APPENDIX A

List of Meeting Attendees

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Voluntary Children's Chemical Evaluation Program (VCCEP)
Peer Consultation on Methyl Ethyl Ketone

February 19, 2004

List of Attendees

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Voluntary Children's Chemical Evaluation Program (VCCEP)
Peer Consultation on Methyl Ethyl Ketone

February 19, 2004

List of Attendees

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APPENDIX B

Meeting Materials

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Voluntary Children's Chemical Evaluation Program (VCCEP) Peer Consultations on Methyl Ethyl Ketone

Meeting Materials

February 19, 2004

Kingsgate Conference Center, Salon C
University of Cincinnati
Cincinnati, Ohio

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Agenda for Methyl Ethyl Ketone
University of Cincinnati, Kingsgate Conference Center, Salon C

Thursday, February 19, 2004

8:00 **Registration and Check In**

8:30 **Meeting Convenes**[1]
Welcome: Ms. Jacqueline Patterson, *TERA*
Introductions and Disclosures, Panel
Meeting Process: Dr. Michael Dourson, Chair

9:00 **Sponsor Introduction and Presentation on Hazard Assessment**
Introduction- Dr. Laura Keller, Product Stewardship/Regulatory Affairs Coordinator, ExxonMobil Chemical Company

Hazard Assessment- Dr. Ken Pavkov, Advanced Toxicology Associate, ExxonMobil Biomedical Sciences

Public Comments on Hazard Assessment

Panel Discussion

11:00 **Sponsor Presentation on Exposure Assessment**
Ms. Rose Zaleski, Manager- Exposure Sciences Programs, ExxonMobil Biomedical Sciences

Public Comments on Exposure Assessment

Panel Discussion

12:00 **Lunch**

1:00 **Panel Discussion on Exposure Assessment (continued)**

Sponsor Presentation on Risk Characterization and Data Needs
Dr. Laura Keller, Product Stewardship/Regulatory Affairs Coordinator, ExxonMobil Chemical Company

Public Comments on Risk Characterization and Data Needs

Panel Discussion on Risk Characterization and Data Needs

4:45 **Closing Remarks and Evaluation of Meeting**

5:00 **Adjourn**

[1] The Chair will call a 15-minute break each morning and afternoon.

Overview of the Peer Consultation Process

Introduction

This peer consultation meeting has been organized by Toxicology Excellence for Risk Assessment (*TERA)*. *TERA* is an independent non-profit organization with a mission to protect public health through the best use of toxicity and exposure information in the development of human health risk assessments. *TERA* has organized and conducted peer review and consultation meetings for private and public sponsors since 1996 (see http://www.tera.org/peer for information about the program and reports from meetings). As a part of this program, *TERA* is organizing peer consultation panel meetings for assessments developed under the Voluntary Children's Chemical Evaluation Program (VCCEP). This panel meeting will review the assessment on methyl ethyl ketone, which was submitted by the American Chemistry Council (ACC) Ketones Panel.

The VCCEP program is a voluntary pilot program and part of the Environmental Protection Agency's (EPA) Chemical Right-to-Know Initiative. The goal of EPA's VCCEP program is to enable the public to better understand the potential health risk to children associated with certain chemical exposures. EPA has asked companies which manufacture and/or import 23 chemicals (that have been found in human tissues and the environment in various monitoring programs) to volunteer to sponsor their evaluation in Tier 1 of a pilot of the VCCEP. Sponsorship requires the companies to collect or develop health effects and exposure information on their chemical(s) and then to integrate that information in a risk assessment and a "data needs" assessment. More information about the VCCEP is available in the December 26, 2000 Federal Register (65 FR 81700) (http://www.epa.gov/oppt/chemrtk/ts00274d.htm) and on EPA's VCCEP web site (http://www.epa.gov/chemrtk/vccep/index.htm).

The purpose of this meeting is to provide a science-based peer consultation on the data needs for methyl ethyl ketone. The assessment developed by the sponsor is being considered by a panel of scientific experts using a peer consultation process developed by *TERA*. These experts have experience in toxicity testing, exposure evaluation, risk assessment, and children's health. *TERA* has selected Peer Consultation Panel members after careful consideration of nominations from the public, and is responsible for convening and chairing panel meetings to discuss the sponsors' submissions. *TERA* will prepare a report for the meeting and make this available to the public at http://www.tera.org/peer/vccep/MEK/MEKwelcome.html. The peer consultation meeting is open to the public.

Background on the Voluntary Children's Chemical Evaluation Program (VCCEP)

The ACC Ketones Panel has volunteered to sponsor a Tier 1 assessment for methyl ethyl ketone, including hazard, exposure, risk characterization, and data needs assessments, utilizing available data. The key question of the program and the peer consultation is whether the potential hazards, exposures, and risks to children have been adequately characterized and if not, what additional data are necessary.

The program was set up to use a tiered testing approach, which is explained in the December 26, 2000 Federal Register notice. For toxicity data, specific types of studies have been put into three tiers. For exposure data, the depth of exposure information increases with each tier, with Tier 1 a screening level assessment and Tiers 2 and 3 more advanced assessments using exposure studies, monitoring data, and modeling. The Federal Register notes that the Tier 1 assessment should use all available data, and therefore some of the chemical assessment documents will include more than what is in the Tier 1 level.

The peer consultation is designed to be a forum for scientists and experts to exchange scientific views on the need for additional toxicity and exposure data and analysis. In selecting the panel, *TERA* has sought to involve stakeholders by considering their nominations for panel members, and has sought to have a range of perspectives on the panel. This is not a consensus based approach; rather the individual panel members will discuss their own views. In the meeting report, opinions of the individual panel members will be noted, along with areas of agreement and disagreement.

The VCCEP program is a voluntary program. The sponsor has volunteered to prepare the Tier 1 assessment. If data needs are identified through this process, the sponsor will choose whether or not to volunteer for Tier 2.

Methyl Ethyl Ketone Peer Consultation Panel

The VCCEP Peer Consultation Panel for methyl ethyl ketone consists of eleven members: eight of the nine VCCEP Core Panel Members for Year 2 and three additional *ad hoc* members specifically selected for this meeting. The Panel includes scientific experts in toxicity testing, risk assessment, exposure assessment, and children's health. Collectively, this panel has many publications and presentations on topics related to children's health risk.

A core group of panel members participates in all panel meetings to ensure consistency among the reviews. *TERA* received 50 nominations for core panel members in early 2002 from VCCEP stakeholders and other interested parties. After a thorough review of these nominees, as well as others independently identified, *TERA* selected a group of nine scientists in June 2002. The original core panelists were invited to return for Year 2 (2004). One core panel member choose not to return for the second year, therefore, the Year 2 core panel consists of the original eight panel members and one new member.

Additional *ad hoc* experts are invited by *TERA* to participate in panel meetings on a case-by-case basis to provide additional expertise relevant to a specific chemical or issue. Nominations were solicited from interested parties for *ad hoc* panelists for the methyl ethyl ketone panel, with the nomination period closing in December 2003. *TERA* independently selected three additional *ad hoc* scientists for the panel. *Ad hoc* panelists have the same status and responsibilities as the core group panelists.

Each panel member has disclosed information regarding potential conflicts of interest and biases related to the VCCEP program, the sponsor, and methyl ethyl ketone. *TERA* evaluated these

disclosures when selecting panel members. Short biographical sketches and disclosure statements for panel members are provided in this package.

Conduct of the Peer Consultation

TERA developed a "charge" document that identifies the scientific issues to be discussed by the panel. The panel received a copy of the submission, the charge, and key references approximately a month prior to the meeting, to ensure adequate time to carefully review the document and be prepared for the discussions.

The meeting will be organized to make the best use of the time available to hear the opinions of the experts on the charge questions and the data needs. The meeting will begin with panel introductions and discussion of conflict of interest and bias issues. The discussion will then address the four assessment sections of the sponsor's submission (hazard, exposure, risk characterization, and data needs). To start each discussion section, the authors of the assessment document will make a short presentation. These presentations will highlight the salient points and issues, and give the panel the opportunity to ask clarifying questions of the authors.

Public Observation and Comments

Members of the public are invited to attend the VCCEP peer consultation meetings and observe the Panel discussions. To ensure that adequate space is available, we ask people to register in advance for the meeting. The public was also given the opportunity to prepare brief technical comments on the assessment document and submit these in writing prior to the meeting. No public comments were received on methyl ethyl ketone. Observers will be permitted to make brief technical comments at the meeting as time permits. Panel members and sponsors may ask clarifying questions of those making comments.

Meeting Report

TERA will prepare a meeting report summarizing the sponsor presentations, the opinions and recommendations expressed by the panel, and any oral comments from the public. Written public comments will also be included. The meeting report will not be a transcript. The report will be reviewed by the panel for accuracy. Sponsors and observers presenting oral comments will be offered the opportunity to review the summaries of their presentations. The finalized report will then be made available to the public at http://www.tera.org/peer/vccep/MEK/MEKwelcome.html.

Panel Charge for Methyl Ethyl Ketone

Introduction

The primary objective of the Peer Consultation Panel is to discuss whether the potential hazards, exposures, and risks for children have been adequately characterized for each of the VCCEP chemicals, based on the information contained in assessment documents submitted by the chemical's sponsor and other pertinent information brought to the meeting by panel members, sponsors, and observers. If risk cannot be adequately characterized, then data needs should be identified. The panel's job is not to critique the assessment document *per se;* rather, the panelists use the document and its references as a source of information (along with personal knowledge, expertise, and observer comments) to answer the questions regarding data needs. The panel is not required to reach a consensus position on any issue or conclusion. Panelists who believe a chemical has not been adequately characterized will be asked to identify what additional information is needed and why it is necessary. All the panelists will be encouraged to discuss and debate each other's suggestions and comments, providing scientific rationales for their points of view. *TERA* will compile the panel discussions in a meeting report that will be sent to the sponsor and made available to the public.

To help the panel discuss the sponsor's submission and address whether a chemical has been adequately characterized, *TERA* has prepared this charge, which identifies a number of discussion topics. The topics are consistent with the directions for VCCEP submissions given in the December 26, 2000, Federal Register: http://www.epa.gov/oppt/chemrtk/ts00274d.htm. These topics will form the basis for the panel discussions.

