmospheric Research Exposure and Assessment
Laboratory, RTP (formerly of the Office of Pesticide Programs)

*Hazard Evaluation and Risk Assessment in the Office of Research
and Development*
Presenter: **John Creason**, Health Effects Research Laboratory, RTP

GRAPHICS/SPATIAL STATISTICS: SPATIAL
STATISTICS FOR HYDROLOGICAL
MONITORING AND MODELING
Commonwealth Room

Session Chair: **George Flatman**, Environmental Monitoring Systems
Laboratory, LV

Spatial Hypothesis Testing
Presenter: **Leon E. Borgman**, Professor of Geology and Statistics, University of Wyoming

Conditional Simulation of Hydrological Parameters
Presenter: **Dale A. Easly**, Graduate Student, University of Wyoming

Parameter Estimation for Groundwater Monitoring Systems
Presenter: **Dennis D. Weber**, Environmental Research Center, University of Nevada, Las Vegas

SOME IDEAS "NEW" TO EPA
Blue Ridge Room

Session Chair: **Herbert Lacayo**, Statistical Policy Branch, OPPE

The Bootstrap Method
Presenter: **Herbert Lacayo**, Statistical Policy Branch, OPPE

James-Stein Estimation: An Overview
Presenter: **Bimal Sinha**, Statistical Policy Branch, OPPE, University of Maryland, Baltimore County

Measurement Error Models
Presenter: **Neerchal Nagaraj**, Statistics Department, University of Maryland, Baltimore County

2:30pm - 2:45pm   Break
Upper Lobby

2:45pm - 4:00pm   **NEW DATA ANALYSIS TOOLS**
Albemarle Room

Session Chair: **Tom Curran**, Office of Air Quality Planning and Standards, RTP

Geographical Information Systems
Presenter: **Larry Svoboda**, Chief, Environmental Monitoring and Assessment Section, Region VIII

Air Quality Mapping System -- Graphical Support for AIRS
Presenter: **Warren Freas**, Office of Air Quality Planning and Standards, RTP

Expert Systems -- A Case Study
Presenter: **Neil Frank**, Office of Air Quality Planning and Standards, RTP

PRINCIPLES AND ISSUES CONCERNING THE DESIGN AND TESTING OF QUESTIONNAIRES
Commonwealth Room

Session Chair: **Mel Kollander**, Statistical Policy Branch, OPPE

Presenter: **Mel Kollander**, Statistical Policy Branch, OPPE

HUMAN EXPOSURE ASSESSMENT: A REVIEW OF THE FIELD
Blue Ridge Room

Session Chair: **Wayne Ott**, Office of Acid Deposition, Environmental Monitoring, and Quality Assurance, ORD

Human Exposure to Environmental Pollution: An Overview of Current Status, Research Needs, and Future Directions
Presenter: **Wayne Ott**, Office of Acid Deposition, Environmental Monitoring, and Quality Assurance, ORD

WEDNESDAY, MARCH 8

8:15am - 8:45am   Continental Coffee
Lower Lobby

8:45am - 10:00am   **ENVIRONMENTAL SURVEYS**
Ballroom

Session Chair: **Henry Kahn**, Office of Water Regulations and Standards, OW

Design of the National Sewage Sludge Survey and Some Preliminary
Presenter: **Henry Kahn**,Office of Water Regulations and Standards, OW

Pollution Prevention Data Requirements Versus Available Agency
Presenter: **Jim Craig**, Office of Pollution Prevention, OPPE

Measurement of Soil Ingestion by Children in a Randomly Selected Population in Washington State
Presenter: **Paul White**, Office of Health and Environmental Assessment, ORD

10:00am - 10:15am   Break
Lower Lobby

10:15am   -   11:30am   SIMS OVERVIEW
Ballroom

<u>Session Co-Chairs</u>: **Bill Nelson**, Atmospheric Research Exposure and Assessment Laboratory, RTP, and **Ruth Allen**, Office of Environmental Processes and Effects Research, ORD

<u>Presenters</u>:
Donald Thomsen, President, Societal Institute of the Mathematical Studies (SIMS), **John Petkau**, Statistics Department, University of British Columbia, and **James H. Ware**, Biostatistics Department, Harvard School of Public Health

11:30am   -   1:15pm   Lunch Break

1:15pm   -   2:30pm   SIMS IN-DEPTH PRESENTATION I
Commonwealth Room

<u>Session Co-Chairs</u>: **Ruth Allen**, Office of Environmental Processes and Effects Research, ORD and **Bill Nelson**, Atmospheric Research Exposure and Assessment Laboratory, RTP

Identifying Structure in Wet Deposition Data
<u>Presenter</u>: **John Petkau**, Statistics Department, University of British Columbia

NCC AND THE STATISTICIAN
Blue Ridge Room

<u>Session Chair</u>: **Judy Stober**, Health Effects Research Laboratory, Cincinnati

<u>Presenters</u>:
Robert Lewis, Technical Manager of User Support, National Computer Center
John Staley, Chief, User Support Service Division, NCC, UNISYS, Inc.

