

Pesticide Formulations and Application Systems

Fourteenth Volume

**Franklin R. Hall, Paul D. Berger,
and Herbert M. Collins, editors**

ASTM STP 1234

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***Pesticide Formulations and
Application Systems:
Fourteenth Volume***

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Peer Review Policy

Each paper published in this volume was evaluated by three peer reviewers. The authors addressed all of the reviewers' comments to the satisfaction of both the technical editor(s) and the ASTM Committee on Publications.

To make technical information available as quickly as possible, the peer-reviewed papers in this publication were printed "camera-ready" as submitted by the authors.

The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution to time and effort on behalf of ASTM.

Foreword

This publication, *Pesticide Formulations and Application Systems: Fourteenth Volume*, contains papers presented at the symposium of the same name held in Fort Worth, Texas, on 12-13 Oct. 1993. The symposium was sponsored by ASTM Committee E35 on Pesticides and its Subcommittee E35.22 on Pesticide Formulations and Application Systems. Franklin R. Hall, Ohio State University, Paul D. Berger, Witco Corporation, and Herbert M. Collins, Stepan Company, presided as symposium chairmen and are editors of this publication.

Overview

The 14th Symposium on Pesticide Formulations and Application Systems was held in Dallas, Texas on 12 and 13 Oct. 1993, with presentations on the delivery and formulation of pest control agents for use in agriculture and the urban environment. The first section of the meeting encompassed Pesticide Atomization and Off-Target Effects with papers focused on drift and evaporation of pesticide sprays. Following a dynamic presentation by W. Griffiths (NOR-AM Corporation) on "U.S. Agriculture Under New Management: Meaning to The Agrochemical Industry," the second section dealt with the aspects of pesticide application technology, including spray cloud characteristics, electrostatics, and a practical tank mixing evaluation procedure. The third section encompassed advances in formulation technology with papers on polymers, surfactants, and water dispersible granules. A fourth section dealt with biological effects of formulation changes such as stability effects, adhesion, pH effects, and controlled release technologies.

For the first time in the history of the ASTM sponsored Symposia, in addition to the traditional oral presentations, there was a successful poster section (ca. 15), some of which are presented in this publication. Included was a history of the ASTM E35 Committee, studies on chemigation, airblast research in tree crops, and surfactant studies on herbicides.

The invitational presentations consisted of issues on the studies of inert ingredients, Pesticide Container Regulations, recycling, and updates on SDTF and ECPA (the European industry coalition). The final trust of the meeting consisted of new formulation developments highlighting efforts on immunoassays, aqueous foams, and the USDA Forest Service Spread Factor Database.

Once again, with a record attendance of ca. 300, the Symposia provided an open forum in which industry, academia, and government met together to present research papers and exchange information and ideas which contribute to an improved use of Crop Protection Agents (CPAs). As usual, the program covered a wide variety of topics and clearly represented the complex, interdisciplinary nature of pesticide application technology and the interaction with formulation and biological effects. The array of papers presented herein include ca. one half of the 52 presentations made at the 1993 meeting. The continued enthusiasm for this forum was indicated by the record attendance and the pressing issues of the need to "deliver the CPAs more efficiently!" Faced with changes in pesticide policy, a "reduced" philosophy, and a growing public concern about pesticides in the environment, as well as food safety, the participants in this Symposium Series have significant opportunities for pooling scarce resources and tackling the difficult problems posed by these ongoing events.

Dr. Franklin R. Hall

LPCAT,

The Ohio State University,

Wooster, OH 44691: symposium
chairman

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Historical Review Paper

James L. Hazen,¹ B. Jack Butler,² and Susan P. Canning³

ASTM COMMITTEE E-35 ON PESTICIDES - TWENTY YEARS OLD!

REFERENCE: Hazen, J.L., Butler, B.J., and Canning, S.P.,
"ASTM Committee E-35 on PESTICIDES - Twenty Years Old!"
Pesticide Formulations and Application Systems: 14th Volume, ASTM STP 1234, Franklin R. Hall, Paul D. Berger, and Herbert M. Collins, Eds.,
American Society for Testing and Materials, Philadelphia, 1995.

ABSTRACT: ASTM Committee E-35 was organized in 1973 in response to the need for a recognized forum for addressing pesticide and associated environmental issues. The founding membership represented, industry, EPA, USDA, USDI, trade association, and university interests. Twenty years later, the organization is vital and continuing to function as a major forum for pesticide - related issues. The Committee membership has 73 established and 11 new Standard Definitions, Test Methods, Practices, and Guides which cover a diverse range of pesticide-related subjects.

KEYWORDS: ASTM Committee E-35, pesticides, standards, test methods, environment, formulations, application systems.