Panelists should keep in mind the following directives from the Federal Register regarding any recommendations for additional testing: (1) If specific toxicity studies are indicated, they should be chosen from the next tier of studies within the overall framework and should allow flexibility, if possible, to pursue either additional toxicity testing and/or exposure evaluation, allowing sponsors to select the option which will most quickly, directly, and cost-effectively reduce uncertainty and allow the creation of a risk assessment; (2) EPA is committed to avoiding duplicative testing, and to reducing, refining, and replacing animal testing when valid alternatives exist; (3) if relevant alternative test methods become validated, EPA will consider their immediate implementation in the program; (4) EPA encourages sponsors to combine tests where possible to conserve resources and reduce the number of animals required for testing; and (5) the Tier 2 and Tier 3 testing will be limited to chemicals for which there is a clear need.

Please note that we anticipate revising these discussion topics based upon experience gained at the VCCEP peer consultation meetings.

Hazard Assessment

1. Discuss whether the information available on mode of action, toxicity studies, and ADME (absorption, distribution, metabolism, and elimination) is adequate to identify and assess potential hazards a) to prospective parents, b) *in utero*, and c) to the infant and child.

2. Discuss whether the quantitative hazard and dose-response information (e.g., RfD, RfC) is appropriately chosen or selected.

Exposure Assessment

3. Discuss whether the fate of this chemical is adequately understood.

4. Based on the information at hand, discuss whether the available data are adequate to characterize exposure to children and prospective parents, taking into consideration the conditions of exposure (sources, routes, frequency, duration, intensity, etc.).

5. Discuss whether all time periods relevant to childhood exposure [(a) parental exposure prior to conception, (b) prenatal development, (c) and postnatal development to the age of sexual maturation] have been adequately considered.

6. Discuss whether the estimates of exposure have been calculated appropriately and correctly.

Risk Characterization

7. Discuss whether the Risk Characterization appropriately integrates the exposure and hazard information for this chemical and adequately characterizes the risk a) to prospective parents, b) *in utero*, and c) to the infant and child.

Data Needs

8. Identify any additional hazard information that is needed and discuss why it is necessary. The focus should be on those studies listed in the next VCCEP tier.

9. Identify any additional exposure data and analyses that are needed and discuss why this information is necessary.

Conflict of Interest and Panel Biographical Sketches

An essential part of Peer Consultation Panel selection is the identification and disclosure of conflicts of interest and biases. Prior to selecting the core and *ad hoc* panelists, each panel member is asked to complete a questionnaire to determine whether their activities, financial holdings, or affiliations could pose a real or perceived conflict of interest or bias. (See http://www.tera.org/peer/COI.html for *TERA's* policy and questionnaire for the Peer Consultation Program related to VCCEP). Questionnaires are reviewed by *TERA* staff and discussed further with panel candidates as needed.

For the Peer Consultation Program related to VCCEP, a conflict of interest (COI) for a candidate would include:

- Working for an organization sponsoring the chemical to be reviewed at the panel meeting,
- Having direct personal financial investments in the sponsoring organization or in the chemical itself, or
- Authoring the sponsoring organization's assessment document submitted to the VCCEP panel.

Bias for a peer consultation panel candidate would be a predisposition towards the subject matter to be discussed at the panel meeting that could influence the candidate's viewpoint. Examples of potential bias would be situations in which a candidate:

- Has previously taken a public position on subjects to be discussed by the panel, or
- Is affiliated with an industry, governmental, public interest, or other group with a partiality regarding subjects to be discussed by the panel.

Most scientists with technical expertise in areas relevant to these peer consultation panels will have existing opinions about the subject matter. Therefore, they may be considered to have some degree of bias.

The purpose of these peer consultation panels is to gather expert scientific opinion from a range of experts, including those who may be affiliated with organizations or companies with an interest in the outcome. All panelists were selected by *TERA* based upon their expertise and qualifications. They are employed by many types of organizations. *TERA* strives to create a balance of expertise and affiliations for each peer consultation meeting; however, individual panel members represent their own expertise and views, not those of their employer, of any group who may have nominated them, or any group with whom they may be associated. This peer consultation panel is a distinguished group with many years experience in a wide range of disciplines.

Toxicology Excellence for Risk Assessment (*TERA*) is conducting this VCCEP peer consultation under its Peer Consultation Program. This program is principally funded by a Cooperative Agreement with the U.S. EPA, the purpose of which is to design, develop, and manage a Peer Consultation process that will serve as a public scientific forum. *TERA's* role in managing the

peer consultation is undertaken primarily at the request of and for the benefit of non-federal stakeholders, particularly the sponsors of VCCEP chemicals.

TERA has performed work for organizations associated with VCCEP, both in the past and at the present time. These include the U.S. EPA, the American Chemistry Council, and some companies that are sponsors of VCCEP chemicals. In the past, *TERA* has conducted assessments and analysis for a number of chemicals included in the VCCEP pilot program (i.e., acetone, decabromodiphenyl ether, methyl ethyl ketone, and toluene) and is currently doing work on trichloroethylene. This work has been done for a variety of public and private sponsors, but none of it is directly related to the VCCEP assessments.

A brief biographical sketch of each panel member is provided below, together with a disclosure statement describing any potential conflict of interest or bias issues. The disclosure statements do not address funding provided by organizations unrelated to VCCEP or these chemicals and sponsor. For the core panelists, the disclosure statements cover the chemicals and sponsors in the entire VCCEP pilot program. For the *ad hoc* panelists, the disclosures are specific to methyl ethyl ketone and the methyl ethyl ketone sponsor. Brief biographical sketches of the sponsors' presenters follow the panelist biographical sketches.

Dr. John Balbus

Dr. John Balbus is currently the Director of the Environmental Health Program for Environmental Defense, where he is working on projects related to antibiotic resistance, health impacts of urban sprawl and transportation policy, and chemical testing and right-to-know. Prior to his current position, he served as the founding Director of the Center for Risk Science and Public Health, as well as an Associate Professor at the George Washington University Medical Center. Dr. Balbus' research activities at the Center for Risk Science and Public Health included addressing susceptibility in risk assessment and risk management, children's susceptibility to waterborne contaminants, and health impacts of climate change. Dr. Balbus was a founding co-director of the Mid-Atlantic Center for Children's Health and the Environment, one of 11 Pediatric Environmental Health Specialty Units funded by the U.S. EPA and ATSDR.

Dr. Balbus received his M.D. from the University of Pennsylvania, an M.P.H. from the Johns Hopkins School of Hygiene and Public Health, and an A.B. in Biochemistry from Harvard University. He completed residencies in internal medicine at Pennsylvania Hospital and in occupational and environmental medicine at Johns Hopkins School of Hygiene and Public Health. Dr. Balbus has also held a variety of additional academic appointments that include: Assistant Professor of Medicine at George Washington University Medical Center, Clinical Fellow in Medicine at John Hopkins School of Medicine, Assistant Professor in Medicine at Uniformed Services University of the Health Sciences, and Clinical Instructor in Medicine at the University of Pennsylvania, School of Medicine.

Dr. Balbus is currently certified by the American Board of Internal Medicine, and the American Board of Preventive Medicine, specialty in Occupational Medicine.

In addition to Dr. Balbus' extensive professional and academic career, he has published numerous articles relating to a variety of topics in risk assessment, public health, and environmental health.

DISCLOSURE:

Dr. Balbus is a VCCEP Core Panel member. He is employed by Environmental Defense. Environmental Defense has taken public positions on chemicals included in the VCCEP pilot program and on the VCCEP program itself.

Dr. James V. Bruckner

Dr. James V. Bruckner is Professor of Pharmacology and Toxicology, Department of Pharmaceutical and Biomedical Sciences, College of Pharmacy, University of Georgia. His research focus is on the toxicology and toxicokinetics of solvents, and drug-solvent interactions at low exposure levels, and toxicokinetic bases for potential susceptibility of children to insecticides and other chemicals. The relevance of experimental designs to "real life" chemical exposures is of particular interest. Dr. Bruckner received his B.S. in Pharmacy and M.S. in Toxicology from the University of Texas; and his Ph.D. in Toxicology from the University of Michigan. He served as the Director of the University of Michigan's Interdisciplinary Graduate Program in Toxicology for 5 years.

He was recently a member of the U.S. EPA's FIFRA Scientific Advisory Panel for Evaluation of Exposure and Hazards to Children from Contact with Chromated Copper Arsenate-Treated Wood Structures; a peer reviewer of U.S. EPA's applications for Hazardous Substances Research Center Grants; a peer reviewer of research conducted by the U.S. EPA's Experimental Toxicology Division at the National Health and Environmental Effects Research Laboratory; a peer reviewer for the EPA state-of-the-science documents including "Incorporating Children's Toxicokinetic Principles into Human Health Risk Assessments; and member of an expert panel on "Assessing Risks of Environmental Agents to Children."

Dr. Bruckner has served on the editorial boards of the *Journal of Toxicology and Environmental Health, Chemosphere, Toxicology,* and *Toxicology and Applied Pharmacology*. He has published more than 200 journal articles, book chapters, and abstracts. He has served on National Academy of Sciences Committees including: (1) Subcommittee on Acute Exposure Guideline Levels; (2) Committee on Health and Safety Consequences of Child Labor; (3) Committee on Pesticides in the Diets of Infants and Children; (4) Subcommittee on Dibromochloropane; (5) Committee on Safe Drinking Water; and (6) Committee on the Use of Third Party Toxicity with Human Research Participants.

DISCLOSURE:

Dr. Bruckner has been selected as an *ad hoc* member for the VCCEP panel on methyl ethyl ketone. Although he has not been an employee, contractor, or consultant for the ACC Ketones Panel or any of its member companies, on past occasions (in 2001, 1998, and 1994) Dr. Bruckner served as a consultant to the Shell Oil Company regarding the chemicals trichloropropane and dibromochloropropane. Dr. Bruckner currently serves on numerous panels and peer review committees involved with the toxicology and toxicokinetics of solvents. He is a co-author of the chapter on solvents and vapors in the 2001 edition of Casarette and Doull's *Toxicology: The Basic Science of Poisons*.

Dr. George Daston

Dr. George Daston is a Research Fellow for the Procter & Gamble Company (P&G) where he has worked since 1985. He has worked the past 21 years in the field of developmental toxicology and risk assessment, particularly in the area of children's risk assessment. Dr. Daston is also an adjunct professor in the Department of Pediatrics and Developmental Biology Program at the University of Cincinnati and Children's Hospital Research Foundation, and lectures in courses on teratology, developmental biology, toxicology, and risk assessment.

Dr. Daston received his Ph.D. in Developmental Biology and Teratology and a B.S. in Biology from the University of Miami. Prior to joining the Procter & Gamble Company, Dr. Daston worked for the U.S. EPA's Health Effects Research Laboratory as a National Research Council Research Associate and as an assistant professor for the Department of Biological Sciences at the University of Wisconsin.