USING THE EPA SURVEYS FILE
Albemarle Room

<u>Session Chair</u>: **Jim Daley**, Information Services Branch, OPPE

<u>Presenter</u>: **Jim Daley**, Information Services Branch, OPPE

2:30pm   -   2:45pm   Break
Upper Lobby

2:45pm - 4:00pm **SIMS IN-DEPTH PRESENTATION II**
Commonwealth Room

Session Co-Chairs: **Bill Nelson**, Atmospheric Research Exposure and
Assessment Laboratory, RTP, and **Ruth Allen**, Office of Environmental
Processes and Effects Research, ORD

Measurement Error Models in Environmental Health Research
Presenter: **James H. Ware**, Biostatistics Department, Harvard School of Public

PC SUPPORT SERVICES FOR STATISTICIANS
Blue Ridge Room

Session Chair: **Denny Daniel**, Manager, Technical Services Division,
Washington Information Center

Presenters:
Denny Daniel, Manager, Technical Services Division, Washington Information
Center, and
Mark Tolton, Manager, RTP Information Centers

Panel:
Robert Faoro, Office of Air Quality Planning and Standards, RTP,
Brian Morton, Office of Air Quality Planning and Standards, RTP, and
David Svendsgaard, Health Effects Reserch Laboratory

**STATOX: A PC-BASED SYSTEM FOR THE
ANALYSIS OF TUMOR INCIDENCE DATA**
Albemarle Room

Session Chair: **Rich Levy**, Hazard Evaluation Division, OPP

Presenters:
Rich Levy, Hazard Evaluation Division, OPP, and
Brion T. Cook, DYNAMAC Corporation

4:15pm - 6:15pm **POSTER SESSION**
Ednam Hall and Lobby

Session Chair: **Barnes Johnson**, Statistical Policy Branch, OPPE

6:15pm - 7:00pm Guest Speaker Reception
Albemarle and Blue Ridge Rooms

THURSDAY, MARCH 9

8:15am - 8:45am   Continental Coffee
Lower Lobby

8:45am - 9:45am   **TECHNOLOGY TRANSFER**
Ballroom

Session Chair: **Ruth Allen**, Office of Environmental Processes and Effects Research, ORD

Presenters:
Ruth Allen, Office of Environmental Processes and Effects Research, ORD, and
David Berg, Office of Cooperative Environmental Management

9:45am - 10:00am   **OIRM/NCC AND THE STATISTICIAN**
Ballroom

Session Chair: **Judy Stober**, Health Effects Research Laboratory, Cincinnati

Presenters:
Robert Lewis, Technical Manager of User Support, National Computer Center
John Staley, Chief, User Support Service Division, NCC, UNISYS, Inc.

10:00am - 10:30am   Break and Check-out

10:30am - 11:45am   **GUEST SPEAKER PRESENTATION**
Ballroom

Session Chair: **John Warren**, Chair, Conference Planning Committee, Statistical Policy Branch, OPPE

Guest Speaker: **Lincoln Moses**, Department of Statistics, Stanford University

11:50am - 12:45pm   **AWARDS AND CONCLUDING REMARKS**
Tavern   (Refreshments available)

Awards Presentation -- **Lincoln Moses**, Statistics Department, Stanford University, and **John Warren**, Chair, Conference Planning Committee, Statistical Policy Branch, OPPE

Conference Summary and Adjournment -- **N. Phillip Ross**, Chair, Statistical Policy Advisory Committee, Chief, Statistical Policy Branch, OPPE

1:00pm   Buses Leave

ATTENDEES

Attendees

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ABSTRACTS

Session: Communications Session

Title: Are We Communicating Properly?: A View from Two Upper
             Managers

Author: **Barry D. Nussbaum**, Chief, Field Operations and
             Compliance Policy Branch, Office of Mobile Sources

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Prior communications sessions at this conference have led to lively discussions between statisticians and managers. This year, a forum is presented to discuss how managers use statistical information in EPA compared with another major government agency.

Both the U.S. Environmental Protection Agency and the U.S. Department of Agriculture must make many operating and policy decisions. Frequently these involve the collection and analysis of data. At EPA analyses are generally performed by the program staffs, while at USDA, the Economic Research Service provides statistical analysis independent of the regulatory function.

A panel of two high government management officials representing each of these agencies will discuss their use of statistical information for decision-making. These two radically different approaches to data analysis and its use for decisions provide an opportunity to explore the advantages and disadvantages of each. After comments by both officials, a discussant will probe the differences for ways to improve EPA communications. The audience will then have an opportunity to question the panel.

The panel will include:

- **Don R. Clay**, Acting Assistant Administrator, Office of Air and Radiation; and

- **Bob H. Robinson**, Associate Administrator, Economic Research Service, U.S. Department of Agriculture.

- **Barry Nussbaum** (discussant)

Session: The Cost-Effective Statistician

Title: The Cost-Effective Statistician

Author: **Kathleen Knox**, Deputy Director, Biological Evaluation and
             Analysis Division, Office of Pesticide Programs

A panel discussion of ways in which statisticians can expand their influence on EPA's
regulatory decisions by participating in the development of testing standards and guidelines
through voluntary standards organizations such as the American Society for Testing
Materials (ASTM) and the Association of Official Analytical Chemists (AOAC) or through
inter- and intra-Agency workgroups. The cost-effective statistician will get "more bang for
the buck" through up-front input into the development of "standard" test methods, e.g.,
disinfectant efficacy, auto emissions testing, water quality sampling. There are not as
many statisticians in EPA as there are engineers, chemists, and other environmental
scientists. If we, EPA's statisticians, can ensure that the scientific measurement and testing
methods which the scientists employ are valid and can provide interpretable results, we will
have a long-range impact on EPA's program decisions even though we are not personally
involved.

This panel discussion will provide a manager's point of view, including an approach to
selling the value of a statistician's input to a manager, and will expand on the "cheap
statistician" theme which was raised at a previous conference. It will also include examples
of EPA statisticians' involvement in ASTM guidelines for indoor air quality studies and
investigations, in World Health Organization (WHO) guidelines for human exposure
studies, in the development of an AOAC test methodology for disinfectant efficacy, and in
inter-Agency guidelines for good field practices (the field testing counterpart of good
laboratory practices).

The panel will include:
- **Tom Harris**, Biological Analysis Branch, Biological Evaluation and
  Analysis Division, Office of Pesticide Programs;
- **Al Jennings**, Director, Biological Evaluation and Analysis, Office of
  Pesticide Programs;

- **Kathleen Knox**, Deputy Director, Biological Evaluation and Analysis Division, Office of Pesticide Programs; and
- **Mel Kollander**, Statistical Policy Branch, Office of Policy, Planning, and Evaluation.