The following information was presented as a poster during the 14th Symposium on Pesticide Formulation and Applications Systems, held at Dallas / Fort Worth, Texas, October 1993. In the interest of maintaining the assembled historical information, we have translated our poster into this manuscript format with a minimum of added text. We believe that the usefulness of this historical information is not diminished by this treatment. The information presented is accurate to the best of our judgment and remains as originally presented.

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Surfactants and Specialties, CN 7500, Cranbury, NJ 08512-7500 USA

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Engineering, University of Illinois, Urbana, IL 61801 USA

³ Staff Manager, Committee E-35, ASTM, 1916 Race Street,
Philadelphia, PA 19103-1187 USA

4 PESTICIDE FORMULATIONS AND APPLICATION SYSTEMS

E-35 MAIN COMMITTEE SCOPE:

To develop Standard Definitions, Test Methods, Practices and Guides for pesticide formulation and application systems. These activities will be coordinated with relevant committees in ASTM and with other professional and government organizations.

CURRENT E35 MAIN COMMITTEE OFFICERS:

CHAIRMAN - Alexander M. Perritt, Perritt Laboratories, Inc.,
P.O. Box 147, Hightstown, NJ 08520

FIRST VICE-CHAIRMAN - James L. Hazen, Rhone-Poulenc Inc.,
CN 7500, Cranbury, NJ 08512-7500

SECOND VICE-CHAIRMAN - James H. Benedict,
5583 Jessup Road, Cincinnati, OH 45247

RECORDING SECRETARY - Wolfgang Brenner, E.I. DuPont de Nemours,
E402/2129 Experimental Station, Wilmington, DE
19880-0402

MEMBERSHIP SECRETARY - Joseph Macko, Jr., HQ Army Materiel Command,
AMCRDE, 5001 Eisenhower Ave., Alexandria, VA
22333

STAFF MANAGER - Susan P. Canning, ASTM,
1916 Race St., Philadelphia, PA 19103

ADMINISTRATIVE ASSISTANT - Gina Graham, ASTM,
1916 Race St., Philadelphia, PA 19103

E-35 MAIN COMMITTEE OFFICERS TENURE:

E-35 CHAIRMAN

1973 - 1979	A.J. Culver
1980 - 1982	J.R. Beck
1983 - 1984	Vacant
1984 - 1990	E.S. Evans
1990 - Present	A.M. Perritt

E-35 FIRST VICE-CHAIRMAN

1979 - 1981	C.R. Walker
1982 - 1987	V.A. Musco
1988 - Present	J.L. Hazen

E-35 SECOND VICE-CHAIRMAN

1981 - 1982	R.M. Comotto
1982 - 1987	B.J. Butler
1988 - Present	J.H. Benedict

E-35 MEMBERSHIP SECRETARY

1979 - 1980	D.L. Klingman
1980 - 1981	C.G. McWhorter
1981 - 1982	Vacant
1982 - 1984	C.R. Walker
1984 - 1985	Vacant
1985 - 1990	A.M. Perritt
1990 - Present	J.A. Macko, Jr.

E-35 RECORDING SECRETARY

1973 - 1975	P.N. Schumann
1976 - 1981	V.A. Musco
1982 - 1983	S.L. Kimball
1984 - 1985	R.P. Schneider
1985 - 1989	G.E. Schultz
1990 - 1991	G.B. Beestman
1992 - Present	W. Brenner

MAIN COMMITTEE MEMBERSHIP RECORD:

1973 - 288	1980 - 353	1987 - 253
1974 - No Data	1981 - 287 *	1988 - 239
1975 - 266	1982 - 237	1989 - 214
1976 - 269	1983 - 218	1990 - 205
1977 - 278	1984 - 210	1991 - 214
1978 - 308	1985 - 204	1992 - 214
1979 - 344	1986 - 220	1993 - 234

* E-47 was formed from E-35.23, E-35.24, and E-35.25.
Those members left E-35.

INITIAL SUB-COMMITTEE LISTING:

E-35.01 Terminology (1973)
 E-35.12 Insect Control Agents (1973)
 E-35.13 Terrestrial Plant Control Agents (1973)
 E-35.14 Aquatic Plant Control Agents (1973)
 E-35.15 Antibacterial and Antiviral Agents (1973)
 E-35.16 Nematode Control Agents (1973)
 E-35.17 Vertebrate Control Agents (1973)
 E-35.18 Aquatic Animal Control Agents (1973)
 E-35.19 Invertebrate Control Agents (1973)
 E-35.21 Safety to Man and Environment (1973) ¹
 E-35.22 Pesticide Equipment (1973) ²
 E-35.23 Safety to Aquatic Organisms (1979) ^{3,4}
 E-35.24 Environmental Chemistry and Fate Modeling (1979) ^{3,4}
 E-35.25 Wildlife Toxicology and Hazard Assessment (1979) ^{3,4}
 E-35.26 Safety to Man (1979) ³
 E-35.90 Executive (1973)

