ASSOCIATION OF STRUCTURAL PEST CONTROL REGULATORY OFFICIALS (ASPCRO)

HISTORICAL RECORD

1997

PRESIDENT:	Benny Mathis, TX
VICE-PRESIDENT:	Cark Falco, NC
SECRETARY:	Jim Hasking, MS
TREASURER:	George N. Saxton, IN
LOCATION OF ANNUAL MEETING:	Nashville, TN
DATE:	8/25/97 to 8/27/97

EXECUTIVE BOARD MEETING: Board members present were:

President Benny Mathis(TX)
Vice President Carl Falco(NC)
Secretary Jim Haskins(MS)
Treasurer George Saxton(IN)
Immediate Past President Jim Wright(SC)
At-Large member Todd Thompson(LA) 97-98
At-Large member Dennis Howard(MD) 97-98
At-Large member Bud Paulson(AZ) 96-97

DRAFT

Also present at the meeting were June Moncrief(TX), Roger Borgelt(TX), Jim Harron(GA), Kiven Stewart(AR), Ray Siegel(IN), David Scott(IN), Mary Ellen Setting(MD), Don Alexander(AR), Bob Winder(AR), Forrest St.Aubin(KS) Penny Pava(IN), Bob Rosenberg(NPCA), Janet Bessey-Paulson(AZ), Charlie Hromada(Terminix), Norman Goldenberg(Terminix), Tom Diederich(ORKIN), Lonnie Mathews(Secure Insurance).

**Ken Kendall of Ensystex Siren Termite Bait gave a brief presentation to board members on the Ensystex Siren Termite Bait.
**Carl Falco(NC) gave an update on the ASPCRO website.
**The Board discussed the PR Notice regarding termiticide labeling. David Scott(IN) and other board members voiced their concerns over retreatment label language. President Benny Mathis(TX) appointed a committee of Bud Paulson(AZ), Kiven Stewart(AR), Jim Haskins(MS), Brian Rowe(MI), Tom Diedrich(Orkin), Charlie Hromada(Terminix) and Brian Forschler (University of Georgia) to review this language.
**Roger Borgelt(TX) gave a report regarding the Federal Trade Commissions investigation of the structural pest control industry.
**Jim Wright(SC) gave a report on Mr. Blondell's report regarding chlorpyrifos. It was agreed that an epidemiologist should review this report.
**A memorandum of understanding has been executed between ASPCRO and EPA which outlines the procedures to allow ASPCRO to review labels and efficacy data for termiticides and termite baits.
**Benny Mathis(TX), Dennis Howard(MD) and Bob Wulfhorst(OH) will continue to review EPA's booklets on Integrated Pest Management(IPM) in schools.
**Dennis Howard(MD) will continue to review information on baits.
**Roger Borgelt(TX) gave a committee report for the technician training committee. The Board directed the committee to hire trainers for the project and move forward.
**David Scott(IN) voiced a concern over soliciting industry sponsorship of meeting events and the perception this forms for the public. The topic was tabled for the mid-year board meeting.
**The appointment of an ASPCRO/AAPCO liaison committee member was tabled until the mid-year board meeting.

ASSOCIATION OF STRUCTURAL PEST CONTROL REGULATORY OFFICIALS (ASPCRO)

HISTORICAL RECORD

1997 (page #2) DRAFT

**George Saxton(IN), Kevin Stewart(AR), Ray Siegel(IN) and Forest St.Aubin were appointed to the Nominations Committee to fill the position of Secretary and one board member.
**Bob Wulfhorst(OH) and Todd Thompson(LA) were appointed to the Resolutions Committee.
**George Saxton(IN) gave the financial report. The report was approved.
**Carl Falco(NC) discussed urban pesticide control strategy regarding methyl parathion and suggested that a database of affected states be added to the ASPCRO Home Page.
**Bud Paulson(AZ) volunteered to host the 1998 ASPCRO meeting in Scottsdale, AZ.

HIGHLIGHTS OF MEETING:
**Opening Remarks-Louis Buck(Tennessee Department of AG)
**President's Remarks-Benny Mathis(TX),
**"From the Web: Resources for Regulators"-Carl Falco(NC)
**"How to Get a Federal Demonstration Grant"-Neil Ogg(Clemson University Department of Pesticide Regulation.
**"A Review of New Industry Technology, Including a Sneak Preview at the New Termiticide Labels"-A Panel of Manufactures, Formulators and Distributors.
**"News from the Research Community"-Brad Kard(USDA Forest Service), Brian Forschler(University of Georgia), Roger Gold(Texas A&M), Mike Potter(University of Kentucky).
**"Update on SFIREG"-Jim Roelofs(EPA)
**"Termite Control: Pretreat Form and Rigid Foam Insulation"-Greg Baumann(NPCA).
**"Methyl Parathion: The Sequel"-Carlton Layne(EPA), Robert McCarty(MS), David Newbill(TN), Bobby Simoneaux(LA).
**"An Uncensored Discussion of Pest Control Topics with Audience Participation"-Bob Bango(Bango Pest Control), Max Dillard(Opryland Hotel), Jim Jones(EPA), Bob Rosenberg(NPCA), Pam Tucker(US Department of Health & Human Services), Karen Vail(University of Tennessee), Jim Wright(SC).
**"EPA Update: Indoor Use Products, Termiticide Labeling, Methyl Parathion and FQPA Implementation"-Jim Jones(EPA)
**"Trends in Technician Training"-Roger Borgelt(TX), James Harron(GA).
**"Bugs, Schools, Kids and Pesticides: The Maryland Case"-Mary Ellen Setting(MD), Gene Harrington(NPCA).
**"Termite Warranties: What Do They Mean?"-Bob Wulfhorst(OH), Helen McMurray(Ohio AG's Office), Lonnie Alonso(Columbus Pest Control).

BUSINESS MEETING:
**Future meetings will be held in Arizona-1998, Kentucky-1999 and Arkansas-2000.
**Jim Wright(SC) gave a committee report on termiticide labeling.
**Kiven Stewart(AR) gave a report on termiticide retreatment label language.
**Roger Borgelt(TX) gave a report for the Registered Technician Training Committee.
**Dennis Howard(MD) gave a report for the New Technologies Committee.
**Bob Wulfhorst(OH) gave a report for the Termite Treatment Standards Committee.

ASSOCIATION OF STRUCTURAL PEST CONTROL REGULATORY OFFICIALS (ASPCRO)

HISTORICAL RECORD

1997 (page #3)

DRAFT

**Robert A. Moncrief(GA) was honored (posthumously) as the first inductee into the ASPCRO Hall of Fame. The award was presented to James Harron(GA).
**Kiven Stewart(AR) gave the following report for the Nominations Committee:

President:	Carl Falco(NC)
Vice-President:	Jim Haskins(MS)
Secretary:	John McCauley(KY)
Treasurer:	George Saxton(IN)
At-Large:	Bob Wulfhorst(OH) 98,99

**President-elect Carl Falco(NC) adjorned the meeting.

RESOLUTIONS:
**Recognition of Tennessee Department of Ag for hosting the meeting.
**Recognition of contributors to the meeting.
**Recognition of state pest control associations for their participation in the ASPCRO meetings

MISC: Historical record includes: meeting pamphlet; minutes of board meeting; copy of resolutions; minutes of registered technician committee meeting in New Orleans, 7/31/97; grant request for the technician training program; minutes from the ASPCRO mid-year board meeting of 3/12/97; letter to Board Members regarding the loss of funding for the Gulfport termiticide efficacy screening program; report on multiple chemical sensitivity (MCS) by Claudia Miller and Howard Mitzel; a copy of the "ASPCRO Structural Pest Control Technician Train-The-Trainer guide". Record also containes various letters, labels and pamphlets. 1997 ASPCRO member states and territories are: AL, AZ, AR, CA, CO, DE, FL, GA, ID, IL, IN, KA, KY, LA, MD, MI, MN, MS, MO, MT, NE, NV, NM, NY, NC, OH, OK, PA, RI, SC, TN, TX, VA, Virgin Islands, WA, WV, and WY.

STANDING COMMITTEES:

Termiticide Labeling Committee:	Jim Wright(SC) Dave Scott(IN) Bud Paulson(AZ)
Registered Technician Committee:	Roger Borgelt(TX) James Harron(GA) David Scott(IN) Jim Iglehart(OH) Todd Thompson(LA) Bob Wulfhorst(OH) Allen Fugler (LAPCA) Jim Criswell(OK CES)
Minimum Standards for Termite Control:	Bob Wulfhorst(OH) Jim Haskins(MS) Brian Rowe(MI)

ASSOCIATION OF STRUCTURAL PEST CONTROL REGULATORY OFFICIALS (ASPCRO)

HISTORICAL RECORD

1997 (page #4)

DRAFT

Liquid Soil Termiticide Residue Survey Committee:	Jim Wright(SC) Dave Scott(IN) George Saxton(IN)
Termiticide Retreatment Label Language:	Bud Paulson(AZ) Kiven Stewart(AR) Jim Haskins(MS) Brian Rowe(MI) Tom Diedrich(Orkin) Charlie Hromada(Terminix) Brian Forschler(Gulfport)
New Technologies Committee:	Dennis Howard(MD) Bob Wulfhorst(OH) Ray Siegel(IN)
ASPCRO Homepage for the Internet:	Carl Falco(NC)
ASPCRO Directory:	George Saxton(IN)
ASPCRO Historian:	George Saxton(IN)

ASSOCIATION OF STRUCTURAL PEST CONTROL REGULATORY OFFICIALS
MID-YEAR BOARD MEETING MINUTES

March 12, 1997

Members Present: Benny Mathis, TX), President; Carl Falco (NC), Vice-President; George Saxton (IN), Treasurer; Jim Wright (SC), Immediate Past President; J. H. "Bud" Paulson (AZ), At-Large, 96-97; Todd Thompson (LA), At Large, 97-98; and Dennis Howard (MD), At-Large 97-98. Member Absent: Jim Haskins (Ms), Secretary.

Visitors Present: Robert Wulfhorst (OH), June Moncrief (TX), Grier Stayton (DE), Tom Diederich(Orkin), Bob Rosenberg (NPCA), Norm Goldenberg (Terminix), Becky Cool (EPA)

George Saxon stated he occasionally receives request for the ASPCRO Directory, and wanted to know if ASPCRO should charge for the directories. Bud Paulson made a motion that ASPCRO charge $10 per copy. Dennis Howard provided a second and the motion carried. One free copy will continue to be sent to each ASPCRO member.

George Saxon stated ASPCRO now has 42 member states. In order to encourage the eight non-member states to join ASPCRO, he stated he would like to offer a free registration to them for the 1998 ASPCRO convention. Jim Wright made a motion that ASPCRO offer the eight non-member states free registration for the 1997 convention. Carl Falco provided a second and the motion carried.

George Saxon stated a ASPCRO Hall of Fame had been discussed in the past but never pursued. Suggested that at the convention nominations could be submitted and then voted on at the mid-year board meeting. Bud Paulson made a motion to establish ASPCRO Hall of Fame for people who have provided leadership and support to the organization. Todd Thompson provided a second, and the motion carried. George Saxon made a motion to nominate Bob Moncrief as the first recipient for the ASPCRO Hall of Fame. Bud Paulson provided a second, and the motion carried.

Jim Wright reported that Tennessee agreed to host the 1997 convention. Arrangements have been made with the Crown Plaza Hotel to hold the meeting from August 24th through 27th, 1997. It was further discussed that Benny Mathis would send out letters to potential contributors.

It was further discussed since Joe Kangiser from Washington had resigned from ASPCRO and taken another position, he would be unable to host the 1998 convention in Washington. Bud Paulson graciously volunteered to host the meeting in Arizona in 1998. It was further discussed that Kentucky had volunteered to host in 1999.

Benny Mathis stated Becky Cool with EPA had been invited to attend the board meeting. Becky Cool stated without ASPCRO's hands on involvement last fall of the PR Notice it would not have happened. Benny Mathis stated it has been a true collaborative between the Agency and ASPCRO and ASPCRO had a crucial role with the development of the PR Notice. He further stated there will be other issues and/or projects in the future that ASPCRO can assist EPA.

The status of the MOU between ASPCRO and EPA. The purpose of the MOU is the implementation of Section XI of Pesticide Regulation. The PR Notice 96-7 discusses coordination between EPA and ASPCRO's Termiticide Review Committee. The MOU defines the purpose of the Committee and scope of its activities and establishes the procedures which the committee shall follow in carrying out its activities including but not limited to protection of all confidential business information submitted to the Committee by termiticide registrants. Becky Cool stated their attorney suggested some minor changes in the MOU. Federal law covers advisory committee. Need to change language to make it independent of the Agency.

Jim Wright added the PR notice asks registrants to submit efficacy data. We need a technical person to provide a certain of expertise. The committee will be comprised of 3 to 5 members. We need to add an individual from the scientific community to act in that specific capacity as a resource. An invitation as been extended to Brad Kard with Gulfport.

Jim Wright reported that nothing has been done at this point on liquid termiticides that were not in the original termiticide soil residue study. After further discussion Benny Mathis and Carl Falco will explore the issue further by possibly contacting other states and the registrants.

Benny Mathis reported that there had been no further action since meeting in Santa Fe on the technician training committee. It was reported that NPCA has a draft ready on the technician training manual. Jim Wright and Carl Falco stated they would talk to John Impson about modifying the grant. Jim Wright stated that possible the grant could be amended whereby it would be done in three phases. Phase 1 would be the manual written by NPCA, phase 2 would be train the trainer and phase 3 would be testing. Carl Falco made a motion that ASPCRO pursue amending the grant application to produce a three phase product. George Saxon provided a second and the motion carried.

Becky Cool stated under Section 25b another list of chemicals exempted will be coming out shortly.

Dave Fix and Michelle Chua of the Federal Trade Commission, Bureau of Consumer Protection were present to discuss the structural pest control industry. Dave Fix explained the agency has two missions - antitrust laws and responsible to generally

enforce consumer protection. FTC looks into various aspects of American business and determines if there are problems that need a nationwide look. FTC's authority is very broad. FTC looks at certain patterns that might not be enumerable to the customers interest. No specific company is targeted and we are in a preliminary stage. FTC has contacts through media and people that are aware of consumer problems - specifically termite problems. Stated he did not know how widespread or how serious. What we are attempting to do at this particular time is talk to regulators and see if there is a problem and get an exact feel for what is there. We would like to enlist the assistance of ASPCRO and there members. FTC would like to prepare a very short survey to send to ASPCRO members in order to provide their assessment. Bud Paulson made a motion that ASPCRO assist with survey and involve AAPCO. Carl Falco provided a second, and the motion carried.

Bob Rosenberg discussed PR Notice regarding indoor use products. Board members continued the discussion as to where indoor use products are heading in the future. Bud Paulson made a motion that ASPCRO go forward with a proposal to obtain funding to support evaluation of data that has been received from Blondell, other entities, agencies and explore competent vendors in seeking a second opinion. Jim Wright provided a second, and the motion carried.

Bob Rosenberg stated we need to go forward with funding program for Gulfport. NPCA would like to propose a very aggressive program by NPCA and ASPCRO and go to Congress and get the program resolved. Would like to put ASPCRO on record to support additional funding for termite control research and to pursue that funding. Carl Falco made a motion that ASPCRO pursue funding for Gulfport. Jim Wright provided a second, and the motion carried.

Carl Falco gave a update on home page. Stated it appears there might be a problem with Pest Web and we might want to try them for six months. Might want to consider Pest World through NPCA, Bud Paulson made a motion that we change to pest world now instead of waiting. George Saxon provided a second, and motion carried. Carl Falco abstained.

George Saxton gave a financial update (copy attached).

Benny Mathis stated the Western Pesticide Conference is being held in May in Reno and plans to represent ASPCRO at that meeting. Bud Paulson made a motion that ASPCRO pay travel expenses for Benny Mathis. George Saxon provided a second and the motion carried.

The meeting was adjourned at 2:30 P.M.

Register Report

12/2/95 Through 3/7/97

3/7/97

ASPCRO FY97

Date	Num	Description	Memo	Category	Clr	Amount
BALANCE 12/1/95						0.00
10/1/96		Opening Balance		Brought Forward	x	88,705.90
10/2/96	1041	Printing Svc		Stationary		-71.27
10/2/96	1042	Lonnie Matthews		Petty Cash		-500.00
10/2/96	1043	OISC		Postage		-21.92
10/7/96	DEP			96 Meeting Reg		665.00
10/7/96	DEP	Cyanamid		Donation		500.00
10/7/96	1044	OISC		Postage		-9.60
10/7/96	1045	God's Country		1996 Meeting		-1,250.00
10/7/96	1046	Awards by Connie		Plaque		-88.85
10/11/96	1047	God's Country		1996 Meeting		-4,200.50
10/20/96	1048	God's Country		1996 Meeting		-113.00
10/20/96	1049	Lonnie Matthews		Petty Cash		-200.00
10/20/96	1050	Bernie Rodriquez		1996 Meeting		-150.00
10/22/96	1051	Sierra Plaques		1996 Meeting		-87.66
10/22/96	1052	Radisson Motel		1996 Meeting		-150.00
10/23/96	1053	Radisson Motel		1996 Meeting		-9,648.48
10/23/96	1054	God's Country		1996 Meeting		-50.00
10/26/96	1055	Dave Scott		RT Meeting		-150.71
10/26/96	1056	Drew Martin		RT Meeting		-515.81
11/1/96	1057	Bob Rosenberg		1996 Meeting		-484.00
11/1/96	1058	USEPA		1996 Meeting		-346.00
11/1/96	1059	Roger Gold		1996 Meeting		-371.28
11/11/96	1060	Vernard Lewis		1996 Meeting		-301.94
11/11/96	1061	Benny Mathis		RT Meeting		-796.09
11/11/96	1062	Benny Mathis		RT Meeting		-125.76
11/11/96	1063	Lora Bramer		Accountant		-200.00
11/11/96	1064	Jim Wright		NPCA Meeting		-333.93
11/13/96	del	OISC		Cancel 1057		484.00
11/13/96	1065	Bob Rosenberg		1996 Meeting		-484.00
11/13/96	1066	LaFonda		1996 Meeting		-3,357.40
11/13/96	DEP			96 Meeting Reg		370.00
11/13/96	DEP			1996 Dues		100.00
11/13/96	DEP	NM PCA		Donation		500.00
11/13/96	DEP	DowElanco		Donation		2,000.00
11/13/96	DEP	VW&R		Donation		1,000.00
11/14/96	1067	Jim Harron		RT Meeting		-143.71
11/15/96	DEP			96 Meeting Reg		1,280.00
11/15/96	1068	Lonnie Matthews		1996 Meeting		-847.45
12/16/96	1069	Jim Wright		DC Meeting		-631.66
12/16/96	DEP	aspcro		cancel 1058		346.00
12/16/96	1070	Carl Falco		DC Meeting		-848.96
1/3/97	TXFR			Savings Acct		-50,000.00
1/13/97	1071	Becky Cool		1996 Meeting		-346.00
1/14/97	1072	void				0.00
1/14/97	1073	June Moncrief		1997 planning		-526.93
1/14/97	1074	Instant Copy		1997 Directory		-318.15

Register Report

12/2/95 Through 3/7/97

3/7/97

ASPCRO FY97

Date	Num	Description	Memo	Category	Clr	Amount
1/14/97	1075	Bob Rosenberg		1997 planning		-368.00
1/17/97	1076	Jim Wright		1997 planning		-531.33
1/24/97	1077	OISC		Postage		-141.52
2/7/97	DEP			1996 Dues		100.00
2/7/97	DEP			1997 Dues		200.00
2/19/97	DEP			1997 Dues		1,200.00
2/19/97	1058	Becky Cool		1996 Meeting		-346.00
2/19/97	DEP	USEPA		reimbursement		346.00
2/24/97	1078	Benny Mathis		DC Meeting		-532.61
2/24/97	1079	Carl Falco		DC Meeting		-537.93
3/7/97	DEP			1997 Dues		800.00
3/7/97	DEP	FMC		Donation		3,000.00
	TOTAL 12/2/95 - 3/7/97					21,468.45
	BALANCE 3/7/97					21,468.45
	TOTAL INFLOWS					101,596.90
	TOTAL OUTFLOWS					-80,128.45
	NET TOTAL					21,468.45

Register Report

12/2/95 Through 3/7/97

3/7/97 Page

Technician Acct

Date	Num	Description	Memo	Category	Clr	Amount
BALANCE 12/1/95						0.00
12/2/95		Opening Balance			x	25,000.00
1/30/96	1001	Roger Borgelt		RT Meeting		-631.06
2/9/96	1002	Jim Harron		RT Meeting		-449.14
4/8/96	1006	Benny Mathis		Conf. Call		-259.47
6/5/96	DEP					25,000.00
6/12/96	1014	Benny Mathis		RT Meeting		-433.65
6/12/96	1015	Roger Borgelt		RT Meeting		-419.20
6/17/96	1016	Drew Martin		RT Meeting		-444.37
6/17/96	1019	Carl Falco		RT Meeting		-312.84
6/19/96	1020	Dave Scott		RT Meeting		-519.94
6/24/96	1021	Dave Molnar		RT Meeting		-396.06
6/24/96	1022	Jim Wright		RT Meeting		-171.20
6/27/96	1023	Bob Wulfhorst		RT Meeting		-184.37
6/27/96	1024	Roger Borgelt		RT Meeting		-718.51
7/8/96	1025	Bob Wulfhorst		RT Meeting		-306.00
7/19/96	DEP			NPCA Reimb		1,336.89
7/19/96	1027	Jim Harron		RT Meeting		-295.67
8/2/96	1030	Todd Thompson		RT Meeting		-219.47
10/26/96	1055	Dave Scott		RT Meeting		-150.71
10/26/96	1056	Drew Martin		RT Meeting		-515.81
11/11/96	1061	Benny Mathis		RT Meeting		-796.09
11/11/96	1062	Benny Mathis		RT Meeting		-125.76
11/14/96	1067	Jim Harron		RT Meeting		-143.71
TOTAL 12/2/95 - 3/7/97						43,843.86
BALANCE 3/7/97						43,843.86
TOTAL INFLOWS						51,336.89
TOTAL OUTFLOWS						-7,493.03
NET TOTAL						43,843.86

Wednesday, August 27

7:30 to 8:00 am	**Continental Breakfast** sponsored by Sears Termite & Pest Control
8:00 am	**Morning Moderator** Jill Bryan, North Carolina Department of Agriculture **EPA Update: Indoor Use Products, Termiticide Labeling, Methyl Parathion and FQPA Implementation** Jim Jones, U.S. Environmental Protection Agency **Trends in Technician Training** Roger Borgelt, Texas Structural Pest Control Board Jim Harron, Georgia Department of Agriculture
10:15 am	**Coffee Break**
10:30 am	**Bugs, Schools, Kids and Pesticides: The Maryland Case** Gene Harrington, National Pest Control Association Mary Ellen Setting, Maryland Department of Agriculture **Termite Warranties: What Do They Mean** Lonnie Alonso, Columbus Pest Control Helen McMurray, Office of the Ohio Attorney General Bob Wolfhurst, Ohio Department of Agriculture
noon	**Adjourn**

ASPCRO Acknowledges and Thanks the Following for their Generous Support

American Cyanamid
Arrow Exterminators
Bayer Corporation
Clorox Company
DowElanco
FMC Corporation
National Pest Control Association
Novartis
Orkin Pest Control
PCT Magazine
Rhone-Poulenc
Responsible Industry for a Sound Environment (RISE)
Sears Termite & Pest Control
Terminix International
United Producers Formulators and Distributors Association
Van Waters & Rogers
Zeneca

ASSOCIATION OF STRUCTURAL PEST CONTROL REGULATORY OFFICIALS (ASPCRO)

1997 Annual Meeting
Nashville, Tennessee

Sunday, August 24

7:30 a.m.	**Annual ASPCRO Golf Classic** Pine Creek Golf Course (meet in hotel lobby)
1:00 to 5:00 pm	**Meeting Registration**
2:30 to 5:30 pm	**ASPCRO Board of Directors**
4:30 to 9:30 pm	**Opening Reception** at the Tennessee Department of Agriculture Ellington Agriculture Center (buses will begin departing from the hotel lobby at 4:00)

Monday, August 25

7:30 am to 5:30 pm	**Meeting Registration**
7:30 to 8:30 am	**Continental Breakfast** sponsored by Sears Termite & Pest Control
8:30 am	**Morning Moderator** Todd Thompson, Louisiana Department of Agriculture & Forestry **Welcome to Tennessee** Louis Buck, Tennessee Department of Agriculture **President's Remarks** Benny Mathis, Texas Structural Pest Control Board **From the Web: Resources for Regulators** Carl Falco, North Carolina Department of Agriculture
9:45 am	**Coffee Break**
10:00 am	**How to Get a Federal Demonstration Grant** Neil Ogg, Clemson University Department of Pesticide Regulation **A Review of New Industry Technology, Including a Sneak Preview at the New Termiticide Labels** A Panel of Manufacturers, Formulators and Distributors
noon to 1:15 pm	**Luncheon** sponsored by Terminix International
1:30 pm	**Afternoon Moderator** John McCauley, Kentucky Department of Agriculture **News From the Research Community** Brad Card, USDA Forest Service Brian Forschler, University of Georgia Roger Gold, Texas A & M University Mike Potter, University of Kentucky
3:30 pm	**Coffee Break**
3:45 pm	**Update on SFIREG** Jim Roelofs, U.S. Environmental Protection Agency **Termite Control: Pretreat Form and Rigid Foam Insulation** Greg Baumann, National Pest Control Association **Methyl Parathion: The Sequel** Carlton Layne, U.S. Environmental Protection Agency Robert McCarty, Mississippi Dept. of Agriculture & Commerce David Newbill, Tennessee Department of Agriculture Bobby Simoneaux. Louisiana Dept. of Agriculture & Forestry
6:00 to 7:30 pm	**Reception** sponsored by Orkin Pest Control

Tuesday, August 26

7:30 am to noon	**Meeting Registration**
7:30 to 8:30 am	**Continental Breakfast** sponsored by Sears Termite & Pest Control
8:30 am	**ASPCRO Annual Business Meeting** (open to all attendees)
10:30 am	**Coffee Break**
10:45 am to 12:15 pm	**Morning Moderator** Jace Burch, Tennessee Department of Agriculture **An Uncensored Discussion of Pest Control Topics With Audience Participation** Bob Bango, Bango Pest Control Max Dillard, Opryland Hotel ~~Roelofs~~ Jim ~~Jones~~ OK, U.S. Environmental Protection Agency Bob Rosenberg, National Pest Control Association Pam Tucker, U.S. Department of Health & Human Services ATSDR Karen Vail, University of Tennessee- URBAN ENTOMOLOGIST Jim Wright, Clemson University Dept. of Pesticide Regulation
5:30 to 9:00 pm	**Reception and Dinner at Shadowbrook, a Private Dining Hall in a Scottish Mansion in the Hills of Central Tennessee** (buses will depart from the hotel lobby at 5:15) Sponsored by the National Pest Control Association, Responsible Industry for a Sound Environment, and their Member Companies

George Saxton

Jim Moye
Homan 2nd
accept Report

Association of Structural Pest Control Regulatory Officials

MEMBER STATES

1. Alabama
2. Arizona
3. Arkansas
4. California
5. Colorado
6. Delaware
7. Florida
8. Georgia
9. Idaho
10. Illinois
11. Indiana
12. Kansas
13. Kentucky
14. Louisiana
15. Maryland
16. Michigan
17. Minnesota
18. Mississippi
19. Missouri
20. Montana
21. Nebraska
22. Nevada
23. New Mexico
24. North Carolina
25. Ohio
26. Oklahoma
27. Pennsylvania
28. Rhode Island
29. South Carolina
30. Tennessee
31. Texas
32. Virginia
33. Virgin Islands
34. Washington
35. West Virginia
36. Wyoming

NON-MEMBER STATES

1. Alaska--Did not return my calls
2. Connecticut--Will not join due to budget
3. Hawaii--I did not contact them
4. Iowa--Did not pay 97 dues
5. Maine--Do not have termites, will not join
6. Massachusetts--will not join due to reorganization
7. New Hampshire--Will not join due to budget
8. New Jersey--Did not pay 97 dues
9. New York--Did not pay 97 dues
10. North Dakota--Did not pay 97 dues
11. Oregon--Requested to be deleted from mailing list
12. Puerto Rico--Did not return mailing
13. South Dakota--Will not join due to budget
14. Utah--Did not pay 97 dues
15. Vermont--Will not join due to budget
16. Wisconsin--Did not pay 97 dues

Register Report

10/1/96 Through 8/21/97

8/21/97

ASPCRO FY97

Date	Num	Description	Memo	Category	Clr	Amount
BALANCE 9/30/96						0.00
10/1/96		Opening Balance		Brought Forward	x	88,705.90
10/2/96	1041	Printing Svc		Stationary		-71.27
10/2/96	1042	Lonnie Matthews		Petty Cash		-500.00
10/2/96	1043	OISC		Postage		-21.92
10/7/96	DEP			96 Meeting Reg		665.00
10/7/96	DEP	Cyanamid		Donation		500.00
10/7/96	1044	OISC		Postage		-9.60
10/7/96	1045	God's Country		1996 Meeting		-1,250.00
10/7/96	1046	Awards by Connie		Plaque		-88.85
10/11/96	1047	God's Country		1996 Meeting		-4,200.50
10/20/96	1048	God's Country		1996 Meeting		-113.00
10/20/96	1049	Lonnie Matthews		Petty Cash		-200.00
10/20/96	1050	Bernie Rodriquez		1996 Meeting		-150.00
10/22/96	1051	Sierra Plaques		1996 Meeting		-87.66
10/22/96	1052	Radisson Motel		1996 Meeting		-150.00
10/23/96	1053	Radisson Motel		1996 Meeting		-9,648.48
10/23/96	1054	God's Country		1996 Meeting		-50.00
10/26/96	1055	Dave Scott		RT Meeting		-150.71
10/26/96	1056	Drew Martin		RT Meeting		-515.81
11/1/96	1057	Bob Rosenberg		1996 Meeting		-484.00
11/1/96	1058	USEPA		1996 Meeting		-346.00
11/1/96	1059	Roger Gold		1996 Meeting		-371.28
11/11/96	1060	Vernard Lewis		1996 Meeting		-301.94
11/11/96	1061	Benny Mathis		RT Meeting		-796.09
11/11/96	1062	Benny Mathis		RT Meeting		-125.76
11/11/96	1063	Lora Bramer		Accountant		-200.00
11/11/96	1064	Jim Wright		NPCA Meeting		-333.93
11/13/96	del	OISC		Cancel 1057		484.00
11/13/96	1065	Bob Rosenberg		1996 Meeting		-484.00
11/13/96	1066	LaFonda		1996 Meeting		-3,357.40
11/13/96	DEP			96 Meeting Reg		370.00
11/13/96	DEP			1996 Dues		100.00
11/13/96	DEP	NM PCA		Donation		500.00
11/13/96	DEP	DowElanco		Donation		2,000.00
11/13/96	DEP	VW&R		Donation		1,000.00
11/14/96	1067	Jim Harron		RT Meeting		-143.71
11/15/96	DEP			96 Meeting Reg		1,280.00
11/15/96	1068	Lonnie Matthews		1996 Meeting		-847.45
12/16/96	1069	Jim Wright		DC Meeting		-631.66
12/16/96	DEP	aspcro		cancel 1058		346.00
12/16/96	1070	Carl Falco		DC Meeting		-848.96
1/3/97	TXFR			Savings Acct		-50,000.00
1/13/97	1071	Becky Cool		1996 Meeting		-346.00
1/14/97	1072	void				0.00
1/14/97	1073	June Moncrief		1997 planning		-526.93
1/14/97	1074	Instant Copy		1997 Directory		-318.15

Register Report

10/1/96 Through 8/21/97

8/21/97

ASPCRO FY97

Date	Num	Description	Memo	Category	Clr	Amount
1/14/97	1075	Bob Rosenberg		1997 planning		-368.00
1/17/97	1076	Jim Wright		1997 planning		-531.33
1/24/97	1077	OISC		Postage		-141.52
2/7/97	DEP			1996 Dues		100.00
2/7/97	DEP			1997 Dues		200.00
2/19/97	DEP			1997 Dues		1,200.00
2/19/97	1058	Becky Cool		1996 Meeting		-346.00
2/19/97	DEP	USEPA		reimbursement		346.00
2/24/97	1078	Benny Mathis		DC Meeting		-532.61
2/24/97	1079	Carl Falco		DC Meeting		-537.93
3/7/97	DEP			1997 Dues		800.00
3/7/97	DEP	FMC		Donation		3,000.00
3/13/97	1080	George Saxton		1997 midyear		-830.14
3/26/97	1081	OISC		Postage		-84.82
3/26/97	1082	Instant Copy		Stationary		-202.59
3/26/97	DEP			1997 Dues		500.00
3/26/97	DEP			96 Meeting Reg		85.00
4/16/97	1083	Awards by Connie		Plaque		-90.60
5/2/97	1084	Dave Scott		RT Meeting		-133.67
5/2/97	1085	OISC		Postage		-16.96
5/7/97	1086	Jim Harron		RT Meeting		-25.86
5/7/97	1087	Bob Wulfhorst		RT Meeting		-284.50
5/21/97	1088	Benny Mathis		W. States Conf.		-711.64
5/21/97	1089	Carl Falco		Gulfport meet		-778.23
5/21/97	1090	Jim Criswell		RT Meeting		-124.50
5/21/97	1091	Roger Borgelt		RT Meeting		-674.00
5/21/97	DEP	Trugreen		Donation		10.00
5/21/97	DEP	United Products		Donation		500.00
5/21/97	DEP	NPCA		Donation		1,000.00
5/21/97	DEP			1997 Dues		500.00
6/3/97	1092	OISC		Postage		-97.60
6/3/97	DEP	Rise		Donation		1,000.00
6/3/97	DEP	Orkin		Donation		3,000.00
6/16/97	1093	OISC		Postage		-29.70
6/16/97	1094	Awards by Connie		Plaque		-20.48
6/16/97	1095	Sandra Wells		RT Meeting		-195.25
6/16/97	1096	OK Dept of AG		RT Meeting		-338.14
6/20/97	1097	Custom Engraving		Plaque		-65.35
6/20/97	1098	Travel Inc		Potter Travel		-430.00
7/1/97	DEP			1997 Dues		100.00
7/1/97	DEP	Forum		Donation		250.00
7/1/97	DEP	Arrow		Donation		500.00
7/1/97	1099	OISC		Postage		-16.64
7/1/97	DEP	Novartis		Donation		500.00
7/1/97	1100	Benny Mathis		RT Conf Call		-81.61
7/1/97	DEP			97 meeting reg		1,785.00
7/27/97	1101	Carl Falco		SFIREG meeting		-750.92
7/28/97	DEP			97 meeting reg		2,210.00
7/28/97	DEP	Bayer		Donation		2,000.00

Register Report

10/1/96 Through 8/21/97

8/21/97

ASPCRO FY97

Date	Num	Description	Memo	Category	Clr	Amount
7/28/97	DEP			Directory sales		10.00
7/28/97	1102	Ray Beal		reimbursement		-85.00
7/30/97	DEP			97 meeting reg		1,360.00
7/30/97	DEP			1997 Dues		100.00
7/30/97	DEP	Clorox		Donation		1,000.00
7/30/97	DEP	DowElanco		Donation		2,000.00
7/30/97	DEP	Rhone-Poulenc		Donation		2,000.00
7/30/97	1103	Instant Copy		Stationary		-64.02
7/30/97	1104	OISC		Postage		-42.12
8/2/97	1105	George Saxton		RT Meeting		-483.18
8/4/97	1106	Jace Burch		1997 meeting		-3,500.00
8/8/97	1107	George Saxton		Picture Frame		-13.60
8/8/97	1108	Robert Wulfhorst		RT Meeting		-440.30
8/8/97	1109	Jim Harron		RT Meeting		-442.70
8/18/97	1110	Sandra Wells		RT Meeting		-182.68
8/18/97	1111	OK Dept of AG		RT Meeting		-181.91
8/18/97	1112	Custom Engraving		Plaque		-65.35
8/18/97	1113	Jim Criswell		RT Meeting		-170.70
8/18/97	1114	Roger Borgelt		RT Meeting		-611.90
8/18/97	DEP	aspcro		cancel 1112		65.35
8/21/97	DEP			1997 Dues		200.00
8/21/97	DEP			97 meeting reg		2,035.00
TOTAL 10/1/96 - 8/21/97						31,912.14
BALANCE 8/21/97						31,912.14
TOTAL INFLOWS						124,307.25
TOTAL OUTFLOWS						-92,395.11
NET TOTAL						31,912.14

Register Report

12/2/95 Through 8/21/97

8/21/97

Technician Acct

Date	Num	Description	Memo	Category	Clr	Amount
BALANCE 12/1/95						0.00
12/2/95		Opening Balance			x	25,000.00
1/30/96	1001	Roger Borgelt		RT Meeting		-631.06
2/9/96	1002	Jim Harron		RT Meeting		-449.14
4/8/96	1006	Benny Mathis		Conf. Call		-259.47
6/5/96	DEP					25,000.00
6/12/96	1014	Benny Mathis		RT Meeting		-433.65
6/12/96	1015	Roger Borgelt		RT Meeting		-419.20
6/17/96	1016	Drew Martin		RT Meeting		-444.37
6/17/96	1019	Carl Falco		RT Meeting		-312.84
6/19/96	1020	Dave Scott		RT Meeting		-519.94
6/24/96	1021	Dave Molnar		RT Meeting		-396.06
6/24/96	1022	Jim Wright		RT Meeting		-171.20
6/27/96	1023	Bob Wulfhorst		RT Meeting		-184.37
6/27/96	1024	Roger Borgelt		RT Meeting		-718.51
7/8/96	1025	Bob Wulfhorst		RT Meeting		-306.00
7/19/96	DEP			NPCA Reimb		1,336.89
7/19/96	1027	Jim Harron		RT Meeting		-295.67
8/2/96	1030	Todd Thompson		RT Meeting		-219.47
10/26/96	1055	Dave Scott		RT Meeting		-150.71
10/26/96	1056	Drew Martin		RT Meeting		-515.81
11/11/96	1061	Benny Mathis		RT Meeting		-796.09
11/11/96	1062	Benny Mathis		RT Meeting		-125.76
11/14/96	1067	Jim Harron		RT Meeting		-143.71
5/2/97	1084	Dave Scott		RT Meeting		-133.67
5/7/97	1086	Jim Harron		RT Meeting		-25.86
5/7/97	1087	Bob Wulfhorst		RT Meeting		-284.50
6/16/97	1095	Sandra Wells		RT Meeting		-195.25
6/16/97	1096	OK Dept of AG		RT Meeting		-338.14
7/1/97	1100	Benny Mathis		Conf. Call		-81.61
8/2/97	1105	George Saxton		RT Meeting		-483.18
8/7/97	1108	Bob Wulfhorst		RT Meeting		-440.30
8/7/97	1109	Jim Harron		RT Meeting		-442.70
8/18/97	1110	Sandra Wells		RT Meeting		-182.68
8/18/97	1111	OK Dept of AG		RT Meeting		-181.91
8/18/97	1113	Jim Criswell		RT Meeting		-170.70
8/18/97	1114	Roger Borgelt		RT Meeting		-611.90
TOTAL 12/2/95 - 8/21/97						40,271.46
BALANCE 8/21/97						40,271.46
TOTAL INFLOWS						51,336.89
TOTAL OUTFLOWS						-11,065.43

Register Report

12/2/95 Through 8/21/97

Date	Num	Description	Memo	Category	Clr	Amount
BALANCE 12/1/95						0.00
1/3/97		Opening Balance		[Savings]	x	50,000.00
4/15/97	DEP	Interest		Savings Acct		547.28
7/14/97	DEP	Interest		Savings Acct		589.78
TOTAL 12/2/95 - 8/21/97						51,137.06
BALANCE 8/21/97						51,137.06
TOTAL INFLOWS						51,137.06
TOTAL OUTFLOWS						0.00
NET TOTAL						51,137.06

8/24/97

Jim Wright · Paul Ross
Ben · Tibold
Carl · Dunn
Jim · Bud
Ken

Topics of Discussion
ASPCRO Board of Directors Meeting

I. Ensystex Siren Termite Bait - Ken Kendall

II. FTC - Federal Trade Commission - Bennett Rushoff

III. PR Notice Termiticide Labeling - Dave Scott
Re-treatment language on Termiticide labels - Dave Scott

IV. Chlorpyrifos Data - Blondell's Report · FALCO/WRIGHT

V. Web Site Address - http:/www.aspcro.org

VI. Termite Labeling Committee - Jim Wright
MOU Memorandum of Understanding - Jim Wright

VII. EPA IPM Booklet

VIII. Update on Baits

IX. ASPCRO Service Technician Committee & Presentation of Draft Train-the-Trainer Document - Roger Borgelt & Jim Harron

X. Industry Sponsorship of Meeting - Solicitation of Contributors - Dave Scott

XI. ASPCRO/APPCO Liaison Committee Member - MID YEAR BOARD MEETING

XII. Director & Board Officers Nominees

XIII. Financial Report - George Saxton

XIV. Urban Pesticide Control Strategy Methyl Parathion - Carl Falco

XV. Review Committee Agreements

XVI. New Business

8/23/00
5:00 PM

Dave
Ray
Perry

Topics of Discussion
Board of Directors Meeting

I. Ensystex Siren Termite Bait - Ken Kendall

II. FTC - Federal Trade Commission - Bennett Rushoff

III. PR Notice Termiticide Labeling - Dave Scott
Re-treatment language on Termiticide labels - Dave Scott

IV. Chlorpyrifos Data - Blondell's Report

V. Web Site Address - http:/www.aspcro.org

VI. Termite Labeling Committee - Jim Wright
MOU Memorandum of Understanding - Jim Wright

VII. EPA IPM Booklet

VIII. Update on Baits

IX. ASPCRO Service Technician Committee & Presentation of Draft Train-the-Trainer Document - Roger Borgelt & Jim Harron

X. Industry Sponsorship of Meeting - Solicitation of Contributors - Dave Scott

XI. ASPCRO/APPCO Liaison Committee Member

XII. Director & Board Officers Nominees

XIII. Financial Report - George Saxton

ASSOCIATION OF STRUCTURAL PEST CONTROL REGULATORY OFFICIALS ANNUAL BOARD MEETING MINUTES

August 24, 1997

Members Present: Benny Mathis, TX), President; Carl Falco (NC), Vice-President; George Saxton (IN), Treasurer; Jim Haskins, (Ms), Secretary, Jim Wright, (SC), Immediate Past President; J. H. "Bud" Paulson (AZ), At-Large, 96-97; Todd Thompson (LA), At Large, 97-98; and Dennis Howard (MD), At-Large 97-98.