Session: Hazard Evaluation and Risk Assessment

Title: Risk Assessment in the Office of Pesticide Programs

Author: **C. J. Nelson**, Atmospheric Research Exposure and Assessment
             Laboratory, RTP (formerly of the Office of Pesticide
             Programs)

Qualitative and quantitative risk assessment as accomplished by statisticians in the Office of
Pesticide Programs (OPP) will be discussed. Actual case studies will illustrate the process
of qualitative risk assessment in OPP.

Session: Hazard Evaluation and Risk Assessment

Title: Hazard Evaluation and Risk Assessment in the Office of
Research and Devlopment

Author: **John Creason**, Health Effects Research Laboratory, RTP

This presentation will discuss the process by which the Office of Research and Development (ORD) discovers the needs of the program offices, bases its research on these needs, and transfers the results back to the program offices. The different manners in which this information ends up in guidelines, risk assessments, and hazard evaluations will also be discussed.

Session: Graphics/Spatial Statistics: Spatial Statistics for Hydrological
             Monitoring and Modeling

Title: Spatial Hypothesis Testing

Author: **Leon Borgman,** Department of Geology and Statistics,
             University of Wyoming

The objective of hypothesis testing is to improve present methods of determining whether contamination is present in a monitoring system. Statistical tests are being developed to determine, within a certain confidence level, when action should be taken. The tests will take into account the number of wells, their relative locations, and their locations with respect to the source of contamination. The overall program and how the three components of conditional simulation, parameter estimation, and hypothesis testing merge into a unified project for the improvement of ground-water monitoring also will be discussed.

Random Sampling :
    World Deterministic, Sample Random

Geostatistical Sampling
    World Random, Sample Deterministic

Session: Graphics/Spatial Statistics: Spatial Statistics for Hydrological
             Monitoring and Modeling

Title: Conditional Simulation of Hydrological Parameters

Author: **Dale Easley**, Graduate Student, University of Wyoming

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The topic of conditional simulation as applied to hydrological parameters will be presented.
The objective of this task is to simulate hydraulic head measurements for use in parameter
estimation procedures. The conditional simulation is used in this application, rather than
kriging, to preserve the total range of variability of the hydraulic head. The principles of
conditional simulation, their application to a case study at Pittman, Nevada, and their use in
the parameter estimation program will be discussed.

Session: Graphics/Spatial Statistics: Spatial Statistics for Hydrological Monitoring and Modeling

Title: Parameter Estimation for Ground-Water Monitoring Systems

Author: **Dennis Weber**, Environmental Research Center, University of Nevada, Las Vegas

The topic of parameter estimation as applied to the determination of aquifer parameters for ground-water modeling will be discussed. The objective of this task is to improve estimates of the aquifer parameters that are used in ground-water modeling such that the model is representative of the actual aquifer. Ground-water models can be used as a tool in the development of contaminant monitoring systems for the optimum placement of wells. The principle of parameter estimation, how it will be used to improve the representativeness of the models, and how the improved ground-water models will be used as a design tool for monitoring systems will be discussed.

Session: Some Ideas "New" to EPA

Title: The Bootstrap Method

Author: **Herbert Lacayo**, Statistical Policy Branch, Office of Policy,
             Planning and Evaluation

This presentation provides a brief introduction to the bootstrap method. Bootstrapping gives the applied statistician a general method for estimating standard errors and confidence intervals when traditional methods prove inadequate. This presentation will include a discussion of some uses of the bootstrap method in analyzing EPA data and a discussion of its advantages and disadvantages.

Session: Some Ideas "New" to EPA

Title: James-Stein Estimation: An Overview

Author: **Bimal Sinha**, Statistical Policy Branch, Office of Policy,
              Planning and Evaluation, Statistics Department, University of
              Maryland, Baltimore County

The purpose of this talk is to present in simple terms the main idea behind the James-Stein estimation of several parameters, to indicate when it works and when it does not, and how it works. Many examples will be presented, and an application to an EPA problem will be indicated.

Session: Some Ideas "New" to EPA

Title: Measurement Error Models

Author: **Neerchal Nagaraj**, Statistics Department, University of Maryland, Baltimore County

Measurement Error Models are regression models in which the explanatory variables are measured with error. Difficulties arising due to the presence of measurement error will be illustrated using the regression model with a single explanatory variable. Attenuation of the ordinary least squares estimator and the identification problem caused by the presence of measurement error will be illustrated.

Method of moments and maximum likelihood estimation of the parameters will be discussed. An example will be presented to illustrate the computations using EV CARP, a PC software developed at the Statistical Laboratory of Iowa State University.

Session: New Data Analysis Tools

Title: Geographical Information Systems

Author: **Larry Svoboda,** Chief, Environmental Monitoring and
             Assessment Section, Region VIII

This presentation will demonstrate how Region VIII has used Geograhical Information
Systems (GIS) as a tool in analyzing and presenting environmental data.

Session: New Data Analysis Tools

Title: Air Quality Mapping System - Graphical Support for AIRS

Author: **Warren Freas**, Office Air Quality Planning and Standards

The Monitoring and Reports Branch has developed a computerized air quality mapping system which uses data readily obtained from the Aerometric Information and Retrieval System (AIRS). The user selects the map type, geographic area, and pollutant by responding to a series of menu options. Typical map options include air quality site location maps or maps of air quality status for states or groups of states. The software has been installed on the Agency's IBM System at the National Computer Center and is readily accessible to all users. An overview of the mapping capabilities for data screening and analysis will be presented. On-line documentation is also available.