His research interests include teratogenic mechanisms, *in vitro* methodologies, and risk assessment. His most recent research includes toxicant-nutrient (especially zinc) and maternal-embryonal interactions in developmental toxicity, the role of pattern formation genes in abnormal development, genomic approaches to endocrine disrupter screening, and improvements in risk assessment methodology for non-cancer endpoints.

Dr. Daston's activities in professional societies include serving as Chair of the Reproductive and Developmental Effects Subcommittee of the American Industrial Health Council, Chair of the Developmental and Reproductive Toxicology Technical Committee of ILSI-Health Effects Sciences Institute; President of the Society of Toxicology's Reproductive and Developmental Toxicology Specialty Section, President of the Teratology Society, member of the National Academy of Sciences Board on Environmental Studies and Toxicology, and member of EPA's Endocrine Disrupter Screening and Testing Advisory Committee (EDSTAC).

Dr. Daston has recently served on the organizing committees for an ILSI/EPA/AIHC workshops on benchmark dose methodology and human variability in toxic response; an EPA workshop on endocrine-mediated toxicity; and as co-chair of an AIHC/EPA workshop on Leydig cell tumors, an ILSI/EPA workshop on interpreting reproductive toxicity endpoints, and a NIEHS workshop on the state of validation of the FETAX assay for teratogen screening.

Dr. Daston is an Associate Editor of *Toxicological Sciences*, Editor-in-Chief of *Birth Defects Research Part B: Developmental and Reproductive Toxicology*, on the Editorial Board of *Human and Ecological Risk Assessment* and *Reproductive Toxicology,* and an *ad hoc* reviewer for *Teratology*, *Journal of Nutrition* and other journals. He has published over 90 peer-reviewed articles, reviews and book chapters, and has edited three books.

DISCLOSURE:

Dr. Daston is a VCCEP Core Panel member. He is employed by the Procter & Gamble Company (P&G). P&G uses thousands of chemicals, which it purchases individually, or in mixtures. It is possible that some VCCEP pilot chemicals are included in these purchases. P&G purchases chemicals from numerous suppliers, including companies that are sponsors of the VCCEP pilot chemicals.

Dr. Michael L. Dourson

Dr. Michael Dourson directs Toxicology Excellence for Risk Assessment (*TERA*), a nonprofit corporation dedicated to the best use of toxicity data for estimating risk assessment values. *TERA*'s projects include the development of complex risk assessments, such as soluble nickel salts; research into improvements of risk methods, such as differential sensitivity of children and adults to chemical toxicity, organizing peer review and consultation meetings for risk assessment topics and documents; and education and outreach on risk assessment values through lectures and data bases, including the International Toxicity Estimates for Risk (*ITER*).

Before founding *TERA* in 1996, Dr. Dourson held leadership roles in the U.S. Environmental Protection Agency for fifteen years; as chair of EPA's Reference Dose (RfD) Work Group, charter member of the EPA's Risk Assessment Forum and chief of the group that helped create the Integrated Risk Information System (IRIS) in 1986. Dr. Dourson received his Ph.D. in Toxicology from the University of Cincinnati and a B.A. in biology from Wittenberg University. Dr. Dourson's research interests include investigating methods to extrapolate toxicity data garnered on experimental animals or healthy adults to the appropriate sensitive human population. Topic such as adversity of effect, and characterization of risk are also of interest.

Dr. Dourson has served on numerous expert panels, such as EPA's peer review panels for IRIS assessments and its Risk Assessment Forum, *TERA*'s International Toxicity Estimates for Risk (*ITER*) independent peer reviews and consultations, FDA's Science Board Subcommittee on Toxicology, the NSF's Health Advisory Board, and SOT's harmonization of cancer and non-cancer risk assessment. Dr. Dourson has also organized over 16 symposia for 9 different organizations on a variety of topics, including: effective risk communication; chromium; information resources for toxicology and environmental health; risk assessment of essential trace elements; risk characterization; EPA's IRIS; role of toxicology in tomorrow's risk assessment practice; techniques for quantifying uncertainty in risk assessment; statistical and dose response models in risk assessment; workshop on benchmark dose methodology; basics of risk assessment; improvements in quantitative noncancer risk assessment; and neurotoxicity risk assessment.

Dr. Dourson is a Diplomate of the American Board of Toxicology and served on its Board as President, Vice President, and Treasurer. He is currently Secretary for the Society for Risk Analysis. He has also served as president of the Dose-Response Specialty Group of the Society for Risk Analysis, of the Society of Toxicology's Specialty Section on Risk Assessment and of the Ohio Chapter of the Society for Risk Analysis. He is currently on the editorial board of three journals. Dr Dourson has published more than 70 papers on risk assessment methods, has co-authored over 100 government risk assessment documents, and has made over 90 invited presentations.

DISCLOSURE:

Dr. Dourson is a VCCEP Core Panel member. He is Director of the non-profit organization Toxicology Excellence for Risk Assessment (*TERA*). Previously, he was employed by the U.S. EPA. *TERA* has performed work for organizations associated with VCCEP. These include the U.S. EPA, the American Chemistry Council, and some companies that are sponsors of VCCEP chemicals. In the past, *TERA* has conducted assessments and analysis for a number of chemicals included in the VCCEP pilot program (i.e., acetone, decabromodiphenyl ether, methyl ethyl ketone, and toluene) and is currently doing work on trichloroethylene. This work has been done for a variety of public and private sponsors, but none of it is directly related to the VCCEP assessments.

Dr. Elaine Cohen Hubal

Dr. Elaine Cohen Hubal is currently the Acting Associate Director for Human Exposure Modeling in the Human Exposure and Atmospheric Sciences Division of the U.S. EPA's National Exposure Research Laboratory (NERL). In this position, she has worked to develop and direct NERL's human exposure modeling research program. This research program is designed to develop modeling tools and conduct modeling analyses to characterize and estimate human exposure to environmental pollutants and to reduce uncertainty in risk assessments for the general population and for highly-exposed subpopulations. A significant focus of the lab's human exposure research program is on understanding and characterizing children's residential exposures to environmental contaminants. She previously worked as a chemical engineer for the Research Triangle Institute, and Camp Dresser and McKee. She also served as a Predoctoral Fellow at the Chemical Industry Institute of Toxicology.

Dr. Hubal received her Ph.D. and M.S. in Chemical Engineering from North Carolina State University and a S.B. in Chemical Engineering from Massachusetts Institute of Technology.

Dr. Hubal has served on a variety workgroups, panels, and committees. She currently serves as a member of EPA's Risk Assessment Forum Cumulative Risk Assessment Technical Panel, the Study Design Working Group for the National Children's Study, ILSI Health and Environmental Sciences Institute Biomonitoring Workshop Steering Team, and the Occupational and Environmental Exposures of Skin to Chemicals (OEESC) 2005 Program Committee.

Dr. Hubal's current research interests focus on characterizing exposure-to-dose relationships and enhancing quantitative risk assessment through application of computational tools and a systems approach. Her general research interest is on reducing uncertainty in risk assessment with a specific focus on children's exposure. She has designed and conducted studies to evaluate dermal exposure assessment approaches and collect exposure factor data in support of the Food Quality Protection Act. She has developed and worked with a variety of computational models to describe the simultaneous mass transport and reaction of inhaled gases in the airway lining. Dr. Hubal has also worked on the development of a modeling platform to predict contaminant fate and transport of environmental pollutants to perform exposure assessments in support of the Hazardous Waste Identification Rule, and conducted research in the area of industrial pollution prevention by developing a framework to evaluate the environmental impact of pollution prevention activities that directly relates the energy requirements to process air, water, and solid waste emissions.

Dr. Hubal has published in the areas of children's exposure and human health risk modeling.

DISCLOSURE:

Dr. Hubal is a VCCEP Core Panel member. She is employed by the U.S. EPA, working at the National Exposure Research Laboratory. EPA has taken public positions on the VCCEP pilot chemicals and on the tests included in the VCCEP Tiers. Dr. Hubal is also a public member of the American Chemistry Council's Human Exposure Assessment Technical Implementation Panel.

Dr. Michael Jayjock

Dr. Michael Jayjock has currently joined The Lifeline Group as a Senior Analyst. He is responsible for the management of exposure and risk assessment projects. He was recently a Senior Research and Environmental Health and Safety Fellow and Manager for Risk Assessment at the Rohm and Haas Company; and he has been working with this company for 35 years. In his previous position, he was responsible for the determination of human health risk from exposure to Rohm and Haas products, reactants, and intermediates. Dr. Jayjock was a member of the National Research Council's Subcommittee on Flame Retardant Chemicals, and, in this capacity, he participated in the review of decabromodiphenyl oxide (aka, decabromodiphenyl ether).

Dr. Jayjock received both his Ph.D. in Environmental Engineering and his M.S. in Environmental Science and Occupational Health from Drexel University . He is also certified in the Comprehensive Practice of Industrial Hygiene by the American Board of Industrial Hygiene.

Dr. Jayjock's professional activities include membership in numerous scientific societies and participation on many professional review boards. He is a former member and current consultant to the U.S. EPA's Science Advisory Board, Integrated Human Exposure Committee; and is a member of and serves on several committees of the National Research Council - National Academy of Sciences. In addition, he is a Member of the Peer Review Panel for the science program at the National Exposure Assessment Laboratory of the EPA. He has authored or coauthored numerous publications and given invited presentations on risk assessment, occupational exposure, industrial hygiene, and modeling.

Dr. Jayjock also serves as a Guest Lecturer for universities and professional organizations. He is a Guest Lecturer at the University of Pennsylvania Medical School, Residency Program for Occupational Medicine; and he is also an Instructor for a Professional Development Course on risk assessment for the American Industrial Hygiene Conference and Exposition. Previously, he served as Course Director and Instructor for Risk Assessment and Intermediate Exposure Modeling at the University of North Carolina Education Research Center, Summer Institute.

DISCLOSURE:

Dr. Jayjock has been selected as an *ad hoc* member for the VCCEP panel on methyl ethyl ketone. He is a retired employee of the Rohm & Haas Company and has been active on several working groups of the American Chemistry Council (ACC), but not on the ACC Ketones Panel that is sponsoring methyl ethyl ketone. His current employer, LINEA, Inc., is working with sponsors of some of the chemicals to be reviewed in the VCCEP pilot program, but not the ACC Ketones Panel.