Ken Kendall of Ensystex Siren Termite Bait gave a brief presentation to board members on their bait.

Carl Falco updated the Board on ASPCRO's website. Stated the website went active about four weeks ago and would update them further during his presentation at the meeting on Monday.

The Board briefly discussed the PR Notice regarding termiticide labeling. Dave Scott along with other board members stated there is a concern among them regarding the retreatment language on termiticide labels. Mr. Mathis appointed a committee to monitor and review the retreatment language on termiticide labels. The committee consists of Bud Paulson, Kiven Stewart, Jim Haskins, Charlie Hromada, Tom Diedrich, Brian Forschler and Brian Rowe.

Mr. Mathis called on Roger Borgelt for an update regarding the Federal Trade Commission. Mr. Borgelt stated the FTC has talked with our representative at the Attorney General's Office and from the information they have received the FTC has not narrowed their focus to date. Mr. Mathis stated that hopefully Bob Rosenberg, National Pest Control Association and ASPCRO members can continue to monitor FTC and see where they are headed with their investigation.

Mr. Mathis called on Jim Wright to give an update on the Blondell's Report regarding chlorpyrifos data. Mr. Wright stated that ASPCRO had requested Brian Forschler to review the report. Dr. Forschler did not agree or disagree with the report. The general consensus was that another Epidemiologist should review the report.

The Memorandum of Understanding (MOU) has been executed between ASPCRO and EPA. The MOU will allow ASPCRO to review labels and efficacy data for termiticides and baits and outlines the procedures to follow.

EPA is going to do another IPM booklet for schools. Benny Mathis, Dennis Howard and Bob Wulfhorst will continue to review the IPM booklet as it becomes available and report back to ASPCRO.

Dennis Howard will continue to review information on baits.

Mr. Mathis called on Roger Borgelt to give an update on the status of the technician training committee. Mr. Borgelt gave a brief overview and stated the committee needed the approval of the board of directors as to whether they are to hire the trainers or exactly how to handle this portion of the grant. The board of directors stated the committee can hire the trainers and move forward.

Dave Scott stated he had some concerns regarding industry sponsorship of meeting events and solicitation of contributions. This agenda item was tabled until the mid-year ASPCRO board meeting.

The appointment of a ASPCRO/AAPCO liaison committee member was tabled until the mid-year board meeting.

Mr. Mathis appointed a nominating committee of George Saxon, Kevin Stewart, Forest St. Aubin and Ray Siegel. The officer position of secretary is available and one board of director position at large is available.

Mr. Mathis appointed Bob Wulfhorst and Todd Thompson to the resolution committee.

George Saxton gave the financial report (copy attached). Carl Falco made a motion to approve the financial report as reported. Dennis Howard provided a second and the motion carried.

Carl Falco briefly discussed urban pesticide control strategy regarding methyl parathion. Suggested it might be beneficial to develop a database for numbers of the states that have encountered this problem and include this information on the website. Bud Paulson stated Arizona would be hosting the 1998 annual convention at the Cottonwoods in Scottsdale. The tentative date scheduled will be the last full week of August.

Board Meeting adjourned at 5:00 p.m.

Resolutions Committee Report
to 1997 ASPCRO Annual Meeting

1. In recognition of the Tennessee Department of Agriculture for its tremendous efforts as the host state in the planning and conduct of an outstanding ASPCRO annual meeting in Nashville, Tennessee.

It is resolved to recognize the Tennessee Department of Agriculture for all of the efforts that were put forward.

2. Many companies and organizations contributed to the success of the 1997 ASPCRO Annual Meeting. The contributors included manufacturers, suppliers, pest control companies and others with a sincere interest in their industry.

ASPRO recognizes: (list of contributors from program agenda)

for their many generous contributions

(over)

3. The importance of the working relationship between structural pest control regulatory programs and the corresponding state pest control associations is very important to the ability of most state programs to work effectively. State pest control associations have been welcomed at the ASPCRO annual meeting for many years. Through their joint participation there occurs a better understanding of the evolving regulatory climate in which we must work together.

It is resolved to recognize the state pest control associations who have taken from their valuable time and have joined us for the 1997 ASPCRO annual meeting. And they are further encouraged to join with us in ~~the~~ future ASPCRO meetings

1997 ASPCRO Meeting
Nashville, Tennessee
August 24 - 27, 1997

Proposed Budget

Meals	Amount	# Of People	Total
Sunday Reception	$15.00	120	$1,800.00
Monday Breakfast	$15.00	120	$1,800.00
Monday a.m. Break	(Coffee Only)		$150.00
Monday Lunch			Sponsored by Terminix
Monday p.m. Break	$2.50 (Coffee & Sodas)	120	$300.00
Monday Reception	$25.00	150	$3,750.00
Tuesday Breakfast	$15.00	120	$1,800.00
Tuesday a.m. Break	(Coffee Only)		$150.00
Tuesday Reception	$10.00	150	$1,500.00
Tuesday Evening Outing	$40.00	150	$6,000.00
		Totals - Meals	**$17,250.00**

Golf	$50.00	28	$1,400.00
River Taxi	$11.00	75	$825.00
Shuttle Fees (Three day Passes)	$3.25	40	$135.00
Busses and Vans			Provided By Tn. Dept. Of Agriculture
Beer and Liquor			$1,000.00
Entertainment			$1,000.00
Speakers			$4,000.00
Postage			$600.00
Badges			$100.00
Spouses Tour			$500.00
Hospitality Suite			$1,000.00
		Total For Misc.	**$10,560.00**

Association of
Structural
Pest
Control
Regulatory
Officials

September 5, 1997

Mr. James Jones
Acting Director, Registration Division
Office of Pesticide Programs
Mail Code 7505C
United States Environmental Protection Agency
401 M Street, Southwest
Washington, D.C. 20460

Dear Mr. Jones:

Please find enclosed the signed Memorandum of Understanding between the Environmental Protection Agency and the Association of Structural Pest Control Regulatory Officials.

Sincerely,

Benny Mathis

BM:jm
cc: Mr. Carl Falco
Mr. George Saxon

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MEMORANDUM OF UNDERSTANDING BETWEEN UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AND ASSOCIATION OF STRUCTURAL PEST CONTROL REGULATORY OFFICIALS

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

This Memorandum of Understanding ("MOU") is entered into between the United States Environmental Protection Agency ("EPA") and the Association of Structural Pest Control Regulatory Officials ("ASPCRO") for the purpose of implementing section XI of Pesticide Regulation ("PR") Notice 96-7 (Oct. 1, 1996). The ASPCRO has established a Termiticide Review Committee (hereinafter "the Committee") to fulfill the ASPCRO's committment, as outlined in Section XI of PR Notice 96-7 to consider applications and amendments for certain termiticide products. The MOU reflects the terms and limitations ASPCRO has established for the work of the Committee, as well as, among other things, protection of CBI. The MOU also defines the nature of the interaction between the Committee and EPA.

1. Purpose of Committee -- The Committee's sole function shall be to act on behalf of ASPCRO as a resource, to EPA and termiticide registrants on the subjects of proposed labeling's Directions For Use (subdivision H, Guideline No. 105-18(a) and 40 CFR § 156,10(l) and supporting efficacy data (subdivision G, Guildeline No. 95-12(b)(l) in connection with FIFRA §3 applications for (i) new soil treatment termiticide active ingredients, and (ii) amendments to label rates or methods of application for currently registered soil treatment termiticides. In carrying out this function, the Committee may raise with EPA and/or a registrant, questions regarding proposed labeling's Directions for Use and supporting efficacy data.

2. Appointment of Committee -- The Committee shall be comprised of 3-5 state officials who are members of ASPCRO and at least one member who represents the scientific research community as a technical resource. Consistent with ASPCRO's Bylaws, the members of the Committee shall be appointed by the President of ASPCRO, who also shall designate one of the Committee's members as its Chair. Each member of the Committee must be from a state whose laws enable him or her to sign and abide by confidentiality agreements to be provided by each registrant which submits CBI to the Committee. Committee members shall serve for three years, and may be reappointed.

3. Scope of Committee's Activities -- Only proposed labeling's Directions for Use (subdivision H, Guideline No. 105-18(a) and 40 CFR §156.10(l) and supporting efficacy data (subdivision G, Guideline No. 95-12(b)(l) in connection with FIFRA §3 applications for new soil treatment termiticide active ingredients, or

amendments to label rates or methods of application for currently registered soil treatment termiticides, shall be within the scope of the Committee and received by the Committee. Proposed labeling and efficacy data in connection with any other FIFRA application, including but not limited to, an application involving fumigants, baits, or Experimental Use Permits, shall be outside the scope of the Committee and shall not be considered by the Committee.

4. Registrant Submissions -- Subject to the limitations set forth in paragraphs 1 and 3 of this MOU, registrants (including new applicants) may submit copies of proposed labeling and efficacy data to the Committee following submission of the same proposed labeling and efficacy data to EPA. Submission of proposed labeling and efficacy data to the Committee is optional. However, a submission to the Committee should allow EPA to expedite the completion of the registration request. Registrant submissions shall be sent directly to each member of the Committee by the registrant.

5. Protection of CBI -- To the fullest extent provided by law, the Committee shall treat as CBI all registrant submissions (i.e. proposed labeling and efficacy data) including the fact that an application has been filed with EPA. Before receiving a registrant's submission, each member of the Committee shall sign a confidentiality agreement, provided by that registrant, and confirm in writing that he or she is authorized under the laws of his or her state to sign and abide by the agreement. Members of the Committee may confer about an application or submission only among themselves, or with EPA and/or the registrant as provided in paragraph 7 of the MOU. Committee members shall not communicate with other ASPCRO members regarding an application or submission except as provided in paragraph 9 of this MOU, and shall not communicate with other personnel from their own states, other registrants, technical consultants, or anyone else regarding an application or submission. Communications between the Committee and EPA and/or registrants, and all internal Committee communications, shall be treated as confidential, until said information is subject to public disclosure as required by law.

6. Criteria -- If no time period of product effectiveness is claimed by a registrant on its proposed labeling, any questions or concerns raised by the Committee shall be limited to whether the data submitted (either USDA Gulfport or other) support five years of efficacy at label rates. If the registrant claims a period of time less than five years (e.g., 3-5 years), then any questions or concerns raised by the Committee shall be limited to whether the submitted data support that claim. In raising questions or concerns regarding different registrants' submissions, the Committee shall use its best efforts to be as consistent as possible.

7. Communications with EPA and Registrants -- The Committee will provide their written comments to EPA within 90 days of receiving the registrant's submission or in time to meet EPA's review deadline for product labeling and efficacy data. The sole purpose of these comments will be to raise any questions or concerns about the proposed labeling's Directions for Use or supporting efficacy data. After consulting with EPA the Committee shall send a copy of any such written communication to the registrant, and shall promptly provide the registrant with a copy of any follow-up correspondence to or from EPA.

8. EPA Action -- EPA shall consider the questions or concerns raised by the Committee, and any response provided by the registrant, in deciding what action to take with respect to a registrant's application.

9. Report to ASPCRO -- Within 30 days after EPA notifies the Committee that it has approved a registration or amendment, the Committee shall report to the members of ASPCRO the fact that the Committee reviewed the proposed labeling and efficacy data. The Committee shall not provide any information subject to a confidentiality agreement entered into under paragraph 5 to the members of ASPCRO without the registrant's express prior consent unless such information is subject to public disclosure as required by law.

10. Approval of MOU -- This MOU becomes effective after all individuals indicated below sign it. The signature of the President of ASPCRO signifies that this MOU has been formally approved by ASPCRO's Board of Directors, and that ASPCRO and the Committee understand and agree to abide by each of its provisions. The signature of each member of the Committee signifies that he has read the MOU, and understands and agrees to abide by each of its provisions. Future members of the Committee must read and sign a copy of the MOU before becoming a member of the Committee. The signature of the Director, Registration Division, Office of Pesticide Programs signifies that EPA approves the MOU, and understands and agrees to abide by the provisions applicable to EPA. A copy of this MOU, containing all signatures indicated below, shall be provided to any termiticide registrant which requests a copy. Except as provided in paragraph 11 below, this MOU shall not be modified in any manner unless the affected parties are provided with a reasonable advance opportunity to comment to EPA and ASPCRO on any proposed changes.

11. Termination -- The ASPCRO and the EPA reserve the right to terminate this MOU at any time by mutual consent or unilaterally.

Date 6/25/97

James Jones
Acting Director, Registration Division
Office of Pesticide Programs

Date 7/1/97

Benny Mathis, President
ASPCRO

Date 7/10/97

Jim Wright
Member, ASPCRO
Termiticide Review Committee

Date 7-22-97

J.H. "Bud" Paulson
Member, ASPCRO
Termiticide Review Committee

Date 7-31-97

Dave E. Scott
Member, ASPCRO
Termiticide Review Committee

Date 8-28-97

Dr. Brad Kard
Member, ASPCRO
Termiticide Review Committee

Association of Structural Pest Control Regulatory Officials

MEMO

To: ASPCRO Members
From: George N. Saxton
Subject: FYI: Loss of funding for Gulfport
Date: June 9, 1997

Enclosed please find information that Benny Mathis has asked me to mail to all ASPCRO members. If you have questions, please call Carl Falco, Director, NCDA - Structural Pest Control Division, at (919) 733-6100.

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 1
To Benny Mathis	From C. Falco
Co. TX SPCB	Co. NCDA-SPCD
Dept.	Phone #
Fax #	Fax #

June 6, 1997

MEMORANDUM

TO: ASPCRO Members

FROM: Benny Mathis

SUBJECT: Loss of funding for Starkville (Gulfport), MS Termiticide Efficacy Screening Program

Enclosed you will find the following documents concerning the above subject:

Letters to U.S. Senators Trent Lott and Jesse Helms.
A one page briefing paper prepared by Janine Powell, USDA-FS, Project Leader.
An NPCA issue paper.

These documents describe recent funding reductions in this valuable program and the concerns of some stakeholders. Additional efforts have been made to encourage the Forest Service to recommit the required resources to this program. ASPCRO attended a meeting with USDA-FS, and EPA staff, NPCA, RISE and a representative of the registrant community on May 13. Unfortunately, this meeting does not seem to have turned around the Forest Service opinion that this research is not within the scope of their mission or the mission of the Starkville facility.

The ASPCRO Board believes this to be a very significant issue for all state regulatory programs. Therefore, we encourage each of you to contact the most appropriate member(s) of your respective congressional delegation with your concerns. Congressional inquiries concerning the importance of this work to EPA should be directed to Steve Johnson, Deputy Director, OPP, at (703) 305-7092.

This issue will be brought up at the SASDA meeting the week of June 9, with a possible resolution requesting additional resources be devoted to this research by USDA; and at the July SFIREG meeting in Arlington, VA.

If you have any questions please contact Carl Falco, Director, NCDA - Structural Pest Control Division, at (919) 733-6100.

James A. Graham
Commissioner

Carl E. Falco
Director

North Carolina
Department of Agriculture
Structural Pest Control Division

May 6, 1997

Honorable Jesse Helms
403 Dirksen Senate Office Building
Washington, DC 20510

Dear Senator Helms:

As the Director of the Structural Pest Control Division, a consumer and environmental protection agency within the North Carolina Department of Agriculture, I closely monitor trends in the field of termite control. Because subterranean termites are distributed throughout North Carolina, this is also a subject of significant concern to homeowners and business owners across the state.

Therefore, I am deeply concerned about the drastic funding cuts the USDA - Forest Service, Southern Research Station, Forestry Sciences Laboratory has suffered in the last few years. The laboratory, recently relocated from Gulfport to Starkville, Mississippi, conducts research and field studies on termiticides. (The lab's field plots remain in Gulfport and several other locations throughout the country.) The research performed by the scientists and technicians at this facility is the only objective, officially sanctioned evaluation of termiticide efficacy. This work is so respected that the U.S. Environmental Protection Agency will not register a termiticide unless it has demonstrated five years of termite control in Forest Service tests, a position reaffirmed by the Agency in a Pesticide Regulation Notice issued in late 1996 (PR Notice 96-7). Our agency uses this same research to establish work performance and environmental protection standards for termite control in North Carolina. Furthermore, federal agencies concerned with new construction, including the Departments of Veteran's Affairs and Housing and Urban Development, also require five year termite soil treatment warranties on all new homes under their respective mortgage loan programs.

Since FY 1992, the funding for the Forestry Sciences Laboratory has decreased from $967,000 to $685,000 and the staff has been cut from eighteen to six, with only one research scientist and one technician dedicated to termiticide efficacy testing. I am deeply concerned that these funding cuts will greatly impair the search for future termite control methods and technologies and the ability of this and other state regulatory programs to protect consumers from investing in ineffective and/or less than safe termite control treatments. With this in mind, I urge you to work to restore the funding level of the Forestry Sciences Laboratory in Starkville, Mississippi to the FY 1992 level of $967,000, plus any adjustments necessary due to inflation.

I appreciate your time and consideration of this matter and urge you to call me if you have any questions.

Sincerely,

Carl E. Falco
Director

cc: James A. Graham
Commissioner of Agriculture

Post Office Box 27647 Raleigh, North Carolina, 27611 • (919) 733-6100 FAX (919) 733-0633

THE STATE OF MISSISSIPPI
DEPARTMENT OF AGRICULTURE AND COMMERCE
BUREAU OF PLANT INDUSTRY
P.O. BOX 5207
Mississippi State, Mississippi 39762-5207
Telephone (601) 325-3390; FAX (601) 325-8397

April 11, 1997

LESTER SPELL JR., D.V.M.
COMMISSIONER

ROBERT MCCARTY
DIRECTOR AND
STATE ENTOMOLOGIST

Honorable Trent Lott
United States Senate
487 Russell Senate Building
Washington, D.C. 20515

Dear Senator Lott:

As Mississippi's chief pesticide regulatory official, I closely monitor trends in the field of termite control, a subject about which every homeowner and business owner in Mississippi should be concerned.

Therefore, I am deeply concerned about the drastic funding cuts the USDA, Forest Service, Southern Research Station, Forestry Sciences Laboratory has suffered in the last few years. The lab, located in Starkville, conducts research and field studies on termiticides. (The lab was previously located in Gulfport, but moved to Starkville a couple years ago. The lab's field plots are in Gulfport and other locations). The results of the field testing are the only objective or officially sanctioned evaluation of termiticide efficacy. Results of the lab's field tests are so respected that the U.S. Environmental Protection Agency will not register a termiticide unless it has shown five years efficacy in the Forest Service tests. Furthermore, federal agencies concerned with new construction, such as the Departments of Veteran's Affairs and Housing and Urban Development, also require five year termite soil treatment warranties.

Since FY 1992, the funding for the Forestry Sciences Laboratory has decreased from $967,000 to $685,000 and the staff has been cut from eighteen to six with only one research scientist and one technician dedicated to termiticide efficacy testing. I am deeply concerned that these funding cuts will greatly impair the search for future termite control methods and technologies. In all probability, many of the newer technologies approved by the lab will call for the application of less chemical which decreases the likelihood of exposure or harmful misapplications. Unfortunately, these massive budget cuts will adversely impact the lab's ability to conduct this valuable research. With this in mind, I urge you to work to restore the funding level for the Forestry Sciences Laboratory in Starkville to the FY 1992 level of $967,000 (with adjustments for inflation).

I appreciate your time and consideration of this matter and urge you to call me if you have any questions.

Very truly yours,

Robert McCarty

Robert McCarty
Director and State Entomologist

RHM/jg

DEDICATED TO SERVING THE PEOPLE OF MISSISSIPPI

FOREST SERVICE
BRIEFING PAPER
FY 1996 BUDGET

TOPIC: FY 1996 Budget

ISSUE: Impacts of research proposed for elimination or reduction for SO-4502, Wood Products Insects (at Gulfport, Mississippi)

BUDGET:

FY 1989	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995 Pres.
$776K	$800K	$903K	$967K	$849K	$851K	$935K

DISCUSSION (KEY POINTS): This unit's reductions are due to a fairly flat budget for the past several years while inflation and the cost of conducting research have risen steadily. Faced with this budget level, the Southern Station will take the following actions:

Discontinue research on using wood extractives as wood preservatives to protect against termites ($10K, includes reduction in supplies and travel).

Discontinue research concerning the use of wood treatments, primarily with borates, for protection of wood and wood products from termites, beetles, and decay ($190K, includes 2 scientist years, 1.4 FTEs for technicians, supplies, and travel).

Discontinue .5 FTE of computer support for the Unit. ($15K, includes .5 FTE for technicians).

RECOMMENDATION:

Total Cost Reduction = $215,000
Total FTE Reduction = 3.9 FTE (2 scientist years and 1.9 support)

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 1

To Dorsey	From Gene
Co. Cong Price	Co. NPCA
Dept. Cong Rel Co	Phone #
Fax # NCDA	Fax #

NATIONAL PEST CONTROL ASSOCIATION Inc.
8100 Oak Street, Dunn Loring, VA 22027
(703) 573-8330 • Fax (703) 573-4116

ISSUE: **Restoration of Funding to Fiscal Year 1992 Level for U.S. Forest Service - Wood Insect Research Lab in Starkville, Mississippi**

BACKGROUND: One of the pest control industry's primary activities is the control of termites and other wood destroying organisms in homes and businesses. Historically, pest control operators have relied on liquid termiticides to create a vertical barrier between the ground and the structure to repel termites from devouring the structure. More recently, the industry has begun to use new control technologies, such as baits. Despite industry's best efforts, however, termites remain a major pest. In fact, it is estimated termites and other wood destroying insects cause at least $1.5 billion damage annually to wood frame structures; more than fires, floods and other natural disasters combined.

Post-it™ brand fax transmittal memo 7671 | # of pages ▸
To Carl Fokes | From Bob Lansley
Co. NCDA | Co.
Dept. | Phone #
Fax # | Fax #

For many years, the U.S. Environmental Protection Agency has relied on the U.S. Forest Service to research, study and field test the effectiveness of termiticides. Traditionally, EPA will not register a termiticide unless Forest Service field tests show the termiticide has more than five years efficacy. Unlike other pesticides, establishing efficacy for termiticides in a credible fashion is vitally important because it is difficult to tell if the product is actually working since termites are usually not visible until they have caused a tremendous amount of damage to the structure.

As part of a recent Pesticide Regulation (PR) notice regarding termiticide labeling, EPA states it "believes that registration of a product demonstrating less than five years of efficacy for control of termites is generally not appropriate from a safety or efficacy standpoint, considering the costs of treatment and potential damage that could occur. The Agency does not believe that the homeowner should be subjected to such costly protection as would occur with products that are only efficacious for one year. Such products could, quite possibly, pose unreasonable adverse effects to the environment and/or humans because of higher risks than longer acting alternatives. The more frequent treatments required could result in greater exposure and risk, or lower benefits, because of being less effective if not retreated, or more expensive if retreated." Federal housing agencies concerned with new construction, such as the Departments of Veteran's Affairs and Housing and Urban Development, also require five year termite soil treatment warranties

Page Two
Restoration of Starkville Funding
April 3, 1997

The Forest Service conducts its termiticide research at the Wood Products Insect Research lab in Starkville, Mississippi. Prior to FY 1995, the Wood Products Insect Research lab, which is part of the Southern Forest Experiment Station, was located in Gulfport, Mississippi. Although the staff and labs have moved to Starkville, the termiticide testing plots remain in Gulfport.

Since FY 1992, funding for the Wood Products Insect Research lab has decreased from $967,000 to $685,000. As a result, staffing has decreased from 18 to six. These cuts in funding and staff threaten to delay or completely arrest the introduction of new termiticides and termite control strategies. This would adversely impact industry, homeowners and businesses owners throughout the country.

POSITION: The National Pest Control Association respectfully requests that funding levels for the Wood Products Insect Research lab be increased to $1.1 million. This figure is based on the inflation adjusted FY 1992 appropriation. NPCA further asks that such funds be specifically earmarked for termite control research concerning current and emerging technologies and efficacy testing for new products.

DRAFT SASDH Resolution

WHEREAS, the USDA - Forest Service, Southern Research Station, Forestry Sciences Laboratory, recently relocated from Gulfport to Starkville, Mississippi conducts research and field studies concerning termiticide efficacy;

WHEREAS, the research conducted by the scientists and technicians at the Forest Sciences Laboratory is the only objective, officially sanctioned evaluation of termiticide efficacy;

WHEREAS, termiticide efficacy data from the Forest Services Laboratory is necessary to ensure that the use of relatively low risk termiticides provides termite control and will not result in greater exposure or risk as the result of repeated termiticide applications or additional cost to the consumer

WHEREAS, the Departments of Agriculture the majority of the southern states regulate the Structural Pest Control Industry in each respective state in an effort to protect consumers and the environment;

WHEREAS, the Departments of Agriculture in these states have an interest in the state and federal registration and use of termiticides which have been shown to be effective in controlling termites;

WHEREAS, the U.S. Environmental Protection Agency relies on the research conducted at the Forest Services Laboratory in its pesticide registration process by generally refusing to register a termiticide unless the Forest Service has tested the termiticide and has determined it to be effective in controlling termites for a minimum of five years;

WHEREAS, the EPA's position regarding termiticide efficacy data from the Forest Services Laboratory was recently reaffirmed by the EPA in a Pesticide Regulation Notice issued in late 1996 (PR Notice 96-7);

WHEREAS, both the homeowner and the licensed pest control operator have an interest in knowing that the termiticides being applied to structures have been scientifically shown to be effective in controlling termites;

WHEREAS, federal agencies concerned with new construction, including the Departments of Veteran's Affairs and Housing and Urban Development, also require five year termite soil treatment warranties on all new home under their respective mortgage loan programs; and,

WHEREAS, since FY 1992, the funding for the Forestry Sciences Laboratory has decreased from $967,000 to $685,000, which has resulted in a decrease in staff from eighteen to six, with only one research scientist and one technician dedicated to termiticide efficacy testing;

BE IT RESOLVED THAT the Southern Association of State Departments of Agriculture encourages the United States Department of Agriculture, in the strongest possible terms, to seek increases in the level of funding for this research and to renew their commitment to this research.

DRAFT

UNITED STATES OF AMERICA
FEDERAL TRADE COMMISSION
WASHINGTON, D.C. 20580

Division of
Service Industry Practices

Michelle Chua
Attorney

Direct Dial:
(202) 326-3248

April 16, 1997

Mr. Benny M. Mathis
State of Texas, Structural Pest Control Board
1106 Clayton Lane, Suite 100 LW
Austin, TX 78723-1066

BY FACSIMILE 512-451-9400

Dear Benny:

Per our conversation today, I am faxing you a draft letter regarding the FTC's interest in possible consumer protection problems in the termite pest control industry. We welcome any edits or suggestions you may have.

If you have any questions, please call me at 202-326-3248. Our fax number is 202-326-3392. I want to thank you again for all your interest and assistance in this matter. We look forward to working with you in the future.

Sincerely yours,

Michelle Chua, Esq.

DRAFT LETTER

To: All ASPCRO MEMBERS
From: Board of Directors of ASPCRO
Date: [ ]

The Federal Trade Commission has expressed a concern about possible consumer protection problems in the termite pest control industry, ranging from instances of deceptive advertising, warranties, unfair practices in pest control inspections and treatments (both pre-construction and post-construction treatment), and unlicensed operators. At this time, the FTC is requesting any ideas, comments or suggestions, or anything else you would like to tell them about problems you have encountered in this area. The FTC contact is:

Michelle Chua
FTC, Room 200
6th St. & Pennsylvania Ave., NW
Washington, DC 20580

Association of Structural Pest Control Regulatory Officials

DATE: April 29, 1997

TO: ASPCRO Members

FROM: George Saxton/ASPCRO Treasurer

RE: Federal Trade Commission and the Termite Industry

ASPCRO President Benny Mathis has requested that the enclosed draft letter from Michelle Chua of the Federal Trade Commission, be distributed to all ASPCRO members for comment. If you have comments, please forward them to me and I will see that they are forwarded to the appropriate offices.

George N. Saxton
Office of Indiana State Chemist
1154 Biochemistry
Purdue University
West Lafayette, IN 47906-1154
(765) 494-1585
(765) 494-4331 FAX
saxtong@isco.purdue.edu

DRAFT LETTER

To: All ASPCRO MEMBERS
From: Board of Directors of ASPCRO
Date: [ ]

The Federal Trade Commission has expressed a concern about possible consumer protection problems in the termite pest control industry, ranging from instances of deceptive advertising, warranties, unfair practices in pest control inspections and treatments (both pre-construction and post-construction treatment), and unlicensed operators. At this time, the FTC is requesting any ideas, comments or suggestions, or anything else you would like to tell them about problems you have encountered in this area. The FTC contact is:

Michelle Chua
FTC, Room 200
6th St. & Pennsylvania Ave., NW
Washington, DC 20580

Association of
Structural
Pest
Control
Regulatory
Officials

RECEIVED
JUL 17 1997
INDIANA STATE CHEMIST

July 10, 1997

Ms. Michelle Chua
FTC, Room 200
6th Street & Pennsylvania Avenue, N.W.
Washington, D.C. 20580

Dear Ms. Chua:

We have enclosed the responses received from our member states to our request for comments on problems in the termite industry. I would also like to provide the following comments on behalf of the Texas Structural Pest Control Board.

1. We have had a major problem with incomplete termite treatments in pre-construction situations in Texas. We hope to alleviate this through our notification regulations, but we know that this problem has plagued the industry for many years.

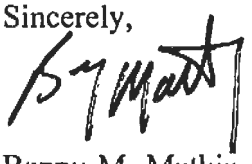
2. We do not find that the termite control products work as effectively as claimed. When pest control operators rely on the statements of manufacturers with respect to the use of their products, they are often left "holding the bag" when the products do not work.

3. Deceptive sales practices are definitely a problem. We have attempted to address this by strengthening our treatment disclosure requirements. There have been cases, however, that have required us to go beyond the Structural Pest Control Act and get our attorney general involved when serious deceptive trade practices arise.

4. We, and the states as a whole, continue to have problems with unlicensed operators. This can cause serious problems for all of us, particularly when they cross state lines.

Please feel free to contact me if you have any questions.

Sincerely,



Benny M. Mathis
President, ASPCRO

BMM:sr

Enclosure

c: Roger B. Borgelt, General Counsel
Esther Chavez, Assistant Attorney General

Billy Ray Smith
Commissioner

Office Telephone
502-564-7274
FAX# 502-564-3773
TDD# 502-564-2075

Commonwealth of Kentucky
Department of Agriculture
Division of Pesticides
100 Fair Oaks Lane, 5th Floor
Frankfort, Kentucky 40601

July 1, 1997

Mr. George Saxton
Office of Indiana State Chemist
1154 Biochemistry Building
West Lafayette, Indiana 47907-1154

Dear Mr. Saxton:

I have reviewed the information pertaining to the concerns of the Federal Trade Commission in regard to possible consumer protection problems in the structural pest control industry. One of the biggest problems we face in Kentucky at the present time are unlicensed pest control operators. It appears that this is a problem that has virtually gone untouched in past years in this Commonwealth. At this time, we are cooperatively formulating a policy with the Office of the Attorney General and the Kentucky State Police in dealing with unlicensed pest control operators as well as actively working with them to alleviate this problem. To date, several arrests of unlicensed pest control operators have been made and more are expected to follow.

If you have any comments or questions regarding this matter, please feel free to contact me. Should the need arise, I am available to meet with ASPCRO members or other concerned parties to discuss what we are doing in the Commonwealth of Kentucky to attack this issue.

Sincerely,

John W. McCauley
Director

STATE OF IDAHO

DEPARTMENT OF AGRICULTURE
DIVISION OF AGRICULTURAL RESOURCES

PHILIP E. BATT
Governor

PATRICK A. TAKASUGI
Director

June 26, 1997

George N. Saxton, ASPCRO Treasurer
Office of the Indiana State Chemist
1154 Biochemistry
Purdue University West Lafayette, IN 47906-1154

Re: Federal Trade Commission and the Termite Industry

Dear Mr. Saxton:

Idaho has, over the last several years, experienced some problems related to termite treatments that required retreatment to gain control of the infestations. We feel that there has been activity in northern Idaho that is related to unlicensed applicators and fraud related to termite treatments. The Department continues to investigate complaints related to termite control but those cases are a very low percent of our case load, (estimated at one-three percent).

One area we feel could be improved upon for several reasons is a certification or standardization program for those individuals who are performing home inspections related to loan approval or buyer requests. Currently, there are no qualifications needed to become a home inspector nor is there any process to enhance the knowledge of individuals that have expertise in one area, such as home construction, and little or no knowledge in other areas such as wood destroying insects.

The Department has a rule related to making recommendations for pesticide use without a license, but most of the home inspections are made outside of this frame work. Due to the jurisdictional responsibility of the Department, and because of the multiple disciplines involved in this profession, it is unlikely that we will pursue certification of these individuals. The Department will continue to investigate complaints and take regulatory action on violations related to the misuse of pesticides, or individuals that are making recommendations without the proper pesticide related license.

If you have any questions please call me at (208) 332-8610 or e-mail me at: rhays@agri.state.id.us.

Sincerely,

Robert S. Hays

Robert S. Hays, Chief
Division of Agricultural Resources

cc: Mike Everett
Idaho Attorney General's Office, Consumer Affairs

2270 Old Penitentiary Road • P.O. Box 790 • Boise, Idaho 83701 • (208) 332-8605 • Fax (208) 334-3547

James A. Graham
Commissioner

North Carolina
Department of Agriculture
Structural Pest Control Division

Carl E. Falco
Director

June 27, 1997

Michelle Chua
FTC, Room 200
6th St. & Pennsylvania Ave., NW
Washington, DC 20580

Dear Ms. Chua:

I am writing in response to your request for information concerning consumer protection problems in the termite pest control industry which we have encountered in North Carolina. Generally, the most commonly encountered consumer protection problems involve deceptive and/or unfair warranties or deceptive sales practices involving misrepresentation and unnecessary treatments.

