INTRODUCTION

Purpose

The EMF Engineering Review Symposium was convened with two purposes in mind: to assess the state of knowledge of electric- and magnetic-field (EMF) engineering issues, and to provide engineering input to the RAPID risk assessment process. (Other symposia have covered contributions from the biological research undertaken under the RAPID Program.)

Symposium Summary[1]

Goals

Approximately 70 engineers and scientists gathered to assess the current state of knowledge and to provide discussion of issues and key questions. The goals were to achieve lively discussion directed toward reaching consensus on (1) issues that can be resolved, and (2) issues that cannot.

Subjects

The following subjects were central to discussions:

Engineering results and how they can contribute to the risk assessment process;

Environmental electric and magnetic fields (with an emphasis on the latter);

Fields in the frequency range 3 hertz (Hz) to 3000 Hz, with an emphasis on power frequencies (transients were not explicitly addressed, but came up during discussion);

Engineering considerations and results in the following areas:

- field parameters
- personal exposure (PE) characterization
- instrumentation/measurements
- EMF exposure modeling
- exposure systems
- surrogates for EMF exposures
- quality assurance
- occupational/non-residential exposures
- field calculations
- general public exposures
- source characterization
- field management
- environment characterization
- policy issues.

In the interests of efficient focus and time management, participants did not focus on related topics that were beyond the scope of the symposium. These topics included the following:

- biological or health effects,

[1] The discussion of purpose, goals, and subjects originally appeared as part of Synopsis #1, prepared and presented by Paul Gailey of Oak Ridge National Laboratory.

- biological mechanisms (except as they pertain to exposure metrics),
- epidemiological outcomes,
- high-frequency fields, or
- the definition of safe field levels.

Process

Synopses of 14 EMF engineering **topics** (including key questions and a list of references) were prepared before the conference and made available on a Web site to all participants in the symposium. Registration packets also contained copies of each synopsis for review.

The meetings were divided into four **technical sessions**. Each session was moderated by an engineer or scientist in the field. An **introduction/technical perspective** opened the sessions, followed by **presentations** on three to four of the 14 **topics**, followed by **topic discussions** via standing microphones where participants could offer comments or pose questions.[2] Each technical session concluded with a **general discussion**, with all presenters available as a panel.

A list of technical sessions, topics, preparers (of synopses) and presenters is found below.

Topic #	Title	Preparer	Presenter
1	The RAPID Engineering Program	Paul Gailey/ *Oak Ridge National Laboratories*	Paul Gailey
2	Field Parameters	William Bailey/ *Bailey Research Associates, Inc.*	William Bailey
3	Instrumentation	Gary B. Johnson/*Power Engineering Research*	Gary B. Johnson
4	Exposure Systems	Martin Misakian/ *National Institute of Standards and Technology*	Martin Misakian
5	Quality Assurance	Fred Dietrich/ *Electric Research and Management, Inc.*	Fred Dietrich
6A	Field Computation Models: Calculations of ELF Electric and Magnetic Fields in Air	Robert G. Olsen/ *EPRI*	Robert G. Olsen
6B	Field Computation Models: Computations in Biological Systems	William Bailey	Robert G. Olsen
7	Source and Environment Characterization	Robert M. Patterson/ *Temple University*	William Feero/*Electric Research and Management, Inc.*

[2] The Organizing Committee chose not to schedule "break-out" sessions, so that all participants might comment on/discuss all topics.

Topic #	Title	Preparer	Presenter
8	Personal Exposure Characteristics	Richard Rankin and T. Dan Bracken/*Applied Research Services, Inc. and T. Dan Bracken, Inc.*	Dana Loomis/*University of North Carolina*
9	Modeling EMF Personal Exposures	T. Dan Bracken	William Kaune/*EM Factors*
10	Surrogates for Magnetic-field Exposure	Robert M. Patterson	Rob Kavet/*EPRI*
11	Occupational and Non-residential Exposures	Robert M. Patterson	T. Dan Bracken
12	General Public Exposures	T. Dan Bracken	Luciano Zaffanella/*Enertech Consultants*
13	Field-management Technology	Gary B. Johnson	Frank Young/*EPRI*
14	Policy Issues	William Bailey	Raymond Neutra/*California Dept. of Health Services*

The proceedings were documented by a court reporter.

Participants were encouraged to submit any additional comments, questions, or corrections to the symposium organizers, so that this final report might comprehensively represent the state of EMF engineering knowledge.

Symposium Advisory Panel

The technical program for the symposium was developed and organized by T. Dan Bracken, of T. Dan Bracken, Inc., with the assistance of a Symposium Advisory Panel.

Imre Gyuk	Department of Energy
Paul Gailey	Oak Ridge National Laboratories
Fred Dietrich	Electric Research and Management, Inc.
Dan Driscoll	New York State Department of Health
Katsuo Isaka	University of Tokushima, Japan
Robert Kavet	EPRI
Alan Preece	University of Bristol, U.K.
Luciano Zaffanella	Enertech Consultants

The Advisory Panel also reviewed the Final Report.

Acknowledgements

Invaluable documentation, commentary, and assistance on-site were additionally provided by Gary B. Johnson, William Bailey, Richard Rankin, and Robert Patterson. William Wisecup, of W/L Associates, provided on-site arrangements and support. Judith Montgomery, of Judith H. Montgomery/Communications, prepared and edited materials for the symposium, as well as for

this report. Sharon Bouray, of T. Dan Bracken, Inc., provided invaluable help in preparing and formatting the report and the symposium materials.

Organization of the Report

As noted earlier, the EMF Engineering Review Symposium was convened to assess the state of knowledge of EMF engineering issues, and to provide engineering input to the RAPID risk assessment process. The goals were to achieve lively discussion directed toward reaching consensus on issues that can be resolved, and issues that cannot.

This report presents each of the 14 Topics, in the order set for the symposium. Each topic section includes: the synopsis prepared for the meetings, and (as appropriate) modified to respond to comments; a summary of the presentation made at the symposium itself; and a summary of the discussion that followed. Comments made during the General Discussions have been placed under the appropriate topics. Material from technical perspectives presented by Drs. Imre Gyuk and Paul Gailey is found under Topic #1.

A 15th section presents a summary analysis of Recurring Themes: those points or subjects that were repeatedly invoked or discussed by participants.

Finally, there are three appendices.

- Appendix A contains the agenda and a list of attendees.
- Appendix B presents a brief history, and more detailed evaluation of the RAPID Engineering Program. It also includes individual abstracts of each RAPID Engineering Project, followed by the executive summaries from each project, enhanced with additional information and with tables and figures to provide a more detailed look at each of the projects. The RAPID Engineering Project Reports will be published later in 1998 by National Technical Information Service.
- Appendix C provides written comments by Topic, submitted during or after the Symposium.