Session: New Data Analysis Tools

Title: Expert Systems -- A Case Study

Author: **Neil H. Frank**, Technical Support Division, Office of Air
             Quality Planning and Standards

An expert system is broadly defined as a system that mimics human decision-making or knowledge processing capabilities to resolve problems or to formulate a response to an issue or concern. One such expert system, called the PM_{10} Advisory System, has been developed to assist regional, state, and local air pollution analysts with the interpretation and implementation of the new particulate matter National Ambient Air Quality Standards. The system was developed using the expert system shell EXSYS to explore the use of expert systems as a technology transfer tool.

Session: Principles and Issues Concerning the Design and Testing of
           Questionnaires

Title: Principles and Issues Concerning the Design and Testing of
           Questionnaires

Author: **Mel Kollander**, Statistical Policy Branch, Office of Policy,
           Planning, and Evaluation

The questionnaire is the most essential element of a statistical survey. It must be designed carefully by a knowledgeable survey expert with the cooperation of the survey sponsor. The survey expert brings to the design process knowledge of the principles of questionnaire design, while the sponsor provides a description of how the information is to be collected and how it is to be used. After a questionnaire is drafted, it must be adequately tested to identify and eliminate errors, inconsistencies, and unusable questions. During the session, we will discuss the recommended process and principles for designing and testing questionnaires from the point of view of the EPA survey statistician.

Session: Human Exposure Assessment: A Review of the Field

Title: Human Exposure to Environmental Pollution: An Overview of
            Current Status, Research Needs, and Future Directions

Author: **Wayne Ott**, Office of Acid Deposition, Environmental
            Monitoring, and Quality Assurance, Office of Research and
            Development

In recent years, great strides have been made to measure the actual exposure -- through air, food, water, and skin -- of the population to environmental pollutants. The new science of total human exposure assessment consists of five distinct research topic areas: (1) human exposure models; (2) measurement methods and instruments; (3) microenvironmental field studies; (4) total exposure field studies; and (5) biomarkers. The new human exposure models include both important microenvironments (automobiles, stores, homes, offices, and various workplaces) and human activity patterns (the visits people make to these microenvironments and their activities in the microenvironments). Measurement methods include instruments for monitoring microenvironments and personal monitors. Microenvironmental field studies are intense studies of certain physical settings (schools, churches, houses, factories, buses, subways). Total exposure field studies utilize probability samples of the population to estimate the exposure frequency distribution of the population of cities or regions. Of greatest prominence are the Total Exposure Assessment Methodology (TEAM) studies, which have been successfully demonstrated for carbon monoxide, volatile organic compounds (VOCs), and pesticides. Biomarkers research seeks to develop methods for inferring the quantity of pollutants actually entering the body. Using total human exposure methods, data have now become available that can accurately characterize the exposures of the population to important environmental pollutants, and these data contain many surprises. This presentation covers the current status, research needs, and future directions of this new field.

Session: Environmental Surveys

Title: Design of the National Sewage Sludge Survey and Some Preliminary Results

Author: **Henry D. Kahn**, Office of Water Regulations and Standards

The Office of Water Regulations and Standards (OWRS) is currently conducting a sample survey of municipal sewage treatment plants. This survey is a questionnaire and analytical survey intended to gather information on the generation, use and disposal of, and contaminant levels in, sludge that results from the treatment of municipal wastewater. The survey will be conducted over an eighteen-month period and the information obtained will be used to support the development of regulations for the use and disposal of sludge as required by the Clean Water Act. This presentation will briefly describe the survey and the sample design and present some preliminary results based on data gathered to date. The sample design is a nationwide probability sample stratified by plant size and sludge disposal method. The survey is designed in two phases with the analytical sample plants a random subset of the questionnaire sample plants.

Session: Environmental Surveys

Title: Pollution Prevention Data Requirements Versus Available
            Agency Data Sources

Author: **Jim Craig**, Office of Pollution Prevention

EPA's newly formed Pollution Prevention Office (PPO) is responsible for the overall development and coordination of the Agency's pollution prevention program. One of PPO's more important tasks is to develop data to use to encourage pollution prevention and assess progress of pollution prevention programs. PPO is currently developing an Agency-wide strategy for collecting information on pollution prevention.

Any strategy for data collection begins with development and understanding of requirements and assessment of available data. Nearly every program office in EPA collects data on facilities it regulates. Some information collections, most notably the Hazardous Waste Generator Survey and Biennial Reports and the Toxic Release Inventory, contain substantial information related to pollution prevention. However, many other data bases on regulated facilities contain little pollution prevention information. The level of detail in Agency databases ranges from name and address only to extensive information on processes or substances regulated.

PPO's data collection strategy needs to build on data collections that begin to meet the data requirements while not interfering with other data collections. The data collection strategy must also balance the Agency's data requirements with the concern about burden on the regulated community. The strategy will ultimately incorporate some questions into existing data collections and develop others as part of a pollution prevention survey or census.

Session: Environmental Surveys

Title: Measurement of Soil Ingestion by Children in a Randomly
            Selected Population in Washington State

Author: **Paul D. White**, Exposure Assessment Group, Office of
            Research and Development

Knowledge of quantities of soils typically ingested by children is a critical component of many EPA assessments of contaminated surface sites. The Exposure Assessment Group in EPA's Office of Research and Development is conducting a series of field studies to quantify soil ingestion rates. In the study presented here, approximately 100 children in Richland, Washington were recruited using a random-digit-dialing solicitation of their parents. The study protocol then required participants to provide data on the children's activities and collect samples of the children's diets and excreta in a one-week study period. Chemical analysis of samples was conducted, and a mass balance approach was used to calculate soil ingestion using the difference between excreted and dietary fluxes of selected trace elements. Good response rates and cooperation of study participants were obtained. Average estimates of soil ingestion centered around 0.1 grams per day but with substantial differences among the three trace elements used. Approaches to combining the data from multiple elements are discussed. Research being conducted to improve measurement accuracy for individual children is presented.