Dr. Sam Kacew

Dr. Sam Kacew is a professor in the Department of Cellular and Molecular Medicine, Faculty of Medicine, as well as a scientist of the Institute of Population Health at the University of Ottawa. His responsibilities include teaching medical students and graduate students the techniques required to write and publish peer-review papers. His current research involves the effects of chemical contaminants in breast milk on infants, the role of confounding factors in toxicity testing, as well as the basis for differences in responsiveness to chemicals between infants and adults.

Dr. Kacew received his Ph.D. in Pharmacology from the University of Ottawa. He served as a Postdoctoral Fellow for the Medical Research Council of Canada at the University of Montreal. Dr. Kacew was certified in 1994 as a Fellow of Academy of Toxicological Sciences. He has received numerous awards, including several achievement, recognition, public communications and travel awards from the Society of Toxicology (SOT), the United States-China Foundation, and the National Science Council of the Republic of China.

Dr. Kacew has served on dozens of expert panels and committees, including as a member of the National Advisory Committee on Environmental Contaminants and the Implications for Child Health, and as a member of the National Academy of Sciences of the USA , Committee on Toxicology. He has also served as a chairman for a variety of symposiums, panels, and committees including the SOT Annual Meeting's General Toxicology Session, the Federation of American Societies for Experimental Biology Annual Meeting, an Assessment Panel for the Canadian Council on Animal Care, a SOT Symposium on Use of Moderate Dietary Restriction in Safety Assessment, and a SOT Symposium on the Role of Diet and Obesity in Endocrine Disruption.

He has presented hundreds of invited lectures for a variety of federal and state government agencies, colleges and universities, private companies, and international organizations. He was an invited participant to the American Society for Pharmacology and Experimental Therapeutics Meeting, the Federation of American Societies for Experimental Biology Annual Meeting, the International Life Sciences Institute, the Chalk River Nuclear Labs, Turkey Society of Biochemistry and the Korea Society of Toxicology.

Dr. Kacew is on a number of grant committees and has served as an external referee for grants and fellowships for a wide variety of organizations and government agencies. He is currently the Editor-in-Chief the *Journal of Toxicology and Environmental Health*, an Associate Editor for *Toxicology and Applied Pharmacology*, an assistant editor for TOMES (Micromedex, Inc.), as well as a member of the editorial board of a number of other journals. Dr. Kacew has over 140 publications in peer-reviewed journals and books in the area of toxicology, risk assessment, and children's health. He has also served as an editor for a number of books on toxicology and children.

DISCLOSURE:

Dr. Kacew is a VCCEP Core Panel member. He is a Professor in the Department of Cellular & Molecular Medicine in the Faculty of Medicine at the University of Ottawa in Canada. Several years ago, in 1993 and 1995, he received honoraria from two VCCEP sponsors, Mobil Oil and Dow, for talks he delivered at their facilities. Based on discussions with Dr. Kacew, TERA does not believe the honoraria he received several years ago will impair his ability to objectively evaluate the MEK submission by the ACC Ketones Panel.

Dr. Chad Sandusky

Dr. Chad Sandusky is currently Director of Research and senior toxicology advisor to the Physicians Committee for Responsible Medicine (PCRM), a non-profit organization that promotes nonanimal experimental methods in medical and scientific research. For PCRM, Dr. Sandusky coordinates the review and preparation of comments on the EPA's High Production Volume Challenge Program (HPV) and Voluntary Children's Chemical Evaluation Program (VCCEP) chemical assessments. As such he stresses the weight-of-evidence approach in these assessments and also the development of exposure scenarios as key to the success of these programs. He is actively engaged in identifying methods which use alternatives to animal testing to meet the needs of the safety assessments, including tests undergoing validation at the European Center for Alternative Methods (ECVAM) and the Interagency Coordinating Committee on the Validation of Alternative Methods (ICCVAM).

Dr. Sandusky was the past Manager of Toxicology and Risk Assessment at ENVIRON and has extensive experience at both the EPA and ENVIRON in pesticide toxicology as well as exposure and risk assessments. For example, he evaluated the toxicology of pesticides and extrapolated these effects in risk assessments; directed the dietary exposure and risk assessments for agrichemicals and other potentially toxic residues in foods using the TAS Dietary exposure software; served as toxicology team leader and senior author of numerous EPA documents, including Registrations Standards and Position Documents; and since the passage of the FQPA in August 1996, coordinated the review and assessment of numerous agrichemicals to address the full range of new requirements, including: assessing aggregate exposure from multiple pathways (e.g., drinking water and residential use), cumulative exposure from multiple pathways from chemicals with a common mode of action, accounting for potential sensitivity to infants and children, and assessing the potential for endocrine disruption.

Dr. Sandusky has extensive international experience including the coordination and submission of dossiers for the EU Reauthorization process under EU 91/414 and presentation of the results to member states. Dr. Sandusky also represented the Institute of Food Technology at the Codex Committee for Pesticide Residues (CCPR) in The Hague for several years. In addition, he also coordinated preparation and reviews of dossiers for chemicals approved as GRAS through the GRAS – self-affirmation process as well as directed the preparation and submission of Food Contact Notifications (FCNs) to the FDA.

Dr. Sandusky received his Ph.D. in Pharmacology from the Emory University. He served as a Postdoctoral Fellow at the Georgetown University Schools of Medicine and Dentistry, Washington , D.C. He is currently a member of the Society of Toxicology, and was previously affiliated with such organizations as the International Society of Exposure Analysis and the Society of Environmental Toxicology and Chemistry.

DISCLOSURE:

Dr. Sandusky is a VCCEP Core Panel member. He currently is employed by the Physicians Committee for Responsible Medicine (PCRM). The PCRM actively promotes nonanimal experimental methods in toxicology studies. PCRM has taken public positions on the VCCEP pilot chemicals, the tiered test methods, and on the VCCEP program itself.

Dr. Jennifer Seed

Dr. Jennifer Seed is a Branch Chief with the Office of Pollution Prevention and Toxics, Risk Assessment Division, Existing Chemicals Assessment Branch of the U.S. EPA. She provides supervision and leadership to a staff of scientists with expertise in toxicology, epidemiology, biostatistics, and ecotoxicology. This branch is responsible for developing human health hazard and risk assessments, toxicology and ecotoxicology test guidelines in support of OECD harmonization efforts and alternatives to animal testing through ICCVAM activities. Dr. Seed serves on a number of EPA committees and workgroups in these areas.

Dr. Seed also worked as a biologist for the Health and Environmental Review Division, where she conducted human health hazard and risk assessments of environmental chemicals regulated under the TSCA. She developed and reviewed Agency risk assessment guidelines for reproductive toxicity and testing guidelines for assessing developmental neurotoxicity for OPPT and OPP, as well as developing and teaching courses on developmental neurotoxicity for U.S. EPA and other agencies. She helped develop OPPT's children's health strategy.

In addition to her work at EPA, Dr. Seed also served as a senior scientist for ILSI Risk Science Institute where she developed and managed teams of scientists from academia, industry, and government charged with resolving issues in toxicology and risk assessment. From 1996 to 1997 she worked as a private consultant on toxicology and risk assessment projects. Dr. Seed received her Ph.D. in Developmental and Cellular Biology and a B.A. in Anthropology (minor in Biology) from the University of Washington. She served as a Postdoctoral Fellow with the Department of Biochemistry, University of Washington.

Dr. Seed has served on a variety of committees, panels, and workgroups. She currently serves on the U.S. EPA's Risk Assessment Forum, as well as the RfD/RfC technical Panel that is responsible for reviewing the methods used by the agency in developing RfD/RfCs to ensure that children and other susceptible subpopulations are adequately protected and on the FQPA 10x workgroup that is developing the implementation policy of the FQPA 10x factor to ensure adequate protection of children's health. Dr. Seed served as a member of the U.S. EPA's Reference Dose Workgroup and co-chaired the Reproductive and Developmental Toxicity Harmonization Workgroup, as well as served as the Chair of the international OECD team to develop a guidance document for reproductive toxicity and as an OPPT representative for the ORD/OPPTS Toxics/Pesticides Research Coordination Team. She has also served on the ILSI steering committee for behavioral developmental toxicity project, scientific advisor for the ILSI Residue Technical Committee, co-chaired the ILSI working group on skeletal variations and children's health risk assessment, SOT steering committee for a workshop on harmonization of risk assessment for cancer and noncancer endpoints, OECD's working group for developmental neurotoxicity guidelines, and EPA's Technical Panel on Framework for Human Health Risk Assessment. Dr. Seed has published in the area of developmental and reproductive toxicity and human health risk assessment, and has contributed to a number of EPA test guidelines and other documents.

DISCLOSURE:

Dr. Seed is a VCCEP Core Panel member. She is employed by the U.S. EPA, working in the Risk Assessment Division of the Office of Pollution Prevention and Toxics. She is EPA Project Officer for the Cooperative Agreement between EPA and *TERA* for developing peer consultation. EPA has taken public positions on the selection criteria used for the VCCEP pilot chemicals and on the toxicology tests included in the VCCEP Tiers.

Dr. Kimberly Thompson

Dr. Kimberly M. Thompson is Associate Professor of Risk Analysis and Decision Science in the Departments of Health Policy and Management and Society, Human Development and Health at the Harvard School of Public Health. She is the Director of the Kid Risk Project that seeks to improve the lives of children by using analytical methods to characterize children's risks and strategies to reduce those risks. Dr. Thompson directs a professional education course on Probabilistic Risk Analysis: Assessment, Management, and Communication, and she seeks to effectively integrate technological, social, political, legal, and economic issues into risk analyses that inform public policy and improve decision making. Her research interests focus on the issues related to developing and applying quantitative methods for risk assessment and risk management, and consideration of the public policy implications associated with including uncertainty and variability in risk characterization.

Over the last decade, for both private and public clients Dr. Thompson has consulted on computer applications, projects concerning environmental quality, fate and transport of toxic chemicals in the environment, analysis of remedial alternatives at landfills and abandoned sites, efforts to characterize uncertainty and variability in risks, and development of white papers for the EPA on topics related to children's risks. Dr. Thompson's most recent consulting includes work with the MIT Lincoln Laboratory as part of an integration team studying the development of a national health surveillance and biodefense system, and her recent book Overkill focuses on microbiological risks in what she calls this "Age of Risk Management."