¹ 1979 - Divided into 4 Subs: E-35.23, E-35.24, E-35.25, & E-35.26

² 1980 - Title changed to:
Pesticide Formulations and Applications Systems

³ 1979 - Created from E-35.21

⁴ 1980 - Left E-35 to become: ASTM Committee E-47
on Biological Effects and Environmental Fate

SUB-COMMITTEE INDIVIDUAL SCOPE AND CURRENT CHAIRMAN:**E-35.01 Terminology**

CHAIRMAN: Bernard Schneider
USG EPA Plant Biology Lab
Columbia, MD
(202) 557-5017

SCOPE: (Not Published)

STANDARDS: 1 Approved

E0609-81 (1991) Definitions of Terms Relating to Pesticides

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E-35.12 Insect Control Agents

CHAIRMAN: Dr. Edward S. Evans
USA Environmental Hygiene Agency
Aberdeen Proving Ground, MD
(410) 671-4131

SCOPE: Development of definitions, classifications, biological test methods, and recommended procedures for determining the effectiveness and usefulness of control agents.

STANDARDS: 9 Approved; 1 new working.

D3092-87 (1993) Test Method for Particle-size Distribution of Space-Insecticide Aerosol
D3093-72 (1992) Test Method for Pickup Efficiency of Residual Aerosol Insecticides
E0652-91 Method for Testing Non-residual Liquid Household Insecticides Against Flying Insects
E0653-91 Method of Testing Effectiveness of Aerosol and Pressurized Space Spray Insecticides Against Flying Insects
E0654-90 Method of Testing Effectiveness of Aerosol and Pressurized Spray Insecticides against Cockroaches
E0938-83 (1988) Test Method for Effectiveness of Liquid, Gel, or Cream Insecticides Against Adult Human Lice
E0939-83 (1988) Test Method for Field Testing Topical Applications of Compounds as Repellents for Medically Important and Pest Arthropods (Including Insects, Ticks, and Mites): I. Mosquitoes
E0951-89 Methods of Laboratory Testing Non-Commercial Mosquito Repellent Formulations on the Skin
E1517-93 Test Method for Determining the Effectiveness of Liquid, Gel, Cream, or Shampoo Insecticides Against Human Louse Ova

E-35.13 Pesticides for Terrestrial Plant Growth Control

ACTING CHAIRMAN: James L. Hazen
Rhone-Poulenc Inc.
Surfactants & Specialties
Cranbury, NJ
(609) 860-4482

SCOPE: Development of definitions, classifications, biological test methods, and recommended procedures for pesticides, biological agents and devices for growth control (or regulation) of terrestrial plants, including herbicides, plant growth regulators, desiccants and defoliants, considering safety and impact in all environments. These activities will be coordinated with related committees and sub-committees of ASTM.

STANDARDS: 4 Approved

E0880-91	Guide for Evaluating the Usefulness of Herbicides on Corn (All Types)
E0940-91	Guidelines for Evaluating the Usefulness of Herbicides on Soybeans
E0952-91	Guidelines for Evaluating the Usefulness of Herbicides on Cotton
E1051-85 (1991)	Guidelines for Evaluating the Usefulness of Herbicides on Potatoes

E-35.15 Antimicrobial Agents

CHAIRMAN: Richard Walter
Dow Chemical
Larkin Lab
Midland, MI
(517) 636-3323

SCOPE: Development of standard definitions, classifications, biological test methods, and recommended practices related to efficacy of anti-microbial agents and devices. These activities will be coordinated with related committees in ASTM and other professional organizations.

STANDARDS: 21 Approved, 5 new working

E0599-89	Test Method for Efficacy of Slimicides for the Paper Industry -- Fungal Slime
E0600-91	Test Method for Efficacy of Slimicides for the Paper Industry -- Bacterial Slime
E0649-78 (1991)	Test Method for Preservatives in Water-Containing Cosmetics
E0645-91	Test Method for Efficacy of Microbiocides Used in Cooling Systems
E0686-91	Method for Evaluation of Antimicrobial Agents in Aqueous Metal Working Fluids
E0723-91	Test Method for Efficacy of Antimicrobials as Preservatives for Aqueous-Based Products Used in the Paper Industry (Bacterial Spoilage)
E0875-88	Test Method for Efficacy of Fungal Control Agents as Preservatives for Aqueous-Based products Used in the Paper Industry
E979-91	Test Method for Evaluation of Antimicrobial Agents as Preservatives for Invert Emulsion and Other Water Containing Hydraulic Fluids
E1052-85 (1990)	Test Method for Efficacy of Virucidal Agents Intended for Special Applications
E1053-91	Test Method for Efficacy of Virucidal Agents Intended for Inanimate Environmental Surfaces
E1054-91	Practices for Evaluating Inactivators of Antimicrobial agents Used in Disinfectants, Sanitizer, Antiseptic, or Preserved Products
E1115-91	Test Method for Evaluation of Surgical Hand Scrub Formulation
E1153-87	Test Method for Efficacy of Recommended for Inanimate Non-Food Contact Surfaces
E1173-93	Test Method for the Evaluation of a Pre-Operative Skin