The cases with warranty issues usually derive from exclusions which operate to deny liability for the thing contracted for by the homeowner. These cases often involve exclusions in damage/repair warranties. For example, a pest control company may contract to treat a home with Timbor to control or prevent wood decay fungus. The "damage/repair" contract excludes liability for damage resulting from wood decay fungus occurring in an area of "excessive moisture" with excessive moisture defined in the contract as any area in which the wood moisture content is 25% or greater. Scientific evidence indicates that a wood moisture content of at least 28% must be present in order to support the growth of wood decay fungus. The exclusion provision therefore denies liability for any damage if the necessary environmental conditions exist for the growth of the pest to be controlled.

Other cases have involved warranties in which the exclusions in the contract include conditions that are present and visible at the time that the parties enter into the contract. The company representative either represents to the homeowner that the conditions will not be a problem or does not bring the existing conditions to the homeowner's attention. When the area later becomes infested with subterranean termites, the company argues that it has no liability because of the exclusion.

In cases involving deceptive sales practices, the company representative often misrepresents to the homeowner that a specific pest is present. Some related cases have included misrepresentations that wood decay fungus is present and that the wood will rot if not treated immediately. The homeowner contracts for a treatment with the belief that there is an existing problem. However, the contract signed by the parties indicates that the moisture readings are less than 20% and that the wood decay fungus is not active. The pest control company later

Post Office Box 27647 Raleigh, North Carolina, 27611 • (919) 733-6100 FAX (919) 733-0633

argues that the treatment was sold as a preventative. The paperwork signed by the homeowner supports this argument. However, the homeowner would not have paid to have his home treated had he not been led to believe that wood decay fungus was already present.

While we do have investigations involving other issues such as substandard treatments, the above described cases represent the biggest problems for us in terms of enforcement. We are working with the Consumer Protection Section of our Attorney General's office to address many of these issues.

Sincerely,

Carl E. Falco
Director

TRANSMISSION REPORT

****

:IN STATE CHEMIST (JUL 01 '97 10:47AM)

DATE	START TIME	REMOTE TERMINAL IDENTIFICATION	MODE	TIME	RESULTS	TOTAL PAGES	DEPT. CODE	FILE NO.
JUL 01	10:45AM	512 451 9400	G3EST	02'00"	OK	04		

STATE OF CALIFORNIA—STATE AND CONSUMER SERVICES AGENCY

PETE WILSON, *Governor*

State of California Department of Consumer Affairs

STRUCTURAL PEST CONTROL BOARD
1422 HOWE AVENUE, SACRAMENTO, CA 95825
Telephone Numbers:
Administration Unit (916) 263-2540
Examination/Licensing/Records Storage (916) 263-2544
Complaint Unit (916) 263-2533
Outside of Sacramento Area 1-800-737-8188
FAX (916) 263-2469

June 6, 1997

RECEIVED
JUN 10 1997
INDIANA STATE CHEMIST

George N. Saxton
Office of Indiana State Chemist
1154 Biochemistry
Purdue University
West Lafayette, IN 47906-1154

Dear Mr. Saxton:

RE: Federal Trade Commission and the Termite Industry

In response to the draft FTC letter you distributed to ASPCRO members on May 2, 1997, we offer the following comments for forwarding to ASPCRO President Benny Mathis and Michelle Chua of the Federal Trade Commission.

The California Structural Pest Control Board regulates the licensing and business of structural pest control operators and companies and, in conjunction with the California Department of Pesticide Regulation, enforces statutes and regulations pertaining to pesticides. The Board's regulatory authority is contained in the California Business and Professions Code which also contains statutes protecting consumers from unfair competition and false advertising. Upon complaint of the Board, the state Attorney General prosecutes pest control operators and companies who violate the Structural Pest Control Act or other provisions of the Code.

Pest control industry problems that are becoming more pervasive in California are deceptive advertising and unfair business practices, especially misrepresentations made with respect to "local" or "spot" pest control devices and chemical treatments. During the past decade, entrepreneurs have successfully capitalized on increased consumer interest in alternatives to whole-structure fumigation as a means of pest control. Although this search for alternatives is meritorious, problems arise when consumers are not given sufficient information to make intelligent choices and they are presented with false and misleading advertisements inducing them to purchase certain pest control products and services. Advertising claims include misrepresentations about treatment efficacy, comparisons with other products and methods, use of spot or local treatment methods for "whole-structure" pest control, environmental safety, and government sponsorship or approval. Warranties issued in conjunction with local or spot pest control treatments suggest that the whole structure is covered by the warranty. Consumers then wrongfully believe that the whole structure was treated.

The California Attorney General recently filed two civil suits currently pending against pest control companies that engage in false advertising and unfair competition. One suit is against a company that uses a microwave system for termite control. Another suit is against a company that uses the

"Electro-Gun Treatment System" to kill termites by electric shock. The Electro-gun is manufactured and marketed both interstate and internationally by Etex, Ltd., a Nevada Corporation.

On June 21, 1994, the Federal Trade Commission issued a decision and order In the Matter of Sonic Technology Products, Inc., et al., adopting a consent agreement restricting representations with respect to respondent's ultrasonic pest control devices. Sonic Technology Products is a Nevada corporation located in California.

Regardless of Structural Pest Control Board and FTC actions against these companies, misrepresentation problems continue in the industry. A number of local pest control companies still equate their local treatment methods to whole-structure treatments. Consumers are exposed to mail order catalogues, including those found in the seat pockets of virtually any major domestic airline, that contain false and misleading advertisements promoting the purchase of ineffective ultrasonic pest control devices.

The California legislature is now considering a bill that would require the registration and regulation of pest control devices manufactured, advertised, offered for sale, sold, leased, transferred or otherwise provided, or used in the state. Similar bills had already been enacted in other states, many of whom actively participate in ASPCRO.

Clearly, these industry problems, and hence the need for better regulation and enforcement, extend beyond California. The California Structural Pest Control Board welcomes the opportunity to work with other members of ASPCRO and the Federal Trade Commission in finding better solutions and taking collective action to protect consumers.

Please do not hesitate to contact me if you desire additional information.

Sincerely,

DONNA J. KINGWELL
Executive Officer

cc: Michelle Chua
Federal Trade Commission, Room 200
6th St. & Pennsylvania Ave., NW
Washington, DC 20580

Robert Eisman
Deputy Attorney General
Office of State Attorney General
300 South Spring Street, Ste. 500
Los Angeles, CA 90013

J. JOSEPH CURRAN, JR.
Attorney General

brushkoff@oag.state.md.us
E-MAIL

(410) 576-7003
TELECOPIER NO.

CARMEN M. SHEPARD
DONNA HILL STATON
Deputy Attorneys General

(410) 576-6514
WRITER'S DIRECT DIAL NO.

STATE OF MARYLAND
OFFICE OF THE ATTORNEY GENERAL

CONFIDENTIAL MEMORANDUM

TO: Termite Control Investigation Contacts (see enclosed list)

FROM: Bennett Rushkoff BR
Special Assistant to the Attorney General, Maryland

DATE: September 3, 1997

RE: **Termite group's third conference call:**

September 15, 1997 at 3:30 p.m. (Eastern Time)
Call-in number 904-779-4719, access code #2266000

Our next termite group conference call will be held on Monday, September 15, at 3:30 p.m. Eastern time. Pest control regulators are welcome to join the assistant attorneys general on the call, but we will need to limit participation to one or two telephone lines per state. This will be our last conference call before we break out into our working groups.

We now have 23 participating states and the FTC (see enclosed list of contacts), and have organized ourselves into six working groups (see enclosed list of working groups). A seventh working group (which would look at Sears) has yet to be organized, and we may also organize a consumer education working group.

The assignments of states to working groups, as shown on the enclosed list, are not cast in stone. Contact me if you want to join or leave a group.

Three of our six working groups will focus on the practices of two national companies and one regional company: Orkin, Terminix, and Home Paramount. These working groups will seek to determine whether the companies, as a matter of routine practice, are (1) properly treating and retreating customers' premises for termite infestations, (2) accurately representing the efficacy of the treatment methods used, and (3) selling consumers only necessary treatments. In addition, it is expected that some individual states will choose to investigate other target companies, including unlicensed operators, that do not operate at the national or regional level.

SEP 05 1997

The "Efficacy Claims and Alternative Treatments" group will review the efficacy claims being made for some of the leading alternatives to traditional termiticide treatment. The group will seek to determine whether the claims being made by particular companies are adequately substantiated. The group will investigate companies not assigned to other groups, and may also develop standards for adequate substantiation of efficacy claims that could be applied by the other groups.

The "Pre-Construction Treatment" group will develop common procedures for investigating whether companies that contract to perform pre-construction termite treatment actually do the work they are paid to do. These procedures will then be used to investigate subcontractors that perform pre-construction treatment in the working group states.

The "Warranties and Service Contracts" group will evaluate whether consumers are getting as much protection as they expect from the various warranties and service contracts offered by termite control companies, including those offered by the major companies assigned to other working groups. If consumers are getting less protection than they expect, the group will consider whether the problem might be attributable to deception in the marketing of the warranties and service contracts and/or to the inherent unfairness of certain provisions of the warranties or service contracts. The group may then assist the other working groups and individual states in developing deception and/or unfairness theories to address issues raised by particular warranties and service contracts.

On our conference call, we will discuss what the initial tasks of each working group will be.

TERMITE CONTROL INVESTIGATION -- WORKING GROUPS (as of 9/97)

ORKIN

Connecticut
FTC
Florida (lead)
Georgia (company headquarters)
Kentucky
Maryland
Nebraska
New Jersey
New Mexico

TERMINIX

FTC
Hawaii
Illinois
Kentucky (lead)
Massachusetts
Missouri
North Carolina
Ohio
Tennessee (company headquarters)

SEARS [group to be formed]

FTC
Illinois (company headquarters)
Texas

HOME PARAMOUNT [regional company]

Maryland (company headquarters)
Pennsylvania (lead)
Virginia
West Virginia

EFFICACY CLAIMS AND ALTERNATIVE TREATMENTS

California (lead)
FTC
Florida
Kentucky
Texas
Virginia

PRE-CONSTRUCTION TREATMENT

Arizona
Arkansas
FTC
Florida
Hawaii
West Virginia (lead?)

WARRANTIES AND SERVICE CONTRACTS

Arkansas
FTC (lead)
Florida
Massachusetts
New Mexico
Ohio
Pennsylvania
Vermont

TERMITE CONTROL INVESTIGATION -- CONTACT LIST 9/97

Hugh Hegyi
Assistant Attorney General
Office of the Attorney General
1275 West Washington Street
Phoenix, AZ 85007

602-542-7717 phone
602-542-4377 fax
hhegyi@ag.state.az.us

Teresa Finkelstein
Assistant Attorney General
Office of the Attorney General
200 Catlett-Prien Building
323 Center Street
Little Rock, AR 72201-2610

501-682-6150 phone
501-682-8118 fax

Robert S. Eisman
Deputy Attorney General
California Department of Justice
300 S. Spring Street
Los Angeles, CA 90245

213-897-2575 phone
213-897-2804 fax
rse@sprintmail.com

Garry Desjardins
Assistant Attorney General
Office of the Attorney General
110 Sherman Street
Hartford, CT 06105

860-566-5374 phone
860-523-5536 fax

Bob Buchner
Assistant Attorney General
Office of the Attorney General
110 S.E. 6th Street
The 110 Tower
Fort Lauderdale, FL 33301

954-712-4628 phone
954-712-4658 fax

Miriam Collins
Investigator
Governor's Office of Consumer Affairs
2 Martin Luther King, Jr. Drive
Suite 356, East Tower
Atlanta, GA 30334

404-657-7544 phone
404-651-9018 fax

Steve Levins
Senior Attorney
State of Hawaii
Office of Consumer Protection
P.O. Box 3767
Honolulu, HI 96812-3767

808-586-2636 phone
808-586-2640 fax
slevins0@counsel.com

Shelton Frey
Assistant Attorney General
Consumer Fraud
Office of the Attorney General
1001 E. Main Street
Carbondale, IL 62901

618-457-3505 phone
618-457-5509 fax

David Vandeventer
Michael S. Schwendeman
Assistant Attorneys General
Office of the Attorney General
1024 Capital Center Drive
Frankfort, KY 40601

502-696-5389 phone
502-573-8317 fax

Bennett Rushkoff
Special Assistant to the Attorney General
Office of the Attorney General
200 Saint Paul Place
Baltimore, MD 21202

410-576-6514 phone
410-576-7003 fax
brushkoff@oag.state.md.us

Chi Chi Wu
Assistant Attorney General
Office of the Attorney General
One Ashburton Place - 19th Floor
Boston, MA 02108-1698

617-727-2200 (ext. 2571) phone
617-727-5765 fax

Patricia A. Molteni
Assistant Attorney General
Office of the Attorney General
P.O. Box 899
Jefferson City, MO 65102

573-751-8455 phone
573-751-7948 fax

Stephanie Emrich
Consumer Specialist
Consumer Protection Division
State Capitol - Suite 2115
P.O. Box 98920
Lincoln, NE 68509-8920

402-471-2682 phone
402-471-3297 fax

Joe Kavesh
Special Assistant to the Director
New Jersey Division of Consumer Affairs
124 Halsey Street, 7th Floor
Newark, NJ 07101

973-504-6311 phone
973-648-3538 fax

Bill Keller
Assistant Attorney General
Office of the Attorney General
P.O. Drawer 1508
Santa Fe, NM 87504-1508

505-827-6601 phone
505-827-6685 fax

Jane Feather
Special Investigator
Office of the Attorney General
Department of Justice
P.O. Box 629
Raleigh, NC 27602-0629

919-716-6000 phone
919-715-0577 fax

Mary Patrick Latham
Assistant Attorney General
Consumer Protection Section
1600 Carew Tower, 441 Vine Street
Cincinnati, OH 45202

513-852-3497 phone
513-852-3484 fax

John E. Kelly
Senior Deputy Attorney General
Office of Attorney General
21 South 12th Street, 2nd Floor
Philadelphia, PA 19107

215-560-2437 phone
215-560-2494 fax

Scott Jackson
Senior Counsel
Office of the Attorney General
425 5th Ave. N., 2nd Floor
Nashville, TN 37243-0491

615-741-2614 phone
615-532-2910 fax

D. Esther Chavez
Assistant Attorney General
Office of the Attorney General
P.O. Box 12548
Austin, TX 78711-2548

512-475-4628 phone
512-473-8301 fax

Julie Brill
Assistant Attorney General
Office of the Attorney General
109 State Street
Montpelier, VT 05609-1001

802-828-3171 phone
802-828-2154 fax

David B. Irvin
Assistant Attorney General
Office of the Attorney General
900 East Main Street, 2nd Floor
Richmond, VA 23219

804-786-8192 phone
804-371-2087 fax

Robert D. Williams
Assistant Attorney General
Consumer Protection Division
Office of the Attorney General
812 Quarrier Street, 6th Floor
Charleston, WV 25301-2617

304-558-8986 phone
304-558-0184 fax

David C. Fix
Michelle Chua
Gregg Shapiro
Federal Trade Commission
Pennsylvania Ave. & Sixth St., N.W.
Washington, DC 20580
[FTC Attorneys
Division of Service Industry Practices
Bureau of Consumer Protection]

202-326-3248 phone
202-326-3392 fax

Louis Silverain
Federal Trade Commission
Pennsylvania Ave. & Sixth St., N.W.
Washington, DC 20580
[FTC Economist
Bureau of Economics]

202-326-3385 phone
202-326-2625 fax

Association of
Structural
Pest
Control
Regulatory
Officials

TO: A.S.P.C.R.O. Board of Directors

FROM: Benny Mathis

DATE: April 2, 1997

RE: Draft Proposal

Enclosed is a draft proposal for a study of EPA's methodology in analyzing indoor use data. If you need a copy of the Blondell report, please let me know. We will seek a sponsor to fund the study.

If you have any comments, please let me know by ***April 15, 1997.***

UPFDA

UNITED PRODUCERS, FORMULATORS & DISTRIBUTORS ASSOCIATION

One Executive Concourse, Suite 103
Duluth, Georgia 30136
770-623-8721
Fax: 770-623-1714

Dave. FYI
Joe ✓ Return
JG

May 30, 1997

Bob Rosenberg
Gov't Affairs
NPCA

Dear Bob,

Please find enclosed a check from UPF&DA for $5,000.00 to assist in funding the ASPCRO study to respond to the "junk science" claims of the "BLONDELL" report.

Please keep us abreast of the progress of the study

Sincerely
UPF&DA
Roland L Rhodes
Sec'y / Treas.

cc: ASPCRO

Association of
Structural
Pest
Control
Regulatory
Officials

May 20, 1997

To: All ASPCRO Board of Directors

From: Benny Mathis, President

Re: ASPCRO Review of EPA/Blondell Report on Chlorpyrifos

In March, the ASPCRO Board of Directors voted to authorize ASPCRO to retain a qualified scientist to review the methodology employed by EPA's Jerry Blondell and Virginia Debozy in their review of chloropyrifos incident data.

I recall the discussion at the Board meeting was that once the protocol was adopted, ASPCRO would seek funding for review, assessment and attempt to identify several independent scientists qualified to undertake the project.

Attached is a list of several well known and well regarded researchers that may meet ASPCRO's needs. Please review the list and make a recommendation on these or provide other names by May 28th.

cc: Mr. Bob Rosenberg

Dr. Joseph C. Verltri
Intermountain Regional Poison Control Center
50 North Medical Drive
Salt Lake City, UT 84132
Phone (801) 581-3182

Dr. Stanley Schuman
Agricultural Medicine
College of Medicine
University of South Carolina
Charleston, SC

Dr. Elizabeth Delzell
School of Public Health
Department of Epidemiology
209 Tidwell Hall
UAB Station
University of Alabama of Birmingham
Birmingham, AL 35294
Phone (205) 934-5857

Dr. Stephen Boron
Dr. Boron is completing a term as visiting researcher at the Toxicology Intensive Care Unit of the Hospital Fernand Widal in Paris. He can be contacted via e-mail at toxicdoc@aol.com or by phone at 33-1-46-06-17-26.

Multiple Chemical Sensitivities

TASK FORCE of New Mexico

PO Box 23079, Santa Fe, NM 87502
505-983-9208

July 23, 1997

George Saxton
Secretary/Treasurer ASPCRO
Office of Indiana State Chemists
1154 Biochemistry
Purdue University
West Lafayette, IN 47907-1154

Dear Mr. Saxton:

Enclosed is a collection of articles on Multiple Chemical Sensitivities (MCS) which The MCS Task Force of New Mexico feels will help ASPCRO members better understand the scientific basis of MCS.

Included is an overview of the scientific controversy (Miller), brain imaging studies (Heuser, Simon), approaches to diagnosis (Rea, Heuser), congressional testimony by Dr. Claudia Miller on Gulf War illnesses and pesticide exposures, and an article on chemical sensitivity following pesticide versus building-related exposures (Miller).

Thank you for distributing these articles prior to the ASPCRO August 24-27, 1997 meeting where dialogue about MCS is expected to continue.

The MCS Task Force of NM is a statewide advocacy organization comprised of people with MCS and their supporters. Our mission is to increase awareness and understanding of MCS. We would be happy to answer questions and provide additional information upon request. We will keep ASPCRO updated with respect to new developments and research on MCS.

Thank you and ASPCRO for your commitment to be well-informed about this important subject.

Sincerely,

Ann McCampbell MD

Ann McCampbell, MD
Chair
MCS Task Force of NM

EDITORIAL: DIAGNOSTIC MARKERS IN CLINICAL IMMUNOTOXICOLOGY AND NEUROTOXICOLOGY

INTRODUCTION

After exposure to toxic chemicals patients often present themselves with multi-system complaints which may include malaise, fatigue, headaches, confusion, agitated or otherwise abnormal behavior, memory and cognitive problems, and a multitude of other complaints. These complaints may last for months and at times years. Even a specialist will usually limit the evaluation of such patients to blood count, blood chemistry, urine analysis, chest x-ray, electrocardiogram, physical examination, and possibly pulmonary function testing. Since the results of these tests are frequently within normal limits, the patients will be labeled as suffering from post-traumatic stress syndrome, somatization or related psychiatric categories.

This editorial stresses the need for comprehensive evaluation which must include properly selected immune function tests as well as neurological and neuropsychological studies. If these approaches are used and properly timed, abnormalities are often found. As a result, the patient is properly diagnosed, properly evaluated for disability, and also often "vindicated".

We have concentrated on immune function testing since it is more practical then testing neurological function; blood can be obtained and sent overnight to an appropriate laboratory which can do all required tests on the specimen. By contrast, sophisticated neurological testing (e.g. SPECT scanning) requires equipment and specialists only available in highly specialized centers.

CHEMICAL INJURY AND MULTIPLE CHEMICAL SENSITIVITY (MCS)

The concept that chemical injury can occur in industrial and other settings has long been accepted. The claim that chemical injury (acute, prolonged, repeated) can cause chemical sensitivity is by now widely known but not yet generally accepted. Our recently published data (Heuser et al., 1992) show that predictable objective changes occur in a chemically sensitive patient who has become symptomatic after willful or incidental exposure to small amounts of a given chemical (or chemicals): TA1 (CD26) cells rise within one day, chemical antibodies become positive (if the patient was exposed to a chemical to which antibodies can be measured), auto-antibodies appear, and SPECT scanning of the brain becomes abnormal.

In view of our studies we have become convinced that MCS indeed exists. While it presents with multi-system complaints which include changes in behavior, it is not purely psychogenic in origin!

In our society almost everyone is exposed to chemicals on an daily basis. Some people are not aware of any effects while others are so sensitive that they become disabled whenever exposed. Still others find themselves more or less effected and are part of a continuum between the above two extremes.

KATIMS, J.J. (1991). "Current perception threshold screening for carpal tunnel syndrome." Arch. Environ. Health 46:207-212.

KHANSARI, D.N., MURGO, A.J., and FAITH, R.E. (1990). "Effects of stress on the immune system." Immunology Today 11:170-175.

KILBURN, K.H. and WARSHAW, R.H. (1992). "Prevalence of symptoms of systemic lupus erythematosus (SLE) and of fluorescent antinuclear antibodies associated with chronic exposure to trichloroethylene and other chemicals in well water." Environ. Res. 57: 1-9.

MORROW, L.A., STEINHAUER, S.R., and HODGSON, M.J. (1992). "Delay in P300 latency in patients with organic solvent exposure." Arch. Neurol. 49:315-320.

MROZ, M.M., KREISS, K., LEZOTTE, D.C., CAMPBELL, P.A., and NEWMAN, L.S. (1991). "Reexamination of the blood lymphocyte transformation test in the diagnosis of chronic beryllium disease." J. Allergy Clin. Immunol. 88:54-60.

NATIONAL RESEARCH COUNCIL (NRC). (1992) "Biological markers in immunotoxicology." National Academy Press, Washington, DC.

NATIONAL RESEARCH COUNCIL (NRC). (1992) "Multiple chemical sensitivities. Addendum to biological markers in immunotoxicology." National Academy Press, Washington, DC.

SHARMA, R.P. and REDDY, R.V. (1987). "Toxic effects of chemicals on the immune system." In: Handbook of Toxicology (T.J. Haley and W.D. Berndt, eds.). Hemisphere Publishing Co., Washington, DC.

SHIGEMATSU, T., OZAWA, N., and NAKAYAMA, H. (1988). "*In vitro* study of the cross-sensitivity of hair dye using hapten-specific lymphocytes." Contact Dermatitis 19:30-35.

SIMON, T.R. (1992). "Breast implants and organic solvent exposure can be associated with abnormal cerebral SPECT studies in clinically impaired patients." 78th Scientific Assembly and Annual Meeting of RSNA, Nov. 29 - Dec. 4.

STEJSKAL, V.D.M., FORSBECK, M., and NILSSON, R. (1990). "Lymphocyte transformation test for diagnosis of isothiazolinone allergy in man." Investigative Dermatology 94:798-802.

STEJSKAL, V.D.M., OLIN, R.G., and FORSBECK, M. (1986). "The lymphocyte transformation test for diagnosis of drug-induced occupational allergy." J. Allergy Clin. Immunol. 77:411-426.

THRASHER, J.D., WOJDANI, A., CHEUNG, G., and HEUSER, G. (1987). "Evidence for formaldehyde antibodies and altered cellular immunity in subjects exposed to formaldehyde in mobile homes." Arch. Envir. Hlth. 42:347-350.

THRASHER, J.D., MADISON, R., and BROUGHTON, A. (1992). "Immunologic abnormalities in humans exposed to chlorpyrifos: Preliminary observations." Arch. Envir. Hlth. (in press).

VOJDANI, A. and GHONEUM, M. (1992). "*In vivo* enhancement of human NK activity by Vitamin C." FASEB J. 6:A12 (Abstract No.1599).

VOSS, J.G. (1977). "Immune suppression as related to toxicology." Crit. Rev. Toxicol. 5:67-101.

GUNNAR HEUSER, M.D., Ph.D., F.A.C.P.
NeuroMed and NeuroTox Associates
Cedars-Sinai Medical Tower
Los Angeles, California

Reprinted from **Archives of Environmental Health**,
published by HELDREF PUBLICATIONS, 1319 Eighteenth Street, NW,
Washington, DC 20036-1802.
(202) 296-6267 (202) 296-5149 FAX

Chemical Sensitivity Attributed to Pesticide Exposure Versus Remodeling

CLAUDIA S. MILLER
HOWARD C. MITZEL
Department of Family Practice
Environmental and Occupational Medicine
The University of Texas Health Science
Center at San Antonio
San Antonio, Texas

ABSTRACT. One hundred twelve individuals who reported onset of multiple chemical sensitivity following well-documented exposure to either (1) a cholinesterase-inhibiting organophosphate or carbamate pesticide or (2) remodeling of a building completed mail-out/mail-back questionnaires concerning their exposure, symptoms, sensitivity to ingestants and inhalants, utilization of health-care resources, and impact of their illness on lifestyle. It was hypothesized that if multiple chemical sensitivity resulted from neurotoxic exposure, then organophosphate-exposed respondents should report greater severity of illness resulting from the relatively greater neurotoxicity of this class of chemicals. Pesticide-exposed and remodeling-exposed multiple chemical sensitivity groups reported similar patterns of symptoms and identified similar inhalants and ingestants as triggers for their symptoms; these results suggested a common mechanism (biological and/or psychological) for their conditions. The pesticide-exposed group, however, reported significantly greater symptom severity than did the remodeling-exposed group, especially for neuromuscular, affective, airway, gastrointestinal, and cardiac symptoms. These findings provide evidence for (1) a possible biological basis for multiple chemical sensitivity and (2) a distinct pathophysiology or final common pathway for the condition that, while as yet undefined, appears to be shared by these two groups. Although subjective multisystem health complaints characterize both multiple chemical sensitivity and somatoform disorder, features of this multiple chemical sensitivity sample were inconsistent with somatoform disorder, i.e., onset after 30 y of age in 83%, the predominance of severe cognitive symptoms, and attributions of environmental causation. No group differences were found with respect to lifestyle impact. Eighty-one percent of respondents said they had been working full-time at the time they were exposed, yet at the time of the survey (on average, 7.7 y post exposure) only 12.5% were working full-time. The majority said they had quit their jobs, changed jobs, or changed careers because of their illness. Approximately 40% reported that they had consulted 10 or more medical practitioners. The persistent, disabling neuropsychological symptoms reported by these multiple chemical sensitivity groups are strikingly similar to those reported among individuals exposed occupationally to pesticides and solvents. These parallel findings suggest that the types and levels of exposures associated with extermination and remodeling may not be inconsequential, at least for a subset of the population. Further studies from a variety of perspectives, including human challenge studies and the development of animal models, are needed to define the pathophysiological and psychological mechanisms underlying this costly condition.

MULTIPLE CHEMICAL SENSITIVITY (MCS), the subject of an escalating debate among physicians and environmental specialists, is being diagnosed in a growing number of patients, including industrial workers; occupants of sick buildings; individuals who live near Superfund hazardous waste sites; Gulf War veterans; and others exposed to pesticides, solvents, combustion products, drugs, and consumer products. Some practitioners believe that MCS is a somatoform disorder or, at a minimum, that patients misattribute symptoms from a variety of medical conditions to environmental exposures.[1-4] Others hypothesize that environmental exposures may sensitize certain—perhaps more susceptible—individuals whose symptoms are then perpetuated by a variety of chemically unrelated inhalants and ingestants.[5-7]

Many MCS patients report lifelong symptoms that appear to have no known initial cause. Other patients describe an abrupt onset of illness that follows an identifiable exposure event. In part because of the diverse symptoms associated with the illness and lack of objective markers, there is no agreed upon case definition for MCS. Symptoms ascribed to MCS overlap asthma, chronic fatigue syndrome, fibromyalgia, depression, and somatoform disorders. Another problem is the enormous range of chemicals reported to induce the condition and to subsequently trigger symptoms (solvents, combustion products, pesticides, drugs, etc.).

We chose to compare features of MCS reported by two groups with chemically distinct but well-documented exposures preceding onset of self-reported MCS: one group was initially exposed to an organophosphate or carbamate cholinesterase-inhibiting pesticide (OP), and the other was exposed to the remodeling of a building (RE). Compared with MCS patients with lifelong symptoms, these individuals reported that they became ill at a discrete point in time, and most individuals were working full time when exposure occurred. The authors felt that these two subgroups of MCS patients would be better able to distinguish which symptoms were or were not related to the condition. In addition, OP and RE exposure groups were chosen because (1) many MCS patients have reported that one of the exposures described initiated their condition; (2) such exposures are likely to be readily identifiable; (3) spraying of pesticides and remodeling of buildings occur at discrete times, unlike protracted exposures of industrial workers to solvents; and (4) group differences, if present, should result from differences in potency of the chemical compounds (putatively) inducing the illness.

Most MCS patients report symptoms, triggered by many foods and chemicals, that affect more than one organ system. This nonspecificity has contributed to the biological or physiological implausibility of this illness. Somatization disorder has many features in common with MCS. *The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* diagnostic criteria for somatization disorder include reports of pain at multiple locations, gastrointestinal symptoms, sexual dysfunction, and neurological symptoms; the onset of these symptoms occurs in individuals who are under the age of 30 y.[8] Other criteria for somatization disorder include food intolerances, depression, anxiety, and panic attacks.[9] Beliefs that invoke external (e.g., environmental) causes for symptoms are not a reported feature of somatoform disorders, a point that has not been addressed by practitioners who categorize MCS as such. If it is assumed that MCS is entirely a psychologically induced disease state, then MCS groups who attribute their condition to either organophosphates or remodeling should report similar illness severity. In other words, explanations of MCS as a somatoform disorder would not predict differences between MCS patients, based on the inducing exposure, because the nature of the exposure is assumed to be unrelated to the illness.

This stands in contrast to an alternative hypothesis for MCS that suggests that different chemical compounds biologically induce essentially the same illness, although differences in illness severity might exist. Under this schema, individuals who report MCS from organophosphates would be expected to report more severe symptoms on average than remodeling-exposed individuals. This prediction follows from the relatively greater potency of organophosphates and their highly specific effect on the nervous system.

A possible exception might be airway and eye irritation. In sick building syndrome episodes, mucous membrane irritation and airway symptoms occur commonly. Such symptoms, therefore, might be expected to be more severe among MCS respondents exposed to remodeling of a building than among respondents exposed to pesticides. Also, because more women than men report MCS,[2-4,7] women are expected to report higher symptom severity.

Other objectives of this study were to compare the two groups' self-reported responses to inhalants and ingestants; their use of medical resources; number and types of providers visited; and impact on careers, family, and lifestyle. Although mail surveys are expedient and economical, interpretative caution is advised because this study utilized (for purposes of comparison) subgroups of the MCS population, rather than a random sample of MCS patients.

Materials and Method

Individuals with self-reported MCS were recruited via announcements in MCS patient newsletters to ensure a sample of strictly self-identified MCS respondents. Respondents were sent a mail-out/mail-back questionnaire that covered the exposure event, a brief medical history, and physical and cognitive symptoms that occurred subsequent to their exposures. No payment was offered to subjects. Two hundred three questionnaires of 379 mailed were returned (54%). To be included in the OP group, respondents had to report having developed MCS as a consequence of a pesticide exposure, had to specify the month and year of exposure, and had to provide the name(s) of the organophosphate or carbamate pesticide(s) to which they had been exposed. Inclusion in the RE group was assured only if respon-

Table 1.—General Characteristics of the Multiple Chemical Sensitivity Study Population

Variable	Group: Organophosphate (n = 37)	Group: Remodeling (n = 75)	Total (n = 112)
Age (y)			
Range	25–63	25–69	25–69
$\bar{X}$	47.7	47.7	47.7
SD	9.5	9.0	9.1
Gender			
Female	29 (78.4%)	60 (80.0%)	89 (79.5%)
Male	8 (21.6%)	15 (20.0%)	23 (20.5%)
Education (y)			
Range	12–20	8–24	8–24
$\bar{X}$	15.3	16.2	15.9
SD	2.9	3.1	3.1
Time elapsed since exposure (y)			
Range	2–18	1–31	1–31
$\bar{X}$	7.2	7.9	7.7
SD	4.3	6.3	5.7
Age at illness onset (y)			
Range	21–61	11–57	11–61
$\bar{X}$	40.5	39.8	40.0
SD	10.6	9.0	9.5

dents reported that they developed MCS as a consequence of exposure to remodeling of a building and if they specified the year and month in which the exposure occurred or began. Those who attributed their MCS to both remodeling and organophosphate exposure, or who did not specify a cause, were not included because our purpose was to compare two groups of MCS patients that identified distinctly different initiating events.

Questionnaires contained (a) items that pertained to the circumstances of the exposure; (b) checklists for 98 common inhalants and 46 common ingestants; (c) severity ratings for 114 symptoms; and (d) questions concerning disability and quality of life issues, number and types of physicians consulted, diagnostic and treatment modalities used, and family history. Treatment modalities used and family history will be reported later. Respondents were directed to check off from lists of inhalants (e.g., diesel exhaust, cigarette smoke, perfume) and ingestants (e.g., chlorinated water, MSG, and foods) any items known to trigger symptoms. Endorsements for each individual and for each item were tallied for both groups. Item frequencies were ordered to form rankings for ingestants and inhalants, thus permitting comparison of the groups' patterns of response.

Symptoms were rated on a four-point severity scale: not a problem, minor problem, moderate problem, and severe problem. Respondents were asked to mark only symptoms that had developed or increased in severity following exposure. One item, "coughing up bright red blood," was included to detect "yea-saying" because this symptom is not associated with MCS. Standard psychometric techniques were used to group items into meaningful subscales and thereby reduce the number of significance tests required. Items that showed poor statistical reliability with scale totals were dropped. Eight symptom severity scales were retained for analysis, and such scales comprised 71 of the original 114 items. In addition, a ninth scale was derived heuristically from the clinical experience of one of the authors (CSM). Included in this scale were symptoms reported frequently by patients presenting with MCS. All nine scales have a 0-30 range, with higher values indicating greater severity. A scale total of 0 indicates responses to all items of "not a problem." Scale totals of 10, 20, and 30 indicate consistent responses of "minor problem," "moderate problem," and "severe problem," respectively. The items that were scaled and scale reliability coefficients are listed in the Appendix. Group inferences were drawn from the nine scale totals, using multivariate analysis of variance (MANOVA). Sex and several covariates (i.e., age, education, and years elapsed since exposure) were incorporated initially to control for possible confounding influences associated with these variables.

The proportions of OP and RE respondents who consulted various medical specialists (e.g., internists, allergists, clinical ecologists) were also compared. Finally, effects on quality of life (e.g., illness-forced changes in occupation, locale) were assessed on a four-point scale (i.e., not affected by illness, affected a little, affected moderately, affected a great deal). Percentages of each group that endorsed the most severe category, "affected a great deal," were calculated.

Results

Thirty-seven questionnaires qualified for inclusion in the OP group and 75 qualified for the RE group. Completed surveys were received from individuals who resided in 33 states and 3 foreign countries. Approximately four times as many females as males returned surveys. There were no statistically significant differences between OP and RE group means for age, education, years elapsed since exposure, or for gender ratios (Table 1). Exposure dates were distributed nonnormally and were skewed toward more recent years. The average time between exposure and completion of survey was 7.7 y. The average age at onset of illness (back-calculated from current age and years elapsed since exposure) was 40 y.