Dr. Thompson received a Sc.D. in Environmental Health from Harvard University's School of Public Health. She received a M.S. and B.S. in Chemical Engineering from the Massachusetts Institute of Technology. Dr. Thompson has served on several National Academy of Sciences committees and subcommittees and a number of other expert review panels. She has been an invited presenter at a variety of workshops, conferences, and annual meetings, such as the Boston Mayor's Symposium on Youth Development, the Congressional Research Services Children's Environmental Risks: Federal Activities in Perspective Symposium on Risk Assessment and Risk Communication, and a NIH/NIEHS Workshop on the Role of Human Exposure Assessment in the Prevention of Environmental Disease. She also served as the chair of the Exposure Assessment Specialty Group and is currently a Councilor of the Society for Risk Analysis.

Dr. Thompson has written over 30 peer-reviewed journal publications in the areas of human health modeling, probabilistic risk assessment, children's health and risk communication. She has also reviewed manuscripts for over a dozen journals, including the Journal of Toxicology and Environmental Health, Risk Analysis, Health Policy, and the Journal of the American Medical Association.

DISCLOSURE:

Dr. Thompson is a VCCEP Core Panel member. She is Associate Professor of Risk Analysis and Decision Science and Director of the Kids Risk Project at Harvard University in the School of Public Health. She received funding from EPA in 2000 to chair a workshop and prepare a publication discussing changes in children's exposure as a function of age. Dr. Thompson's research program benefits from unrestricted grants made to Harvard University by the American Chemistry Council and Synthetic Organic Chemicals Manufacturers Association. Both of these organizations are sponsors of VCCEP chemicals. ExxonMobil donated its Christmas 2003 advertising space to the Kids Risk Project and ran the piece that Dr. Thompson wrote, titled "Children Are Our Present."

Dr. Susan Youngren

Dr. Susan Youngren is a Senior Managing Scientist with the legal firm of Bergeson & Campbell, PC, having recently moved there from a similar position with Exponent, Inc. (formerly Novigen Sciences, Inc.). Her previous assignments include positions at EA Engineering, Science, and Technology, Inc, and the ILSI Risk Science Institute. Dr. Youngren is responsible for assessing a variety of scientific issues for the clients of Bergeson & Campbell, PC for both regulatory actions as well as product stewardship. This work ranges from assessments for registration and re-registration of pesticides to labeling issues for consumer products in the area of company responsibilities to their customers.

Dr. Youngren received her Ph.D. in Environmental Biology and Public Policy from George Mason University , her M.S. in Environmental Sciences and Engineering from the Virginia Polytechnic Institute and State University , and her B.S. in Microbiology and Public Health from Michigan State University .

Dr. Youngren has over 15 years experience in risk assessment, with particular emphasis on exposure assessment. She has conducted many types of risk assessments, such as residential, dietary, microbial, occupational, and hazardous waste sites. She has assessed dermal, oral, and inhalation exposures for paints, indoor and outdoor foggers, and for products used on carpets, turf, and home gardens. Her work has included development of project-specific algorithms, data analysis, determination of the applicability of surrogate data, development of distributional data, and complex distributional analysis.

Dr. Youngren is a Councilor and member of the International Society of Exposure Analysis. She also belongs to the Society of Risk Analysis, the Society for Occupational and Environmental Health, and the American Association of University Women. She has numerous publications in the areas of risk assessment and exposure, such as a risk assessment for children playing on lawns treated with pesticide. She also has made many presentations on topics such as children's exposure to pet products, choosing distributional forms for use in Monte Carlo exposure assessments, and advancing exposure assessment in the residential environment.

DISCLOSURE:

Dr. Youngren has been selected to serve as an *ad hoc* panel member for methyl ethyl ketone. She is employed as a senior scientist by the law firm of Bergeson & Campbell. She previously worked for Novigen Sciences, Inc. As a part of her responsibilities for her present and previous employers, she has been in contact with scientists at companies who are members of the American Chemistry Council Ketones Panel on issues unrelated to methyl ethyl ketone or to VCCEP. While Dr. Youngren was with Novigen, her employer did work for the American Chemistry Council regarding appropriate databases to be used for selecting the chemicals for VCCEP. This work did not include recommending selections of any specific chemicals.

Sponsor Presenter Biographical Sketches

Dr. Laura H. Keller

Product Stewardship/Regulatory Affairs Coordinator
ExxonMobil Chemical Company

Dr. Keller received her Ph.D. in Toxicology from Texas A&M University in 1992, and started working at Exxon Biomedical Sciences in New Jersey. In 1998, she transferred to (then) Exxon Chemical Company in Houston to serve as the environmental coordinator for the Oxo and Oxy Solvents businesses. Dr. Keller is currently the Staff Product Stewardship and Regulatory Affairs Coordinator (Americas) for those businesses for ExxonMobil Chemical Company. She is also the primary technical contact for ExxonMobil on scientific issues regarding children's health, biomonitoring, and endocrine disruption. She is the Chair of the American Chemistry Council's (ACC) Phthalate Esters Panel, and also is a member of the ACC Ketones Panel, Isopropanol Panel, and Public Health Team. As a member of the ACC Public Health Team, Dr. Keller was involved in the original formation and structure of the VCCEP pilot program.

Dr. Kenneth L. Pavkov

Advanced Toxicology Associate
ExxonMobil Biomedical Services

Dr. Pavkov is an Advanced Toxicology Associate with ExxonMobil Biomedical Sciences, Inc. (EMBSI) where he has worked since joining Exxon in 1994. As a Program Manager, in the Toxicology and Environmental Sciences division, he is jointly responsible for ExxonMobil Chemical Company's Intermediates Fluids toxicology research programs and is directly responsible for the EMBSI toxicology project management of the Oxy-fluid product lines (methyl ethyl ketone, sec-butanol, etc.).

Dr. Pavkov received his Ph.D. in Anatomy from The Ohio State University. He is experienced in contract research and industrial toxicology. He represents ExxonMobil with an active role in the ACC Ketones Panel Toxicology Research Task Group (TRTG) and serves the ACC Isopropyl Alcohol (IPA) Panel TRTG as Chairperson.

Dr. Pavkov began his career with the Battelle Columbus Laboratories conducting toxicology studies for the pharmaceutical industry, the National Cancer Institute Preclinical Toxicology program, and performing carcinogenicity studies for the National Toxicology Program.

Ms. Rosemary T. Zaleski

Exposure Sciences Program
ExxonMobil Biomedical Services

Ms. Zaleski is an exposure scientist with 14 years experience in environmental fate and effects and exposure assessment. She earned a M.S. in Environmental Sciences from Rutgers and a B.A. in Biochemistry from Cook College. She started working at Exxon Biomedical Sciences, Inc. (now ExxonMobil Biomedical Sciences, Inc. - EMBSI) in 1989. She currently manages EMBSI's Exposure Sciences programs, and is actively involved in children's exposure assessment and improving exposure factors databases. Ms. Zaleski was an expert panelist at the ACC/EPA VCCEP workshop in December

2001 and an invited speaker on children's exposure assessment at the ACC VCCEP Sponsor Workshop in April 2002. Ms. Zaleski is on the Steering Committee of ExpoFacts, a project to develop an exposure factors database for European populations. She is a member of the Alliance for Chemical Awareness (ACA) technical committee, where she co-led development of an ecological exposure framework and contributed to the development of human exposure frameworks.

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APPENDIX C

Observer Policy and Comments

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VCEEP Peer Consultation Policy and Procedures for Observers

TERA conducts VCCEP peer consultations under the *TERA* Peer Consultation and Review Program. The Voluntary Children's Chemical Evaluation Program (VCCEP) peer consultation meetings are open to the public to observe the proceedings. To ensure adequate space is available, we ask that all Observers register in advance for the meeting. Registration information for specific meetings can be found at http://www.tera.org/peer/vccep.

In the VCCEP pilot program, industry Sponsors are preparing assessments of the available toxicity and exposure information on a list of 20 chemicals, to determine whether the toxicity and exposure data are sufficient to adequately characterize the risk of the chemical to children or prospective parents. A group of scientific experts (Peer Consultation Panel) with experience in toxicity testing, exposure evaluation, and risk assessment will evaluate each assessment. The public is invited to attend the meetings and observe the Panel discussions.

Written Comments

Written technical comments from the public received prior to the meeting will be shared with the Panel and Sponsors. Instructions for submitting comments are found with each meeting's registration information. These comments should be brief (no more than five pages) and should address scientific and technical matters as outlined in the Panel Charge. The purpose of Observer comments is for stakeholders and others to share scientific data and analyses with the Panel and Sponsors. Written comments should be sent to *TERA* two weeks prior to the meeting so that the Panel members and authors have the opportunity to review and consider the comments prior to the meeting. *TERA* will make copies available to other Observers at the meeting.

Oral Comments

In addition to written comments, there will be some time set aside at the peer consultation meeting for observers to make brief technical comments to the panel (2-3 minutes). Those wishing to present technical comments at the meeting should register with *TERA* in advance and provide a written copy of the comments as outlined above. Depending on the time available during the meeting, the Chair may allow additional oral technical comments. Comments should be limited to technical issues and *TERA* reserves the right to limit the time devoted to Observer comments. Since the purpose of the observer comments is to share scientific data and analyses, panel members and Sponsors will be provided the opportunity to ask clarifying questions of those Observers making comments. Note – these peer consultations are not public hearings. The meeting's main purpose is to gain the insights and opinions of the expert panel and as a result, only a limited amount of time can be available for Observers to address the panel. Those wishing to make comments are strongly encouraged to provide clear and concise written comments for the panel to consider.

Meeting Report

TERA will prepare a meeting report, which will summarize the range of opinions and recommendations expressed by the panel. Sponsor presentations and Observer comments will also be summarized. The Sponsors and Observers will be offered the opportunity to review text on their presentations to make sure the text is accurate. A draft of the complete report will be sent to panel members for comments and concurrence prior to finalization.

No public comments were received for this meeting.

APPENDIX D

Sponsor Presentation Slides and Supplemental Exposure Table

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MEK VCCEP

HAZARD CHARACTERIZATION

Presented by:

Kenneth L. Pavkov, Ph.D.