Session: SIMS Overview

Title: SIMS Overview

Authors: **Donald L. Thomsen, Jr.**, President, Societal Institute of the
Mathematical Sciences, **John Petkau**, Department of Statistics,
University of British Columbia, **James H. Ware**, Department
of Biostatistics, Harvard University

The Societal Institute of the Mathematical Sciences (SIMS), through a cooperative agreement with several ORD offices (OMMSQA, OHR, OHEA), is developing statistical techniques and methodologies useful in answering some of the Agency's most important questions.

Currently the SIMS program includes two major groups investigating applications to (1) human health effects, including developmental biology and teratology, and personal exposure assessment and (2) acid deposition, quality assurance, total human exposure, geostatistics, and global climate change. Results are provided to ORD in a technical report format. Most reports are eventually published in peer-reviewed journals. An objective of the SIMS program is to expand the interaction between EPA statisticians and university researchers through workshops, conferences, and visiting scientist exchange programs.

This session will survey recent findings from the two current projects and discuss on-going statistical research and resulting environmental applications.

Session: SIMS In-Depth Presentation I

Title: Identifying Structure in Wet Deposition Data

Author: **John Petkau**, Department of Statistics, University of British
       Columbia

Identifying the spatial and temporal structure in the chemistry of wet deposition using data obtained from a fixed network of rainfall-monitoring sites over an extended period of time is a challenging problem. This presentation will briefly describe the methodology used and the results obtained in two different studies carried out by the SIMS group at the University of British Columbia. In both studies, a primary objective was the assessment of temporal trends.

The first study was based on rainfall-event pH measurements from the nine-station MAP3S/PCN monitoring network for the period 1977-1982. The focus of the study was an attempt to validate the model developed by Eynon and Switzer (1983)[1] on an independent data set. The structure of the data was explored in detail, but no clear indication concerning trends was apparent.

Prompted in part by these results, a study involving a more comprehensive network was undertaken and is still in progress. This study is based on monthly data aggregates from the NADP/NTN monitoring network for the period 1980-1986. Various exploratory and nonparametric tools are being used in a detailed examination of the data. Preliminary results with each of sulphates, nitrates, and hydrogen ions include a major surprise: while levels diminished in the first part of the study period, this trend appears to have reversed approximately midway through the study period.

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[1]The Canadian Journal of Statistics, 11, 11-24.

Session: NCC and the Statistician

Title: NCC and the Statistician

Authors: **Robert Lewis,** Technical Manager of User Support, National
Computer Center (NCC) and **John Staley,** Chief, User Support
Service Division, NCC, UNISYS, Inc.

The National Computer Center (NCC) is an evolving organization. The restructuring of the
organization itself, along with the implementation of new computing technology has
dramatically impacted the NCC user community. Four areas that need to be understood by
the NCC user are: future directions of Agency computing, the different methods the NCC
uses to communicate with the user, the Central Problem Management System, and where to
get help when you need it. These subjects will be covered so that each participant will have
an understanding of how and where to obtain assistance from the NCC and what the future
has in store for the Agency computer user.

A question and answer period will follow the formal presentation.

Session: Using the EPA Surveys File

Title: Using the EPA Surveys File

Author: **Jim Daley**, Information Services Branch, Office of Policy,
            Planning, and Evaluation

This session will consist of a demonstration on the use of the EPA Surveys File for tapping into prior Agency survey experience. The session chair will discuss the content the EPA Surveys File and describe a few recent file searches. Session attendees will be able to design and implement various search strategies based upon subject area, data collection method, or other survey characteristic data, on a PC and to compare the results.

Session: SIMS In-Depth Presentation II

Title: Measurement Error Models in Environmental Health Research

Author: **James H. Ware**, Biostatistics Department, Harvard University

It is widely recognized that the "exposures" used in exposure assessments and in epidemiologic studies of environmental pollutants are approximations to the true exposures of individuals. In air pollution research, for example, studies of personal exposure and indoor concentrations have shown that individual exposures to air pollution are not well described by measurements at an outdoor monitoring site. There is substantial statistical literature on methods for modeling measurement error as part of a statistical analysis, but these methods have rarely been used in environmental research. This talk discusses why this might be so and discusses the potential for linking new methods of environmental measurement with new methods of statistical analysis to quantify the effects of measurement error on individual studies and risk assessment.

The effects of measurement error in exposure-response studies are briefly reviewed and two investigations of measurement error problems are described, one involving the effects of measurement error in the data analysis. The potential and limitations of measurement error methods are described, and we briefly examine the additional issues that arise in multipollutant settings, such as exposure assessment in areas of chemical manufacturing or around hazardous waste sites.

Session: PC Support Services for Statisticians

Title: An Overview of IC Services and Technology Assessment and a
           Background on the Statistician and Computer Support

Authors: **Denny Daniel**, Manager, Technical Services Division,
           Washington Information Center and **Mark Tolton**, Manager,
           RTP Information Centers

This presentation will be a brief overview of what the Information Centers have to offer in support of the statistician, including a brief look at three of the most common statistical software packages available on the personal computer. As part of the discussion about Information Center Services there will also be a discussion about the new Technology Assessment Program that could immediately benefit EPA statisticians. Following this initial discussion there will also be a panel of PC users to discuss the pros and cons of three of the most commonly used software packages in the Agency. During the Poster Session, there will be a demonstration of the three packages and a chance for anyone to "test drive" the packages with an "expert" there to assist and answer questions.

The panel will include:
- **Robert Faoro**, mathematical statistician, Office of Air Quality Planning and Standards, RTP (PC SAS);
- **David Svendsgaard**, statistician, Health Effects Research Laboratory, RTP (Statgraphics); and
- **Brian Morton**, economist, Office of Air Quality Planning and Standards, RTP (Systat).