OP exposures occurred in the work place in 16 cases (43%), at home in 20 cases (54%), and during outdoor recreation in 1 case. Proportionately more remodeling exposures occurred at work (51 cases, 68%), compared with exposures at home (24 cases, 32%). Twenty-one OP respondents implicated a single pesticide, whereas 16 respondents described mixed-pesticide exposures. Organophosphates or carbamates most frequently named were chlorpyrifos (19), diazinon (9), malathion (6), and carbaryl (4). Although REs were not asked whether new carpeting was laid during the remodeling exposure, 59% mentioned new carpeting in their narrative descriptions. In response to an open-ended question concerning the exposure event, OPs reported approximately twice as frequently as REs that neurolog-

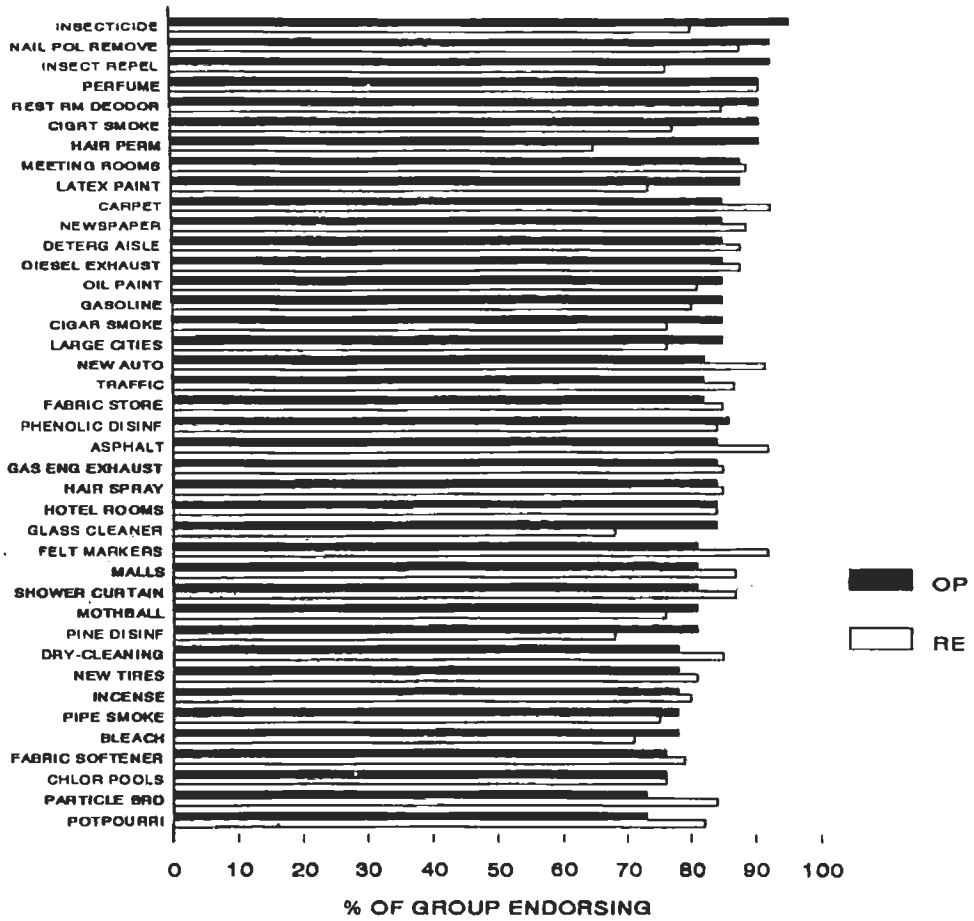


Fig. 1. Organophosphate-exposed (OP) versus remodeling-exposed (RE): comparison of endorsement rates for inhalant items. Items shown were endorsed by more than 75% of the 112 survey respondents.

ical and cardiac symptoms were their earliest symptoms, and REs cited mucous membrane irritation and headache approximately twice as frequently as OPs.

Respondents were asked to identify their current, single, most troublesome exposure. Among the 112 respondents, 28% reported insecticides, 18% reported new carpeting, and 11% reported perfume as their most problematic exposure. Twenty-three (21%) listed more than one exposure as being the "worst." Four respondents named formaldehyde and 3 named diesel exhaust as the "worst" exposure. Only 1 respondent cited cigarette smoke as being most problematic. Not unexpectedly, insecticides were cited by 68% of OP respondents, whereas building-related exposures (i.e., carpet, paint, varnish) were cited by 38% of RE respondents as being their "worst" exposure. None of the OP respondents rated building-related exposures as "worst," but 5 of the RE respondents rated insecticides as causing the most difficulty for them at the time of the survey.

On average, OPs implicated 66.6 (standard deviation [*SD*] = 26.0) of 98 possible inhalants as triggering symptoms, compared with 63.3 (*SD* = 21.7) for REs. Similarly, OPs reported that 14.4 (*SD* = 13.7) of 46 common ingestants caused symptoms, compared with 11.3 (*SD* = 12.4) for REs. Differences were not statistically significant. For any given inhalant, there were, on average, 3.4 more endorsements, and for any given ingestant there were 7.2 more endorsements from OPs than from REs. This statistical dissociation indicates more agreement among OPs than among REs with respect to the ingestants they endorsed.

A comparison is made in Figure 1, by group, of problem inhalants cited by at least 75% of the sample. These inhalants include insecticides, solvents, fragrances, fuels, and combustion products. Items cited by one-third or less of the sample included cats, vinegar, cellophane tape, and watching television. Twenty-five of the 112 respondents said that watching television had caused symptoms. Plastic housing, circuit boards, and components associated with televisions, computers, and other electronic equipment, especially if they are new, emit low levels of volatile organic compounds when warm.

A consistently greater number of ingestants were implicated by OPs, compared with REs (see Figure 2). Among the top 15 ingestants for both groups were 4 that are associated with chemical additives: (1) chlorinated tap water, (2) monosodium glutamate (MSG), (3) food dyes, and (4) toothpaste. Foods containing milk products (i.e., milk, cheese, and pizza) were among the

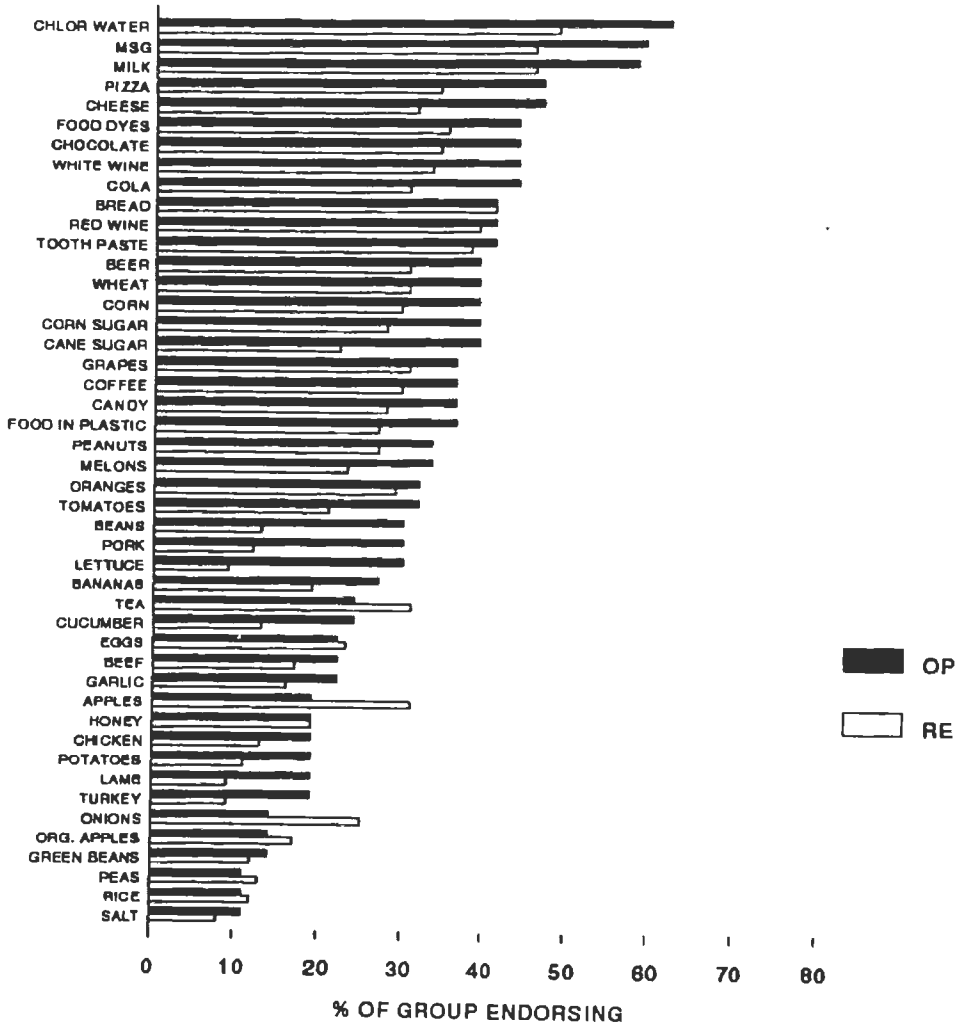


Fig. 2. Organophosphate-exposed (OP) versus remodeling-exposed (RE): comparision of endorsement rates for all ingestant items.

15 most frequently cited items for both groups, as were 3 alcoholic beverages (i.e., white wine, red wine, and beer). Also near the top of both groups' lists were xanthine-containing foods, including chocolate, cola drinks, and coffee. Foods containing or derived from grains (i.e., pizza, bread, beer, corn, and wheat) also appeared near the top of both lists.

The correlation coefficients between the percentage of endorsements by OPs and by REs shown in Figures 1 and 2 were $r = .91$ ($p < .0001$) for inhalants and $r = .85$ ($p < .0001$) for ingestants, indicating that the magnitudes of the endorsements for the two groups were quite similar. In addition, the pattern or ordering of items shown in Figures 1 and 2 was nearly identical for the two groups. The similarity in the ranked order of endorsement was examined with Kendall's coefficient of concordance. Agreement between the two groups accounted for 93% of the maximal variance in the inhalant items and for 92% of the maximal variance in the ingestant items. This agreement implies that the two groups were very similar in their patterns of endorsement for chemical and ingestant items.

Not unexpectedly, individuals who noted that a greater number of inhalants caused difficulty also reported that a greater number of ingestants caused problems for them ($r = .64$, $p < .001$ [Fig. 3]). Similar correlations were found between symptom severity and the number of ingestants and inhalants cited by respondents, i.e., higher symptom severity scores were associated with more chemical and food intolerances.

Symptom severity ratings were compared on the basis of eight factored scales and on the basis of symptoms selected heuristically for their discreteness and frequency in MCS patients. The Appendix contains items included in the nine scales. An overall multivariate F test of the eight factored scales was significantly different in the groups for exposure type ($p < .008$) but not for gender. The significant overall F test "protects" the interpretation of the univariate tests reported next.[10] None of the covariates (age, education, years since exposure) originally fit with the model was statistically significant, and all were dropped.

All symptom severity scale means were higher (more severe) for the OP group, compared with the RE group.

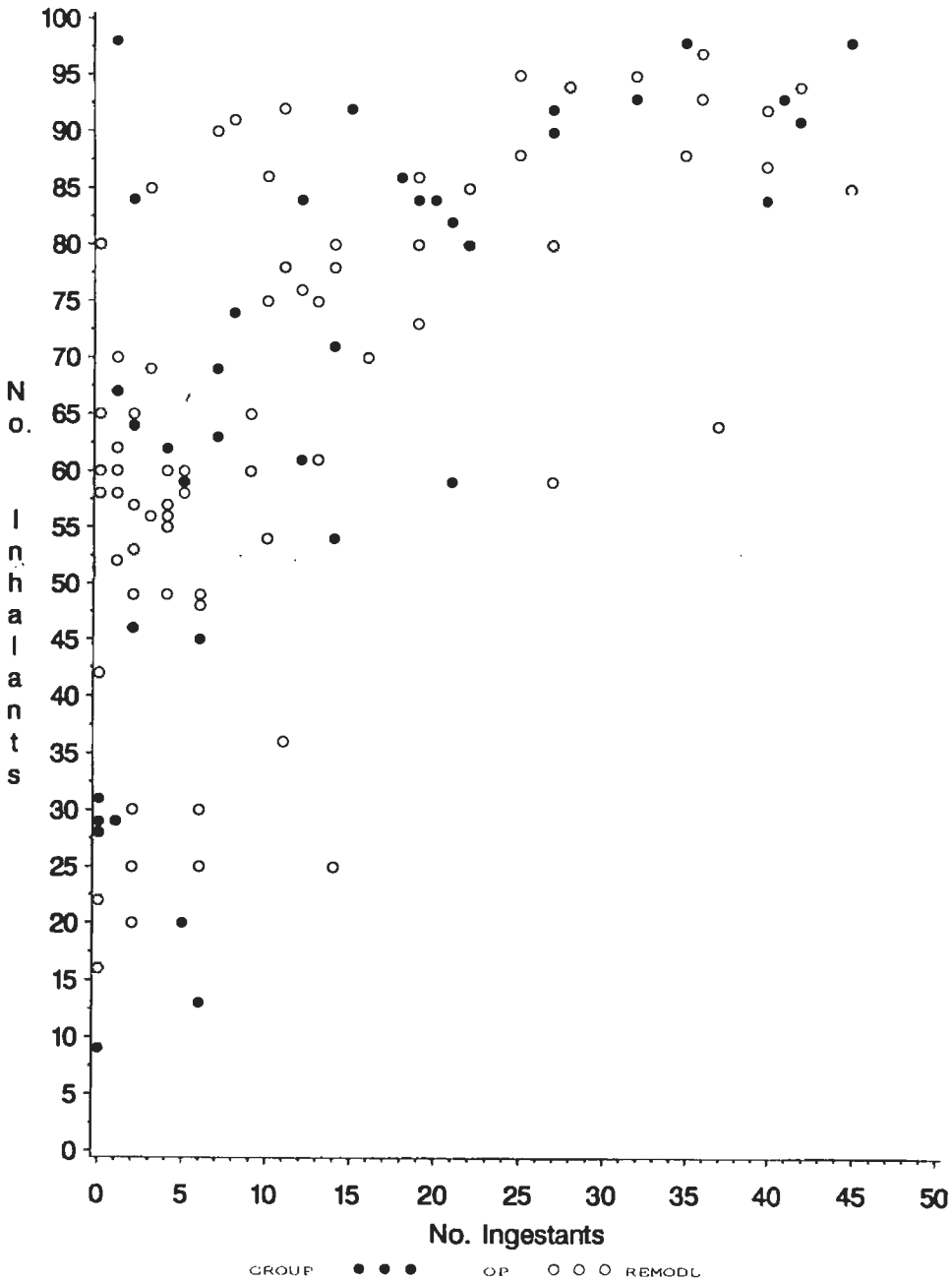


Fig. 3. Scatter plot of endorsement level for inhalants versus ingestants for all 112 respondents.

Symptom severities, based on univariate analyses of variance, differed significantly between OPs and REs for five of the eight factored scales. Statistical significance was reached by about a one-half standard deviation difference between the group means, and this significance corresponded to just under a one-half-unit elevation of average severity from "minor problem" to "moderate problem" for the RE group, compared with the OP (Table 2). Neuromuscular, affective, airway, gastrointestinal, and cardiac symptoms were rated as more severe by OPs than REs. Muscle-related symptoms bordered on significance, with OPs being higher than REs. Cognitive and head-related symptoms were not significantly different between the two groups. Notably, for both groups, cognitive symptoms attained the highest mean severity, whereas the largest intergroup difference occurred for cardiac symptoms. Presumably, cognitive symptoms caused the most difficulty for these respondents. Airway symptoms were significantly more severe for OPs than for REs, thereby disconfirming one study hypothesis.

In a separate univariate analysis of variance, OPs and REs were compared, using the heuristically derived scale incorporating 15 symptoms commonly associated

Table 2.—Comparison of Severity of Symptom Scales in Multiple Chemical Sensitivity Exposure Groups

Symptom scale	Organophosphate		Remodeling		p
Neuromuscular	12.9	(7.5)*	9.0	(6.5)	< .007
Head-related	15.9	(7.6)	13.4	(8.3)	< .12
Muscle-related	17.5	(8.8)	14.2	(8.7)	< .06
Affective	17.7	(7.3)	13.0	(6.8)	< .001
Airway	14.9	(7.5)	12.0	(6.5)	< .04
Cognitive	18.0	(8.3)	15.8	(7.7)	< .17
Gastrointestinal	15.3	(7.9)	11.1	(8.4)	< .01
Cardiac	16.5	(8.2)	9.9	(9.0)	< .001
Fifteen most frequent symptoms†	20.8	(6.2)	16.7	(6.0)	.003

*Values presented as means, accompanied by standard deviations in parentheses.
†Symptom items which comprise the nine scales are reported in the appendix.

with MCS. Age was retained as a significant covariate, suggesting that older respondents tended to report more symptoms on this configuration. Again, symptom severity was statistically significantly greater for the OP group than for the RE group. Furthermore, this scale had the highest severity rating of the nine scales. It is not unexpected that symptoms reported commonly would also be among those rated as most severe. Symptom severity, as determined earlier, did not differ by gender, thus disconfirming another study hypothesis.

The symptom included to detect yea-saying, "coughing up bright red blood," was endorsed by only 4 OP and 2 RE respondents. This item was not included in the factored scales. We sought to determine if these six responses were associated with yea-saying responses to other symptom items; therefore, all 112 respondents were rank-ordered according to the number of symptoms they endorsed (maximum = 114 symptoms). The 6 respondents who reported coughing up blood fell at ranks 25, 33, 80, 96, 98, and 111. A higher ranking connoted more extreme responses. The 25th-ranked respondent had a sum total of 880, out of a maximum of 3 420 points (114 × 30 = 3 420), and the 111th respondent had 2 760 points. The highest (112th) ranked respondent had a sum total of 2 820, which total included 13 responses of zero ("not a problem") to the severity items. Given this analysis and the caveat that symptom reports of coughing up blood may be associated with bona fide medical conditions (e.g., epistaxis, chronic bronchitis, carcinoma, and tuberculosis), no cases were excluded as probable yea-sayers.

OPs and REs reported that they had consulted similar numbers of medical practitioners (including psychiatrists and psychologists) after exposure occurred: 21.6% consulted 1-4 doctors; 39.6%, 5-9 doctors; 20.7%, 10-14 doctors; 10.8%, 15-19 doctors; and 7.2%, 20 or more doctors. The frequency with which OPs and REs visited internists (95% of OPs and REs combined), allergists (79%), clinical ecologists (67%), psychologists or psychiatrists (63%), occupational medicine doctors (49%), neurologists (47%), gastroenterologists (24%), and endocrinologists (24%) were comparable. However, OP respondents were more likely to have seen a cardiologist (42% versus 19%, $p < .02$) subsequent to exposure.

There were no significant group or sex differences with respect to quality-of-life ratings. Both OPs and REs reported a major impact upon their ability to work and a substantial lowering of their quality of life. At the time of their exposure, 26 of 37 OP respondents (70%) and 65 of 75 RE respondents (87%) reported that they worked full time (81% of total). At the time of our survey (average of 7.7 y postexposure), 84% of 90 respondents indicated they were no longer able to work full time. Only 2 OPs (5%) and 12 REs (16%) reported that they worked full time (12.5% of total). Seventy-nine percent of those employed full time at the time of their exposure reported that they had quit their jobs, had changed jobs, or had changed careers because of their illness (88% of OPs; 75% of REs).

Both groups reported that many facets of their lives had been affected "a great deal" by their illness: occupation (84%); choice of personal care products (82%); plans for the future (82%); places they go, e.g., shopping, restaurants (80%); income (73%); social activities (73%); ability to travel to other cities (72%); hobbies (68%); home construction, heating, etc. (65%); choice of home furnishings (64%); marriage or family (63%); diet (60%); geographic location (57%); appearance, hairstyle, makeup, etc. (57%); clothing (56%); the car they drove (56%); their ability to do housework (50%); and their decision whether to have more children (28%). The percentage of OPs and REs who reported that they had been involved in litigation related to their exposure were similar: 47% and 43%, respectively.

Discussion

Recently, some investigators reported symptoms that are similar to those described here among workers exposed to organophosphates and to solvents. For example, Rosenstock et al. noted decrements in neuropsychological performance among Nicaraguan agricultural workers, and that decrement persisted years after accidental organophosphate intoxication.[11] Other authors describe persistent memory difficulties, cognitive problems, motor impairment, mood alterations, feelings of unreality, nervousness, noise sensitivity, and multiple somatic complaints (e.g., fatigue, chest pain, hand tremor, nausea), following an organophosphate exposure.[12-14] Several of our OP respondents reported symptoms consistent with acute OP intoxication minutes to hours following their exposure, e.g., excessive salivation, visual changes, agitation, confusion, and muscle spasms.

Morrow et al. found that solvent workers who had been treated for an acute solvent exposure had persistent cognitive difficulties, and these workers were more likely to show no improvement or to worsen on neuropsychological testing over time than were solvent-exposed workers absent such a history.[15] "Cacosmia"

(i.e., feeling ill from odors), a characteristic complaint of MCS patients, has also been observed among solvent workers who exhibited neurobehavioral dysfunction.[16] Cone and Sult reported on a group of casino workers who were exposed to a mix of carbamate and pyrethrin insecticides and solvents and who subsequently developed persistent multisystem symptoms; cognitive impairment, and sensitivities to the odor of perfumes, gasoline, newsprint, cleaning materials, and pesticides.[17]

The persistent neuropsychological symptoms, including cognitive difficulties and cacosmia, that have been reported in pesticide- and solvent-exposed workers are remarkably similar to symptoms reported by our MCS sample, of whom most were exposed at home or in an office building. This finding suggests that levels of pesticides and solvents associated with remodeling or routine extermination may not be inconsequential, at least for a subset of the population.

The similar rank order for inhalants and ingestants cited by OPs and REs in this study suggests that once MCS develops, similar kinds of substances will trigger symptoms, irrespective of the chemical nature of the original exposure. Comparison of the 8 symptom clusters and 15 most frequent MCS symptoms for both groups suggests that, on average, OPs experience more severe symptoms than do REs, particularly neuromuscular, affective, airway, gastrointestinal, and cardiac symptoms. Group means are most divergent for severity of cardiac symptoms, a result that is consistent with our finding that OPs were much more likely to consult a cardiologist (42%, compared with 19%). The highest mean severity score for both OP and RE groups occurred for cognitive symptoms.

From a toxicologic point of view, one would expect that individuals who become ill from a cholinesterase-inhibiting pesticide or from exposure to remodeling of a building would exhibit different severities of symptoms, assuming that exposures were sufficiently high to induce symptoms: organophosphates and carbamates inhibit acetylcholinesterase.[18] Remodeling involves complex mixtures of solvents (e.g., toluene, butanol, hexane, and xylene) that outgas from paints, adhesives, new carpeting, building materials, and furnishings. Given that air monitoring during remodeling occurs most often after occupants complain, if it occurs at all, peak exposure concentrations are generally unknown. Likewise, cholinesterase levels of more "susceptible" persons during routine extermination have not been studied. These data gaps, coupled with the disabling symptoms reported by these respondents (on average, a highly educated group with nearly 4 y of college), who explicitly attributed onset of illness to extermination or remodeling, suggest that the safety of these common activities warrants further scrutiny. Such familiar exposures must not be presumed harmless solely on the basis of established toxicologic models and exposure limits. New models that might explain unanticipated observations deserve exploration.

Bell et al. hypothesized that MCS results from sensitization (partial kindling) of olfactory-limbic pathways by environmental chemicals and/or salient stressors.[7] According to this model, strong or repeated low-to-moderate-level stimuli could induce erratic signaling in limbic structures and could reduce the threshold for response to subsequent environmental exposures. Disruption of normal limbic function might affect emotions, short-term memory, endocrine regulation, and autonomic nervous system activity. High levels of acetylcholinesterase in the limbic region may protect against "bizarre sensitivity" by maintaining acetylcholine concentrations at nerve junctions within critical bounds.[19] Notably, organic solvents inhibit acetylcholinesterase activity in the membrane of human red blood cells in vitro and, by analogy, are believed to act on nerve cell membranes.[20,21] If both solvents and organophosphates inhibit cholinesterase, this might help explain the similar symptom patterns—but divergent severity—reported by OPs, compared with the REs in this study.

Rosenthal described a retired attorney with depression who developed worsening depression, multisystem symptoms, and odor intolerances after household extermination (organophosphate).[22] Citing a cholinergic theory of depression,[23] Rosenthal suggested that depressed individuals may be particularly sensitive to acetylcholine. Noting that the breakdown of acetylcholine is inhibited by organophosphates, Rosenthal theorized that vulnerability to acetylcholine might explain both environmental sensitivities and an endogenous tendency toward depression. Another hypothesis for MCS offered by Meggs involves neurogenic inflammation that arises from stimulation of chemical-irritant receptors.[24]

Regardless of which mechanism for MCS might be correct, volatile organic compounds outgassing from building materials would be expected to affect the nervous system less specifically and less robustly (solvents "depress" the central nervous system) than would cholinesterase-inhibiting pesticides. Although pesticide formulations include solvent vehicles or carriers, the greater overall severity of symptoms reported by our OP group in the present study suggests relatively greater neurotoxicity or potency for this class of pesticides, compared with remodeling-associated solvent exposures.

Only 3 respondents (1 OP, 2 RE) reported that foods/ingestants did not make them ill. The fact that ingestants containing chemical additives (chlorinated tap water, food additives, MSG) and food-drug combinations (alcoholic beverages and xanthine-containing foods) were frequently implicated by both groups, is consistent with a hypothesis that these individuals exhibit amplified responses to pharmacologic doses of a variety of substances.[7] Although occupational medicine practitioners may feel dietary issues are not a primary concern in their evaluation of MCS patients, participants in this study clearly viewed foods as major factors in their illness, with 60% indicating that their diets had been affected "a great deal."

This survey represents the largest group of MCS patients studied to date. Unlike prior studies, this study

compared two groups that attributed their illnesses to relatively homogeneous, well-characterized antecedent exposures. Limitations of this retrospective survey study include problems with recall bias and uncertain influences of pending litigation on reporting of symptoms. The investigators have not participated in any litigation involving these respondents, and we informed all participants from the outset that they would not be offered any medical advice during or following completion of the survey. The self-selected sample for this study is probably not representative of MCS patients overall; advertising in patient-support newsletters likely disposed the sample toward more severely ill and better "informed" respondents regarding MCS and its manifestations. Patients who are very ill, who are unable to read, or who are less educated may be underrepresented in this sample, whereas nonworking MCS patients who have more time to read newsletters and respond to a survey may be overrepresented.

The finding that pesticide-exposed respondents report similar, but much more severe symptoms than remodeling-exposed respondents is consistent with prior anecdotal observations, and this finding supports the hypothesis that some biological mechanism is operative. A threat to the validity of these findings remains, that of sampling from pre-existing groups, a difficulty always present with retrospective studies. For example, the OP group might have overreported symptoms relative to the RE group because organophosphate exposure is more specific and involves a known neurotoxin, whereas the RE group attributed illness to building remodeling, which most people consider benign. To explain the findings in this study with such a cognitive hypothesis would require that patients hold powerful beliefs regarding the health impact of pesticide versus remodeling exposures that permeate both their symptom reports and their ideas as to which inhalants and ingestants trigger symptoms. Although possible, this explanation seems less parsimonious than the one offered here.

The fact that MCS patients *attribute* their illness to chemical exposure distinguishes MCS from illnesses with overlapping features, such as chronic fatigue syndrome and somatoform disorders. Such attributions may provide fertile ground for future cognitive research. For example, nearly a quarter of our sample indicated that watching television can trigger symptoms, but it seems unlikely that this relatively low-level exposure source was discovered independently by so many respondents. MCS patient support newsletters (via which this sample was recruited) contain much information about potential exposure sources, undoubtedly creating shared "mental models" for MCS. Little is known about how information communicated in this way influences the causal attributions people make toward substances in their environment. Some maintain that MCS patients share an erroneous "belief system." However, shared mental models, if correct, might enable patients to identify problem exposures and cope more successfully with a poorly understood medical condition.

Practitioners who feel that MCS is a somatoform disorder have characterized these patients as "universal reactors"[25] who have histories of *life-long* illness and childhood abuse.[26] Yet the majority of respondents in this sample reported that they were well and working full time (81%) at the time of their initial exposure. (National full-time employment levels for the past 4 y have ranged from a low of about 61% of eligible women to a high of about 79% of eligible men.[27]) Furthermore, cognitive symptoms among patients with somatoform disorders tend to be far down on the list of complaints, if they appear at all, in contrast to the high severity ratings our MCS sample assigned to cognitive symptoms.[9,28] More concretely, somatoform disorders almost always have an age of onset under 30 y.[8] Only 19 (17%) of our 112 respondents reported onset before age 30 y, a result suggesting that for the majority of MCS patients, somatoform disorder is not applicable as a diagnosis. A diagnosis of somatoform disorder is based on otherwise medically unexplained symptoms; our findings suggest that a biological basis for MCS may indeed exist.

Bell proposes a "synthesis" of biological and psychological explanations for MCS and related illnesses, arguing that a debate centered on premorbid psychopathology (*versus* chemical exposure) as the causal factor in MCS oversimplifies what in reality may be an extremely complex etiology.[7,29,30] The central nervous system (CNS) can be viewed as a transducer of both biological and psychosocial experiences, both of which are integrated into neural activity. In turn, this activity has biological, psychological, and social consequences. Preexisting psychiatric disorders (e.g., depression and anxiety) involve alterations in brain chemistry and neurotransmitters that may make certain individuals more vulnerable to environmental chemicals (e.g., organophosphates). In recent months, the role of stress and anxiety in Gulf War "syndrome" has been mentioned frequently in press reports and by government spokespersons. At the same time, Gulf War servicemen and women were exposed to complex mixtures of hydrocarbons, including solvents, combustion products, and cholinesterase inhibitors (e.g., pyridostigmine bromide, pesticides, and, possibly, low concentrations of nerve agents[31]).

Complex sociobiological questions concerning the etiology of MCS will not be resolved by retrospective survey studies—perhaps not by retrospective studies of any kind. It may be necessary to develop animal models in which factors, such as stress and chemical exposures, can be manipulated independently. In human studies, stronger scientific inference regarding the roles of chemical exposures and psychological factors may be made by blinded challenges in a controlled environment.[5,6,32] In the longer term, studies from a variety of perspectives are needed from which a picture of the pathophysiological and psychological mechanisms underlying this costly illness may finally emerge.

Appendix: Reliability Estimates for the Symptom Severity Scales

Listed below are items that constitute the nine symptom severity scales and the reliability coefficients for each scale. Standard factor analytic techniques were applied to the original 114 symptom items, using the SAS program.[33] Items that were unstable (i.e., facilely

changed scale affiliation), loaded negatively, or had standardized coefficients of less than .25 were culled systematically. The remaining 71 symptom items are listed below and appear under each named scale. Scale values were computed for each respondent by simply summing the item and then rescaling to a 0-30 range. Reliability coefficients (also computed with the SAS program[33]) represent the correlation of the item with the scale total, with the item in question removed from the scale. Cronbach's alpha reliability coefficient is reported opposite each of the nine scale names and represents the internal consistency among the items. All of these are quite high, a result of using factor analytic techniques to create the scales. The factor analysis used to derive the scales included all 203 original survey respondents, the result of which increased the stability of the variance-covariance matrix. However, the reliability coefficients presented here are based on the 112 respondents in the OP and RE groups.

Neuromuscular	**0.90**
Loss of consciousness	0.62
Stumbling/dragging foot	0.74
Seizures	0.30
Print moving/vibrating	0.68
Feeling off balance	0.74
Tingling in fingers/toes	0.67
Double vision	0.54
Muscle jerking	0.59
Fainting	0.47
Numbness in fingers/toes	0.69
Clumsiness	0.67
Problems focusing eyes	0.67
Cold or blue nails/fingers	0.41
Uncontrollable sleepiness	0.52
Head-related	**0.83**
Head fullness/pressure	0.78
Tender face/sinuses	0.57
Sinus infections	0.35
Tightness in face/scalp	0.74
Brain feels swollen	0.64
Ringing in ears	0.47
Headache	0.45
Feeling groggy	0.44
Muscle-related	**0.88**
Joint pain	0.70
Muscle aches	0.73
Weak legs	0.58
Weak arms	0.68
General stiffness	0.69
Cramps in toes/legs	0.61
Painful trigger points	0.61
Gastointestinal	**0.88**
Abdominal gas	0.81
Foul gas	0.75
Problems digesting food	0.71
Abdominal swelling/bloating	0.70
Foul burping	0.59
Diarrhea	0.47
Abdominal pain/cramping	0.67
Constipation	0.41
Cardiac	**0.83**
Heart pounding	0.72
Rapid heart rate	0.70
Irregular heart rate	0.71
Chest discomfort	0.51

Affective	**0.87**
Feeling tense/nervous	0.70
Uncontrollable crying	0.59
Feeling irritable/edgy	0.61
Depressed feelings	0.66
Thoughts of suicide	0.66
Nerves feel like vibrating	0.53
Sudden rage	0.59
Loss of motivation	0.52
Trembling hands	0.50
Insomnia	0.47
Airway	**0.83**
Cough	0.66
Bronchitis	0.52
Asthma or wheezing	0.47
Post nasal drainage	0.52
Excessive mucous production	0.53
Shortness of breath	0.40
Eye burning/irritation	0.52
Susceptible to infections	0.42
Dry eyes	0.50
Enlarged/tender lymph nodes	0.44
Hoarseness	0.56
Cognitive	**0.92**
Memory difficulties	0.76
Problems with spelling	0.70
Slowed responses	0.83
Problems with arithmetic	0.71
Problems with handwriting	0.76
Difficult concentration	0.72
Difficulty making decisions	0.66
Speech difficulty	0.72
Feeling of unreality/spacey	0.57
Most frequent	**0.86**
Feeling tired/lethargic	0.54
Memory difficulties	0.62
Depressed feelings	0.46
Dizziness/lightheadedness	0.61
Feeling of unreality/spacey	0.67
Shortness of breath	0.42
Feeling irritable/edgy	0.54
Problems focusing eyes	0.59
Chest discomfort	0.44
Loss of motivation	0.36
Problems digesting food	0.38
Muscle aches	0.58
Tingling in fingers/toes	0.55
Eye burning/irritation	0.38
Headache	0.47

* * * * * * * * * * *

The authors acknowledge the able assistance of Geralyn E. Martinez and the late Shelly B. Jackson, R.N., with the management and coding of survey data; and Mireya Gonzales for her assistance with questionnaires and manuscript preparation. We also thank the two reviewers whose comments greatly improved this manuscript. The cognitive hypothesis offered to explain group differences in the discussion section was suggested by a reviewer of the manuscript, and the authors gratefully acknowledge the contribution.

This research was supported in part by an appointment of the first author to the Agency for Toxic Substances and Disease Registry (ATSDR) Clinical Fellowship Program in Environmental Medicine, administered by Oak Ridge Associated Universities through an interagency agreement between the U.S. Department of Energy and ATSDR.

Submitted for publication February 24, 1994; revised; accepted for publication September 1, 1994.

Requests for reprints should be sent to Claudia S. Miller, M.D., Department of Family Practice, The University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, Texas 78284-7794.

* * * * * * * * * * *

References

1. Simon GE, Katon WJ, Sparks PJ. Allergic to life: Psychological factors in environmental illness. Am J Psychiatry 1990; 147:901–06.
2. Terr AI. Environmental illness: A review of 50 cases. Arch Intern Med 1986; 146:145–49.
3. Black DW, Rathe A, Goldstein RB. Environmental illness: A controlled study of 26 subjects with "20th Century Disease." JAMA 1990; 264(24):3166–70.
4. Staudenmayer H, Selner JC. Neuropsychophysiology during relaxation in generalized, universal "allergic" reactivity to the environment: a comparison study. J Psychosomatic Res 1990; 34:259–70.
5. Ashford NA, Miller CS. Chemical sensitivity. A report to the New Jersey State Department of Health. December, 1989.
6. Ashford NA, Miller CS. Chemical exposures: low levels and high stakes. New York: Van Nostrand Reinhold, New York, 1991.
7. Bell IR, Miller CS, Schwartz GE. An olfactory-limbic model of multiple chemical sensitivity syndrome: possible relationships to kindling and affective spectrum disorders. Biol Psychiatry 1992; 32:218–42.
8. *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV).* Washington, D.C.: American Psychiatric Association, 1994.
9. Mayou, R. Somatization. Psychother Psychosom 1993; 59:69–83.
10. Bock RD. Multivariate Statistical Methods in Behavioral Research. New York: McGraw-Hill, 1975; ch 6.
11. Rosenstock L, Keifer, M, Daniell W, McConnell R, Claypoole K. Chronic central nervous system effects of acute organophosphate pesticide intoxication. Lancet 1991; 338(8761):223–27.
12. Savage EP, Keefe TJ, Mounce LM. Chronic neurological sequelae of acute organophosphate pesticide poisoning. Arch Environ Health 1988; 43(1):38–45.
13. Gershon S, Shaw FH. Psychiatric sequelae of chronic exposure to organophosphorus insecticides. Lancet 1961; 1:1371–74.
14. Tabershaw IR, Cooper C. Sequelae of acute organic phosphate poisoning. J Occup Med 1966; 8:5–20.
15. Morrow LA, Ryan CM, Hodgson MJ, Robin N. Risk factors associated with persistence of neuropsychological deficits in persons with organic solvent exposure. J Nerv Mental Dis 1991; 179(9):540–45.
16. Ryan CM, Morrow LA, Hodgson M. Cacosmia and neurobehavioral dysfunction associated with exposure to mixtures of organic solvent. Am J Psychiatry 1988; 145:1442–45.
17. Cone JE, Sult TA. Acquired intolerance to solvents following pesticide/solvent exposure in a building: a new group of workers at risk for multiple chemical sensitivities? Toxicol Ind Health 1992; 8(4):29–39.
18. Lopez-Carillo L, Lopez-Cervantes M. Effect of exposure to organophosphate pesticides on serum cholinesterase levels. Arch Environ Health 1988; 43(1):38–45.
19. Girgis M. Biochemical patterns in limbic system circuitry: biochemical-electrophysiological interactions displayed by

chemitrode techniques. In Doane B, Livingston K, Eds. The limbic system: functional organization and clinical disorders. New York: Raven Press, 1986; pp 55–65.
20. Korpela M, Tahti H. The effect of selected organic solvents on intact human red cell membrane acetylcholinesterase in vitro. Toxicol Appl Pharmacol 1986; 85:257–62.
21. Korpela M, Tahti H. Effect of organic solvents on human erythrocyte membrane acetylcholinesterase activity in vitro: toxic interfaces of neurones, smoke and genes. Arch Toxicol Suppl 1986; 9:320–23.
22. Rosenthal N, Cameron CL. Exaggerated sensitivity to an organophosphate pesticide (letter). Am J Psychiatry 1991; 148(2):270.
23. Dilsaver SC. Cholinergic mechanism in depression. Brain Research Reviews 1986; 11:285–316.
24. Meggs WJ. Neurogenic inflammation and sensitivity to environmental chemicals. Environ Health Perspect 1993; 101(3):234–38.
25. Selner JC, Staudenmayer H. Neuropsychophysiologic observations in patients presenting with environmental illness. Toxicol Ind Health 1992; 8(4):145–55.
26. Staudenmayer H, Selner ME, Selner JC. Adult sequelae of childhood abuse presenting as environmental illness. Annals of Allergy 1993; 71(6):538–46.
27. Bureau of Labor Statistics. Unpublished tabulations. The Current Population Survey. Washington, D.C.: U.S. Department of Labor, 1993.
28. Kellner R. Psychosomatic syndromes and somatic symptoms. Washington, D.C.: American Psychiatric Press, Inc., 1991.
29. Bell IR. Somatization disorder: health care costs in the decade of the brain. Biol Psychiatry 1994; 35:81–83.
30. Bell IR. Neuropsychiatric and biopsychosocial mechanisms in multiple chemical sensitivity: an olfactory-limbic system model. National Research Council multiple chemical sensitivity addendum to biologic markers in immunotoxicology. Washington, D.C.: National Academy Press, 1991; pp 89–108.
31. Adler T. Desert storm's medical quandary. Science News 1994; 145:394–95.
32. National Research Council. Multiple chemical sensitivities: addendum to biologic markers in immunotoxicology. Washington, D.C.: National Academy Press, 1992.
33. SAS Institute Inc. SAS/STAT User's Guide, Release 6.03 Edition. Cary, NC: SAS Institute Inc., 1988.