Peer Consultation Panel for the U.S. EPA
Voluntary Children's Chemical Evaluation
Program

1

MEK Hazard Overview

- Most VCCEP studies have been completed
- Hazard data were sufficient to develop an EPA IRIS RfC and RfD in 2003
- Studies show MEK has low acute and repeated-dose toxicity
- Supported by studies of sec-butanol (sBA), which is extensively metabolized to MEK

2

MEK Hazard Overview

- Extensive regulatory assessment and peer-review of MEK data
  - EPA IRIS Assessment (2003)
  - EPA CAA Review (2003)
  - EPA EPCRA Review (1998)
  - OECD SIDS Dossier & SIAR (MEK, 1997; sBA, 2002)
  - *Patty's Toxicology* (2001)
  - World Health Organization IPCS EHC Document (1992)
  - ATSDR Toxicology Profile (1992)

3

Tier 1

- Reliable studies on MEK meet the VCCEP Tier 1 requirements
- Multiple studies show MEK acute toxicity is low
- Multiple studies show MEK is not genotoxic (*In Vitro* - Gene Mutation, Yeast Mitotic Gene Conversion and Chromosome Aberration Assays; *In Vivo* - Bone Marrow Erythrocyte Micronucleus Cytogenetic Assay)

4

Tier 1

- Tier 1 Repeated-dose Toxicity & Reproductive Toxicity (1-Generation) study is superseded by multiple reliable Tier 2 studies (discussed below)

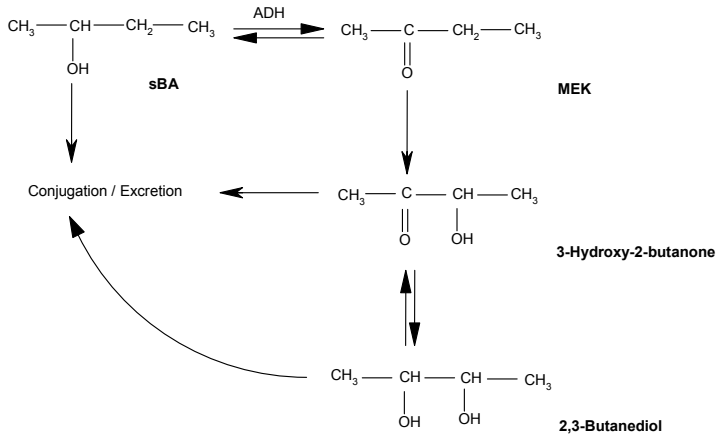
5

Tier 2

- Metabolism
  - Well studied - (Dietz *et al*., 1981; DiVincenzo *et al*., 1976)
  - Rapid absorption; ready distribution equally in aqueous / fatty compartments
  - MEK $t_{1/2\text{-serum}}$ = 270 min
  - Metabolites are:
    - 2-butanol (sBA)
    - 3-hydroxy-2-butanone (3H-2B)
    - 2,3-hydroxy-butanedione (2,3-BD)
  - sBA is rapidly and extensively metabolized to MEK (~96%)

6

Tier 2



7

Tier 2

- 90-Day repeated-dose study in rats - (Cavender et al., 1983)
  - Inhalation exposure 6 hr/day, 5 days/week
  - Slight but significant increased liver weight & decreased body weight at 5000 ppm (14700 mg/m^3)
  - No adverse effects on clinical health or growth up to 5000 ppm
  - Extensive histopathologic examination of tissues

8

Tier 2

- 90-Day repeated-dose study in rats (continued)
  - Study researchers identify 5000 ppm as NOAEL
  - MEK SIAR concludes 5000 ppm is NOAEL
  - IRIS Toxicology Review acknowledges absence of any clearly adverse effects at 5000 ppm; does not specify a LOAEL/NOAEL

9

Tier 2

- 6-Month repeated-dose neurotoxicity study in rats - (Egan *et al*., 1980)
  - Inhalation exposure 22 hr/day, 7days/week at 500 ppm (1470 mg/m^3) MEK
  - Extensive neuropathologic examination of regions of maximum vulnerability based on known hydrocarbon neuropathy
  - MEK failed to produce CNS or PNS changes

10

Tier 2

- 2-Generation Reproductive Toxicity - (Cox et al., 1975)
  - sBA dosed orally *ad lib* via water bottle (~24 hr/day) for 8 weeks premating and during gestation
    - F0 Generation: 0, 0.3, 1.0, or 3.0 %
    - F1 Generation: 0, 0.3, 1.0, or 2.0 %
    - Maternal NOAEL: 1771 mg/kg/day (1.0%)
    - Pup NOAEL: 1771 mg/kg/day (1.0%)
  - Key study to develop IRIS RfD of 0.6 mg/kg/day

11

Tier 2

- Developmental toxicity
  - Sprague-Dawley Rats - (Schwetz *et al*., 1974)
    - 0, 1000 or 3000 ppm **MEK**, 7 hr/day, GD 6-15
    - Maternal NOAEL: 3000 ppm (8820 mg/m^3)
    - Pup NOAEL: 1000 ppm (2940 mg/m^3)
  - Sprague-Dawley Rats - (Deacon et al., 1981)
    - 0, 400, 1000 or 3000 ppm **MEK**, 7 hr/day, GD 6-15
    - Maternal NOAEL: 3000 ppm (8820 mg/m^3)
    - Pup NOAEL: 3000 ppm (8820 mg/m^3)

12

Tier 2

- Developmental toxicity (continued)
  - Swiss Mice - (Schwetz *et al*., 1991)*
    - 0, 400, 1000 or 3000 ppm **MEK**, 7 hr/day, GD 6-15
    - Maternal NOEL: 1000 ppm (2940 mg/m^3)
    - Pup NOEL : 1000 ppm (2940 mg/m^3)
  - Sprague-Dawley Rats - (Nelson *et al*., 1989)
    - 0, 3500, 5000 or 7000 ppm **sBA**, 7 hr/day, GD 1-20
    - Maternal NOAEL: 3500 ppm
    - Pup NOAEL: > 7000 ppm

*Study used to derive IRIS RfC of 5.0 mg/m^3.

13

Tier 2

- Immunotoxicity
  - MEK showed no indication of immune suppression or enhancement in repeated dose studies - (Cavender *et al*., 1983 and Cox *et al*., 1975)
  - MEK is not a contact allergen or sensitizer - (Descotes 1988 and Cannelongo *et al*., 1978)
  - Acetone (methyl methyl ketone) had no effect on the anti-SRBC response in CD-1 mice - Woolhiser *et al., 2003*

14

Tier 3

- Chronic Toxicity / Carcinogenicity
  - IRIS toxicology review of MEK concludes: "SAR (structure activity relationship) analysis suggests MEK is unlikely to be carcinogenic based on the absence of any structural alerts indicative of carcinogenic potential (Woo *et al*., 2002)."
  - SIAR concludes, "MEK is not genotoxic and is not likely to be carcinogenic."

15

Tier 3

- Neurotoxicity screening battery
  - IRIS toxicology review of MEK concludes: "Animal studies provide no convincing evidence that exposure to MEK alone causes persistent neurotoxic effects." - (IRIS 2003)
  - Supported by extensive histopathology in studies by Egan & Cavender
  - MEK was excluded from the EPA neurotoxicity test rule

16

Tier 3

- Developmental neurotoxicity (DNT)
  - Totality of scientific evidence for MEK is not suggestive of a DNT hazard
    - Tissue examination of fetuses in multiple developmental studies (3 MEK and 2 sBA) and evaluation of the pups in the 2-G sBA reproduction study showed no indication of a primary effect on the nervous system. - (Schwetz *et al*., 1974; Deacon *et al*., 1981; Schwetz *et al*., 1991; Nelson et al., 1989; Cox *et al*., 1975)
    - Extensive neuropathology of rodents in the 3 & 6 month studies showed no clinical/behavioral symptoms or histopathologic lesions attributed to MEK. - (Eagan *et al*., 1980; Cavender *et al*.,1983)

17

Conclusion

- Reliable studies on MEK (methyl ethyl ketone; 2-butanone), sBA (sec-butanol), and acetone (methyl methyl ketone) support a robust data set for VCCEP
- Data set demonstrates low acute and repeated-dose toxicity
- Data were used in 2003 to establish the EPA IRIS RfC (5.0 mg/m^3) and RfD (0.6 mg/kg/day)

18

MEK VCCEP

EXPOSURE ASSESSMENT

Presented by:

Rosemary Zaleski, M.S.

Peer Consultation Panel for the U.S. EPA Voluntary Children's Chemical Evaluation Program

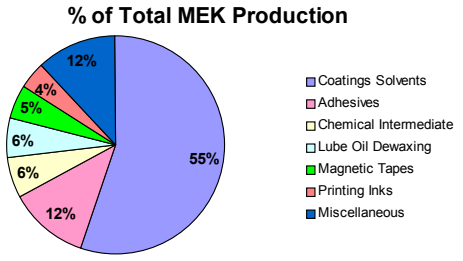
Scope of the Exposure Assessment

- Assessment focused on relevant sources using child-specific approach
  - Sources considered by child's micro-environment and exposure route, including parental transfer to child and child presence during parental use
  - Natural and anthropogenic sources considered
- Chain of commerce exposures evaluated quantitatively
- Extreme product abuse/ intentional misuse not addressed

2

Production, Use and Release of MEK

- US 1999 production was 573 million pounds



Primarily industrial, but in some consumer products especially adhesives and coatings (e.g. paints)

- US 2001 Industrial emission was 29 million pounds, primarily to air (>99%)
- Also a combustion product

3

MEK Occurrence in Nature

- Human metabolite
- Produced by bacteria, algae, plants, insects
- Volcanic emissions and combustion
- Natural occurrence in food
  - detected in items within all food groups, maximum values reported in cheese and yogurt

4

Food

- Natural occurrence, age-specific child intake rates (mg/kg/day):

Age	One-Day Dose	Avg. Annual Daily Dose
<1	0.0009 - 0.36	0.0004 - 0.14
1-2	0.0008 - 0.61	0.0005 - 0.28
3-5	0.0007 - 0.39	0.0004 - 0.23
6-11	0.0005 - 0.24	0.0003 - 0.16
12-19	0.0003 - 0.14	0.0002 - 0.1

- Exposure via flavoring use <1% of natural

5

Potential Infant Exposure via Maternal Milk

- Background (based upon NHANES blood levels): 0.0007 - 0.0024 mg/kg/day
- Occupationally exposed mother:
  - 0.63 mg/kg/day, bounding estimate: continuous maternal exposure to 200 ppm in air, infants fed at work at intervals which start 6 minutes after each work exposure ends
  - 0.16 mg/kg/day upper estimate: above adjusted based upon highest reported 8-hour TWA

6

Indirect Exposures via Environment

- Air- monitoring data:

Environment	Air Conc. (mg/m^3)
Ambient	Typical: ND, Annual Max: 0.002
	Short-term: 0.00003 - 0.04
Indoor (residence)	0.002 - 0.04
Indoor (school)	Not reported or not detected, expected to be $\leq$ residential
New Home	Geomean: 0.026, Max: 0.124
New Car	Max. (unresolved peak): 0.5