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Session: STATOX: A PC-Based System for the Analysis of Tumor
            Incidence Data

Title: STATOX: A PC-Based System for the Analysis of Tumor
            Incidence Data

Authors: **Richard Levy**, Hazard Evaluation Division, OPP and **Brion
            T. Cook**, DYNAMAC Corporation

This session provides a demonstration of a personal computer data-base and statistics system for use by the Toxicology Branch. The data management portion of the system provides an interactive, user-friendly environment for data entry, editing, and archival of individual animal data submitted by registrants. The statistical portion of the system provides state-of-the-art statistical routines for the analysis of animal survival and tumor incidence data.

Session: Poster Session

Title: Acidic Deposition, Health Effects, and Statistics: What Are the Links?

Author: **Ruth H. Allen**, National Acid Precipitation Assessment Program

The Acid Precipitation Act of 1980 (Title VII of the Energy Security Act of 1980, Public Law 96-294) created the Interagency Task Force on Acid Precipitation to develop and implement the National Acid Precipitation Assessment Program (NAPAP). The purpose of NAPAP is to increase our understanding of the causes and effects of acid deposition. The scientific information produced by this effort will be reported to Congress in a series of reports and assessments to support decision-making regarding acidic deposition control and abatement strategies. The purpose of this presentation is to highlight statistical issues in the area of assessment of indirect human health effects of acid deposition. The example of bioaccumulation of metals in the human food chain and its relationship to acid deposition is used to illustrate the role of statistics in an integrated understanding of indirect health effects of acidic deposition.

Session: Poster Session

Title: An Automated Data Collection System for the AMES Bioassay

Authors: **Judy A. Stober, J.R. Meier, K.M. Schenck,** Health Effects
             Research Laboratory, Cincinnati, OH, and **W. Judge,**
             Computer Sciences Corporation

The salmonella mutagenicity assay is used extensively throughout the world. Because large amounts of data can be generated relatively quickly, a systematic way of collecting, analyzing, and storing the data is desirable. A computer program which operates on an IBM PC/AT interfaced to a Biotran II automated colony counter has been developed for this purpose. The program runs interactively and consists of a series of data entry screen panels. User-defined selection menus are accessed for entry of assay types, test strains, positive controls and solvent types. Common information is retained from one data set to the next. These fractures minimize entry errors and operator time. Plate count data may be manually entered or automatically collected from the counter. The program has the following data capacities per data collection session: 5 test strains, -/+ S9 (2 levels), -/+ b glucuronidase, negative/positive/solvent/"other" control data, 50 treatment groups, 5 replicates/treatments. These options make the program useful for a variety of applications including dose-response assays, mutagen inactivation mixtures. A built-in editor simplifies data correction, and standardized file format facilitates the transmission of data to other computer systems. The report format includes a graphical display of the data and preliminary analysis of the dose-response curves using linear regression procedures. An iterative feature allows the exclusion of toxic doses and re-analysis. The data can then be transferred to other systems for inclusion in quality control data bases and for formal statistical analyses, which include various modeling procedures developed specifically for the assay. The utility of this program for rapid collection and preliminary quantitative analysis of data has provided a valuable tool for experimental planning. This abstract does not necessarily reflect EPA policy.

Session: Poster Session

Title: ANOVA in Correlated Fields

Author: **Liliana Gonzalez**, University of Wyoming (presented by
George Flatman, Environmental Monitoring Systems
Laboratory, LV)

ANOVA is one of the recommended "statistical methods" for the legally required monitoring of a RCRA hazardous waste facility" under 40 CFR Part 264 "Statistical Methods for Evaluating Ground-Water Monitoring from Hazardous Waste Facilities: Final Rule." Ground-water data usually are spatially correlated. Such correlation degrades random variable tests. This poster presentation describes an ANOVA test when the data are from a correlated field.

Session: Poster Session

Title: EPA Personal Locator

Author: **William Smith**, Office of Standards and Regulations

Finally, the EPA telephone directory is available on PC for instant access to Headquarters and RTP employees. No, this is not the out-of-date telephone book; it is based on information updated daily by the EPA locator facility. A fast retrieval program, "The Personal Locator" was created by William Smith (SPB/OPPE) to access this database. You can search employees by name, room, building, mail-code, office, or any substring, then press F2 to dial the number. The PC can be used as a one-speaker phone, or turned off for normal conversation.

Session: Poster Session

Title: Estimates from Composite Samples

Authors: **J. Schwemberger** and **P. Robinson**, Office of Toxic
            Substances; **G. Mack, B. Leczynski, T. Berner,** and **J.
            Orban**, Battelle

The National Human Adipose Tissue Survey (NHATS), conducted by the U.S. Environmental Protection Agency (EPA), analyzes samples of human adipose tissue for levels of various chemicals. The NHATS was begun in 1967 to monitor levels of pesticides in human tissue. The survey protocol calls for collecting at least five grams of adipose tissue (about the size of a rounded tablespoon) from cadavers and surgical patients.

Composite samples were introduced in the NHATS in the 1980s. Monitoring the environment occasionally requires composite samples that combine two or more individual samples. Composites reduce costs, but information on individual samples is diminished. The list of chemicals monitored in the 1980s was expanded to include, for example, dioxins and furans. This expansion led to a change in the method of chemical analysis for the NHATS. The cost of the new method forced the NHATS program to composite samples before doing the chemical analysis. Under the direction of the Design and Development Branch in OTS, statisticians at Battelle designed a set of composite samples for individual specimens sampled nationally. Subsequently, the composite samples were physically created and analyzed for selected chemicals.

A model, consistent with the design of composites, was developed to interpret the measured concentrations of the composites. The parameters in the model were estimated and tested for statistical significance. Estimates of mean concentration levels for the population an certain subpopulations were computed from model parameter estimates. The relative standard error of the mean concentration estimates was calculated through a Taylor series expansion.