Multiple Chemical Sensitivities, Addendum to Biologic Markers in Immunotoxicology, National Academy Press, 1992

Diagnostic Markers Of Multiple Chemical Sensitivity

G. Heuser, A. Wojdani, and S. Heuser

One hundred thirty five patients (75% females) were evaluated for complaints of often disabling sensitivity to small concentrations of multiple chemicals after chemical exposure in the recent or distant past.

A comprehensive evaluation of all subjectively involved systems showed a high yield of abnormal objective findings on random (unrelated to time of exposure) testing. When properly timed, certain immune function tests (TA1 cells and chemical antibody levels) became abnormal, or more abnormal, after unintentional self-reported acute exposure and were thus shown to be potential markers of multiple chemical sensitivity (MCS).

We suggest that appropriate tests of the central nervous system, peripheral nervous system, nose and sinuses, pulmonary function, T-cell subsets, chemical antibodies and autoimmunity be performed. If four of these seven systems show abnormality, the diagnosis of MCS is supported. If certain functions become abnormal or more abnormal after unintentional significant exposure, the diagnosis is confirmed.

INTRODUCTION

The senior author has directed a headache and chronic pain clinic for more than ten years. As clinical histories were taken in increasing detail over the years, it became apparent that in many patients, headaches were triggered by chemicals in the environment. What appeared to be very small concentrations of perfumes, fumes, smoke and mist, would trigger headaches in some patients but not in friends and family members who were present in the same environment. Eventually, the senior author realized that small amounts of chemicals cannot only cause headaches but also a multitude of other complaints in some patients. This realization became a starting point for his increasing interest in chemical sensitivity.

One of the co-authors (A.V.) is also chemically sensitive. This is why, as an immunologist, he became interested in developing appropriate tests for chemical sensitivity. He made chemical antibody testing commercially available to our patients.

The other co-author (S.H.) specializes in computer assisted medical information

retrieval. She works one day a week in a one story office which was built more than ten years ago. Furniture, equipment, carpets, and paint are also about ten years old. Never-the-less, she recently developed headaches and nose bleeds. These regularly developed the morning after she had worked in the office. An investigation showed that the manually set air intake valve for that office building had fallen shut. As a result, all air in the office was now being recirculated. No fresh air could enter anymore. When this situation was corrected, both headaches and nose bleeds disappeared. No other person in the office developed headaches and nose bleeds. The conclusion was reached that S.H. is chemically sensitive.

The three of us combined forces in order to develop a team approach to multiple chemical sensitivity (MCS). Consultants in varying specialties are complementing the efforts of our core group.

Initially, we became interested in complaints of chemical sensitivity in our headache patients. Now, we attract an increasing number of environmentally ill patients ("EIs"). Many of them claim disability and request help so that they can get State or Social Security. Others find themselves in litigation (personal injury, workers' compensation). Therefore, an objective evaluation of all patients became mandatory.

Patients with MCS present to their physicians with a startling spectrum of complaints. These complaints are often presented in a manner highly suggestive of a psychiatric disorder. None of them easily lend themselves to measurement. General malaise and weakness, fatigue, headaches, irritability, depression, memory problems, itching, numbness, "creepy and crawly" sensations, burning sensations in the nose, sore throat, hoarseness, shortness of breath, cough, abdominal distress, are all "soft" complaints and therefore not easily documented.

Patients may arrive in the office equipped with oxygen tank, air filter, and mask. Typically, patients describe either one single or repeated exposures to one or more chemicals in the past and the development of chemical sensitivity thereafter. It is striking how similar the history is, regardless of education or walk of life or background. This consistency from one patient to another certainly suggests that we are dealing with a disease entity.

On physical examination there is striking paucity of abnormal findings. Small erythematous lesions over the skin areas exposed to chemicals come and go. On chest examination, wheezing is occasionally found. Soft signs may or may not be present on neurological examination.

Routine laboratory tests (CBC, blood chemistry) and EKGs are also usually normal. We quickly learned that chemically sensitive patients almost regularly refuse to deliberately expose themselves to chemicals. We thus abandoned the idea of exposing our patients to chemicals in a controlled environmental chamber. Instead, we waited for unintentional exposure to occur and suggested testing within a given interval thereafter. The results were then compared with base line values obtained either before or a longer time after acute exposure.

Our results led us to conclude that patients who claim MCS could and should be used as their own controls. Obviously, whenever research funds are available, this patient population should be compared to non-exposed and non-symptomatic matched controls.

A patient with multiple complaints is difficult to evaluate. Most physicians have learned that such a patient usually turns out to suffer from "psychosomatic illness". This is why even a well trained physician is easily persuaded to assign a psychiatric diagnosis to

patients with multiple chemical sensitivity. By contrast, it became our goal to look for objective markers of multiple chemical sensitivity. We believe that this paper shows initial steps in this direction.

MATERIALS AND METHODS

Control Population. One hundred sixty healthy volunteers were examined. Their ages ranged from 22 - 55 years. They had no known disease and denied drug use and smoking. 60% were caucasian, 20% african-americans, 20% were hispanics. 62% were females, 38% were males. Their bloods were examined and normal ranges were established for all immune function tests reported in this paper.

Experimental subjects. One hundred thirty five patients (75% females) were selected from our private patient population. All complained of sensitivity to small amounts of chemicals in their work, home, or other (commuting, shopping, hobbies) environments. This sensitivity had diminished the quality of life in most patients many of whom claimed disability. In the extreme they now lived in self-imposed isolation from society. Some had gone to extraordinary efforts to live in an environmentally "clean" home. Some lived in tents on the beach, some in remote locations in California or out of state. Some had held well paying jobs, had made significant contributions to society but had to give it all up because of their environmental illness.

All patients were personally examined by the senior author. Their work or home environments could not be examined by the authors who had to rely on the patients' reports. Material safety data sheets (MSDS) were examined whenever available from the work site.

Table I lists the settings in which patients claimed to have been exposed. Please note that most exposures were due to groups of chemicals rather than a single chemical.

TABLE I

Group of 135 Patients Exposed to Chemicals

Pesticides	39	Electron Microscopy	1
Sick homes/Buildings	55	Printing	2
Solvents/Fuels	15	Plating	2
Chlorine Gas	1	Art/Wood	3
Copper Compounds	2	Others	15

All laboratory tests were initially obtained at random i.e. regardless of time of chemical exposure or severity of symptoms. Whenever possible, tests were thereupon

specifically timed so as to be obtained a given number of days after exposure and resultant symptoms. Patients were thus instructed to wait for follow-up tests until they were involuntarily exposed and developed symptoms as a result.

Whenever symptoms suggested impairment of neurological or psychological function, we suggested an electroencephalogram (EEG) and evoked response studies. MRI of the brain was usually ordered only if these electrophysiological studies were borderline or abnormal. More recently, we started ordering brain mapping and SPECT studies in a select group of patients.

Whenever symptoms suggested a peripheral neuropathy, we ordered nerve conduction and/or neurometric (perception threshold) studies.

If patients specifically complained of nasal or throat symptoms, consultation was obtained from a board certified ENT-specialist. Studies then frequently included sinus x-rays.

Shortness of breath and related complaints led to pulmonary function testing (PFT) and if indicated, chest x-rays.

Patients underwent immunological studies whenever possible.

We routinely obtained CBC and blood chemistry. As indicated, additional studies (viral, bacterial, endocrine and others) were done.

Neurological testing. Most EEGs were performed in the office of G.H. and included spontaneous sleep, hyperventilation, and photic stimulation. A 16 channel Beckman instrument was used. EEGs had at times been performed elsewhere.

Most MRI brain scans were performed at Medical Imaging Center of Southern California and read by a neuroradiologist.

Perception thresholds were tested with a Neurometer and evaluated by a neurologist with special experience in the use of this instrument. The results are indicators of peripheral nerve (A to C fibers) function.

Evoked response and conduction studies were done and evaluated by board certified neurologists.

SPECT scanning was done at Harbor General Hospital (UCLA affiliated).

Nasal and sinus evaluation. All symptomatic patients were referred to a board certified specialist.

Pulmonary evaluation. Pulmonary function tests (PFT) were done with a Brentwood Spirometer in our office. Some patients had undergone testing elsewhere.

Immune testing. Tests were performed at Immunosciences Laboratories under the direction of A. Wojdani, Ph.D.. In view of the importance of these tests in the context of this evaluation, the methodology is described in detail.

Preparation of formaldehyde-human serum albumin (F-HSA) and Formaldehyde-bovine serum albumin (F-BSA) conjugates:

F-HSA and F-BSA was prepared by the method of Patterson et. al. (1985). Briefly, one mg. of HSA or BSA (Biocell, Carson, Ca.) in PBS (Phosphate Buffered Saline) PH 7.4, each separately, were exposed to 270 of formaldehyde (Fisher Scientific, Fairlawn, N.J.). The mixture was incubated for 30 minutes at 37 C and was then extensively dialyzed against PBS. The F-HSA or F-BSA was sterilized with a 0.2 m filter (Milliport Corp., Bedford, Mass.).

Electrophoretic and immunoelectrophoretic comparison of HSA, BSA with F-HSA and F-BSA was performed to determine conjugation occurrence. Conjugation was evidenced by altered mobility of F-HSA, F-BSA when it was compared with HSA or BSA respectively. Moreover, the number of free amino acid groups present in the F-HSA or F-BSA was determined by the method of Snyder and Sobocinski (1975) and was used to assess the amount of substitution. The number of amino groups bound to formaldehyde was 26 for HSA and 31 for BSA. In this calculation, the formation of intermolecular cross-linking was considered.

Preparation of toluene diisocyanate-human serum albumin (TDI-HSA) and Bovine serum albumin (TDI-BSA) conjugates:

This preparation was similar to the methods of Dewar and Baur (1982). According to this method, 1g HSA or 1g BSA was dissolved in 100 ml of a buffer solution containing potassium chloride (0.05 mol/l), sodium borate (0.05 mol/l), PH 9.4 and cooled to 4 C. Dioxane (10 ml) containing 0.15 ml of toluene diisocyanate was then added dropwise while stirring over a period of 3 hours, followed by addition of 2 ml of ethanolamine, centrifugation, dialysis filtration and lyophilization. Similar to F-HSA and F-BSA, conjugation was confirmed by electrophoresis and determination of free amino groups present in the conjugate. The number of amino groups bound to TDI was 37 for HSA and 43 for BSA. In addition, spectrographic analysis of the conjugate was undertaken according to Zeiss et. al. (1980). There was a marked increase in absorption from 230 to 260 nm which indicated that TDI had become covalently linked to the protein carrier. This increase in absorption did agree with NH_2 group determination only 76% for HSA and 81% for BSA

Preparation of trimellitic anhydride-human serum albumin (TMA-HSA) and Trimellitic anhydride bovine serum albumin (TMA-BSA):

To prepare these conjugates 25 mg. of TMA was dissolved in 0.5 ml of dioxane and added dropwise either to 25 mg of HSA or BSA dissolved in 5 ml of cold 7% NaHCo3 in water. After stirring for 60 minutes at 4 C the conjugates were dialyzed against four changes of 0.1 M NaHCO3 and one change of buffer. Finally the conjugates were filtered and kept at -20 C until used. OD analyses of TMA-HSA, and TMA-BSA were done to determine the number of TMA residues linked to the corresponding carrier protein. The concentration of the carrier protein was converted to molar concentration with the molecular weight of HSA and BSA. From the ratio of the molar concentration of the TMA ligand and the protein carrier, the ratio of TMA residues per molecules of carrier was calculated. TMA-HSA was estimated to contain 5 TMA residues per HSA molecules and for TMA-BSA seven residues per albumin molecule (Pien et al., 1988).

Preparation of phthalic anhydride-human serum albumin (PA-HSA) and Phthalic anhydride bovine serum albumin (PA-BSA) conjugates:

These hapten-conjugates were prepared by adding 75 mg of PA to a cooled solution of 300 mg of HSA or BSA in 100 ml of H_2O. The reaction mixture was stirred overnight, dialyzed against 0.1 M PBS using tubings with a cutoff of 8000 dalton. Using the method of

Zeiss et. al. (1977) the molar ratios were calculated. The molar ratios were found to be 22/28 for PA/HSA and 25/30 for PA/BSA.

Preparation of benzene ring HSA (B-HSA) and Benzene ring BSA (B-BSA) conjugates:

For these preparations, 40 mg. of P-aminobenzoic acid was dissolved in 2 ml of 1 N HCL and cooled by immersion in an ice bath. A cold solution of 14 mg/ml was added dropwise. After each addition, the mixture was stirred for 30 seconds. In parallel, one gram of HSA or BSA was dissolved in boric acid 0.16 M sodium chloride (0-15 M) buffer PH 9.0 (PH was raised with NaOH). The beakers containing the solutions of albumins were surrounded by an ice bath on magnetic stirrer. The solution of diazonium salt was added dropwise, with rapid stirring, to the cold protein solution. After addition of each drop the PH is readjusted to 9.0 to 9.5 with one normal NaOH. When all the solution had been added, the reaction was allowed to continue with slow stirring for at least an hour with further additions of NaOH solution and maintaining the PH at the range of 9.0 to 9.5. Unreacted small molecules were removed by extensive dialysis or by passage through a column of sephadex G-25 in the cold room, with an isotonic salt solution as the eluting buffer. OD analyses of orange color development of B-HSA and B-BSA were done to determine the number of B residues linked to the corresponding carrier protein. The amount of B substitution for HSA were approximately 41 and for BSA 53 (Migrdichian, 1957).

Antibody Determinations:

Specific antibodies against F-HSA, TDI-HSA, TMA-HSA, PA-HSA and B-HSA were analyzed by a noncompetitive ELISA assay. Wells of microtiter plates (Dynatech, Alexandria, VA) were coated with 100 l of antigen solutions (100 g/ml) in 0.1 M PBS PH 7.2 overnight at 4 C. Plates were washed 4 times with 0.1 M PBS containing 0.05% tween 20 between each step. Free absorption sites were blocked with 2% protease free bovine serum albumin at room temperature for 4 hours and stored at -20 C until used.

Analytical Procedure:

The procedure included the following: (1) washing four times, (2) addition of 100 l of diluted serum (1:2 for IgE and 1:100 for IgM and IgG) in PBS tween-20 with 1% BSA (3) incubation for 4 hours at 20 C, followed by washing 4 times, (4) addition of 100 l of an optimal dilution of alkaline phosphatase labeled affinity purified goat anti-human IgE ( ) (1:200), IgM (1:500) and anti IgG (1:1000), purchased from KPI (Maryland) (5) incubation for 120 minutes at 20 C, (6) washing 6 times, (7) addition of 100 l of P-nitrophenyl phosphate (Sigma Chemical Co.) (8) incubation for 60 minutes at 20 C (9) addition of 50 l of 3 N sodium hydroxide solution, and (10) duplicate reading. The results were calculated based on absorbances of duplicate samples of 405 nm using microtiter reader. All samples were read against an HSA antigen as a control of binding not specific to F-HSA, TDI-HSA, TMA-HSA, PA-HSA and B-HSA. Results were

expressed as titer. Titer is being the last dilution of serum giving absorbance twice of HSA control.

Specificity and Cross-inhibition Studies:

For determination of antibody specificity a cross-inhibition study was undertaken. Positive sera for each hapten-protein conjugate were run after appropriate incubation and precipitation with tenfold increasing increments of hapten bound HSA or BSA as inhibitors to cover the range of antibody to antigen excess. This range was between 50 g to 1000 g for hapten-BSA and 80 g to 1000 g for hapten-RSA. After incubation at 37 C and removal of precipitate by centrifugation, the samples from before and after cross-inhibition study were then placed on plates with wells coated with the specific conjugate. The subsequent steps were followed as described above for the ELISA study.

IgG and IgM antibody binding to different conjugates was inhibited by hapten-HSA or hapten-BSA from 36-85%. At a given concentration, both hapten-HSA and hapten-BSA inhibited the antibody level in similar manners.

Partial inhibition of IgE antibody binding to different hapten conjugates was observed when serum was pre-incubated with hapten-HSA or hapten-BSA. This incomplete observation of inhibition of IgE antibody was mainly related to nonavailability of serum with high IgE titers against different chemicals in our laboratory.

Determination of Normal Levels of Antibodies (Controls):

Based on the above procedures, 160 blood donor samples of healthy individuals, of both sexes, between the ages of 22-55, were examined for antibody levels against F-HSA, TD-HSA, TMA-HSA, PA-HSA, and B-HSA. The average titer was 1:800 400 for IgG, 1:3200 1600 for IgM and 1:8 4 for IgE. Thus, in our laboratory titers greater than 1:1600 for IgG, 1:6400 for IgM and 1:16 for IgE are considered positive.

In a given patient, rises or falls in antibody titers by more than one dilution were considered significant (see Tables).

Lymphocyte Subset Enumeration:

A single laser flow cytometer (Epics Profile: Coulter Epics, Inc., Hialeah, FL) which discriminates forward and right angle light scatter, as well as two colors, was used with a software package (Quad Stat: Coulter). Mononuclear cell populations were determined by two-color direct immunofluorescence by using a whole-blood staining technique with the appropriate monoclonal antibody and flow cytometry (Fletcher et al., 1989) The following pairs of fluorescein isothiocyanate (FITC), or phycoerythrin (PE)-conjugated monoclonal antibodies (Coulter immunology) were selected: T11-RDI/B4-FITC, T4-RDI/T8-FITC, T3-FITC/NKH-1-RDI and T11-FITC/Ta1-PE for determination of T-cell/B cell, T-helper/T-suppressor, NKHT3+/NKHY3- and for alternate pathway of lymphocyte activation respectively.

To monitor lymphocyte markers, bit maps were set on the lymphocyte population of the forward-angle light scatter versus a 90 light scatter histogram. The percentage of

positively stained cells for each marker pair, as well as the percentage of doubly stained cells was determined. Estimates of absolute numbers of lymphocytes positive for the respective surface markers were determined by multiplying peripheral lymphocyte cell count by the percentage of positively stained cells for each marker pair. Also, the percentage of doubly stained cells was determined. Estimates of absolute numbers of lymphocytes positive for the respective surface markers were determined by multiplying peripheral lymphocyte cell count by the percentage of positive cells for each surface marker.

Measurement of anti-myelin basic protein antibodies:

Human myelin basic protein (HMBP) was prepared by the method of Diebler et al. (1972) and checked for purity by polyacrylamine gel electrophoresis. Antiserum to HMBP was induced in rabbits by repeated injection of HMBP in complete Freund's adjuvant. Antibody activity in the rabbit sera and patient's samples was detected by adding different dilutions (1:100 to 1:10,000) of sera to wells of a microtiter plate previously coated with HMBP as follows: HMBP 250 g/ml was dissolved in carbonate buffer, PH 9.6 and 200 l of this solution were added to each well. After incubation, washing and blocking as above, 200 l of either diluted rabbit or human serum were added to the wells. After incubation for 1 hour at 37 C the sera were shaken out of the wells and then were washed 5 times with wash solution. 200 l of peroxidase-conjugated goat anti-rabbit or goat anti human IgG, IgM or IgA (optimal dilution) were added to the appropriate well. After incubation and repeated washing 200 l of ABTS substrate were added to each well. Plates were incubated for one hour at room temperature and read in a microtiter reader at 405 nm wavelength. Using rabbit antisera, a titration curve was plotted and patient's sera were compared to this standard curve. Based on more than 200 controls and patients' sample determinations, titers greater than 1:2000 for IgA, 1:5000 for IgM, and 1:8000 for IgG were considered positive.

RESULTS

Table II lists the neurological tests done in patients who had complaints of headaches, irritability, memory loss, depression, numbness, tingling, crawling sensation etc.
Some studies were done in sufficient number to be suggestive of a significant trend. EEGs were abnormal in 45% of tested patients. They showed mild rather than severe abnormalities, with mostly unilateral (at times bilateral) intermittent slowing, dysrhythmia, and occasional single sharp waves and spikes in the temporal and adjacent leads. MRI scans were also abnormal in a high percentage of cases. In some scans there was a definite impression of atrophy (13%) or demyelinating disease (7%). Others (8%) had more ill-defined non-diagnostic lesions. Visual evoked (VER) and brain stem auditory evoked (BAER) responses were also abnormal in a high percentage of cases.

The number of patients who underwent single photon emission computerized tomography (SPECT) studies of brain perfusion and metabolism as well as computerized analysis of their EEG activity (BEAM) was small but initial results suggest further studies in a greater number of patients.

TABLE II

Neurological Tests in Patients with Multiple Chemical Sensitivity

Test	% Abnormal	# of Patients
Spect	75	4
Conduction	62	13
Neurometer	47	7
EEG	45	76
BEAM	43	7
BAER	33	18
MRI	28	54
VER	25	32

Current perception threshold studies by Neurometer were also performed in only a small number of patients. Never-the-less, they hold promise as potential markers of peripheral neuropathy, just as conduction studies do.

TABLE III

Examination of Nose, Sinuses and Pulmonary Function in Patients with Multiple Chemical Sensitivity

TEST	% ABNORMAL	# of PATIENTS
ENT Specialist	100	19
Sinus x-rays	52	25
PFT	62	78
Chest x-rays	16	32

Table III shows that a thorough ENT exam will show abnormalities in a high

percentage of patients. The consistent findings were atrophic rhinitis in patients with severe nasal complaints. Sinusitis or at least thickened mucous membranes were found on sinus examination.

The typical abnormality on PFT was a decrease of FEF 25 - 75% to below 70% of predicted value, indicating small airway disease.

The tests done in table II and III were obtained at random i.e. unrelated to time of exposure.

Table IV shows that, again on random testing, increase in TA1 cell count and percentage is the most frequent abnormality in patients with MCS. Helper/suppressor (H/S) ratios can be increased (50%), unchanged, or decreased upon random testing. Suppressor cells were decreased in 27% of 110 patients. Whether their continued decrease leads to auto-immune disease is not yet apparent from our initial data. Mitogenesis was abnormal in 42% of 12 patients. Normal ranges in our control group were as follows: TA1 Cells 0-432/mm3 or 0 - 10%; H/S ratio 1 - 2.2; Helper Cells 336 - 2,376/mm3 or 35 - 55%; Supressor Cells 192 - 1598/mm3 or 20 - 37%; Lymphocytes 960 - 4,320/mm3 or 20 - 40%; B Cells 48 - 648/mm3 or 5 - 15%.

TABLE IV

Immune Cell Population in Patients with Multiple Chemical Sensitivity

TEST	% ABNORMAL	# OF Patients
TA1	66	92
H/S	50	109
Helper	43	109
Lymphs	27	110
B-Cells	25	104

For normal ranges, see text.

Table V shows abnormal levels of chemical antibodies in a high percentage of patients with MCS. By contrast "normal" (patients unaware of symptoms from chemical exposure) individuals remained in the normal range. (see Materials and Methods section).

Table VI illustrates elevated levels of chemical antibodies in a symptomatic patient. There was a significant change in IgG (benzene ring) and IgM (isocyanate) levels which decreased after exposure ceased and the patient became "asymptomatic" (while however still chemically sensitive).

We also examined for IgE chemical antibodies which were not elevated in any of our studies.

Table VII shows a significant decrease to normal levels of chemical antibodies in a patient who traveled out of state and stayed in a "non-contaminated" environment where she slowly became "asymptomatic". TA1 cells were not a good marker of MCS in this case.

TABLE V

Elevation of Antibodies to Chemicals in Patients with Multiple Chemical Sensitivity

TESTS	% ELEVATED	# of PATIENTS
All/Any	64	111
TMA	41	111
Benzene	28	74
Isocyanate	30	110
Formaldehyde	30	111
Phthalic Anhydride	6	81

For normal ranges see TABLE VI.

TABLE VI

	SYMPTOMATIC 3-30-90 IgG/IgM	ASYMPTOMATIC 6-22-90 IgG/IgM	NORMAL RANGE IgG/IgM
FO	3,200/1,600	1,600/800	1,600/6,400
ISO	3,200/3,200	1,600/800	1,600/6,400
TMA	6,400/1,600	3,200/800	1,600/6,400
PHTH A	1,600/3,200	800/1,600	1,600/6,400
BENZ	6,400/3,200	1,600/3,200	1,600/6,400

K. W., 42, female, was symptomatic from exposures to auto mechanic repair shop in 3/90. No more exposures after early April 1990.

Table VIII illustrates a case in which chemical antibodies were a poor marker of chemical sensitivity. By contrast, cells of the immune system were significantly abnormal and slowly approached normal as the patient stayed away from her home for several months. While the patient was originally bed ridden from exposure at her home, she was ambulating and much improved after four months away from her home. By contrast, her

TABLE VII

	Before IgG/IgM	+ 4 Mos. IgG/IgM	Normal Range IgG/IgM
FO	6,400/12,800	800/800	1,600/6,400
ISO	6,400/3,200	800/800	1,600/6,400
TMA	3,200/3,200	1,600/3,200	1,600/6,400
TA_1 #	207	168	0-432
TA_1 %	7.6	7.5	0-10

M. D., 53, female, with MCS before and after leaving "toxic" environment at her home.

husband denied chemical sensitivity (he actually had some minor symptoms on detailed questioning) and could only be persuaded to be tested after he was away from his home for four months. It should be noted that the couple re-entered their home every few weeks to fetch some of their belongings. This led to intermittent exposure and may account for the slow recovery of the wife. While the patient claimed exposure to malathion, her home had possibly become contaminated by other pesticides.

Table IX illustrates rapid increase in TA1 cells and decrease in immunocompetent natural killer cells (NKHT3) in a student with MCS who entered an anatomy laboratory for sufficient length of time to become severely symptomatic. By contrast, T-cells and helper-suppressor ratios did not change within that same time interval.

Table X illustrates increase in IgM antibodies to TMA, phthalic anhydride and compounds with a benzene ring, and also in IgG antibodies to the benzene ring, approximately two weeks after significant exposure. By contrast changes in TA1 cells were seen within only one day! Note that other parameters were unchanged when studied during this short time interval.

Table XI illustrates that antibodies to TMA can be the only antibodies elevated after exposure. In table XII only two antibodies (isocyanate and chemicals containing the benzene ring) are elevated after significant exposure. Table XIII illustrates increase in benzene related antibodies in the wife who showed more evidence of chemical sensitivity than the husband. Note that other antibodies were not elevated. Results in tables XI, XII and XIII suggest specificity in the respective chemical antibody tests.

Table XIV shows increased antibodies in husband and wife. Both claimed total disability from severe MCS with the wife showing more symptoms. Testing was done at random and years after the acute exposure. Table XV also illustrates the long term effects of exposure in a mobile home which the couple had moved out of three years earlier. They both claimed MCS and were symptomatic when seen in our office. Note elevated antibodies to formaldehyde and TMA together with high TA1 counts in both husband and wife.

Table XVI depicts the presence of auto-antibodies in our patient population.

TABLE VIII

	Wife + 4 Wks.	Wife + 6 Wks.	Wife + 4 mos.	Husband + 4 mos.	Normal Range
H/S	0.7	0.8	1.1	2.1	1 - 2.2
$NKHT_3$ +#	471	396	77	27	14 - 216
$NKHT_3$ +%	15.1	9.2	3.4	1.7	1,5 - 5.0
TA_1 #	624	689	452	192	0 - 432
TA_1 %	22	16	20	12.4	0 - 10
FO IgG/IgM	800 / 800	----	800 / 800	800 /800	1,600/ 6,400
ISO IgG/IgM	800 / 800	----	800 / 800	800 / 800	1,600/ 6,400
TMA IgG/IgM	800 / 1,600	----	800 / 800	800 / 800	1,600/ 6,400
Phth IgG/IgM	800 / 800	----	1,600 / 1,600	1,600 / 6,400	1,600/ 6,400

Married couple, (male, 45 and female, 56) exposed to malathion with symptoms far more severe in the wife.

Not shown in table XVI are additional results with respect to autoimmunity: ANA titers were positive in 17% of 96 patients. The highest percentage of elevated antibodies was seen when anti-myelin antibodies were studied. They were positive in 80% of 50 patients studied. Typically the elevation was in the IgM and/or IgA rather than IgG antibodies.

In contrast to our findings, "normals" have been reported to have a very low incidence of positive auto-antibodies: ANA 3-4%, parietal approximately 2%, smooth muscle approximately 3%, mitochondrial approximately 1%.

DISCUSSION

We embarked on our studies with the hope that patients with a claim of MCS could eventually be objectively evaluated. We felt that an approach should be found which could accommodate a great number of patients and could be supervised by a primary physician.

Our studies were done by specialists and with equipment available in most cities in the US. The immunological studies described in this paper are sophisticated but can be executed on blood which is mailed over-night to an appropriate laboratory.

The growing number of patients claiming MCS will in our opinion make it impossible

TABLE IX

	BASELINE 7 - 21 - 90	+ 2 DAYS 8 - 14 - 90	NORMAL RANGE
T #	2,975	2,005	701 - 3,758
T %	85.8	85.7	73 - 87
H/S	2.3	2.2	1 - 2.2
TA_1 #	523.7	985	0 - 432
TA_1 %	15.1	42.1	0 - 10
$NKHT_3$ + #	10.4	4.7	14 - 216
$NKHT_3$ + %	0.3	0.2	1.5 - 5

Patient L. W., 34, female with MCS, reacting to exposure in an anatomy laboratory on 8-12-90.

to study them all in environmental chambers under controlled conditions. These chambers will however be needed for further research.

Table XVII shows a list of chemicals brought to the senior author by a patient with MCS. She was exposed to some or all of these chemicals at work on an everyday basis. This table illustrates the dilemma for both patient and physician in trying to attempt to disentangle a complex problem such as this. An environmental chamber approach might not be practical in such a case as it would take too long and would be too expensive to study this matter in great detail.

While exacting research requires well selected controls, these are not easily found in our polluted urban environment. For example, most people are more or less aware of and effected by pollution in Los Angeles. Thus, there seems to be a whole spectrum of sensitivity, with our patient population being at one extreme.

Nevertheless we, have accumulated in excess of one hundred patients who did not complain of MCS and had no elevation of chemical antibodies (also see Material and Methods section for discussion of controls) nor of TA_1 cells.

In view of the above we feel that a patient should serve as his/her own control and that therefore all studies should be longitudinal. Our results show that properly timed studies can bring about significant changes in certain parameters after self-reported exposure. We are not certain at this time when TA1 cell counts reach a peak after exposure. We now know however, that these cells are elevated one to two days after exposure. We are also uncertain when chemical antibody levels reach a peak value. All we have shown so far is an elevation about two weeks after exposure.

Chemical exposure and its effects on the immune system has recently become the subject of discussion by leading allergists (Salvaggio, 1990). Changes in immune cell

TABLE X

Chemical Antibodies and Subpopulations Before and After Exposure

TESTS	9-14-90	10-19-90	TESTS	9-14-90	9-28-90
FO-IgG	800	1,600	WBC	7,300	8,800
-IgM	800	1,600	LYMPH %	27	37
ISO-IgG	800	1,600	T%	76	79
-IgM	800	1,600	H%	47	45
TMA-IgG	1,600	3,200	S%	27	29
-IgM	800	3,200	H/S	1.7	1.6
Phth-IgG	800	800	B%	21	17
-IgM	800	3,200	TA_1%	4.4	16.1
Benz-IgG	800	3,200	TA_1 #	86	512
-IgM	800	6,400			

A. G., Female, 52, MCS from work in sick bldg. Re-entry into same bldg. after severl months on 9-27-90.

populations, specifically TA1 cells, after exposure to chemicals were recently described by another group (Thrasher et al., 1989; Thrasher et al., 1990).

Chemical antibody measurements in chemically exposed patients recently became commercially available. Appropriate immunological procedures were originally developed by Dr. Wojdani and used in patients of the senior author (Thrasher et al., 1987). The original procedures were then expanded by Dr. Wojdani to include additional chemicals (this paper) and adopted and verified by another laboratory (Antibody Assay Laboratories) where additional research was done and published (Thrasher et al., 1989; Thrasher et al., 1990).

At this time, it should be noted that benzene is not per se antigenic. However, our data suggests that some chemical compounds containing the benzene ring are antigenic. Further studies are needed to determine which of these compounds cause antibody formation.

Our data suggest that chemical exposure can push some patients in the direction of autoimmune disease. Multiple sclerosis is an example. A number of our patients are suspected of having that disease on the basis of not only their clinical presentation but also abnormal MRI and evoked response studies together with high anti-myelin antibodies. This was previously discussed (Gard and Heuser, 1990).

Studies other than immune tests should also be done in a longitudinal fashion. Cost containment, a lack of research funding and other factors made this impossible in our patient population. However, PFT were at times studied immediately after exposure and became abnormal. It is possible that some neurological parameters (EEG, BEAM, and SPECT) may also show some significant changes.

TABLE XI

	BASELINE IgG / IgM	+ 2 WEEKS IgG / IgM
FO	1,600 / 1,800	800 / 800
ISO	800 / 800	800 / 800
TMA	1,600 / 3,200	3,200 / 12,800
BENZ	6,400 / 3,200	3,200 / 6,400

Patient, L. W., 34, female, with MCS, reacting to exposure in a "Sick Building".

TABLE XII

	8-14-90 IgG / IgM	10-9-90 IgG / IgM	NORMAL RANGE IgG / IgM
FO	800 / 800	1,600 / 1,600	1,600 / 6,400
ISO	800 / 1,600	3,200 / 1,600	1,600 / 6,400
TMA	800 / 800	1,600 / 800	1,600 / 6,400
PHTH A	800 / 800	1,600 / 800	1,600 / 6,400
BENZ	800 / 800	3,200 / 3,200	1,600 / 6,400

Patient L. C., 45, male, with MCS before and after exposure to "noxious" environment on 9-25-90.

While we have come to expect a high percentage of abnormal immune function tests, we were surprised at the high percentage of abnormal neurological tests. This indicates that the "psychiatric" presentation by many of these patients may well have a neurological basis.

The high number of abnormal test results in our patient population is probably explained by the fact that many patients were disabled with MCS and therefore quite sick.

Our EEG and SPECT studies point toward the limbic system as being involved in MCS. This system's possible role is aptly discussed in this conference by Dr. Miller. It, together with the role of the olfactory system deserves further study (also see Dr. Bell's presentation at this conference). Early studies by Russian authors (Bokina et al., 1976) pointed in this same direction.

TABLE XIII

	WIFE IgG / IgM	HUSBAND IgG / IgM	NORMAL RANGE IgG / IgM
FO	800 / 1,600	800 / 800	1,600 / 6,400
ISO	800 / 1,600	800 / 1,600	1,600 / 6,400
TMA	800 / 1,600	800 / 800	1,600 / 6,400
PHTH A	800 / 3,200	800 / 800	1,600 / 6,400
BENZ	1,600 / 12,800	800 / 6,400	1,600 / 6,400

Married couple (male, 43 and female, 35) with MCS after intermittent exposure (ongoing) to gasoline fumes.

TABLE XIV

	WIFE IgG / IgM	HUSBAND IgG / IgM	NORMAL RANGE IgG / IgM
FO	6,400 / 3,200	6,400 / 1,600	1,600 / 6,400
ISO	12,800 / 1,600	6,400 / 1,600	1,600 / 6,400
TMA	6,400 / 1,600	6,400 / 1,600	1,600 / 6,400
PHTH A	1,600 / 3,200	1,600 / 1,600	1,600 / 6,400

Married couple (male, 38 amd female, 34) with MCS after exposure to roofing materials approximately 2 years earlier.

While EEG studies showed mostly mild abnormalities in the temporal and adjacent leads (see results), our youngest patients (sister and brother, ages two and four respectively) developed actual clinical seizures with grossly abnormal EEGs about three weeks after moving into a new home and playing on the brand new carpet. For several months thereafter the mother observed MCS in both her children. Seizures and MCS slowly abated after the family moved out of the new home.

Diagnostic criteria for MCS. The diagnosis of MCS should be suspected if a patient reports

TABLE XV

	WIFE	HUSBAND	NORMAL RANGE
H/S	2.2	2.0	1.0 - 2.2
TA_1 #	923	1,579	0 - 432
TA_1 %	45	47	0 - 10
FO (IgG / IgM)	6,400 / 3,200	3,200 / 3,200	1,600 / 6,400
ISO (IgG / IgM)	1,600 / 1,600	800 / 1,600	1,600 / 6,400
TMA (IgG / IgM)	8,000 / 12,800	4,000 / 3,200	1,600 / 6,400

Married couple (male, 60 and female, 58) with MCS after exposure to Formaldehyde in 1986. Tests done in 1989.

TABLE XVI

Autoimmunity in Patients with Multiple Chemical Sensitivity (N = 92)

PARIETAL CELL	24%	MITOCHONDRIAL	4%
SMOOTH MUSCLE	17%	BRUSH BORDER	4%
MICROSOMAL	15%	RETICULIN	3%
THYROGLOBULIN	7%		

impaired well-being whenever exposed to more than one chemical in concentrations which do not effect the general population. In the extreme, the concentrations are very low and the patient is very sick and claims disability.