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	Preparation
E1174-87	Test Method for the Evaluation of Health Care Personnel Handwash Formulation
E1257-88	Test Method for Evaluation of Antimicrobials in Distillate Fuels (Based on Preliminary Screening and Compatibility)
E1326-90A	Guide for Evaluating Non-Conventional Microbiological Tests Used for Enumerating Bacteria
E1327-90	Test Method for Evaluation of Health Care Personnel Handwash Formulations by Utilizing Fingernail Regions
E1427-91	Guides for Selecting Test Methods to Determine the Effectiveness of Antimicrobial Agents and Other Chemicals for the Prevention, Inactivation, and Removal of Biofilm
E1428-91	Test Method for Evaluating the Performance of Antimicrobials in or on Polymeric Solids Against Staining by Streptovorticillium Reticulum, A Pink Stain Organism
E1482-92	Test Method for Neutralization of Virucidal Agents in Virucidal Efficacy Evaluations

E-35.16 NEMATODE CONTROL AGENTS

ACTING CHAIRMAN: James L. Hazen
Rhone-Poulenc Inc.
Surfactants & Specialties
Cranbury, NJ
(609) 860-4482

SCOPE: Not Published.

STANDARDS: 8 Approved

E0612-91	Guidelines for Field Evaluation of Nematode Control Agents -- Site Selection Procedures
E0613-92	Guide for Evaluation of Nematode Control Agents -- Side Effects of Nematicide Application on Other Organisms
E0614-92	Guide for Greenhouse or Growth Chamber Evaluation of Nematicides Against Root-Knot Nematode
E0628-91	Guide for Field Evaluation of Nematode Control Agents -- Test Materials and Environmental Conditions
E0629-91	Guide for Field Evaluation of Nematode Control Agents -- Determination of Nematode Population Responses to Control Agents
E0630-91	Guide for Evaluation of Nematode Control Agents -- Plant Responses
E0655-91	Guide for Evaluation of Nematicides Against Root-Knot Nematode -- Population Eradication Test
E0656-91	Guide for Evaluation of Hatching Heterodera Schachtii Larvae

E-35.17 Vertebrate Control Agents

CHAIRMAN: Dr. William B. Jackson
Bowling Green State University
Biological Sciences
Bowling Green, OH
(419) 372-8375

SCOPE: Development of standard definitions, classification, appropriate test methods and recommended practices for vertebrate control agents, devices and equipment related to efficacy, safety and impact in appropriate environments. These activities will be coordinated with relevant committees in ASTM and with other professional and Government organizations.

STANDARDS: 12 Approved

E0551-81 (1990) Test Methods for Developing Effective Bird Control Chemicals
E0552-75 (1989) Test Method for Efficacy of Acute Mammalian Predicides
E0554-89 Guide for Use and Development of Strychnine as an Avicide
E0555-75 Practice for Determining Acute Oral LD50 for Testing Vertebrate Control Agents
E0565-90 Test Method for Efficacy of a Single-Dose Rodenticide Under Laboratory Conditions
E0589-76 (1989) Guide for Use and Development of PA-14 Avian Stressing Agent
E0590-76 (1989) Guideline for the Use and Development of Sodium Monofluoroacetate (Compound 1080) as a Predicide
E0593-77 (1989) Test Method for Efficacy of a Multiple-Dose Rodenticide Under Laboratory Conditions
E0615-77 (1989) Guidelines for Use and Development of Sodium Cyanide as a Predicide
E0657-78 (1989) Test Method for Comparative Acute and Long-Term Oral or Gustatory Avian Repellency
E0658-78 (1989) Test Method for Efficacy of Dog Repellents Designed for Direct Application to Garbage Bags
E0757-80 (1989) Test Method for Efficacy of Canine Reproduction Inhibitors

E35.22 Pesticide Formulation and Application Systems

CHAIRMAN: H.M. "Chip" Collins
Stepan Company
Winder, GA
(404) 867-7471

SCOPE: Develop systems, techniques, and specifications for formulating and utilizing pesticides.

STANDARDS: 15 Approved; 5 new working

E0549-87 (1993) Guide for Preparing Ground Field Sprayer Calibration Procedures