Session: Poster Session

Title: Forest Response to Ozone: A Regression Analysis of the
             Southeastern United States

Authors: **Bruce Madariaga** and **Leland Deck**, Office of Air Quality
             Planning and Standards

Forest damage is among the suspected adverse effects from tropospheric ozone. To set
national standards, an immediate need exists to understand forest response to elevated
levels of ambient ozone. This study investigates the existence and extent of the relationship
between ambient ozone levels and forest health in the southeastern United States. A forest
growth model is developed and regression analysis techniques are used to produce
estimates of the effect on pine stand growth from ambient ozone.

Session: Poster Session

Title: Guidelines for Conducting the AHERA Clearance Test to
             Determine Compliance of an Asbestos Abatement Project

Authors: **Bradley D. Schultz** and **Mary Frankenberry**, Office of
             Toxic Substances and **Jean Chesson**, Chesson Consulting

The Asbestos Hazard Emergency Response Act (AHERA) required EPA to specify when
an asbestos work site is sufficiently clean for removal of the containment barriers isolating
the work site from the rest of the building.   In the absence of an airborne asbestos
standard, EPA developed a test based on a statistical comparison of airborne asbestos
concentrations inside the work site with concentrations outside the work site. The test was
developed assuming a lognormal distribution for airborne asbestos concentrations and
sample sizes were specified to achieve acceptable false positive and negative error rates
while minimizing cost. An initial screening step, which allows a work site to pass without
analyzing all samples under certain circumstances, and a check for sources of
contamination were added to the basic comparison. The statistical performance of the entire
three-step decision process was evaluated under a variety of conditions using Monte Carlo
simulation. The results of this evaluation were taken into account prior to promulgation of
the final rule.

Session: Poster Session

Title: Multistage Procedure Performance

Author: **Karen Hogan**, Office of Toxic Substances

Performance of the linearized multistage procedure was examined, in light of recent criticism that it is not responsive to experimental carcinogenesis data, and that the resulting slope factors, or cancer potency measures, may be mostly reflections of the magnitude of the maximum tolerated dose. GLOBAL86 was applied to a wide range of dose response patterns, and the resulting slope factors compared. Slope factors can vary three orders of magnitude (when doses are expressed as a proportion of the highest dose in a study), and excluding carcinogenic responses at highly toxic doses from the estimation procedure can result in markedly increased slope factors (when there are carcinogenic responses at the remaining doses).

Session: Poster Session

Title: PC Demonstrations for PC SAS, Systat, and Statgraphics

Authors: **Robert Faoro** and **Brian Morton,** Office of Air Quality
            Planning and Standards, **David Svendsgaard,** Health Effects
            Research Laboratory, RTP, and **Mark Tolton,** RTP
            Information Centers

PC SAS, Systat, and Statgraphics software will be available on PCs. Poster session
attendees will have the opportunity to test, compare, and ask questions regarding these PC-
based statistical software packages.

Session: Poster Session

Title: Power of Nonparametric Tests for Spatial Variables

Author: **Be-Ling Lee**, University of Wyoming (presented by **George Flatman**, Environmental Monitoring Systems Laboratory, LV)

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40 CFR Part 264, "Statistical Methods for Evaluating Ground-Water Monitoring from Hazardous Waste Facilities," emphasizes the responsibility of the owner/operator of a RCRA hazardous waste facility to know the beta, or probability of a false negative, in his statistical method. The rule also states the value of using non-parametric tests. This poster presentation extends the random variable Wilcoxan Test to a correlated field such as spatially correlated ground-water samples.

Session: Poster Session

Title: A Program for Testing Homogeneity of Some Repeated
          Measures

Author: **Clayton Stunkard**, Office of Standards and Regulations and
          University of Maryland

A FORTRAN program is presented to enable the researcher to analyze data from a variety of situations involving what is commonly known as the single-dimension repeated measures design. The test used is essentially the Pitman-Welch permutation test for the randomized blocks design. Special cases for which programs already exist are demonstrated and include the following: Friedman's Analysis of Variance of ranked data, and McNemar's and Cochran's tests for dichotomized data. Stuart's extension of McNemar's two dependent-samples test to multichotomous data, and Madansky's test of interchangeability are also performed. Madansky's test generalizes the Cochran "Q" test for marginal homogeneity of k correlated dichotomous variables to k correlated multichotomous variables. Measured or ranked data are input casewise, but categorical data may be input either casewise or in summary form for groups of cases with identical patterns for the k variable or occasions.

Session: Poster Session

Title: Statistical Analysis of Ground-Water Monitoring Data at RCRA
            Facilities

Authors: **James Brown**, Office of Solid Waste and **Jeff Mocker**,
            Midwest Research Institute

In 1982, EPA promulgated regulations for ground-water monitoring and response standards for permitted facilities in Subpart F of Part 264, for detecting releases of hazardous wastes into ground water from storage, treatment, and disposal facilities (47 FR 32274: July 26, 1982). The Subpart F regulations required the ground-water monitoring data to be examined by Cochran's Approximation to the Behrens Fischer Student's t-test (CABF) to determine whether there was a significant exceedance of background levels, or other allowable levels, of specified chemical parameters and hazardous waste constituents. Concerns were raised that this procedure could result in a high rate of "false positives" (Type I errors), thus requiring an owner or operator to advance into a more comprehensive and expensive phase of ground-water monitoring. More importantly, another concern was that the procedure could result in a high rate of "false negatives" (Type II errors), i.e., instances where actual contamination would go undetected.

As a result of these concerns, EPA replaced the CABF procedure with five different statistical procedures that are more appropriate for ground-water monitoring (53 FR 39720: October 11, 1988). These amendments also outline sampling procedures and performance standards that are designed to help minimize the occurrence of Type I and Type II errors. The five different statistical methods that may be used to evaluate ground-water monitoring data are:

    1) Parametric Analysis of Variance (ANOVA);
    2) Nonparametric ANOVA;
    3) Tolerance Intervals;
    4) Prediction Intervals; and
    5) Control Charts.