A comprehensive evaluation of seven systems should then be undertaken. It should be understood that not all seven systems (central nervous system, peripheral nervous system, nose and sinuses, PFT, T-cells subsets, chemical antibodies, autoimmune panel) are always affected. However, we suggest that abnormalities in four out of these seven systems strengthen the suspicion of MCS. If parameters become abnormal or become more abnormal following self-reported acute exposure, the diagnosis is basically confirmed. Studies in environmentally controlled chambers will be necessary to further advance the field.

TABLE XVII

Chemicals Used at Work
Polychlorinated Biphenyls (PCBs)
Pesticides
1,1,1 Trichloroethane
[methyl] Isocyanates
Xylene
N Pentane
Cyclopentane
Hexane Isomers
N-hexane
Formaldehyde
Perchloroethylene
Monochlorodifluoromethane/Chloropentafluoroethane
Barryman blend
Tectyl 802A
PSKD-NF/ZP-9 Developer
SKL-HF/S Spotcheck Penetrant
Nitrocellulose lacquer [Sinclair]
Krylon Enamel
Tapmatic No. 1 cutting fluid
Industrial lacquer
Chevron thinner

The suggestion to use four out of seven criteria is taken from the diagnostic criteria for systemic lupus erythematosus (SLE), where four out of eleven criteria have to be present to make the diagnosis (see table XVIII). It should be noted that psychiatric features are seen in a significant number of patients with SLE. Thus, the same should not be unexpected in patients with MCS.

CONCLUSIONS

Patients who present with complaints of MCS deserve a comprehensive objective evaluation. If this is performed, a high percentage will be shown to have abnormal test results. This is true if the central and peripheral nervous systems as well as pulmonary and immune functions are tested. Also, anatomical changes are frequently found in the nasal passages on close inspection. By contrast, CBC and blood chemistry are usually within normal limits. So are findings on general physical examination.

Whenever possible, longitudinal studies should be performed in which the patient is used as his/her own control. Increases in TA1 cells and chemical antibodies can then be seen following self-reported unintentional exposure and are therefore suggested as markers of MCS.

Our results suggest diagnostic criteria for MCS. These are sorely needed as the number of patients who claim disability as a result of MCS is growing. Millions of dollars are potentially at stake as claims increase. Patients who are truly sick deserve attention and help from industry, housing authorities and government agencies as well as physicians. Patients who make unjustified claims should be quickly identified.

Patients and industry and government are all in need of a practical approach to the diagnosis of MCS. We believe that our findings are pointing the way to such an approach.

Acknowledgements: We thank Dr. D. Alessi for ENT evaluations, Dr. R. Holgate (neuro-radiology) for evaluation of MRI brain scans, Dr. R. Lawrence (neurology) for interpreting the neurometer studies and Dr. I. Mena (nuclear medicine) for evaluation of SPECT brain scans.

REFERENCES

Bokina, A.I., N.D. Eksler, A.D. Semenenko, and R.V. Merkur'yeva. 1976. Investigation of the mechanism of action of atmospheric pollutants on the central nervous system and comparative evaluation of methods of study. Environ. Health Perspect. 13:37-42.

Dewar, M.A., and X. Baur. 1982. Studies on antigens useful for detection of IgE antibodies in isocyanate-sensitized workers. J.Clin. Chem. Clin. Biochem. 20:337-340.

Diebler, G.E., R.E. Martenson, and M.W. Kies. 1972. Large scale preparation of myelin basic protein from central nervous tissue of several mamalian species, Prep. Biochem. 2:139-165.

Fletcher, M.A., S. Azen, B. Adelsberg, G. Gjerset, J. Hassett, J. Kaplan, J. Niland, T. Maryhon, J. Parker, D. Stites, and J. Mosley. 1989. Immunophenotyping in a multicenter study. The transfusion safety study experience. Clin. Immunol. Immunopathol. 52:38-47.

Gard, Z. and G. Heuser. 1990. Re: Multiple sclerosis, solvents and pets. Letter to the Editor. Arch. Neurol. 47:138.

Migrdichin, V. 1957. Conjugated and synthetic antigens in organic synthesis. Reinhold, New York.

Patterson, R., K.E. Harris, and L.C. Grammer. 1985. Canine antibodies against formaldehyde-dog serum albumin conjugates: induction, measurement, and specificity. J. Lab. Clin. Med. 106:93-100.

Pien, L.C., C.R. Zeiss, C.L. Leach, N.S. Hatoum, D. Levitz, P.J. Garvin, and R.Patterson. 1988. Antibody response to trimellitic hemoglobin in trimellitic anhydride induced lung injury. J. Allergy Clin. Immunol. 82:1098-1103.

Salvaggio, J.E. 1990. The impact of allergy and immunology on our expanding industrial environment. J. Allergy Clinical Immunol. 85:689-699.

Snyder, S.L. and P.Z. Sobocinski. 1975. An improved 2,4,6-Trinitrobenzosulfonic acid method for the determination of amines. Ann. Biochem. 64:285-288.

Thrasher, J.D., A. Wojdani, G. Heuser, and G. Cheung. 1987. Evidence for formaldehyde antibodies and altered cellular immunity in subjects exposed to formaldehyde in mobile homes--a brief communication. Arch. of Environ. Health. 42:347-350.

Thrasher, J.D., R. Madison, A. Broughton, and Z. Gard. 1989. Building-related illness and antibodies to albumin conjugates of formaldehyde, toluene diisocyanate, and trimellitic anhydride.
Am. J. Industrial Med. 15:187-195.

Thrasher, J.D., A. Broughton, and R. Madison. 1990. Immune activation and autoantibodies

in humans with long-term inhalation exposure to formaldehyde. Arch. Environ. Health. 45:217-223.

Zeiss, C.R., R. Patterson, R., J.J. Pruzansky, M.M. Miller, M. Rosenberg, and D. Levitz. 1977. Trimellitic anhydride-induced airway syndromes. Clinical and immunologic studies. J. Allergy Clin. Immunol. 60:96-103.

Zeiss, C.R., T.M. Kanellakes, J.D. Bellone, D. Levitz, J.J. Pruzansky, and R. Patterson. 1980. Immunoglobulin E-mediated asthma and hypersensitivity pneumonitis with precipitating anti-hapten antibodies due to diphenylmethane diisocyanate exposure. J. Allergy Clin. Immunol. 65:346-352.

Multiple Chemical Sensitivities, Addendum to Biologic Markers in Immunotoxicology, National Academy Press, 1992

Considerations for the Diagnosis of Chemical Sensitivity

William J. Rea, Alfred R. Johnson, Gerald H. Ross, Joel R. Butler, Ervin J. Fenyves, Bertie Griffiths, and John Laseter

INTRODUCTION

The study of the effects of the environment upon the individual is now feasible due to new technology developed in the construction of environmental units.[1,2,3]. Our observations reveal that individual or multiple organs may be involved. The brain is the target organ in only a subset of chemically sensitive patients, and its involvement should not be confused with psychosomatic disease.

Over the last 16 years physicians and scientists at the Environmental Health Center in Dallas have had an opportunity to observe over 20,000 patients who had chemical sensitivity problems. These patients were studied under various degrees of environmental control. This experience is unique in the world and has resulted in numerous peer-reviewed scientific articles, chapters in books, and books on this subject.

Studies have resulted in over 32,000 challenge tests by inhalation, oral, or injection methods, of which 16,000 are double-blind. Blood chemical levels and fat biopsies for organic hydrocarbons number over 2,000, while the measurement of immune parameters are over 5,000 tests. Objective brain function tests have been accomplished in over 5,000 patients. Other objective tests, like computerized balance studies, depollutant enzyme levels, and autonomic nervous system changes as measured by the Iriscorder, number near 1,000.

We wish to share our findings with the participants of the National Academy of Sciences Committee for the study of chemical sensitivity.

DEFINITION AND PRINCIPLES

Chemical sensitivity is defined as an adverse reaction to ambient doses of toxic chemicals in our air, food, and water at levels which are generally accepted as subtoxic. Manifestation of adverse reactions depend on: (1) the tissue or organ involved; (2) the chemical and pharmacologic nature of the toxin; (3) the individual susceptibility of the exposed person (genetic make-up, nutritional state, and total load at the time of exposure); (4) the length of time of the exposure; (5) amount and variety of other body stressors (total

load) and synergism at the time of reaction. (6) the derangement of metabolism that may occur from the initial insults.

To demonstrate cause-and-effect proof of environmental influence on an individual's health, one must understand several important principles and facts. These principles involve those
of *total body load* (burden), *adaptation* (masking, acute toxicological tolerance), *bipolarity*, *biochemical individuality*. Each principle will be discussed separately.

TOTAL BODY LOAD (BURDEN)

This is the patient's total pollutant load of whatever source (usually from air, food and water or surroundings [1,2,4]. The body must cope with this total burden; usually it must be utilized, expelled or compartmentalized. Total body load includes: (1) *physical factors* (e.g. hot, cold, weather changes, positive ions.[5] electromagnetic phenomena.[6] radon); (2) *toxic chemicals* (e.g. inorganics: Pb, Cd, Hg, Al, Br, etc.; organics: pesticides, formaldehydes, phenols, car exhausts, etc.).[7-21] (3) *biological* (bacteria, virus, parasites, molds,[22] food.)[23,24] (4) *psychological or emotional factors* also significantly affect the patient, confirmed by recent work in psychoneuroimmunology, linking the psyche and the neuroendocrine and immune systems.[25,26,27,28] Failure to reduce the total body load prior to pollutant challenge will frequently yield inaccurate results. Accordingly, we believe it is essential to conduct investigative procedures in controlled environmental circumstances with the total load reduced.

ADAPTATION
(MASKING, ACUTE TOXICOLOGICAL TOLERANCE)

Induced by the internal or external environment, this is a change in the homeostasis (steady state), of body function with adjustment to a new "set point".[29,30,31,32] Adaptation is an acute survival mechanism in which the individual "gets used to" a constant toxic exposure in order to survive, at the same time suffering a long-term decrease in efficient functioning and perhaps longevity. Selye was among the first to describe this compensatory mechanism.[33] Because of adaptation or tolerance, the patient's total body load may increase undetected because the *perception* of a cause-and-effect relationship is lost. With no apparent correlated symptoms, repeated exposures may continue to damage his immune and enzyme detoxification systems.[34,35] The eventual result of continued toxic exposure over a period of days, weeks, months to years is end-organ failure.[11] Withdrawal or avoidance of an offending substance for at least four days will aid in reducing the total body load, after which a controlled re-exposure challenge will reproduce cause-and-effect reactions. In these deadapted individuals, there is high reproduciblity of these evoked reactions permitting the physician to acquire sound scientific information.[36]

BIPOLARITY

After an exposure, the body initially develops a bipolar response of a stimulatory phase

followed by a depressive phase,[37,29,1] usually with induction of immune and enzyme detoxification systems.[38] If the incitant is strong enough, or if substantial size or duration of exposure occurs, the induced enzyme and immune detoxification systems are depleted or depressed by overstimulation and overutilization. An individual may also initially experience a stimulatory reaction in the brain, perceiving the inciting substance not as being harmful, but as actually producing an energizing "high". Therefore, he continues to acquire more exposures. After a period of time, however, be it minutes, months, or years, his body's defenses are adversely overstimulated and he develops disabling depression-exhaustion symptoms.[31] This stimulation and depression-exhaustion pattern has been observed with many pollutant exposures, including ozone.[30,12] When studying the effects of pollutants upon adapted individuals, the stimulatory phase is often missed or misinterpreted as being normal, thus giving faulty data. Studies in the controlled environment, involving 16,000 challenges in 2,000 deadapted patients, has proven this bipolarity phenomenon repeatedly.

BIOCHEMICAL INDIVIDUALITY

Another principle necessary to understand environmental aspects of health and disease, and especially chemical sensitivity, is that of biochemical individuality. Biochemical individuality of response is the individual's uniqueness.[39] This uniqueness of response depends on the differing quantities of carbohydrates, fats, proteins, enzymes, vitamins, minerals, immune and enzyme detoxification parameters with which an individual is equipped to handle pollutant insults. These variations determine an individual's ability to process the noxious substances he encounters. They further contribute to the intensity of his reaction to toxic exposures and to his susceptibility to chemical sensitivity. Thus, a group of individuals may be exposed to the same pollutant. One person may develop arthritis, one sinusitis, one diarrhea, one cystitis, one asthma, and one may remain apparently unaffected.

We have differing quantities and interactions of carbohydrates, fats, proteins, enzymes, vitamins, minerals, and immune parameters with which to respond to environmental factors. One simple example is the noted relationship between low serum magnesium levels and the HLA B35 genotype.[40] This biochemical individuality allows us to either clear the body of noxious substances, or to collect them and contribute to the body burden. Biochemical individuality is dependent on at least three factors: genetic endowment, the state of the fetus's nutritional health and toxic body burden during pregnancy, and the individual's present toxic body burden and nutritional state at the time of exposure.

Some individuals, for example, are born with significantly lower quantities of specific enzymes (it may be 75%, 50% or even 25% of the norms). Their response to environmental stimuli is often considerably weaker than those born with 100% of the normal detoxifying enzymes and immune parameters. Examples are the babies with phenylketonuria or the individuals with transferase deficiency, who do well until exposed to their environmental triggers, and then damage sets in. There are over 2,000 genetically-transmitted metabolic errors, suggesting that most of the population will have at least one abnormality.[41] Toxic volatile organic chemicals have been shown by Laseter to biocon-centrate in the fetus, increasing the acquired burden in some babies.[42]

It is well known that some individuals acquire their toxic load at work or around their homes.[42] This changes with different seasons and weather conditions thus giving variable effects and responses over time. Extreme care must be taken in evaluation of each patient, who may exhibit unique clinical responses due to his specific biochemical individuality. As

an example, it is well known that not all patients will exhibit every reported symptom associated with systemic lupus erythematosus (SLE). Similarly, each patient exposed to the same environmental pollutant will react with his or her unique complex of symptoms. Because this vital fact is misunderstood, many studies are flawed when the wrong signs and symptoms are assessed for that individual.

SPREADING PHENOMENA

Spreading is a secondary response to pollutants that can involve new incitants or new target organs. Spreading that involves new incitants occurs when the body has developed increased sensitivity to increasing numbers of biological inhalants, toxic chemicals, and foods at increasingly smaller doses. At this time, overload becomes so taxing that a minute toxic exposure of any substance may be sufficient to trigger a response or autonomous triggering my occur. For example, a person initially may be damaged by a pesticide and then eventually have his disease process triggered by exposure to a myriad of toxic chemicals and foods, such as phenol, formaldehyde, perfume, beef, lettuce, etc.

Spreading may occur for many reasons. It may be due to a failure of the detoxification mechanisms--oxidation, reduction, degradation and conjugation--brought about by toxic overloading, or it may occur because of depletion of the enzyme or coenzyme's nutrient fuels, such as zinc, magnesium, all B vitamins, amino acid, or fatty acid. This depletion may account for an increasing inability to detoxify and respond appropriately. The blood brain barrier or peripheral cellular membranes of the skin, lung, nasal mucosa, gastrointestinal or genitourinary systems may be damaged allowing previously excluded toxic and nontoxic substances to penetrate to areas that increase the risk of harm. Immune or pharmacological releasing mechanisms may become so damaged that they are triggered by many substances toxic, then non-toxic (such as food) in addition to the specific one to which they were intended to respond. It is well substantiated that antigen recognition sites may be disturbed or destroyed by pollutant overload. Hormone deregulation (feedback mechanisms) may occur allowing for still greater sensitivity.

In contrast to patients who experience increased sensitivity to multiple triggering agents, some chemically sensitive patients may have one isolated organ involved in their disease process for years, only to have dysfunction spread to other organs as their resistance mechanisms break down. This kind of spreading from one to another or multiple end-organs enables the progression of hypersensitivity and the eventual onset of fixed named disease.

SWITCH PHENOMENON

The switch phenomenon is the changing of one end-organ response to another. This usually occurs acutely, but may occur over a much longer period of time. This phenomenon was first described by Savage in the 1700s. He observed that when mental patients were at their worst, they usually had a remission of their asthma or sinusitis. When they were better mentally and they were seen in the outpatient clinic, they had a much higher incidence of sinus and asthma problems. Randolph and most other environmentally oriented physicians have also observed this phenomenon. At the EHC-Dallas, we have observed similar occurrences in our patients and, in fact, take cognizance of this phenomenon when evaluating therapy outcome.

In observing thousands of controlled challenges in the environmental unit, we have seen the target organ responses of many of our patients switch to several different ones during a long (e.g., 24-hour) reaction. Often we have seen, for example, transient brain dysfunction followed by arthralgia, followed by diarrhea, followed by arrhythmia.

Therapy can appear to have been effective, even when a pollutant has not been totally eliminated. In this case, a new set of symptoms may begin indicating that a pollutant response has simply switched to another end-organ. This phenomenon occurs frequently when symptom-suppressing medication therapy or inadequate environmental manipulation is used. For example, a patient may have his sinusitis cleared by medication (e.g., cortisone). but later, since the cause has not been eliminated, he may develop arthralgia and eventually arthritis, or his colitis may have cleared only later to have cystitis develop.

This life-long progression of disease does not have to occur if the switch phenomenon is recognized during initial evaluation. To prevent it, individuals and physicians need simply to be cognizant of seemingly unrelated events. For example, statements are often made to the effect that a child will outgrow a problem when, in reality, one symptom complex dissipates only to be replaced by a new set of symptoms. For example, a child may have recurrent ear infections. Eventually, these may stop, but bedwetting may ensue. Over time the bedwetting may cease, but the child may then develop asthma. These changes in health may appear to be totally unrelated; in this instance, however, they are switch phenomena. The situation of an adult who sprays pesticides in his home, and then visits a neurologist with complaints of headaches and a rheumatologist with symptoms of arthritis is similar. Both the physician and the patient frequently fail to recognize the relevancy of these seemingly disparate symptoms as being part of a larger pattern needing further investigation.

POLLUTION FACTS

In order to accomplish concise studies of the chemical sensitivity phenomena, one must understand some facts about environmental pollutants.

Modern technology's rapidly accelerating rate of growth has produced a wide variety of chemical products, that contribute to the total chemical environment. Recent studies show that nearly 50% of the global atmospheric pollutants are generated by man, (either isolated from natural products or synthesized), and the ubiquitous nature of the toxic chemical agents is widely appreciated.[8,13,14] It has been estimated that more than 2,000 new chemical compounds are introduced annually, and that over 60,000 different organic chemicals are used commercially today.

The widespread presence of hazardous chemicals has rendered critical the environmental sensitivity problems described by Randolph almost 40 years ago.[43] While celebrated instances of gross contamination have long been the object of professional attention, only recently have literally thousands of synthetic chemical products, heretofore believed innocuous, been incriminated as agents of homeostatic dysfunction[14,11].

Current data affirm the view that standard methods for the determination of chemical incitants may no longer be effective.[7,8,36,1] With the finding that sensitivities can occur from subthreshold and picomolar quantities of chemicals, has come the discovery that standard procedures, such as skin prick or scratch tests, often fail to demonstrate positive reactions which are otherwise verifiable.

Recent literature confirms the harmful effects of chemical incitants, like formaldehyde,[44,45] phenol,[45,46] some pesticides,[7] chlorine,[47] and petroleum alcohol,[48]

Commonly encountered chemicals like glycine,[9,49] DDT, toluene and turpentine,[50,51,52] and drugs such as hydralazine have been found to induce advanced-staged disease process.[53]

A number of familiar metals have also been incriminated, among them nickel, cobalt, chromium,[54] aluminum,[55] mercury,[56] and platinum.[57] Other common environmental chemical incitants include xylene,[58] various acrylates,[59] and acrylated prepolymers,[60] benzyl peroxide, carbon tetrachloride,[61] sulfates,[62] dithiocarbamates,[63] and diisocyanates.[64]

WATER POLLUTION

Water has an important role in delivering contaminant minerals, toxic organic and inorganic chemicals, particulate matter and radiation to the human organism. In developed nations, the incidence of many chronic diseases, particularly cardiovascular disease, is associated with water characteristics, like purity and mineral content.[13] Hardness, or the lack thereof, is involved in heart disease, hypertension, and stroke.[13] Among the theorized protective agents found in hard water are calcium, magnesium, vanadium, lithium, chromium and manganese.[13] Certainly, once cardiovascular pathology is induced, waters with high sodium content may be harmful. Other adverse agents include the metals cadmium, lead, copper, and zinc, which tend to be found in higher concentrations in soft water. Nitrates in water (usually from fertilizer) pose immediate threats to children under three months of age due to production of methemoglobin,[65] and sulfur can also cause reactions in susceptible patients.

City water, much of it secondhand, often contains from 100 to 10,000 times as many synthetic compounds as natural spring water.[66] This, coupled with the rapid growth in the use of synthetic chemicals, has focused concern on the chemical quality of drinking water.[13] Although microbes are important, attention is now being drawn to the microchemical contaminants. Advances in analytic chemistry has been able to reveal chemical contaminants in the parts-per-billion or parts-per-trillion range. It is a serious mistake to assume that extensive contamination of drinking water with "low" levels of synthetic pollutants is "normal." These chemicals are widespread, and we should not be lulled into assuming these contaminants are innocuous. Examination of our ground water has revealed many hundreds of toxic chemicals in these ranges.[67,68]

Many examples of water contamination exist and have been documented, including Times Beach, Missouri with winter floods flushing dioxin-contaminated oil used 20 years ago, Niagara's Love Canal area, Waterbury, Connecticut, and Middleboro, Kentucky.[69]

In many cases, deadly materials have been accumulating for years in dumps and landfills. In the United States, some 80,000 pits and toxic waste lagoons hold chemicals ranging from carbon tetrachloride to discarded mustard-gas bombs.[68] Slowly escaping from their burial sites, these leftovers directly contaminate our ground water. Polluted ground water exists at 347 of the nations 418 worst chemical dumps, and probably is occurring in the rest.[68] Laseter[7] and others[70] have shown that a virtual organic chemistry laboratory exists in most drinking water.

In the early 1980s, California, New York, New Jersey, Arizona, Nova Scotia, and Pennsylvania condemned dozens of public water supply wells due to trichloroethylene or tetrachloroethylene pollution.[71] Leaking fuel tanks contaminated nine Kansas public water supplies in 1981.[71] Officials in New Mexico identified 25 cities where hydrocarbons and solvents contaminated the ground water.[71] Analysis of New Orleans drinking water alone revealed the presence of 13 halogenated hydrocarbons.

Sources of water pollution fall into three major categories: (1) municipal sewage; (2) agricultural wastes; and (3) industrial wastes. Approximately 55% of the water treated in municipal plants is from homes, while another 45% is from industry. Agricultural wastes include those from livestock and toxic chemicals (pesticides, herbicides, fertilizers), and farm runoff collects in rivers, lakes, and ground water. Industrial wastes, however, contain some of our more toxic substances. Over one-half of the total volume of industrial wastes come from paper mills, organic chemical manufacturing plants. petroleum companies, and steel manufacturing. The major pollutants are chemical byproducts, oil, grease, radioactive waste and heat. Other sources of contamination are drinking water disinfectants and byproducts;[68] it should be remembered that chlorine, interacting with organic material, produces toxic trihalomethanes and other organochlorines. Alternatives to treating water with chlorine include ozone, chloramines, ultra-violet irradiation, iodination, or home reverse-osmosis and charcoal filtration.[68]

Chloride, added at many sewage treatment plants, can also react with organic matter in the water to form chlorinated hydrocarbons, many of which are also known to cause cancer. Copper sulfate, aluminum sulfate and fluorine are other major contaminants which may add to the total body burden.[68]

Over a thousand different toxic chemicals have been found in public water supplies including pesticides, herbicides, industrial solvents, and polychlorinated biphenyls, just to name a few.

Inorganic pollutants include arsenic, cadmium, chromium, copper, manganese, mercury, silver, and selenium.[13] The use of inorganic arsenic insecticides has lead to high arsenic levels in some water supplies.[13] Barium (greater than 1 mg/L) has toxic effects on the heart, blood vessels, and nerves,[68] while cadmium at levels greater than .Olmg/L has adverse arterial effects. At levels greater than lmg/L or one ppm, the following metals found as water contaminants have produced severe chronic toxicity: antimony,[72] beryllium,[73] cobalt,[73] gold,[73] iodine,[73] lithium,[73] mercury,[74] and vanadium.[73] In Minamata, Japan, between 1953 and 1960, various plastic companies dumped methyl mercury chloride into the water, producing 50 to 85 ppm of mercury in nearby fish. Four hundred and six people died after ingesting these mercury-contaminated fish, and the adverse toxicological effects on developing children are continuing to be measured.[75]

A recently completed study found that skin absorption contributed from 29 to 91% of the total body dose of pollutants (from water), with an average of about 64%.[76] This is even more important when one looks at the large number of volatile organic compounds found in our drinking and bath water.

Radiation occurs in some waters in the form of radon, a naturally occurring radionuclide that seeps from rocks and may be concentrated in airtight homes, especially the basements. At this stage, more information is needed to fully assess its effects. It probably, however, can increase the total body load.

In 1965, a serious drinking-water problem was seen in 40 percent of patients hospitalized for a program of comprehensive environmental control.[1,77,78] Today it is up to 80%. We have found that patients susceptible to water contaminants virtually always exhibit multiple sensitivities, with advanced and severe environmental reactions, especially to airborne chemicals.[1] Interestingly, water sensitivity in children was found to increase on a circadian and seasonal basis.[79] Increased severity was seen during June and July or in September and October, when grass, pollen, and mold counts were also high.[79] Some ECU patients had difficulty with waters containing high levels of sodium, others with calcium, and still others with high bicarbonate waters. A few individuals tolerated distilled water, even

though it may contain some hydrocarbon residuals. Hundreds of outpatients have shown symptoms in reaction to both chlorinated and nonchlorinated waters, including numerous spring, charcoal-filtered, and distilled waters. If these water-induced symptoms remain undiscovered, food and chemical testing, may be distorted. It is vital to test and find safe water before proceeding with other testing in these severely sensitive individuals.

CHEMICAL CONTAMINATION IN FOODS

The contamination of our urban food supplies is the result of widespread use of food additives, preservatives, and dyes in growth, manufacturing and processing. Virtually all commercially grown and prepared foods have pesticides and herbicides in them.[79,9]

The literature abounds with reports of chemical sensitivities to many additives.[80,81] Contaminant reactions complicate the study of food sensitivity, forcing one to define more clearly the nature of the incitant, not only as it is encountered in foods, but in the air and water as well. Be11 has reported urticarial reactions and immunological changes to exposures to a number of food additives.[82] Condemi[83] and Bell both suggest that food dyes may trigger reactions in sensitive individuals; including conditions commonly thought to be psychogenic, or certain forms of hyperactivity.[28,84,85,86,87,88,89] Lindemayer has associated urticarial reactions with several additives such as p-hydroxybenzoic acid propylester, benzoic acid, sodium benzoate, ponceau rouge, and indigo carmine.[90] Monroe's data indicate a casual role played by tartrazine azo dyes and salicylates in the provocation of vascular alterations.[36] Other additives, including sodium nitrite and sodium glutamate, have been found to trigger migraine phenomena in susceptible patients.[91]

Sulfur dioxide[16] and sodium salicylate can provoke asthmatic reactions,[92] while aspirin-like food contaminants and dyes may trigger urticaria, angioedema, bronchoconstriction and purpura.[93] An even wider variety of symptoms, including severe gastro-intestinal disorders, has been associated with sensitivities to aniline, commonly found in rapeseed oi1.[94]

In our experience, natural toxic components of foods, such as alkaloids, phenols, lectins, etc. must also be accounted for when studying the secondary food sensitivity which occurs from pollutant overload in the chemically sensitive. Therefore, three factors must be considered when evaluating the total food load. These are man-made pollutant contamination, natural toxic effects of foods, and food sensitivity. Failure to consider all three in the chemically sensitive patient may color or negate otherwise a clearly defined case of chemical sensitivity.

CHEMICAL INCITANTS IN THE HOME ENVIRONMENT

Indoor air pollution in the home environment has produced a multitude of sensitivities to chemicals.[8,95] Time and space limitations allow only a cursory review of the numerous commercial hygienic products which can be noxious for chemically susceptible individuals. Among these are a wide variety of cosmetics.[96,97] particularly those containing glycerin, propylene glycol, or butylene glyco1,[98] perfumes,[99] and hair products such as dyes,[100,101] creams,[102] sprays,[103] and shampoo.[104] Moreover, sensitivities have been demonstrated to occur in association with lip salve,[105] fingernail preparations,[106] soaps,[107] sanitary napkins,[108] mouthwash,[109] antiperspirants,[110] contact lenses.[111] contact lens solutions,[112] and suntan lotions.[113]

Reports are widespread of sensitivities to chemicals in textiles, including synthetic acrylic fibers,[114] polyester spin finishes,[115] the epoxy resins, and synthetic clothing.[116] Products such as fabric spray starch may also be considered toxic for the chemically sensitive individua1[117] for whom even the metallic buttons on blue jeans may trigger reactions to nickel.[118] Formaldehyde[44] on synthetics or tetrachloroethylene, from dry-cleaned clothing can also produce problems.

Household cleaning products, particularly those containing formaldehyde, phenols and chlorine are hazardous for many patients. Several laundry products and detergents may be identified as household incitants[119], as well as a number of products used to clean and polish furniture[120].

The very construction of many homes may prove dangerous for the chemically sensitive patient. Data suggests that chemicals contained in wood preservatives (e.g., pentachlorophenols) are environmental incitants capable of triggering a variety of symptoms.[121,122,123] Others report problems with reactions to formaldehyde-containing pressboard, carpets, plywood and petrochemical contaminants.[124]

Current data confirm earlier findings regarding the hazards of pesticides[125] such as 2,4,DNP and fungicides[126]. Moreover, research increasingly suggests the possibility of sensitivities to apparently innocuous items such as rubber bands,[127] coins,[128] epoxy,[129] and countless paper products.[130,131] Pesticides, along with oil, gas or coal are major offenders for sensitive individuals.

Research shows house plants[132,133] and common insects[134] can now be viewed as environmental incitants or causes of homeostatic dysfunction. In addition, sensitivities to cold and heat,[36] and to contaminants in household water supplies have been associated with symptoms ranging from urticaria to severe respiratory distress.

Natural gas heat and stoves, and routine insecticiding or termite proofing of homes can be prime offenders in chemical sensitivity. One must consider these potential sources of contaminants when developing studies on chemical sensitivity. In our experience, failure to evaluate building and home environments before challenge testing will often make challenge studies invalid for the diagnosis of chemical sensitivity.

MECHANISMS

The mechanisms involved in chemical sensitivity are becoming clearer, one of which has pollutant injury occurring to the lungs or liver, with resultant free radical generation[135]. Disturbances then occurs at the cellular, subcellular and molecular levels, producing injury either immunologically, or nonimmunologically through enzyme detoxification systems. Vascular or autonomic nervous system dysfunction will then occur with one or a myriad of end-organ responses.

IMMUNOLOGICAL

Type I hypersensitivity is usually mediated through the IgE mechanism on the vessel wall. Classic examples are angioedema urticaria, and anaphylaxis due to sensitivity to pollen, dust, mold, or food,[136] or some chemicals such as toluene diisocyanate. Ten percent of the patients with immunological involvement with chemical sensitivity seen at the ECH-Dallas seem to fall within this category.

Type II cytotoxic damages may occur with direct injury to the cell. A clinical example of this is seen in patients exposed to mercury[137]. A group in Minimata, Japan developed neurological disease from eating fish exposed to toxic methyl mercury chloride. Mercurial pesticides fall into this category. Twenty percent of the patients with immunological involvement seen at the EHC-Dallas seem to fall into this Type II category.

Type III shows immune complexes of complement and gamma globulin damaging the vessel wall. A clinical example of this is lupus vasculitis. Numerous chemicals, including procainamide and chlorothaizide, are known to trigger the autoantibody reaction of lupus-like reactions. Many other toxic chemicals can also trigger the autoimmune response[138]. Other chemicals, such as vinyl chloride, will produce microaneurysms of small digital arterioles, probably due to this mechanism[139,51].

Type IV (cell-mediated) immunity occurs with triggering of the T-lymphocyte. Numerous chemicals such as phenol, pesticides, organohalides, and some metals will also alter immune responses, triggering lymphokines, and producing the Type IV reactions[138]. Clinical examples are polyarteritis nodosa, hypersensitivity angiitis, Henoch-Schonlein purpura, and Wegener's granulomatosis [1,139]. A recent study done at the Environmental Health Center - Dallas on 104 proven chemically-sensitive individuals (70 vascular, 27 asthmatic, and 7 rheumatoid), comparing them with 60 normal controls, showed that those manifesting a chemical sensitivity through their vascular tree had suppression of the suppressor T-cells (greater than 4 S.D.)[47]. Clearly the larger portion of our patients with immunological involvement fall into the Type III and IV categories.

NON-IMMUNE ENZYME DETOXIFICATION

Non-immune triggering of the cell and vessel wall may occur. Complement may be triggered directly by molds, foods, or toxic chemicals[139], and mediators like kinins, postaglandins, etc. may also be directly triggered. These reactions then cause vascular spasm, with resultant hypoxia and release of lysozymes, which further produces more spasm, hypoxia, etc. Eventually end organ failure will occur.

Triggering of the enzyme detoxification, mostly in the systems liver and respiratory mucosa, plays an important role in clearing of pollutants. It occurs, however, to a lesser extent in all systems. Foreign compound biotransformations have considerable variability, depending on genetic factors, age, sex, nutrition, health status, and the size of the dose.

The metabolism of foreign compounds usually occurs in the microsomal fraction (smooth endoplasmic reticulum) of liver cells. A few biotransformations are non-microsomal (redox reactions involving alcohols, aldehydes and ketones). There are basically four biotransformation categories -- oxidation, reduction, degradation, and conjugation.

The first three biotransformation pathways for xenobiotics are the same pathways that the body uses to process food and nutrients. If these enzyme systems are over-utilized by competing foreign pollutants, inadequate handling of food proteins can result, with the subsequent induction of food sensitivities. However, because these detoxification pathways are dependant on nutrient and mineral cofactors, these systems are *inducible* by appropriate oral or systemic supplementation. Such supplementation serves as an important factor in stabilizing and treating patients with chemical sensitivity. The fourth category of biotransformation, that of conjugation, is almost exclusively for handling foreign compounds. Conjugation appears to be uniquely utilized for the catabolism of foreign compounds, using amino acids and their derivatives with peptide bonds, and carbohydrates and their

derivatives with glucide bonds. Simpler compounds like sulfate and acetate are also involved in conjugation with linkage of ester bonds. Activated conjugated compounds plus specific enzymes are often detoxified by coupling with co-enzymes, Examples: co-enzyme A with acetate, and other short-chain fatty acids adenosine or phosphoadenosine phosphate is detoxified with a methyl group from sulfate methionine, or the ethyl group from ethionine. Similarly, uridine and phosphate with glucose and glucuronic acids[140,141].

There are generally five major categories of foreign-compound conjugative processes[140]. These are: 1) *acetylation* through co-enzyme A, for detoxifying aromatic amines and sulfur amides; 2) *peptide conjugation* with glycine and aromatic carboxylic acids to hippuric acid; 3) *sulfonation* with glutathione (containing cysteine) or PAPS, and microsomal enzyme conjugation for multi-ring systems such as naphthalene, anthracene, and pheno-anthracene, which eventually results in benign mercaptic acids or alternatively benign sulfate esters; 4) *alkylations* by methionine of amines, phenols, thiols, noradrenalin, histamine, serotonin, pyridine, pyrogallol, ethylmucaptin sulfites, selenites and tellurites; 5) *Glucuronation*. Glucuronides detoxify pesticides, alcohols, phenols, enols, carboxylic acid, amino hydroxamines, carbamides, sulfonamide and thiol[140,141]. All of these processes are dependent upon nutrient fuels to keep these processes running efficiently. Toxic chemicals disturb the supply of the nutrient fuels by 1) producing poor quality food, 2) reducing intake, 3) reducing normal absorption, 4) setting up competitive absorption in the gut with nutrients, 5) imbalancing intestinal flora, 6) disturbing transport mechanisms, 7) disturbing proper decomposition and metabolism, 8) causing renal leaks, and 9) directly damaging nutrients. If nutrient inadequacy occurs, normal metabolism is overloaded and disturbed, resulting in selective changes in the pools of nutrients such as vitamins, minerals, amino acids, enzymes, lipids, and carbohydrates. Once this occurs, there is a viscous cycle of dysmetabolism, often with production or worsening of chemical sensitivity. These detoxification and metabolic defects are often measurable and have been accomplished in over 2,000 chemically sensitive patients.

DIAGNOSIS

The diagnosis of chemical sensitivity can now be made with a combination of the following history, physical examination, immune tests including IgE, IgG, complements, T & B lymphocyte subsets, blood levels of pesticides, organic compounds, heavy metals (intracellular), and occasionally objective brain function tests. Antipollutant enzymes, such as superoxide dismutase, glutathione, peroxidase, and catalase have been found to be suppressed in the chemically sensitive. Vitamin deficiencies, mineral deficiencies and excess, amino acid deficiency and disturbed lipid and carbohydrate metabolism has been observed.

Challenge tests are the cornerstone of confirmatory diagnosis. These may be accomplished through oral, inhaled, or intradermal challenges. Care should be taken to rule out inhalant problems with pollen, dust, and molds. Food sensitivity occurs in approximately 80% of the people with chemical sensitivity; and must be evaluated. When diagnosing chemical sensitivity, one must investigate water contaminant sensitivities, as 90% of people with chemical sensitivity have water contaminant reactions[4]. This can be checked by placing the patient on less chemically-contaminated, charcoal filtered, distilled, or glass-bottled spring water for four days, with subsequent rechallenge of the patient's regular drinking water. This procedure will often elicit a reaction to the water pollutants in the sensitive individual.