7

Indirect Exposures via Environment

- Facility air emissions: Estimated maximum airborne concentrations beyond facility boundaries based upon EPA-approved air dispersion modeling techniques are all well below RfC of 5.0 mg/m^3 ; EPA concluded actual exposures are likely well below maximum modeled values
- Water and soil minor pathways based upon physical-chemical properties, monitoring data

8

Consumer Products

- Compared databases to identify presence and concentration in consumer products:
  - Sack et al. (1992) GC/MS survey of consumer products
  - EPA Source Ranking Database (Sack + other data)
  - California Air Resources Board Database
- Updated above with more current information:
  - Material Safety Data Sheets, store visits
- Integrated above, identified products believed to have the greatest potential for children's exposure based upon:
  - use amount, weight fraction, product form, child use or presence during use

9

Consumer Product Scenarios

- Carburetor cleaner (aerosol)
- Spray paint
- Wood stain/ varnish (aerosol)
- Paint thinner (liquid)
  - **addition to wood varnish**
  - **brush cleaner**
  - **clean-up**
- Adhesives (liquid)
  - **hobby use**
  - **adult use in a home application**
- Hobby model paints (liquid)

10

Excerpts from Product Labeling

- Products contained clear warning labels on front, with use instructions stressing adequate ventilation:
  - Hobby Paint:
    - Front: WARNING: Flammable liquid and vapor. Vapor harmful.
    - Use instructions include: To avoid breathing vapors or spray mist, open windows and doors or use other means to ensure fresh air entry during application and drying.
  - Hobby glue:
    - Front: DANGER: Flammable. Vapor Harmful.
    - Use instructions include: Use under well-ventilated conditions

11

Excerpts from Product Labeling (cont'd.)

- Paint thinner/cleaner/remover:
  - Front: Danger! Flammable, Vapor harmful.
  - Use instructions include:
    - Whenever possible, use outdoors in an open air area. Do not use in areas where vapors can accumulate and concentrate such as basements, bathrooms or small enclosed areas. USE ONLY WITH ADEQUATE VENTILATION TO PREVENT BUILDUP OF VAPORS. Open all windows and doors. Use only with a cross ventilation of moving fresh air across the work area.

12

Consumer Product Methods

- EPA model (E-FAST) for most scenarios, PROMISE for evaporation from open can and probabilistic analyses
- Day of Use exposures:
  - maximum use amount and weight fraction
  - median use amount and weight fraction
- Chronic exposures assumed 90th percentile for frequency of use/year for every year, all use indoors, and median exposure/use (as per E-FAST approach)

13

Consumer Product Assumptions

- Use information obtained from manufacturers or professional judgment based upon Westat survey
- For carburetor cleaner, spray paint, spray wood stain/varnish and paint thinner:
  - indoor - windows open (but no active ventilation)
  - passive exposures elsewhere in house
- For adhesive use and hobby model paint
  - windows closed
  - passive exposures both in room and elsewhere in house

14

Consumer Product Results

- Acute exposure estimates across scenarios:
  - 4 hr TWA ranged from 0.03 - 92 mg/m^3
  - Task-time weighted averages ranged from 1 - 328 mg/m^3
  - Highest exposures were for inhalation during aerosol use
- Highest active exposures were for teen users, highest passive exposures were for infants

15

Consumer Product Results

- Exposure Ranges (mg/kg/day):

	Active teen	Passive- <1 age group
Day of Use, Max.	0.0005-1.62	0.02-1.59
Day of Use, Median	0.002-1.00	0.002-0.98
Chronic Est.	0.00007-0.016	0.00006-0.016

- Aggregating chronic exposures for all scenarios results in a total chronic exposure of 0.035 mg/kg/day for the active teen and 0.027 mg/kg/day for the passive infant

16

Exposure Assessment Summary

Acute exposure:

- Consumer product use results in 4-hr TWA < 100 mg/m^3, task-TWA < 350 mg/m^3

Chronic exposure:

- On a daily chronic basis, natural presence in food likely the greatest source
- Indirect exposures via environment are minor chronic sources
- Nursing mothers with high occupational exposures may result in infant exposures; upper bound estimates are of similar magnitude to the upper estimates of exposures via natural presence in food
- Chronic exposures from repeated indoor use of multiple consumer products are low

17

MEK VCCEP

RISK CHARACTERIZATION
and
DATA NEEDS ASSESSMENT

Presented by:
Laura Keller, Ph.D.

Peer Consultation Panel for the U.S. EPA
Voluntary Children's Chemical Evaluation
Program

Risk Characterization Overview

- Evaluated exposures using health protective but not extreme assumptions.
- Hazard assessment is consistent with previous EPA assessments (IRIS, EPCRA, CAA); also OECD SIDS, WHO, ATSDR.
- Chronic exposures compared to IRIS RfC and RfD.
- Acute exposures compared to threshold of 200 ppm for sensory irritation.
  - Additional comparisons are presented here in response to reviewers' comments

2

Potential for Unique Susceptibility of Children

- RfC and RfD represent safe doses for general population lifetime exposures, including susceptible subgroups such as children.
- Concerning acute exposures, EPA has stated “there is no reason to consider children as a sensitive subgroup for such a highly subjective, non-adverse effect as mild irritancy.” (May 30, 2003)

3

Chronic Hazard Evaluation

- Background exposures (ambient air, indoor air, water, soil): all very low compared to IRIS RfC of 5.0 mg/m^3 and RfD of 0.6 mg/kg/day.
- Facility Releases: EPA has determined facility releases may not reasonably be anticipated to result in adverse health effects (based on extensive analysis).

4

Chronic Hazard Evaluation

Exposure to children via occupationally-exposed mothers

- Upper bound estimate of 0.63 mg/kg/day is essentially equivalent to RfD.
- Assumes exposure at 200 ppm (TLV) 8 hrs/day, 5 days/week for 40 weeks; mother nurses while at work.
- Actual exposures are expected to be well below upper bound estimates, and hence well below RfD.

5

Chronic Hazard Evaluation

Consumer products

- Exposures estimated for product use scenarios believed to represent highest potential for exposure.
- Assumed 90th percentile use frequency, median quantity used, all use is indoors, MEK present in all products used.
- Margins of safety (RfD/exposure) for individual products for all age groups range from 37.5 to 30,000.
- Any MOS > 1 is indicative of no likely health risk.

6

Potential Aggregate Exposures

Deemed a low concern because:

- MEK is eliminated from the body very quickly.
- Background exposures (air and water) are very low.
- Exposures from consumer products in most cases are <1% of RfD.
- Most products containing MEK are not intended for use by children.
- Most products containing MEK are used only on an intermittent basis.
- MEK is typically present in only a fraction of available brands for a given type of product.
- Chronic exposure estimates assume MEK is present in 100% of the brands for each product.

7

Potential Aggregate Exposures

Assuming 16-19 year old (group with highest active exposure estimates) used all of the following products indoors during one year, and MEK was present in all product brands used, this would result in total chronic exposure of 0.035 mg/kg/day:

- Carburetor cleaner, 6X/year
- Spray paint, 6X
- Aerosol woodstain/varnish, 6X
- MEK added to liquid varnish, 12X
- MEK used to clean paint brushes, 12X
- Paint thinner used to clean hands, 12X
- Adhesives during hobby use, 52X
- Adhesives during adult use, 15X
- Hobby paint use, 52X

- MOS for aggregate exposure = 17

8

Potential Aggregate Exposures, cont.

- The infant age group (<1 year) had the highest passive exposure estimates.
- Assuming infant is present in the house during the indoor uses listed on the previous slide, and MEK is present in each product brand used, would result in a total chronic exposure of 0.027 mg/kg/day.
- MOS = 22

9

Acute Exposures

- Compared to 4-hour threshold of 590 mg/m^3 (200 ppm) for sensory irritation (Dick et al. 1992; Muttray et al. 2002) (recently selected as AEGL-1 value for up to 8 hours to protect against sensory irritation).
- All 4-hour TWAs for maximum and median use scenarios are below 100 mg/m^3.
- For use scenarios that last less than 4-hours, estimated exposure concentrations during product use (task time-weighted averages) are all below 590 mg/m^3.
- MEK's strong odor and explicit product warnings help reduce likelihood of exposure above 590 mg/m^3.

10

Acute Exposures, cont.

Alternate acute exposure benchmarks:

- For 24 hour exposure period, remove 10-fold uncertainty factor for database insufficiency from RfC of 5 mg/m^3:
  - Adjusted RfC = 50 mg/m^3
  - All 24 hr TWAs < 17 mg/m^3
- For shorter TWA, remove database insufficiency 10-fold uncertainty factor and 7 hr/24 hr time adjustment:
  - Adjusted RfC = 50 mg/m^3 X (24/7) = 171 mg/m^3
  - All 4 hr TWAs < 100 mg/m^3

11

Risk Characterization Summary

- Quantitative risk characterization indicates children's exposure to MEK from ambient background and consumer product sources pose negligible health risks.
- Potential for aggregate chronic exposures at levels of concern is considered low.
- Short term air concentrations are not expected to cause adverse effects.

12

Uncertainty & Variability

- Uncertainty in hazard evaluation
  - Addressed in RfD/RfC derivation via uncertainty factors.
  - Threshold for sensory irritation (200 ppm) is based on two published human studies, accepted at recent AEGL meeting.
- Uncertainty in exposure assessments
  - Assumptions and overall approach were intended to be conservative (i.e. health protective) but not extreme.
  - MEK VCCEP sponsors believe margins of safety are more likely to be understated than overstated.

13

Data Needs Assessment -- Hazard

- Most VCCEP studies for MEK have been conducted, and indicate low chronic and acute toxicity.
- Two-generation reproduction study is provided by sBA study (used to derive IRIS oral RfD).
- Data deemed adequate to allow for development of an RfD and RfC.
- Further testing for immunotoxicity, carcinogenicity, and developmental neurotoxicity is considered scientifically unnecessary.

14

Data Needs Assessment -- Exposure

- Additional exposure assessment work is certainly possible.
- Sources and exposure pathways that have not been assessed are believed to be relatively minor, unlikely to contribute significantly to children's exposures.
- Additional exposure assessment work for MEK is not considered necessary for VCCEP assessment.

15

Data Needs Assessment -- Risk Assessment

- Hazard data indicate relatively low toxicity for MEK.
- Exposure analyses indicate that exposures are low relative to IRIS RfC and RfD.
- On this basis, sponsors conclude no further studies, exposure measurements or risk analysis are warranted for purposes of VCCEP.