Additionally, an alternative statistical procedure may be used, provided that it meets the performance standards specified in the revised amendments (53 FR 39720: October 11, 1988).

In order to help regional and state personnel implement this regulation, EPA prepared a guidance document entitled, "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities." The guidance document provides a detailed analysis of the five statistical methods and describes situations and examples under which each method would be appropriately used. As a supplement to the guidance, software on some of these statistical procedures has been developed. This software provides the user with the capability of analyzing ground-water monitoring data with the parametric and nonparametric ANOVA, tolerance intervals, and confidence intervals. Additionally, when less than 50% of the data are not quantifiable, the system performs a test of proportions to help determine whether a release from a regulated unit has occurred.

Session: Poster Session

Title: STATOX: A PC-Based System for the Analysis of Tumor
              Incidence Data

Author: **Richard Levy**, Hazard Evaluation Division, OPP and **Brion
              T. Cook**, DYNAMAC Corporation

This poster provides a demonstration of a personal computer data-base and statistics system for use by the Toxicology Branch. The data management portion of the system provides an interactive, user-friendly environment for data entry, editing, and archival of individual animal data submitted by registrants. The statistical portion of the system provides state-of-the-art statistical routines for the analysis of animal survival and tumor incidence data.

Session: Poster Session

Title: Summertime and the Living is Easy: The Summer of '88,
              Ambient Ozone, and Public Health

Authors: **Brian Morton** and **Leland Deck**, Office of Air Quality
              Planning and Standards

Across the United States, millions suffered through the past summer. Not only were the streets hotter than a match head; air quality was noticeably poor. Ambient ozone concentrations were remarkably high--even historically pristine Acadia National Park in Maine violated the National Ambient Air Quality Standard for the first time.

Using a model developed by the Ambient Standards Branch in the Office of Air Quality Planning and Standards, we can estimate the effect of ambient or tropospheric ozone on public health. The model operates using monitored ozone concentrations and concentration-response functions for a variety of acute health endpoints (symptoms) induced by short-term exposure to ozone. By comparing the estimate of health effects for the Summer of 1988 to the estimate of health effects for a better summer, we estimate the number of excess symptoms attributable to the poorer air quality observed during the Summer of 1988.

Session: Poster Session

Title: Textile Drug Room Monitoring Study

Authors: **Margaret G. Conomos** and **Bradley D. Schultz,** Office
             and Toxic Substances

Dye weighers in textile dyeing and printing plants are involved in the weighing and transfer
of relatively small quantities of numerous powder dyes and other chemicals. This results in
a potential exposure to a diverse range of chemicals which exhibit a broad spectrum of
toxicological properties. To gain more detailed information about workplace exposure to
powder dyes, a study has been conducted to measure concentrations of dyes in the
workplace air and to characterize worker activities and industrial hygiene practices. This
study was unique in that both government (U.S. Environmental Protection Agency) and
industry (American Textile Manufacturers Institute and Ecological and Toxicological
Association of Dyestuffs Manufacturing Industry) collaborated on an impartial basis and
the dyehouses studied participated on a strictly voluntary basis.

The study included a survey of 24 randomly selected textile dyeing or printing sites which
used powder dyes. At each site, one worker was observed for an eight-hour shift; personal
monitoring and area sampling data were taken. Certified industrial hygienists recorded
worker activities, duration of potential exposure, personal engineering controls in use and
quantities and frequency of use of each dye that was handled during the monitoring period.
Bulk samples of each dye were taken. The particulates collected on the air monitoring
filters were analyzed for commercial dye content using a spectrophotometric method
developed for the study.

This study provides the most comprehensive review ever undertaken of textile worker
exposure to powder dyestuffs. This poster provides a summary of the results.

Session: Poster Session

Title: Using Computer-Based Training (CBT) to Meet SAS Training
             Needs

Authors: **Kelly Flynn**, EPA National Computer Center--Educational
             Services

"Getting Started with the SAS System" is a tutorial that helps users learn the SAS System for personal computers. It shows the essentials of running a simple job using the SAS Display Manager System. Students can select lessons from the tutorial menu or use the tutorial index to branch directly to topics of interest. The tutorial is appropriate for both beginning and experienced users.

Session: Poster Session

Title: The Use of Fractals for Spatial Simulation

Author: **Angelo Yfantis**, Environmental Monitoring Systems Laboratory, LV (presented by **George Flatman**, Environmental Monitoring Systems Laboratory, LV)

The Theory of Chaos with its affine transformations, such as fractals, has received a lot of publicity as computer generated art of environmental subjects. More than computer art, fractals can be conditioned by known data values at sample locations and a semivariogram to give a site specific kriging type simulation. This would be a statistically justifiable study tool for ground-water plume estimation. Fractals seem much more economical of computer time than alternative algorithms for spatial simulation.

Session: Technology Transfer

Title: Technology Transfer

Authors: **David Berg**, Director, Technology Innovation and Economic Committee, Office of Cooperative Environmental Management and **Ruth Allen**, National Acid Precipitation Assessment Program (formerly Project Director for the ORD Superfund outreach initiative on RI/FS)

Using the Superfund RI/FS (remedial investigation/feasibility study) processes as a case study, panelists will discuss the nature of technology transfer needs and opportunities within EPA today. Applications of statistical survey methods are mentioned, as are international technology transfer needs.

Session: OIRM/NCC and the Statistician

Title: OIRM/NCC and the Statistician

Author: **Robert Lewis**, Technical Manager of User Support, National
            Computer Center (NCC) and **John Staley**, Chief, User Support
            Service Division, NCC, UNISYS, Inc.

This session will provide statisticians with information on how and where to find assistance for their computing needs within the National Computer Center. Future directions for Agency computing will also be highlighted.

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