Patients frequently know where and when the onset of their problems occurred, e.g., sudden exposure to pesticides, working around printing machines and factory machines, etc. They usually develop increased odor perception to gasoline, perfumes, new paints, car exhausts, gas stoves, fabrics, clothing or carpeting stores, chlorine and chlorox, and cigarette smoke. Not only will they find these smells offensive, but may have marked reactions to them as well. Other symptoms can range from the almost universally-seen fatigue, to classic end-organ failures. Physical findings frequently are vascular in nature, with edema, petechiae, spontaneous bruising, purpura, or peripheral arterial spasm. Frequently there is flushing, adult-onset acne, and a yellowness of the skin without jaundice. Chronic, recurring nonspecific inflammation is usually a significant sign, e.g., colitis, cystitis, vasculitis, etc. Laboratory findings are often non-specific, e.g., sedimentation rates may increase or liver profile may be mildly off. Fifteen percent of environmentally sensitive patients have positive C-reactive proteins. Twenty-five percent show abnormal serum complement parameters. Fifty percent of the chemically sensitive patients have depressed T cells. Twenty-five percent have impaired blastogenesis, and twenty-five percent have impaired delayed hypersensitivity, as evidenced by cell-mediated immunity skin tests. Of the patients with T-cell abnormalities, the depletion of the suppressor cells is seen, by over four standard deviations from a control group of normals[141]. Ten percent of these patients have elevated IgE or IgG. Patients with recurring infections have impaired phagocytosis and killing capacity. Very accurate blood measurements are now available for the chlorinated pesticides as well. The following were found in over 200 chemically sensitive patients:

PESTICIDE IN BLOOD	% DISTRIBUTION IN 200 PATIENTS
DDT and DDE	62.0%
Hexachlorobenzene	57.5
Heptachlor Epoxide	54.0
beta-BHC	34.0
Endosulfan I	34.0
Dieldrin	24.0
gamma-Chlordane	20.0
Heptachlor	12.5
gamma-BHC (Lindane)	9.0
Endrin	5.5
delta-BHC	4.0
alpha-BHE	3.5
Mirex	2.0
Endosulfan II	1.5

Organophosphate levels are only positive within 24 hours after exposure, and are not much help. Lab tests for pentachlorophenols and organic solvents like hexane and pentane, are also now available, as are herbicide levels. General volatile organic hydrocarbons are found in a large portion of chemically sensitive patients. Their presence indicates either recent exposure, or a failure in the enzyme detoxification system. Those found in over 500 chemically sensitive patients include benzene, toluene, trimethylbenzene, xylene, styrenes, ethylbenzene, chloroform dichloromethane, 1,1,1,-trichloroethane, trichloroethylene, tetrachloroethylene, dichlorobenzenes. Metals including lead, mercury, cadmium, and aluminum are sometimes found in the intracellular contents of some chemically sensitive patients. These again are found in 10% of the patients.

Fat biopsies have been preferred on many patients with over 100 different compounds studied. Often there is more in the fat than blood in some cases such as organochlorine insecticides and more in the blood than fat such as seen with such substances as 2-methylpentane and 3-methylpentane.

Skin biopsies of bruising and petechiae reveal perivascular lymphocyte infiltrates around the vessel wall in chemically sensitive patients.

Challenge tests can be done by the sublingual or intradermal route. The efficiency of these tests is now well established as numerous studies, (several double-blind), have now been done[4,47,142,24,143,144,145]. These need to be done since 80% of the chemically sensitive are food sensitive. Blind intradermal challenge for chemicals can now be done with terpenes, petroleum derived ethanol, glycerine, formaldehyde, phenol, perfume, and newsprint, whereby production of symptoms will help establish the patient's chemical sensitivity.

Over 200,000 intradermal challenges of chemicals have been done under environmentally-controlled conditions at the EHC-Dallas. These are clearly reliable, especially as they meet the positive criteria of sign and symptom reproduction, wheal growth and negative placebo response.

Inhalation challenge is another method for the diagnosis of chemical sensitivity, done under varying degrees of environmentally controlled conditions. For best results, one uses an anodized aluminum and glass booth to do ambient dose challenge of any toxic chemical in a hospitalized, environmentally controlled setting. Some studies done in our center, under strictly controlled conditions in an environmental unit, showed significant findings (4 S.D.) of the chemical reactors over the controls when using less than .20 ppm formaldehyde, less than .0025 ppm phenol, less than .33 ppm chlorine, less than .50 ppm petroleum derived ethanol, less than .034 ppm of the pesticide, 2,4,DNP, along with 3 placebos. These tests have been used in over 3,000 patients with over 99% accuracy. Similar studies can be done in the office setting, although controls are much more difficult and one finds many more placebo reactions. This is because environmentally-controlled conditions are generally much more difficult to achieve and patients are often studied in the masked or adapted state, wherein symptoms may not be perceived. With the inhaled challenges, one can measure and plot blood levels, immune parameters, metabolic changes as well as sign and symptom scores.

Vitamin and intracellular mineral levels are needed to completely evaluate the chemically-sensitive individual. In our Center, analysis of over 300 chemically sensitive patients showed the following vitamin deficiencies: 64% with B6 deficiency, 30% with B2, 29% with Bl, 27% with folic acid, 24% with vitamin D, 19% with B3, 6% with vitamin C, 3% with vitamin B12. Out of 190 chemically sensitive patients with mineral deficiencies, 88% had chromium deficiency, 12% selenium, 8% zinc, 40% magnesium and 35% sulfur. Many had mineral excess in their blood cells.

TREATMENT

The cornerstone of treatment for chemical sensitivity is avoidance[146]. This will decrease total body burden, allowing recovery of the overtaxed detoxification systems. Less

chemically contaminated water (including spring, distilled, and charcoal filtered), may be used, but only in glass or steel containers. Water will leach a variety of contaminants from the walls of synthetic plastic containers. A rotary diet of less chemically contaminated food, should also be used to reduce load and keep the patient in the unmasked state. Remove as many household incitants as possible, including petroleum-derived heat, insecticides, synthetic carpets and mattresses, and formaldehyde-containing substances such as pressboard and plywood. Toxic exposures can be monitored by the general volatile organic hydrocarbon blood tests. Some job changes may be needed, while occasionally the most severely affected patients have to leave badly polluted areas. Techniques should be developed for follow-up and monitoring of these modalities.

Injection therapy for inhalants, foods, and some chemicals will also help this problem[24,144,145,147,148,149,150]. Low-dose sublingual therapy in patients with allergic rhinitis was effective[151]. These treatments can be done daily, but usually every four to seven days. In our opinion, a properly balanced rotary diet is essential in treating the patient with food sensitivity, whether or not it may be induced by chemical overload. Vitamin and mineral supplementation is often necessary to replace the deficiencies that occur from the direct toxic damage, exhausted enzymatic detoxification pathways, and from the direct competition absorption. In rare cases, nutritional replacement with intravenous hyperalimentation is needed for severely debilitated patients. Techniques should be developed for monitoring and evaluating the outcome.

CONCLUSION

The philosophy and techniques of environmental medicine developed over the last 25 years offers a means to scientifically investigate and treat patients affected by pollutants. This approach gives the physician valuable, accurate information, in the pursuit of optimum health for these environmentally-sensitive patients.

REFERENCES

1. Randolph, T.G., Human Ecology and Susceptibility to the Chemical Environment. Springfield, Illinois: Charles C. Thomas, 1962 (sixth printing 1978).

2. Dickey, L.D. (Ed.), Clinical Ecology. Springfield, Illinois: Charles C. Thomas, 1976.

3. Bell, I.R., Clinical Ecology. Bolinas, California: Common Knowledge Press, 1982.

4. Rea, W.J. and Mitchell, M.J. Chemical sensitivity and the environment. Immun Allerg Prac, Sept/Oct: 21-31, 1982.

5. Wordan, J.I. The effect of air in concentrations and polarity on the C02 capacity of mammalium plasma. Fed Proc 1954; 13:557.

6. Choy, R.V.S., Monro, J.A., Smith, C.W., Electrical Sensitivities in Allergy Patients. Clin Ecol Vol IV No. 3. pp. 93-102.

7. Laseter, J.L.; DeLeon, I.R.; Rea, W.J.; Butler, J.R. Chlorinated hydrocarbon pesticides in environmentally sensitive patients. Clin Ecol, 2(1):3-12, 1983.

8. National Research Council. Indoor Pollutants. Washington, D.C.: Natl. Academy Press, 1981.

9. Gilpin, A. Air Pollution, 2nd Ed. St. Lucia, Queensland: University of Queensland Press, 1978.

10. Wark, K. and Warner, C. Air Pollution: Its Origin and Control. New York: Harper & Row, 1961.

11. Adelman, R.C. Loss of adaptive mechanisms during aging. Fed. Proc. 38:1968-1971, 1979.

12. Stokinger, H.E. Ozone toxicology: A review of research and industrial experience, 1954-1962. Arch Environ Health, 110:719, 1965.

13. The National Research Council. Water hardness and health. In Drinking Water and Health. New York. National Academy of Science, 1977, 439-447.

14. Winslow, S.G. The Effects of Environmental Chemicals on the Immune System: Selected Bibliography With Abstracts. Oak Ridge, TN: Toxicology Information Response Center, Oak Ridge National Laboratory, 1981.

15. Calabrese, E.J. Pollutants and high-risk groups. The Biological Basis of Increased Human Susceptibility to Environmental and Occupational Pollutants. NY: Wiley -

Interscience, 1977.

16. Freedman, B.J. Sulphur dioxide in foods and beverages: its use as a preservative and its effect on asthma. Br J Dis Chest, 74(2):128-134, 1980.

17. Davidson, M. and Fienleib, M. Disulfide poisoning: A review. Am Heart J, 83:100, 1972.

18. Innami, S., Tojo, H., Utsuja, S.; Nakamura, A.; and Nagazama,S. PCB Toxicity and Nutrition I. PCB Toxicity and Vitamin A. Jap J Nutr, 32:58-666, 1974.

19. Villeneune, D.C., Grant, D.L., Phillipos, W.E.J.; Clark, M. L.; and Clegg, D. J. Effects of PCB administration on microsomal enzyme activity in pregnant rabbits. Bull Environ Contam Toxicol, 6:120, 1971.

20. Rea, W.J.; Johnson, A.R.; Smiley, R.E.; Maynard, B.; and Dawkins-Brown, 0. Magnesium deficiency in patients with chemical sensitivity. Clinical Ecology, 4(1): 17-20, 1986.

21. Pan,Y., Johnson, A.J., Rea, W.J.: Aliphatic Hydrocarbon Solvents in Chemically Sensitive Patients. Clin Ecol 5(3):126-131,1987-88.

22. Olson, K.R., et al: Amanita phalloides-type mushroom poisoning. West. J. Med. (37:282, 1982).

23. Brostoff, Jonathan, and Challacombe Stephen; Food Allergy and intolerance, London, Bailliere Tindall/W.B. Saunders, 1987.

24. Rapp, O.J. Double-blind confirmation and treatment of milk sensitivity. Med J Aust. 1:571-572, 1978.

25. Rea, W.J.; Pan,Y. et al: Toxic Volatile Organic Hydrocarbons in Chemically Sensitive Patients, Clin Ecol 5(2):70-74,l987.

26. Hill, Johanna Peptides and Their Receptors as the Biochemicals of Emotion, proceedings of the American Acad. Envir. Med. Annual Mtg., Nashville, TN, Oct. 29, 1987.

27. Ader, Robert Behavioral Influences of Immunity, proceedings of Amer. Acad. Envir. Med. Annual Mtg., Nashville, TN, Oct. 29, 1987.

28. King, D.S. Can allergic exposure provoke psychological symptoms? A double-blind test. Biol Psychiat. 16:3-19, 1981.

29. Randolph, T.G. Specific Adaptation. Ann Allergy. 40:333-45, 1978.

30. Mustafa, M.G. and Tierney, D.F. Biochemical and metabolic changes in the lung with oxygen, ozone, and nitrogen dioxide toxicity. Am Rev Resp Dis, 118(6), 1978.

31. Stokinger, H.E. and Coffin, D.L. Biological effects of air pollutants. In A.C. Stern (Ed.), Air Pollution. New York: American Press, 1968.

32. Rinkel, H.J.; Randolph, T.G.; and Zeller, M. Food Allergy. Norwalk, Connecticut: New England Foundation of Allergic an Environmental Disease, reprint of 1951 text.

33. Selye, H. The general adaptation syndrome and the diseases of adaptation. J. Allergy, 17:23, 1946.

34. Jollow, D.J., et al. 1977 Biological Reactive Intermediates: Formation, Toxicity, and Innetivation. New York.

35. Wand, A.M., et al. 1976 Immunological mechanisms in the pathogenesis of vinyl chloride disease. Brit. Med. J.l, 6015:936-938.

36. Rea, W.J.; Peters, D.W.; Smiley, R.E. et al. Recurrent environmentally triggered thrombophlebitis. Ann Allergy, 47:338-344, 1981.

37. Savage, G.H. Insanity and Allied Neuroses. Philadelphia: Lea and Febiger, 1884.

38. Rowe, A.H. Allergic toxemia and migraine due to food allergy. Calif West Med. 33:785-792, 1930.

39. Williams, R.J. Biochemical Individuality. New York: Wiley, 1963.

40. Noordhout, B., et al. "Latent Tetany, magnesium and HLA tissue antigens." Magnesium-Bulletin 3 (offizielles organ Gesellshaft fur magnesium forsehung) 9, 3, 1987.

41. Stanbury, J.B., et al. The Metabolic Basis of Inherited Disease, 5th printing New York, McGraw-Hill Book Co., 1983.

42. Nadal,A. and Lee, L.Y. Airway hyperirritability induced ozone. In S.D. Lee (Ed.), Biochemical Effects of Environmental Pollutants. Michigan: Ann Arbor Science Publishers, 1977.

43. Randolph, T.G. Sensitivity to petroleum. Including the derivatives and antecedents. a. Lab Clin Med 40:931-932 Dec. 1952.

44. Fisher, S.A.: Dermatitis due to the presence of formaldehyde in certain sodium lauryl sulfate (SLS) solutions. Curtis 27(4):360-2, 366, Apr, 1981.

45. Fregert, S.: Irritant dermatitis from phenol-formaldehyde resin powder. Contact Dermatitis 6(7):493, Dec., 1980.

46. U. S. Environmental Protection Agency: Unfinished Business. A Comparative Assessment of Environmental Problems.

47. Rea, W.J., Johnson, A.R., Youdim, S., Fenyves, E.J., Samadi, N. T & B Lymphocytes. Parameters Measured in Chemically Sensitive Patients and Controls.

48. Mohave, L., Moller, J: The Atmospheric Environment in Modern Danish Dewllings -- Measurements in 39 Flats. Institute of Hygiene, University of Aarhus, Denmark. Paper presented at International Indoor Climate Symposium. Copenhagen, 1978.

49. Suhonen, R.: Contact allergy to dodecyl-di-(aminoethyl) glycine (Dedsimex i). Contact Dermatitis 6(4):290-1, Jun., 1980.

50. McMillian, R.: Environmentally-induced thrombocytopenic purpura, JAMA 242(22):2434-5, Nov. 30, 1979.

51. Rea, W.J.; Bell, I.R.; and Smiley, R.E., Environmentally triggered large-vessel vasculitis. In F. Johnson and J.T. Spence (Eds.), Allergy: Immunology and Medical Treatment. Chicago: Symposia Specialist, 1975.

52. Rea, W.J. Review of cardiovascular disease in allergy. In C.A. Frazier (Ed.), Biannual Review of Allergy. Springfield, Illinois, 1979-80.

53. Peacock, Al: Case reports, hydralazine-induced necrotizing vasculitis, Br Med J 282(6270):1121-2, April 4, 1981.

54. Dooms-Goossens, A., Ceuterick, A., Vanmaele, N., Degreef, H.: Follow-up study of patients with contact dermatitis caused by chromates, nickel, and cobalt. Dermatologica 160(4):249-60, 1980.

55. Clemmensen, 0., Knudsen, H.E.: Contact sensitivity to alumi- num in a patient hyposensitized with aluminum precipitated grass pollen. Contact Dermatitis 6(2):305-8, Aug., 1980.

56. Vermeiden, Oranje, A.P., Vuzevski, V.0.: Stolz, E. Mercury exanthem as occupational dermatitis. Contact Dermatitis, 6(2):88-90, Jan., 1980.

57. Hughes, E.G.: Medical surveillance of platinum refinery workers. Soc Occup Med 30(1):27-30, Jan., 1980.

58. Bell, I., King, D.: Psychological and physiological research relevant to clinical ecology: an overview of the recent literature, Clin Ecol, 1982.

59. Bjorkner, B., Dahlquist, I., Fregert,S.: Allergic contact dermatitis from acrylates in ultraviolet curing inks. Contact Dermatitis 6(6):405-9, Oct. 1980.

60. Bjorkner, B.: Sensitization capacity of acrylated prepolymers in ultraviolet curing inks tested in the guinea pig. Acta Derm Venercol (Stockh), 61(1):7-10, 1981.

61. Romaguera, Gimalt, Sensitization to benzoyl peroxide, retinoic acid and carbon tetrachloride. Contact Dermatitis, 6(6):442, Oct., 1980.

62. Satish, J. Importance and measurement of sulfates in floating dust. Soz Praeventivmed 25(4):201-2, Sep., 1980.

63. Kleibl, K., Rackova, M.: Cutaneous allergic reactions to dithiocarbamates. Contact Dermatitis 6(5):348-9, Aug., 1980.

64. Gallagher, J.S., Tse, C.S., Brooks, S.M., Bernsten, I.I.: Diverse profiles of immunoreactivity in toluene diisocyanate (TOI) asthma. JOM 23(9):610-6, Sep., 1981.

65. Wilson C.W.M. Hyperactivity to Maine tap water in children: its clinical features and treatment. Nutri and Health 2: 51-63, 1983.

66. Glaze, W.E., North Texas State University, Environmental Division, Denton, Texas, Personal communication.

67. Cherry, R. and Cherry, F.: What's in the water we drink? The New York Times Magazine, Dec. 8, 1974.

68. Environmental Protection Agency (EPA): Is your drinking water safe? (Booklet)

69. Trimble, J. U.S. News and World Report, Feb. 28, 1984, pp.27-32.

70. Spalding, R.F.; Junk, G.A. Richard, J.J. Water: Pesticides in ground water beneath irrigated farmland in Nebraska, Pesticides Monitoring Journal 1(2): 70-73, 1980.

71. Junk, G.A.; Spalding, R.F. and Richard, J.J. Aureal, Vertical, and temporal differences in ground water chemistry. II. Organic constituents, 1983.

72. Corwin, A.H. Heavy metals in air, water, and our habitat In Dickey, L.D. (Ed) Clinical Ecology, Springfield, Il: Charles C. Thomas, 1976, pp. 292-305.

73. Moran, J.M.; Morgan, M.O. Wiersma J.N Introduction to Environmental Science 2nd Ed. New York: W.H. Freeman and company, 1986, pp. 177-209.

74. Skiba, N.S. Role of river discharge of solids in migration of mercury, Zap Kirgizsk Otd Vses Mineralog Obschchestva 4:31, 1963; Chem Abst, 61:5357e, 1964.

75. Takenchi, T. Morikawa, N.; Matsumoto, H.; and Shiraishi, Y. Apathological study of Minamata disease in Japan, Acta Neuropathol 2:40, 1962.

76. Brown, H.S. Bishop, D.R.; Rowan, C.A. The role of skin absorption as a route of exposure for volatile organic compounds in drinking water, Am J Pub Health 74: 479-484, 1984.

77. Randolph, T.G. Ecologic orientation in medicine: Comprehensive environmental control in diagnosis and therapy. Ann Allergy. 23:7-22, 1965.

78. Randolph, T.G. The ecologic unit. Hospital Management, Part I, 97:45, 1965; Part II, 97:46, 1965.

79. Wilson, C.W.M. Hypersensitivity to Maine tap water in children: its clinical features and treatment. Nutrition and Health 2:51-63, 1983.

80. Juhlin, L.: Incidence of intolerance to food additives. Int J Dermatol 19(10):548-51, Dec., 1980.

81. Fries, J.H.: Food allergy: Current concerns. Ann Allergy 46(5):260-3, May, 1981.

82. Bell, I, King, D.: Psychological and physiological research relevant to clinical ecology: An overview of the recent literature. Clin Ecol, 1982.

83. Condemi, J.J.: Aspirin and food dye reactions.Bull N.Y. Acad Med 57(7):600-7, Sep., 1981.

84. Rea, W.J. Environmentally triggered small vessel vasculitis. Annals of Allergy, 38:245-51, 1977.

85. Potkin, S.G.; Weinberger, D.; Kleinman, J. et al. Wheat gluten challenge in schizophrenic patients. Amer J. Psychiat.138:1208-1211, 1981.

86. Hanninen, H.; Eskelinen, L.; Husman, K.; and Nurminen, M. Behavioral effects of long-term exposure to a mixture of organic solvents. Scand. J. Work Environ. Health. 4:240-55, 1976.

87. Randolph, T.G. The history of ecologic mental illness. In C.A. Frazier (Ed.), Annual Rev Allergy 1973. Flushing, NY: Med Exam Pub Co, 1974.

88. Savage, G.H. Insanity and Allied Neuroses Philadelphia: Lea and Febiger, 1884.

89. Rea, W.J.; Butler, J.R.; Laseter, J.L.; and DeLeon, I.R. Pesticides and brain function changes in a controlled environment. Clinical Ecology, 2(3):145-50, 1984.

90. Lindemayr, H. Schmidt, J.: Intolerance to acetylsalicylic acid and food additives in patients suffering from recurrent urticaria (author's transl.). Wien Klin Wochenschr 91(24):817-22, Dec., 21, 1979.

91. Hanington, E.: Diet and migraine. J. Hum. Nutr. 34:175-80,1980.

92. Dahl, R.: Sodium salicylate and aspirin disease. Allergy 35(2):155-6, Mar., 1980.

93. Wuthrich, B., Fabro, L.: Acetylsalicylic acid and food additive intolerance in urticaria, bronchial asthma and rhinopathy. Schweiz. Med. Wochenchr. 111(39):1445-50, Sep. 26, 1981.

94. Tabuenca, J.M.: Toxic-allergic syndrome caused by ingestion of rapeseed oil

denatured with aniline. Lancet 12:2(8246):567-8, Sep. 1981.

95. Cullen M. ed. Workers with Multiple Chemical Sensitivities. Occup. Med. State of the Art Reviews. 2(4),1987.

96. Thune, P: Photosensitivity and allergy to cosmetics. Contact Dermatitis 7(1):54-5, Jan., 1981.

97. Zaynoun, S.T., Aftimos, B.A., Tenekjian, K.K., Kurban, A.K.: Berloque dermatitis a continuing cosmetic problem. Contact Dermatitis 7(2):111-6, Mar., 1981.

98. Fisher, A.A.: Reactions to popular cosmetic humectants, Part III. Glycerin, propylene glycol, and butylene glycol. Curtis 26(3):243-4, 269, Sep., 1980.

99. Guin, J.D., Berry, V.K.: Perfume sensitivity in adult females. J Am Acad Dermatol 3(3):299-302, Sep., 1980.

100. Foussereau, J., Reuter, G., Petitjean, J.: Is hair dyed with PPD-like dyes allergenic? Contact Dermatitis 6(2):143, Jan., 1980.

101. Klein, A.D. 3d, Rodman, O.G.: Allergic contact dermatitis to paraphenylenediamine in hair dye. Milit Med 146(1):46-7, Jan., 1981.

102. Ramsay, C.A.: Skin responses to ultraviolet radiation in contact photodermatitis due to fentichlor. J Invest Dermatol 72(2):99-102, Feb., 1979.

103. Schlueter, L.E., Soto, R.J., Baretta, E.D., Herrmann, A.A., Ostrander, L.E., Stewart, R.D.: Airway response to air spray in normal subjects and subjects with hyperreactive airways. Chest 75(5):544-8, May, 1979.

104. Stoll, D., King, L.E., Jr.: Disulfiram-alcohol skin reaction to beer-containing shampoo. JAMA 244(18):2045, Nov., 1980.

105. Hindson, Phenyl salicylate (Salol) in a lip salve. Contact Dermatitis 6(3):216, Apr., 1980.

106. Fisher, A.A.: Permanent loss of finger nails from sensitization and reaction to acrylic in a preparation designed to make artificial nails. J Dermatol Surg Oncol 6(1):70-1, Jan., 1980.

107. Jordan, W.P., Jr.: Contact dermatitis from D & C yellow 11 dye in a toilet bar soap. J Am Acad Oermatol 4(5):613-4, May, 1981.

108. Larson, W.G.: Sanitary napkin dermatitis due to the perfume. Arch Dermatol 115(3):363, Mar., 1981.

109. Mathias, C.G., Chappler, R.R., Maibach, H.I.: Contact urticaria from cinnamic aldehyde. Arch Dermatol 116(1):74-6, Jan., 1980.

110. Aust, L.B., Maibach, H.I.: Incidence of human skin sensitization to isostearyl alcohol in two separate groups of panelists. Contact Dermatitis 6(4):269-71, Jun., 1980.

111. Sertoli, A., Di Fonzo, E., Spallanzani, P., Panconesi, E.: Allergic contact dermatitis from thimerosal in a soft contact lens wearer. Contact Dermatitis 6(4):292-3, Jun., 1980.

112. Zeigen, S.R., Jacobs, I.H., Weinberger, G.I.: Delayed hyper-sensitivity to thimerosal in contact lens solutions. J Med Soc NJ 78(5):362-4, May, 1981.

113. Jackson, R.T., Nesbitt, L.T., Jr., DeLeo, V.A.:6-Methylcoumarin photocontact dermatitis. J Am Acad Dermatol 2(2):124-7, Feb., 1980.

114. ElSaad El-Rifaie, M.: Perioral dermatitis with epithelioid cell granulomas in a woman: a possible new etiology. Acta Derm Venereal (Stockh) 60(4):359-60, 1980.

115. Burrows, D., Campbell, H.S.: Contact dermatitis to polyesters in finishes. Contact Dermatitis 6(5):362-3, Aug., 1980.

116. Imbeau, S.A., Reed, C.E.: Nylon stocking dermatitis. An unusual example. Contact Dermatitis 5(3):163-4, May, 1979.

117. McDaniel, W.H., Marks, J.G., Jr.: Contact urticaria due to sensitivity to spray starch. Arch Dermatol 115(5):628, May, 1979.

118. Larson, F.S., Brandrup, F.: Nickel release from metallic buttons in blue jeans. Contact Dermatitis 6(4):298, Jun, 1980.

119. Rudzki, E., Kozlowska, A.: Causes of chromate dermatitis in Poland. Contact Dermatitis (63):191-6, Apr., 1980.

120. Kleinhans, Days. Formaldehyde contact allergy. Derm Beruf Umwelt 28(4):101-3, 1980.

121. Klaschka, F., von Nieding,F., Walter, R. Skin sensitization to wood preservatives containing pentachlorophenol (PGP). Zentralbl Arbeitsmed Arbeitsschutz Prophyl 29(6):150-4, Jun., 1979.

122. Bach, B., Pedersen, N.B.: Contact dermatitis from a wood preservative containing tetrachloroisophthalonitriles. Contact Dermatitis 6(2):142, Jan., 1980.

123. Spindeldreier, A., Deichmann, B.: Contact dermatitis against a wood preservative with a new fungicidal agent. Derm Beruf Umwelt 28(3):88-90, 1980.

124. Frigas, E., Filley, W.V., Reed, C.E.: Asthma induced by dust from urea-formaldehyde foam insulating material. Chest 79(6):706-7, Jun., 1981.

125. Matsushita, T., Nomura, S., Wakatsuki, T.: Epidemiology of contact dermatitis from

pesticides in Japan. Contact Dermatitis 6(4):255-9, Jun., 1980.

126. Rudzki, Mapiorkowska, Dermatitis caused by the Polish fungicide Sadoplon 75. Contact Dermatitis 6(4):300-1, Jun, 1980.

127. Weinstein, L.H., Fellner, M.J.: Rubber band dermatitis. Int J Dermatol 18(7):558, Sep., 1979.

128. Conde-Salazar, L., Romero, L., Guimaraens, D.: Metal content in Spanish coins. Contact Dermatitis 7(3):166, May, 1981.

129. Fregert, S.: Epoxy dermatitis from the nonworking environment. Br J Dermatol 105 Sppl 21:63-4, Sep., 1981.

130. Guin, J.D.: Contact dermatitis to perfume in paper products letter. J Am Acad Dermatol 4(6):733-4, June, 1981.

131. Marks, J.G., Jr.: Allergic contact dermatitis from carbonless copy paper. JAMA 245(22):2331-2. June 12, 1981.

132. Calnan, C.D.: Dermatitis from ivy (Hedera canariensis variegata). Contact Dermatitis 7(2):124-5, Mar., 1981.

133. Sugai, T., Takahashi, Y., Okuno, F.: Chrysanthemum dermatitis in Japan. Contact dermatitis 6(2):155, Jan., 1981.

134. Fuchs, E. Insects as inhalant allergens. Allergol Immunopathol (Madr) 7(3):227-30, May-June, 1979.

135. Levine, S. and Kidd, P. Antioxidants Adaptations, BioDivision, Allergy Research Group, San Leando, California, 1985.

136. Theorell, H.; Blambock, M; Kockum, C. Demonstration of reactivity to airborne and food antigen in cutaneous vasculitis by variation in fibrino6peptide and others, blood coagulation, fibrinolysis, and complement parameters, Thrombo Haemo Sts (Stattz), 36: 593, 1976.

137. Gaworoki, C.L. and Sharma, R.P. The effects of heavy metals on (3H) thymidine uptake in lymphocytes, Toxicol App Pharmacol, 46(2): 305-13, 1978.

138. Winslow, S.G. The effects of environmental chemicals on the immune system: a selected bibliography with abstracts, Oak Ridge, Tennessee: Toxicology Information Response Center, Oak Ridge National Laboratory, 1981, pp. 1-36.

139. Rea, W.J. and Suits, C.W. Cardiovascular disease triggered by foods and chemicals In Gerrard, J.W. (Ed.) Food allergy: new perspectives, Springfield,Illinois: 1980. Charles C. Thomas, 1980.

140. Jakoby, W.B. (Ed.) Enzymatic Basis of Detoxication, Vol. I 1983, Academic Press.

141. Reeves, A.L. (Ed.) Toxicology: Principles and Practice Vol. 1981, John Wiley & Sons, New York.

142. 0'Shea, J.; Porter, A. Double-blind study of children with hyperkinetic syndrome treated with multi-allergen extract sublingually, J Learning Disabil 14: 189-91, 1981.

143. Forman, R.A. Critiques of evaluation studies of sublingual and intracutaneous provocation tests for food allergy, Med hypotheses 7: 1019-27, 1981.

144. Miller, J.B. A double-blind study of food extract injection therapy, Ann Allergy 38(3): 185-91, 1977.

145. Boris, Shiff, Weindorf, S. Bronchoprovocation blocked by neutralization therapy, J Allergy Clin Immunol 7: 92, 1983.

146. Rea. W.J., Pan,Y, Johnson,A.R. Clearing of Toic Volatile Hydrocarbons from Humans. Clin Ecol 5(4)"166-170, 1987/88.

147. Boris M., Schiff M., Weindorf S. Antigen-Induced Asthma Attenuated by Neutralization Therapy. Clin Ecol, 1985; 3:59-62.

148. Boris M, Schiff M, Weindorf S. Injection of Low-dose Antigen Attenuates the Response to Subsequent Bronchoprovocative Challenge. Otolaryngol-Head Neck Surg, 1988; 98:538-545.

149. Miller JB, Intradermal Provocative/Neutralizing Food Testing and Subcutaneous Food Extract Injection Therapy. In Brostoff J, Challacombe S, (Eds): Food allergy and Intolerance, London, Bailliere Tindall Publishers, 1987: 932-946.

150. Rea WJ, et al: Elimination of Oral Food Challenge Reaction by Injection of Food Extracts, Arch Otolaryngoll, 1984; 110:248-252.

151. Scadding G. Brostoff, J.: Low-dose Sublingual Therapy in Patient With Allergic Rhinitis Due to House Dust Mite, Clin Allergy, 1986; 16: 483-491.

NEUROSPECT FINDINGS IN PATIENTS EXPOSED TO NEUROTOXIC CHEMICALS

GUNNAR HEUSER, ISMAEL MENA, AND FRANCISCA ALAMOS

Division of Nuclear Medicine
Harbor-UCLA Medical Center
Torrance, California

Exposures to neurotoxic chemicals such as pesticides, glues, solvents, etc. are known to induce neurologic and psychiatric symptomatology. We report on 41 patients — 16 young patients (6 males, 10 females, age 34 ± 8 yrs.) and 25 elderly patients (9 males, 16 females, age 55 ± 7 yrs). Fifteen of them were exposed to pesticides, and 29 to solvents. They were studied with quantitative and qualitative analysis of regional cerebral bood flow (rCBF), performed with 30 mCi of Xe-133 by inhalation, followed by 30 mCi of Tc-HMPAO given intravenously. Imaging was performed with a brain dedicated system, distribution of rCBF was assessed with automatic ROI definition, and HMPAO was normalized to maximal pixel activity in the brain. Results of Xe rCBF are expressed as mean and S.D. in ml/min/100g, and HMPAO as mean and S.D. uptake per ROI, and compared with age-matched controls — 10 young and 20 elderly individuals.

Neurotoxics

HMPAO% Uptake	Young	Elderly
R. Orbital frontal		
R. Dorsal frontal	.70 **	.66*
R. Temporal		.64*
R. Parietal	.66**	.66**

* $p < 0.05$
** $p < 0.001$

We conclude that patients exposed to chemicals present with diminished CBF, worse in the right hemisphere, with random presentation of areas of hypoperfusion, more prevalent in the dorsal frontal and parietal lobes. These

1. Address all correspondence to: Ismael Mena, M.D., Chief, Division of Nuclear Medicine, Lac Harbor UCLA Medical Center, 1000 W. Carson St.-BX#23, PO Box 2910, Torrance, CA 90509-2910. Tel.:(310)222-2842. Fax:(310)328-7288.

2. Abbreviations: MRI, magnetic resonance imaging; rCBF, regional cerebral blood flow; SPECT, single photon emission computed tomography.

3. Key Words: blood flow, brain, pesticides, solvents, SPECT.

Toxicology and Industrial Health, Vol. 10, No. 4/5, pp. 561–571

ISSN: 0748-2337

findings are significantly different from observations in patients with chronic fatigue and depression, suggesting primary cortical effect, possibly due to a vasculitis process.

INTRODUCTION

Exposure to neurotoxic chemicals occurs often in our environment. Intermittent contact with solvents and pesticides can even be as frequent as a daily occurrence. This pattern can be intensified if there is an accidental exposure (Dean et al., 1985; Heuser, 1992; Heuser et al., 1992).

Many exposed individuals present with chronic ill health, memory loss, attention-span loss, emotional instability, headaches, depression, fatigue, impaired coordination, tremor, insomnia, and dysesthesias (Baker et al., 1985).

Because of the predominantly neurologic and psychiatric symptomatology, we are reporting on results of functional brain imaging assessing cerebral blood flow by NeuroSPECT. It is hypothesized that selective diminution of rCBF should correlate quantitatively with symptomatology (Hagstaduis et al., 1989; Callender et al., 1993; Read et al., 1993).

NeuroSPECT has been determined quantitatively by ^{133}Xe inhalation and qualitatively with high resolution HMPAO ^{99m}Tc (Ceretec TM) imaging.

MATERIALS AND METHODS

Patient Population

We report on 41 patients — 16 young individuals (6 males and 10 females, age 34 ± 8 years) and 25 elderly individuals (9 males and 16 females, age 55 ± 7 years). Fifteen of them were exposed to pesticides and 26 to solvents.

Patient selection. Right-handed adults were selected for the study if they satisfied the following criteria: 1) Exposure to toxin was well documented; 2) Patients and their significant others volunteered complaints of intermittent or continuous impairment of cerebral function (memory impairment, emotional liability, etc.) ever since exposure; 3) Absence of diagnosis such as diabetes, hypertension; and 4) Negative history of head injury, alcoholism, and excessive drug intake.

As a rule, patients had been exposed to more than one chemical. For instance, most pesticides are propelled with solvents that also contain a high percentage of inert material that may also be potentially toxic to humans. New carpet and related materials (glue, backing) contain many potentially toxic chemicals, including solvents and pesticides. While exposure was always well documented in our cases, we were at times unable to pinpoint individual chemicals and therefore had to accept the fact that our patient had been exposed to several chemicals. We also realized that interaction between some chemicals could be assumed to take place before as well as after the chemicals entered the body.

Our patient population had been exposed any time between six months to four years prior to the SPECT study and had continued to have persistent complaints since exposure.

Control population. These patients were compared for ^{133}Xe rCBF with 40 elderly controls, age 66.1 ± 8.8 years, for Tc-HMPAO with 20 controls, age 65.1 ± 8.9 years, and for ^{133}Xe rCBF and HMPAO with 10 young individuals, age 33 ± 6.8 years (Mena et al., 1993).

Brain Imaging

Two methods were applied consecutively for the assessment of cerebral blood flow: 1) ^{133}Xe rCBF for absolute quantification of cerebral blood flow, followed by 2) high-resolution ^{99m}Tc-HMPAO for qualitative analysis of brain perfusion imaging. All brain perfusion measurements were performed with the subjects lying supine with the head positioned carefully, verified by means of three beams of light projecting over the orbitomeatal line and the vertical midline. This achieved parallel transaxial cuts to the orbitomeatal line and correction for lateral tilting of the head. Environmental stimuli such as light and noise were controlled, particularly at the time of HMPAO intravenous injection (Holman et al., 1992).