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MEK VCCEP EXPOSURE ASSESSMENT SUPPLEMENTAL TABLE:

Estimated MEK Air Concentrations for the Exposure Event, Active Use Scenarios							
		4 hr TWA	24 hr TWA	Estimates for Total Time in Room of Use (Use + After)		Estimates for Time of Active Use	
				Duration	Est. TWA	Duration	Est. TWA
Scenario	Model	mg/m^3	mg/m^3	hr	mg/m^3	hr	mg/m^3
Carburetor Cleaner	E-FAST	3.9	0.7	1.00	16	0.37	43
Spray Paint	E-FAST	56	9.3	1.00	224	1.00	224
Wood Stain	E-FAST	92	15.3	2.00	184	1.92	192
Paint Thinner	E-FAST	1.9	0.3	3.00	3	2.75	3
Brush Cleaning	PROMISE	13.7	2.3	0.17	328	0.17	328
Adhesives - Hobby	E-FAST	0.43	0.1	1.00	2	0.50	3
Adhesives - Adult	E-FAST	3.2	0.5	2.00	6	1.40	9
Hobby Model Paint	E-FAST	0.4	0.1	2.00	1	2.00	1

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APPENDIX E

Panelist Handout of MEK Evaporation Discussion and Spreadsheet

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Use of Mass Transfer Algorithms in Modeling Vaporization

During the panel discussion on the MEK Exposure Assessment, a panel member (Dr. Michael Jayjock) alerted the panel and sponsors to an issue with the evaporation rate of MEK used in some calculations in the exposure assessment. He explained that the calculation establishing the vaporization rate, which was presented in Appendix G-6 of the submission, uses a mass transfer coefficient no longer used by EPA (Jayjock, 1992; Jayjock, 1994). Use of this coefficient is overly simplistic in that it predicts the evaporation of a solvent solely as a function of its molecular weight. It is more appropriate to use an algorithm utilizing both temperature and molecular weight to estimate a diffusion coefficient and combine this information with pool length along the airflow path and airflow velocity to estimate the vaporization rate (U.S.EPA, 1991).

The panelist cited a spreadsheet (provided below) that contains the coded algorithms (U.S.EPA, 1991) with calculations for MEK vaporization. Assuming 10 ft/min lateral airflow, this model predicts a higher evaporate rate (0.00030 g/sec/cm^2) than the evaporation rate of 0.00018 g/sec/cm^2 predicted in the submission's Appendix G-6. Higher airflows often found indoors would predict vaporization rates ranging from 0.00042 (at 20 ft per min) to 0.00066 at a linear airflow rate of 50 ft per minute. Use of a more appropriate evaporation rate would result in up to two-fold higher inhalation exposures, but lower dermal exposures.

References

Jayjock, M.A. 1992. Toolbox of Mathematical Models for Occupational Exposure Assessment, Professional Development Course, American Industrial Hygiene Conference and Exposition

Jayjock, M.A. 1994. Back Pressure Modeling of Indoor Air Concentration From Volatilizing Sources. Am. Ind. Hyg. Assoc. J. 55 (3): 230-235

U.S. Environmental Protection Agency (U.S. EPA). 1991. Preparations of Engineering Assessments, Vol. 1: CEB Engineering Manual, IT Environmental Programs, Inc., 11499 Chester Road, Cincinnati, Ohio, Contract No. 68-D8-0112, Work assignment No. P3-7, PN 3786-64, U.S. EPA, OTS, Washington DC, February 28, 1991.

********** **LET THE USER BEWARE** **********

This is a program that we have developed and found useful for statistical analysis. It is offered without guarantee or claim as to its accuracy. The code has not been extensively validated. It is suggested that you use this initially on data sets in which you have worked out the solutions by hand or by other independent means. If you find errors in the code please let us know.

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ZERO VENTILATION MODEL

COMPOUND NAME	COMPOUND NUMBER	WEIGHT PERCENTAGE	MOLECULAR WEIGHT	MOLES	MOLE FRACTION	BOIL PT DEG (C)	ATM. PRESSURE (TORR)	ENTROPY
MEK	1	100.00	72.100	1.387	1	79.60	760.00	4.90
	2				0		760.00	
	3				0		760.00	
	4				0		760.00	
	5				0		760.00	
	6				0		760.00	
	7				0		760.00	
	8				0		760.00	
	9				0		760.00	
	TOTALS	100.00		1.387	1.00			

AMBIENT TEMP(C)	VP OVER PURE (TORR)	VP OVER SOLN (TORR)	PPM OVER SOLN	MG/M3 VAP OVER SOLN	V. DOSE UG/KG PER DAY	A. DOSE UG/KG PER DAY	TOTAL DOSE UG/KG/DAY	DERMAL EQ.DOSE (GRAMS)
25	91	91	119459	352269	50339210	1429	50340639	3524
25.00		0	0		0		0	
25.00	759.9762144	0	0	0	0	0	0	#DIV/0!
25.00	759.9762144	0	0	0	0	0	0	#DIV/0!
25.00	759.9762144	0	0	0	0	0	0	#DIV/0!
25.00	759.9762144	0	0	0	0	0	0	#DIV/0!
25.00	759.9762144	0	0	0	0	0	0	#DIV/0!
25.00	759.9762144	0	0	0	0	0	0	#DIV/0!
25.00	759.9762144	0	0	0	0	0	0	#DIV/0!
	TOTALS	91	119459	352269				

EVAPORATION MODEL FOR OPEN SURFACES
(FROM 1991 EPA ENGINEERING MANUAL)
NOTE: EQUATIONS 4-22, 4-23, AND 4-24 LISTED IN THE COLUMN HEADINGS BELOW ARE PROVIDED IN PAGES FOLLOWING THE SPREADSHEETS

COMPOUND NUMBER	COMPOUND NAME	MOLECULAR WEIGHT	VP OVER SOLUTION (TORR)	VP OVER SOLUTION (In. Hg)	SURFACE AREA (SQUARE (CM)	SURFACE AREA (SQUARE FEET)	AIR VELOCITY (FT/MIN)	TEMPERATURE OF LIQUID (DEG K)
1	___	72.10	90.77	3.57	1	0.001076392	10.00	298.00
2	_	_	0.00	0.00	1	0.001076392	10.00	298.00
3		0.00	0.00	0.00	1	0.001076392	10.00	298.00
4		0.00	0.00	0.00	1	0.001076392	10.00	298.00
5		0.00	0.00	0.00	1	0.001076392	10.00	298.00
6		0.00	0.00	0.00	1	0.001076392	10.00	298.00
7		0.00	0.00	0.00	1	0.001076392	10.00	298.00
8		0.00	0.00	0.00	1	0.001076392	10.00	298.00
9		0.00	0.00	0.00	1	0.001076392	10.00	298.00

COMPOUND NUMBER	POOL LENGTH (FEET)	ATM PRESSURE (ATM)	[**EQ. 4-23**] DIFFUSION COEFF. (CM2/SEC)	DIFFUSION COEFF. (FT2/SEC)	[**EQ. 4-22**] GENERATION RATE (LB/HOUR)	[**EQ. 4-24**] GENERATION RATE (LB/HR)	[**EQ. 4-24**] GENERATION RATE (GM/SEC)
1.00000	0.03280	1.00000	0.11011	0.00012	0.00237	0.00235	0.00030
2	0.0328	1	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
3	0.0328	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
4	0.0328	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	0.0328	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
6	0.0328	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
7	0.0328	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	0.0328	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
9	0.0328	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

EVAPORATION MODEL FOR OPEN SURFACES
(CONT.)
(FROM 1991 EPA ENGINEERING MANUAL)

COMPOUND NUMBER	ROOM VOL CUBIC FEET	MIXING AIR CHANGES PER HR.	VENTING RATE CFM	MIXING FACTOR (0.1-1.0)	EQUILIBRIUM CONC. (PPM)	EQUILIBRIUM CONC. (MG/M3)	TLV (PPM)	PERCENT OF TLV
1	1000	1.00	16.67	1	12.52254455	36.92742176	200	6.261
2	1000	1.00	16.67	1				#DIV/0!
3	1000	1.00	16.67	1	#DIV/0!	#DIV/0!		#DIV/0!
4	1000	1.00	16.67	1	#DIV/0!	#DIV/0!		#DIV/0!
5	1000	1.00	16.67	1	#DIV/0!	#DIV/0!		#DIV/0!
6	1000	1.00	16.67	1	#DIV/0!	#DIV/0!		#DIV/0!
7	1000	1.00	16.67	1	#DIV/0!	#DIV/0!		#DIV/0!
8	1000	1.00	16.67	1	#DIV/0!	#DIV/0!		#DIV/0!
9	1000	1.00	16.67	1	#DIV/0!	#DIV/0!		#DIV/0!

$$G = \frac{13.3792\, M\, P^{\bullet}\, A}{T} \left(\frac{D_{ab} V_z}{\Delta Z} \right)^{0.5}$$ Equation 4-22

where:
- G = Generation rate, lb/hr
- M = Molecular weight, lb/lb mole
- $P^{\cdot}$ = Vapor Pressure, in Hg
- A = Area, ft^2
- D_{ab} = Diffusion coefficient, ft^2/sec of a through b (in this case b is air)
- V_z = Air velocity, ft/min
- T = Temperature, ºK
- ΔZ = Pool length along flow direction, ft

Gas diffusivities of volatile compounds in air are available for several existing chemicals. However, the diffusion coefficient often will not be known. An equation to estimate diffusion coefficient is expressed as:

$$D_{ab} = \frac{4.09\, x\, 10^{-5} (T)^{1.9} \left(\frac{1}{29} + \frac{1}{M} \right)^{0.5} (M)^{-0.33}}{P_t}$$ Equation 4-23

where:
- D_{ab} = Diffusion coefficient, cm^2/sec
- T = Temperature
- M = Molecular weight, lb/lb mole
- P_t = Pressure, atm

Substituting into evap:

$$G = \frac{2.79\, x\, 10^{-3}\, M^{0.835}\, P^{\bullet} \left(\frac{1}{29} + \frac{1}{M} \right)^{0.25} (V_z)^{0.5}\, A}{T^{0.05} \Delta z^{0.5} P_t^{0.5}}$$ Equation 4-24

where:
- G = Generation rate, lb/hr
- M = Molecular weight, lb/lb mole

$\dot{P}$ = Vapor Pressure, in. Hg
V_z = Air velocity, ft/min
A = Area, ft^2
T = Temperature, ºK
ΔZ = Pool length along flow direction, ft
Pt = Overall pressure, atm