^{133}Xe rCBF Imaging. ^{133}Xe rCBF measurements were performed with a high-sensitivity brain-dedicated system that provided high count-rate dynamic studies (Headtome 2 SET 031, Shimadzu, Kyoto, Japan). The sensitivity of the system was 31,000 counts per second per microcurie per ml of ^{133}Xe. The Headtome had three individual rings of 64 NaI detectors, each arrayed in a 42 cm. diameter circle. Studies were performed by inhalation of 30 mCi (1100 MBq) of I- ^{133}Xe. These measurements were based on the method described by Fick (1870), relating to the clearance of a freely diffusible tracer substance. Kety (1951) later applied this principle for the measurement of cerebral blood flow. The washout of ^{133}Xe (133Xe), an inert lipophilic gas and its exponential constant, are an exclusive function of cerebral blood flow. A fraction of inhaled ^{133}Xe passes through the alveolar wall and enters the pulmonary circulation. In the brain, it diffuses through the blood brain barrier and distributes in the extracellular space, exchanging freely with the blood compartment. A period of two minutes of inhalation for equilibrium is followed by a rapid brain clearance once the patient begins to breathe room air. This blood brain clearance is directly related to regional perfusion. Namely, if perfusion is diminished, blood clearance is slow; the opposite is also true — if blood flow is increased, the blood clearance is accelerated. Sequential one-minute images were gathered simultaneously for three transaxial slices during the study period. During the acquisition, the patient breathed through a mouthpiece with the nose clipped during the three acquisition phases: 1) Background acquisition, performed for one minute; 2) Inhalation or equilibrium of one minute, during which ^{133}Xe mixed with 30% oxygen was administered in a closed system at a concentration of 30 mCi per liter (1100 MBq/l) ^{133}Xe gas (DuPont, Billerica, MA); and 3) Washout phase of five to six minutes, during which the patient breathed room air and exhaled into a charcoal activated trap to retain

the exhaled Xenon gas. End tidal CO^2 and respiratory rate were monitored continuously (Hewlett Packard 78354A, Palo Alto, CA) in order to document and avoid hyperventilation.

A sequence of six tomograms, one every minute, were reconstructed using the backprojection algorithms with Butterworth and Ramachandran filtering (cutoff 20 mm, order = 8), on a 32 x 32 pixel matrix. Images were obtained simultaneously at three different levels, namely, two, six, and ten cm above the orbitomeatal line. An air curve was constructed from the end tidal concentration of ^{133}Xe that served as the input function for an iterative convoluted procedure, using a least square criteria for goodness of fit. The algorithm performed a pixel by pixel analysis and generated a family of output curves. Each pixel had a time versus activity curve from the concentration of ^{133}Xe in the sequence of pictures. Each curve had a simple rising component for the first minute of the inhalation period, followed by an exponential decrease (the washout period). rCBF was calculated from the sequence of pictures method, applying a single exponential component model on the washout segment using the equation

$$F = \log n2 \times \lambda / T1/2\ EXP$$

where:
F = flow in ml/min/100g
logn2 = 0.693
λ = mean partition coefficient between blood and brain = 1.5 ml/100g, and
T1/2 EXP = negative slope for the brain exponential function expressed in minutes.

SPECT images delimit gray from white matter and therefore produce minimal overlap curves, in marked contrast to multiprobe systems that image simultaneously and overlap white and gray matter, requiring correction of slow and fast washout components.

Three transaxial images were obtained at two, six, and ten cm simultaneously above the orbitomeatal line, with a thickness of two cm. Blind areas existed at four cm and eight cm above the reference plane. The images were extrapolated to a 128 x 128 matrix and displayed using a color scale coded to ml/100g/min.

^{99m}Tc-HMPAO Imaging. After completing the ^{133}Xe study, we used ^{99m}Tc-DL-hexmethylpropylene-amineoxime (HMPAO Exametazime Ceretec™ Amersham) as a cerebral perfusion high resolution imaging tracer. It is a lipophilic molecule that crosses the blood brain barrier in its DL optical form and has a high first-pass extraction. The brain uptake ranged from 3.5 to 7% of the injected dose, and equilibrium was reached within two minutes. Only 15% of the amount taken up by the brain could diffuse back. After this period, the brain concentration diminished slowly at a rate of not greater than 1%/hour. Once in the brain, ^{99m}Tc-HMPAO converts to a secondary compound in hydrophilic form and is therefore trapped so it cannot diffuse back across the blood brain barrier. Because this phenomenon occurs outside of the brain as well, entrance into the brain of fresh Tc-HMPAO was

completed in this two-minute period. This means that the images gathered later corresponded to a window of time no greater than two minutes after the intravenous injection.

The patient's antecubital vein was cannulated 10 minutes prior to injection and a dose of 30 mCi (1100 MBq) was administered intravenously. All patients were maintained in a low ambient light and noise environment during the intravenous injection and brain uptake phase (two minutes) after injection. After one hour, in order to allow for background washout, imaging of HMPAO distribution in the cerebral cortex was performed with the same brain dedicated imaging device, using a fan beam high resolution collimator. A set of three 1.6 cm thick transaxial cuts were gathered over 10 minutes. These images were separated by 3.2 cm blind areas filled by two sequential precise 1.6 cm imaging bed shifts, and acquisitions during two additional 10-minute periods were performed. A final fourth 1.6 cm shift completed the acquisition and generated transaxial cuts at the level of the convexity of the brain, which were necessary for completion of the top of the brain image. The total number of counts of this series was 20 million, which is approximately six times more than what is obtained with a rotating single head camera. Reconstruction was done with the backprojection reconstruction algorithm using the Butterworth and Ramachandran filters. We applied Chang's attenuation correction, and the spatial resolution was 8 mm in the brain cortex and 9.6 mm at the level of the basal ganglia. Twelve contiguous transaxial images were displayed with a color scale based on regional tracer uptake that defined the normal to abnormal cortical interfaces at 60% of maximal activity in the brain with a 95% confidence level.

Quantification of rCBF

Both ^{133}Xe rCBF and ^{99m}Tc-HMPAO data sets were further quantified as follows: ^{133}Xe rCBF images obtained at two and six cm above the orbitomeatal line were analyzed. All images were displayed using the same color scale that defines the outer edge of the cortex at the level where rCBF drops to 45 ml/min/100g. Fourteen regions of interest (ROIs) were manually placed over the cortex in each slice, and all ROIs were the same size, with a diameter of 1.9 cm. The outer edge of the ROIs was set at the interphase of 45 ml/min/100g, or its projection. For ^{99m}Tc-HMPAO, five consecutive transaxial images were analyzed. The most caudal image was at the level of the inferior temporal lobes, extending cephalad to the right parietal lobe. Twelve proportional and irregular ROIs were defined by a program that automatically detected cortical boundaries. The algorithm automatically created brain cortical circumferential profiles from an ellipse which had its center over the basal ganglia. The external cortical edge was defined at the point of maximal difference between two adjacent points and the internal cortical edge was defined at 30% of the distance from the external boundaries to the center of the ellipse. The mean counts per pixel in each region were normalized to the maximum observed in the brain and expressed as a percent. We refer to this value as HMPAO uptake. All values are reported as mean and standard deviation. rCBF and HMPAO uptake were compared with control subjects age matched. In addition, the within-group Manova test was used to assess consistency within groups.

Normal Controls

133Xe rCBF. Studies performed in 43 elderly normals demonstrate a homogeneous distribution of blood flow in two cm-thick cuts at two and six cm above the orbitomeatal line (OM). Mean rCBF fluctuated in basal state between 40 and 45 ml/min/100g in both hemispheres. In 19 young normal controls (age 18–45), mean rCBF fluctuated between 50 and 60 ml/min/100g in both hemispheres.

HMPAO uptake. In 19 normal individuals, HMPAO uptake was normalized to the maximal rCBF in the brain, which fluctuated between 67% in the anterior temporal lobes and 76% in the occipital cortex. The uptake was thus uniformly distributed throughout the cortex.

EXPOSURE TO NEUROTOXICS

rCBF Xe-133

Figure 1 (Color Plate 1) demonstrates in one patient (male, age 58) a marked diminution of cerebral blood flow in the right dorsal frontal lobe, both parietal lobes, and left temporal lobe, with blood flow fluctuating between 24 and 34 ml/min/100g. Maximal perfusion is observed in the visual cortex and anterior cingulate gyrus at 64 ml/min/100g, while the remainder of the gray matter blood flow fluctuates between 34 and 54 ml/min/100g which is mildly diminished. Mean rCBF values in the elderly group is 40 ± 7; mean rCBf in the young group is 45 ± 7, $p < 0.02$ ml/min/100g (Figures 2 and 3).

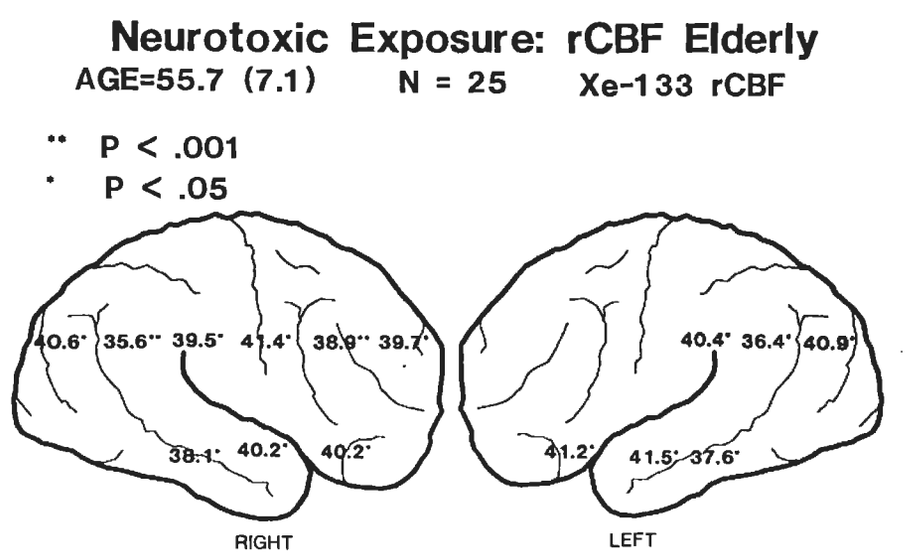


FIGURE 2. rCBF demonstrates a moderate diminution throughout the areas tested in the brain, with lateralization to the right hemisphere.

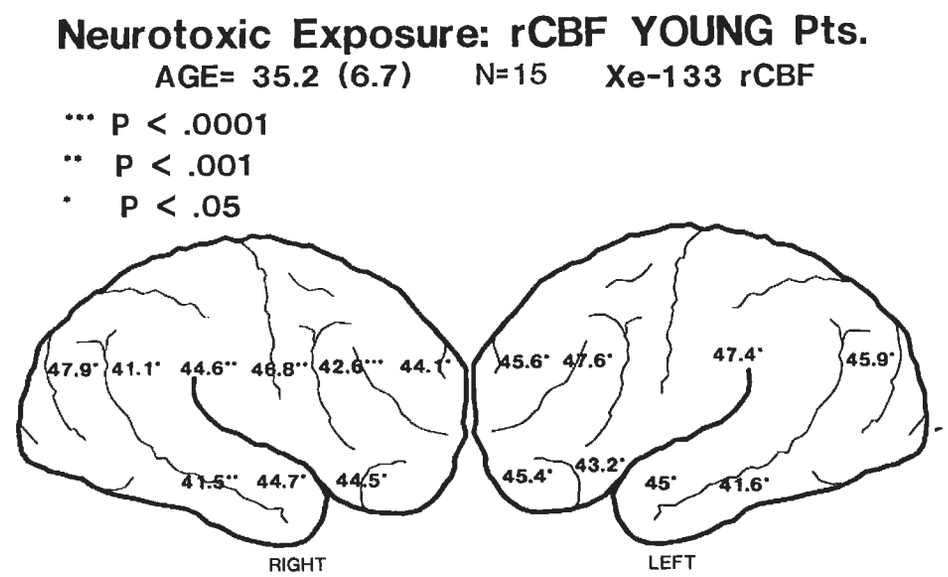


FIGURE 3. In young patients, regional cerebral blood flow (rCBF) is diminished bilaterally.

The same individual demonstrated, with a confidence value of 95, a marked diminution of cerebral blood flow in both temporal lobes, extensively in the right frontal, right dorsal, and right parietal lobe (Figure 4 — Color Plate 1). There was hypoperfusion with marked thinning of the functional cortical gray matter in the dorsal aspects of frontal and parietal lobes, with a scalloping presentation. In 25 elderly patients (Figure 5), there was a marked diminution of rCBF in the dorsal aspects of frontal and parietal lobes and dorsal right temporal lobe, with uptakes fluctuating between 64–70%, with a $p < 0.001$, fluctuating to 0.05. In the left hemisphere, there was diminished uptake of HMPAO in the dorsal occipital lobe. In the young group of patients (age 34 years) (Figure 6), there is diminished uptake in the dorsal frontal lobe and dorsal parietal lobe in both hemispheres, without evidence of a strong lateralization as demonstrated in the elderly population. There was also diminution of perfusion in the left temporal lobe, with diminished uptakes and p values between 0.001 and 0.05.

Statistical analysis among patients exposed to solvents versus pesticides produced borderline differences, with solvents showing more diminution of blood flow in the left temporal lobe than pesticides, with a $p < 0.05$ (Figure 7).

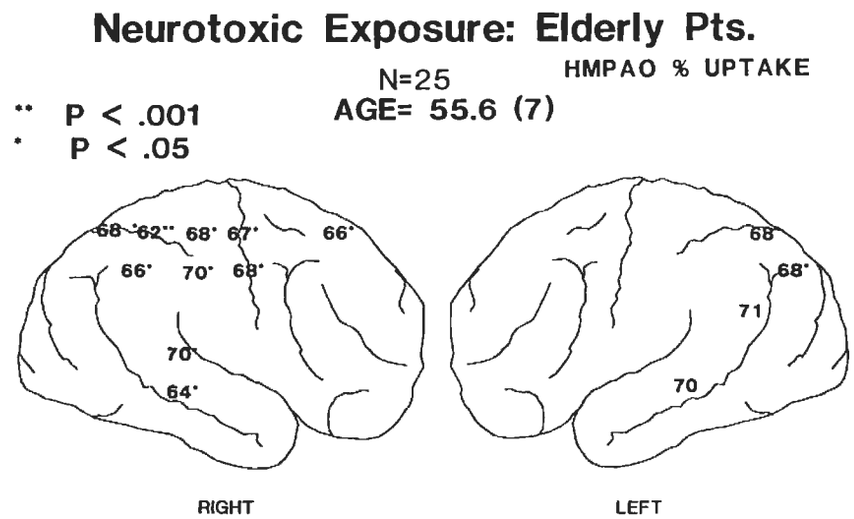


FIGURE 5. In 25 elderly patients, there was significant diminution of HMPAO uptake, denoting hypoperfusion extensively in the right hemsiphere, dorsal frontal lobe, parietal lobe, and dorsal temporal lobe. In the left hemisphere, there was hypoperfusion in the occipital lobe. Age = mean years ± (S.D.)

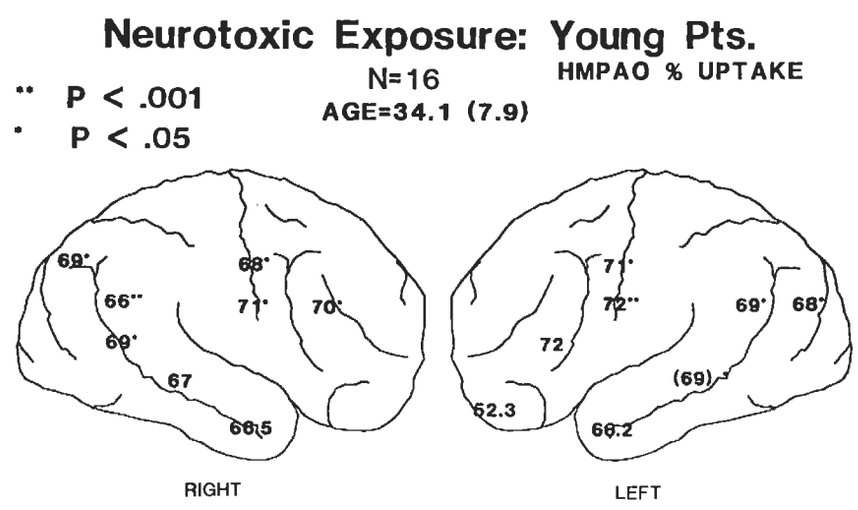


FIGURE 6. In 16 young patients, there was bilateral dorsal frontal, parietal and dorsal temporal hypoperfusion. There was no evidence of a significant lateralization phenomenon.

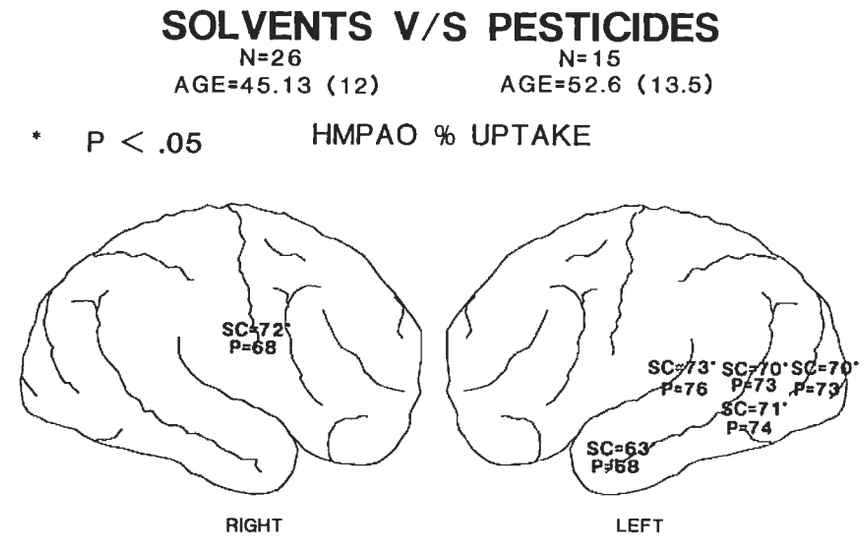


FIGURE 7. Comparison of cerebral perfusion by HMPAO uptake demonstrates more marked impairment of cerebral perfusion in patients exposed to solvents (SC) versus pesticides (P). These findings are more evident in the left hemisphere in the temporal lobes.

DISCUSSION

Our studies show that significant impairment of brain function may last years after exposure to neurotoxic chemicals has ceased. In 1991 and again in 1992, we suggested the use of SPECT as a sensitive and potent indicator of CNS function impairment after neurotoxic exposure (Heuser, 1992; Heuser et al., 1992; Heuser et al., 1993). In 1993, Callender et al. reported a series of patients who had abnormal SPECT scans after occupational neurotoxic exposure. While their SPECT scans were evaluated by visual inspection done by several radiologists, our results are based on both visual inspection and quantitative visual analysis. Also, our patient population was statistically compared to the normal control population. Our studies included many patients whose exposure had not been in an occupational setting.

Most patients had MRI brain scans, the majority of which were nondiagnostic. Therefore, even severe functional impairment as assessed by SPECT is not usually associated with cell death, demyelinization, atrophy, or other anatomical changes as assessed by MRI (Holman and Devous, 1992; Simon, 1992). We believe that neurotoxic damage leaves a diagnostic signature that is dissimilar to other diseases and conditions such as depression, Alzheimer's disease, multiple infarct dementia, CVA, head injury, obsessive compulsive disorders, and others (Rubin et al., 1992; Miller, 1992).

Quantitative cerebral blood flow demonstrates a modest diminution of global cerebral blood flow, while regional quantitative analysis documents significant focal clustered impairment of

blood flow in the dorsal aspects of frontal and parietal lobes. There is lateralization of these abnormalities to the right hemisphere in the elderly, but not in young patients. There is also focal hypoperfusion in both temporal lobes in the young, and in the right temporal lobe in the elderly.

These findings contrast significantly with observations in late-life depression and late-life chronic fatigue syndrome (Heuser et al., 1993). In these conditions, there is a more severe global diminution of cerebral blood flow, and the localization of areas of abnormalities is centered in the orbitofrontal lobe, with predominance in the right hemisphere. There is also involvement of the temporal lobe. Only in young patients with neurotoxic exposure have we observed significant temporal hypoperfusion. Thus the findings in depression and chronic fatigue syndrome may correspond to a diaschisic phenomenon originating in the limbic system, while neurotoxic chemicals may have a direct effect on the cortex.

This cortical focal hypoperfusion presents in a scalloped pattern of perfusion, consisting of random thinning of cortical gray matter — a pattern of perfusion shared with cocaine abuse (Holman et al., 1992; Mena et al., 1992; Strickland et al., 1993), lupus, and early HIV infection of the brain. Its exact nature will be investigated by means of coregistration of neuroSPECT with magnetic resonance imaging (MRI) (Darcourt et al., 1993). Thus far, it appears to point to a vasculitis mechanism.

The possible reversibility of these lesions has not been investigated and, if present, would shed light on the mechanism of damage. Cellular death would be ruled out.

Refinement of analytical tools, such as circumferential profile analysis to better document both progression of disease and/or natural improvement after pharmacological intervention, is being accomplished at our laboratory.

Exposure to neurotoxic substances, solvents, or pesticides appears to significantly impair cerebral function as assessed by neuroSPECT.

ACKNOWLEDGMENT

The authors wish to thank Ms. Linda Blakely for typing of the manuscript and preparation of graphic material.

REFERENCES

BAKER, E.L., SMITH, T.J., and LANDRIGAN, P.J. (1985). "The neurotoxicity of industrial solvents: A review of the literature." Am. J. Ind. Med. 8:207–217.

CALLENDER, T.J., MORROW, L., SUBRAMANIAN, K., DUHON, D., and RISTOVV, M. (1993). "Three-dimensional brain metabolic imaging in patients with toxic encephalopathy." Env. Res. 60:295–319.

DARCOURT, J., CHANG, L., McBRIDE, D., CAUVIN, J.-C., MILLER, B., and MENA, I. (1993). "Comparison of Tl-201 and Tc-^{99m}-Sestamibi SPECT for brain tumor detection." Clin. Nucl. Med. 18(10):925.

DEAN, J., LUSTER, M.I., and MUNSON, A.E. (1985). Immunotoxicology and Immunopharmacology. Raven Press, New York.

FICK, A. (1870). Ueber edie Messung des Blutquantums in den Herzventriklen." S.B. Phys. Med. Ges. Wurzburg 2:16.

HAGSTADUIS, S., ORBAEK, P., RISBERG, J., and LINDGREN, M. (1989). "Regional cerebral blood flow at the time of diagnosis of chronic toxic encephalopathy induced by organic solvent exposure and after the cessation of exposure." Scan. J. Work. Environ. Health 15:130–135.

HEUSER, G. (1992). "Diagnostic markers in clinical immunotoxicology and neurotoxicology." (Editorial) Intl. J. Occup. Med. Tox. 1(4):v–x.

HEUSER, G., MENA, I., GOLDSTEIN, J., THOMAS, C., and ALAMOS, F. (1993). "NeuroSPECT findings in patients exposed to neurotoxic chemicals." Clin. Nucl. Med 18(10):923.

HEUSER, G., WOJDANI, A., and HEUSER, S. (1992). "Diagnostic markers of multiple chemical sensitivity." In: Markers in Immunotoxicology. National Academy Press, Washington, D.C. pp. 117–138.

HOLMAN, B.L., GARADA, B., JOHNSON, K., MENDELSON, J., HALLGRING, E., TEOH, S.K., WORTH, J., and NAVIA, B., (1992). "A Comparison of brain perfusion SPECT in cocaine abuse and AIDS dementia complex." J. Nucl. Med. 33:1312–1315.

KETY, S.S. (1951) "Theory and applications of the exchange of inert gas at the lungs and tissues." Pharmacol. Rev. 3:1–41.

HOLMAN, B.L. and DEVOUS, M.D. 1992. "Functional brain SPECT: The Emergence of a powerful clinical method." J. Nucl. Med. 33:1888–1904.

MENA, F., MENA, I., ALAMOS, F., SOLE, C., and NEUBAUER, S. (1993). "Normal data base of SPECT ^{99m}Tc-HMPAO brain perfusion and ^{133}Xe rCBF in children, young adults and elderly." Clin. Nucl. Med. 18:(10):924.

MENA, I., GIOMBETTI, R.J., MILLER, B.L., GARRETT, K., VILLANUEVA-MEYER, J., MODY, C., and GOLDBERG, M.A. (1992). Cerebral Blood Flow Changes with Acute Cocaine Intoxication: Clinical Correlations with SPECT, CT, and MRI. "Proceedings of Imaging Techniques in Medications Development: Preclinical and Clinical Aspects" (the NIDA Technical Review Meeting) Keystone, Colorado June 18–19. In press.

MILLER, B.L., CHANG, L., MENA, I., BOONE, K., and LESSER, I.M. (1992). "Progressive right frontotemporal degeneration: Clinical, neuropsycholgical and SPECT characteristics." Dementia 4:204–213.

READ, S.L., MILLER, B., MENA, I., KIM, R., and ITABASHI H. (1993.) "SPECT in dementia: Clinical and pathologic correlation." J. Am. Ger. Soc. Submitted.

RUBIN, R.T., VILLANUEVA-MEYER, J., ANANTH, J., TRAJMAR, P.G., and MENA, I. (1992). "Regional ^{133}Xe cerebral blood flow and cerebral ^{99}mTc-HMPAO uptake in unmedicated patients with obsessive compulsive disorder and matched normal control subjects: Determination by high-resolution single-photon emission computed tomography." Arch. Gen. Psych. 49:695–702.

SIMON, T.R. (1992). "Breast implants and organic solvent exposure can be associated with abnormal cerebral SPECT studies in clinically impaired patients." 78th Scientific Assembly and Annual Meeting of RSNA, Nov. 29–Dec. 4.

STRICKLAND, T., MENA, I., VILLANUEVA-MEYER, J., MILLER, B., CUMMINGS, J., MEHRINGER, C.M., SATZ, P., and MYERS, H. (1993). "Cerebral perfusion and neuropsychological consequences of chronic cocaine use." J. Neuropsych. Clin. Neurosci. 5:419–427.

agents. Patterns identified from examinations performed on patients with known exposure to petroleum distillates, pesticides and other materials linked with neurotoxicity were identified in some veterans of the Desert Shield/Desert Storm operation. A single case of repeated examinations on a veteran showed a reversion of these patterns toward normal after therapy. This reversion followed independent assessments of clinical improvement.

INTRODUCTION

Various groups have shown that exposure to cocaine, alcohol, and other substances of abuse can result in abnormal scintigrams of the brain using tracers such as Tc-99m HMPaO (Tumeh et al., 1990; Holman et al., 1991; Woods et al., 1991; Erbas et al., 1992). This study sought to confirm that work and add information relating to regional cerebral blood flow. This combined approach imaged the tracer twice. First, a fast gamma camera system was used with a controlled intravenous injection procedure to obtain flow data. Later, the tracer was measured after being trapped in neurons by a mechanism correlating with a glutathione-mediated process through which the lipophilic tracer that enters the neurons is converted to a hydrophilic molecule and trapped in the cell (Andersen, 1989). In addition to the well described functional image abnormalities, a mismatch occurred in the regional activity between the flow and functional image sets of patients with a history of chemical abuse. This degree of mismatch was not seen in control subjects who underwent careful screening to exclude candidates with exposure to neurotoxic chemicals. As these observations were extended to other groups, a substance abuser who became psychotic after sniffing organic solvents was tested and found to exhibit the same pattern. This examination lead to an assessment of environmental exposures to organic solvents, petroleum distillates, pesticides, and other materials linked with neurotoxicity. Various similar patterns are seen in patients who have sustained such exposure. This study sought to determine if those patterns also occur in veterans of the Desert Shield/Desert Storm conflict. In addition, this study provided an opportunity to determine the stability of the pattern in an individual undergoing therapy.

METHODS

Six Desert Shield/Desert Storm veterans (DS) who were referred for brain scintigraphy as part of a comprehensive clinical evaluation were examined. Scintigraphs were compared to images obtained from normal subjects who were matched by gender and approximate age. Normal controls were taken from a group determined to be free of exposure to neurotoxic agents who had given informed consent to participate in a study approved by the appropriate Investigational Review Board.

Subjects were injected with approximately 925 MBq (25 mCi) of [technetium-99m]hexamethylpropyleneoxime over two minutes using a microprocessor controlled Harvard Pump. Fifteen seconds after initiation of the injection, a two minute single photon emission computed tomographic (SPECT) acquisition was begun, using a three headed

SPECT system (Triad) with image binning at six degree intervals. Eighteen minutes thereafter, imaging at three degree intervals was performed for approximately 33 minutes. Both image sets were filtered and backprojected onto three planes orthogonal to the canthomeatal plane.

The images were then qualitatively evaluated by two experienced nuclear medicine physicians using a standardized questionnaire (Figure 1). One patient consented to a repeat examination after therapy. During therapy, his symptoms of memory loss and fatigue had greatly remitted. This second examination was compared to that patient's earlier examination to determine whether any scintigraphic changes had developed.

Tc99m-HMPaO RESULTS
Desert Storm/Desert Shield Veteran Study

Patient Name._____ Date of Examination __/__/9__

Overall Impression? ☐ Severely abnormal ☐ Moderately ☐ Mildly Abnormal ☐ Normal

Is cross-cerebellar diaschisis present? ☐ None ☐ Left ☐ Right

Diversion to soft tissue? ☐ No ☐ Yes

Please rate the lobar perfusion using a scale from 1 to 5.
Severe-C; Moderate-B; Mild-A
1 = Significantly Hypoperfused (>50% Decrease)
2 = Hypoperfused (<50% Decrease)
3 = Normal
4 = Hyperperfused (<50% Increase)
5 = Significantly Hyperperfused (>50% Increase)

LEFT		RIGHT
☐	Frontal Lobe	☐
☐	Temporal Lobe	☐
☐	Parietal Lobe	☐
☐	Occipital Lobe	☐
☐	Subcortical Region	☐
☐	(Basal Ganglia, Thalamus)	☐

Please rate focal findings using a scale from 1 to 6.
Severe-C; Moderate-B; Mild-A
1 = Multiple hot foci
2 = Single hot focus
3 = Normal
4 = Single cold focus
5 = Multiple cold foci
6 = hot and cold foci

LEFT		RIGHT
☐	Frontal Lobe	☐
☐	Temporal Lobe	☐
☐	Parietal Lobe	☐
☐	Occipital Lobe	☐
☐	Subcortical Region	☐
☐	(Basal Ganglia, Thalamus)	☐

Please rate the general uptake in the flow phase compared to that seen in the functional phase using a scale from 1 to 5.
1 = Flow much more than function
2 = Flow slightly more than function
3 = Matched
4 = Function slightly more than flow
5 = Function much more than flow

Reader Initials: TRS☐ DCH☐ Date: __/___/9_

FIGURE 1. Standardized questionnaire used for qualitative evaluations of brain scintigrams.

RESULTS

All six DS subjects and six controls were males. Ages ranged from 23 to 54 years in the DS group (averaging 36.6) and from 25 to 46 (averaging 35.5) in the control group.

All six DS subjects were subjectively rated as abnormal (three as severe, two as moderate, and one as mild). Diversion of activity to the soft tissues was noted in three of the DS patients (50%) and was absent in the controls. Lobar perfusion discrepancies were present in three of the DS patients (50%) but only one control (16%). The degree of difference was much greater in the DS group (Table 1). Five of the DS veterans (83%) showed widespread focal abnormalities that were much more prominent than the three variant sites identified in the same control subject who had discrepant lobar findings. Significant mismatches between the flow and functional phases were identified in 4 DS patients (67%). A single case of slight mismatch was identified in the control group. All mismatched cases showed more activity in the functional phase than in the flow phase.

TABLE 1. Scintigraphic Findings

Subject	Impression	Soft Tissue Diversion	Lobar Discrepancies	Focal Findings	Phase Matching
DS1	Severe	No	2	Many	Severe mismatch
DS2	Severe	Yes	No	Many	No
DS3	Severe	Yes	1	Many	Severe mismatch
DS4	Mild	No	No	No	No
DS5	Moderate	No	2	Many	Severe mismatch
DS6	Moderate	Yes	No	Many	Severe mismatch
C1	Normal	No	2	Three	No
C2	Normal	No	No	No	Mild mismatch
C3	Normal	No	No	No	No
C4	Normal	No	No	No	No
C5	Normal	No	No	No	No
C6	Normal	No	No	No	No

DISCUSSION

This limited study shows differences between the DS group and normal controls in terms of regional findings and overall flow and functional comparisons. The pattern encountered is similar to that seen in patients with known exposure to widely recognized neurotoxins including petroleum distillates and pesticides. This pattern is, as yet, nonspecific for the particular neurotoxic agent. However, other testing and a history of known exposures can help clinically in isolating the etiologic agents.

REFERENCES

ANDERSEN, A.R. (1989). "^{99M}Tc-D,L-Hexamethylene-propyleneamine Oxime (^{99m}Tc-HMPAO): Basic kinetic studies of a tracer of cerebral blood flow." Cerebrovasc. Brain Met. Rev. 1:288–318.

ERBAS, B., BEKDIK, C., ERENGI, G., ENUNLUT, T., AYTAC, S., KUMBASCAR, H., and DOGAN, Y. (1992). "Regional cerebral blood flow changes in chronic alcoholism using Tc-99m HMPAO SPECT: Comparison on CT parameters." Clin. Nuc. Med. 17:123–127.

HOLMAN, B.L., ARVALHO, P.A., MENDELSON, J., TEOH, S.K., NARDIN, R., HALLGRING, E., HEBBEN, N., and JOHNSON, K.A. (1991). "Brain perfusion is abnormal in cocaine-dependent polydrug users: a study using Technetium-99m-HMPAO and ASPECT." J. Nucl. Med. 32:1206–1210.

TUMEH, S.S., NAGEL, J.S., ENGLISH, R.J., MOORE, M., and HOLMAN, B.L. (1990). "Cerebral abnormalities in cocaine abusers: demonstration by SPECT perfusion brain scintigraphy: work in progress." Radiol. 176:821–824.

WOODS, S.W., PEARSALL, H.R., SEIBYL, J.O., and HOFFER, P.B. (1991). "The Quinn essay: single photon emission computed tomography in neuropathic disorders." In: Yearbook of Nuclear Medicine (P.B. Hoffer, ed.). Mosby Year Book, Chicago. pp. xiii–xlvi.

TERMITE CONTROL TODAY AND FOR THE FUTURE

AN IPM APPROACH

Michael F. Potter
University of Kentucky

Termite IPM is not a new concept invented by manufacturers, university researchers or government agencies -- most of the techniques have been used by termite control professionals for generations. When a PCO carefully inspects every foot of a tight crawl space, hauls out a load of scrap lumber, realigns a splash block, installs foundation vents, re-calibrates their termite rig, foams a dirt-filled porch, and thinks through the reason(s) for a retreat, he or she is practicing IPM. What is different today is the public's heightened anxiety about things they do not understand -- specifically, termites and pesticides, and the growing arsenal of technologies available for managing termite infestations.

As with most pests, termites are better managed using a combination of techniques. The more formidable the foe, the more important this becomes, and termites certainly have proven worthy adversaries! With the rise in substandard building construction and termite damage claims, inspections must be more thorough than ever before. Inspection tools such a bright flashlight, moisture meter, and fiber optics are helpful, but there is still no substitute for experienced, trained personnel who are willing to get dirty. *Finding and keeping such people may be the greatest challenge in termite control today.* Taking steps to correct conducive conditions (wood-to-ground contacts, moisture conditions, poor ventilation, etc.) also merits more attention. Some termite-producing conditions can be corrected by the termite control professional, while others will require the cooperation of the property owner.

The first step in gaining client cooperation is education. Educating the public is another great challenge for the Industry, and for no pest is this more important than termites. The consumer has very little understanding of termites, IPM, or what it takes to eliminate an infestation. Companies must find within themselves the confidence to tell homeowners what must be done to help correct their termite problem. This may involve installing a drainage system, hiring a plumber to fix a moisture leak, or "bulldozing" an attached slab to see why previous control efforts failed. By the same token, companies should be truthful in their dealings with customers, should take time to explain the advantages (and limitations) of available control options, and should refrain from using scare tactics to rapidly close a sale. In the long run, consumers will be more inclined to purchase from firms that present factual information.

Above all else, termite IPM is a decision-making process. The IPM practitioner must understand -- and be able to select from -- a growing number of potential control options: sanitation, mechanical alterations, soil barrier treatments, below and above-ground termite baits, wood treatments, heat, cold, foam, etc. Determining which option(s) to use in a particular situation will require clear thinking and a good deal of knowledge. Some of these options (e.g., baits) will require continuous monitoring and diligent record keeping. As new information is gathered, the operator will often need to rethink, reevaluate, and adjust their control efforts accordingly -- In other words, the termite management program must remain flexible.

Termite control is undergoing unprecedented change. As the 'pace' continues to quicken, success will come to those who keep an open mind and the desire to learn. For these professionals, the future of termite control promises to be exciting, rewarding, and, once again, profitable.

(Excerpted from the 8th Edition of the *Handbook of Pest Control*)

UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE ■ DEPARTMENT OF ENTOMOLOGY

Entfact-639

TERMITE BAITS: A GUIDE FOR HOMEOWNERS

By Michael F. Potter, Extension Entomologist

No structural pest causes more confusion than termites. Most homeowners have little knowledge of these troublesome insects, and what it takes to get rid of them. Our understanding of termites has progressed considerably in recent years. New management tools have begun to emerge, including the use of baits. As more termite control companies begin to offer baiting as an option, homeowners will have many questions. This publication will help them make a more informed purchasing decision.

TERMITES IN PERSPECTIVE

Subterranean termites, the variety common to Kentucky and most other states, typically live below ground in highly organized societies or "colonies." Termite colonies can be enormous; in fact, a single mature subterranean termite colony may contain several hundred thousand members, occupying many nesting and foraging sites in the soil. The tiny, cream-colored workers, the lifestage doing the damage, can also forage considerable distances -- in some cases as much as the length of a football field! Consequently, the termite colony or colonies responsible for damage may actually be located in a neighbor's yard, rather than beneath the house that is infested.

Subterranean termites excavate narrow, meandering tunnels through soil, eventually encountering wood, their primary food. Decaying tree roots, logs, stumps, woodpiles, and plant debris afford a ready and abundant supply of food for the colony. In nature, termites are very beneficial since they aid in the decomposition of wood and the recycling of nutrients back to the soil. Occasionally, during their random foraging, termites encounter wood associated with buildings. Once a suitable feeding site is found, the workers establish an invisible odor trail to attract other termites to the structure.

Subterranean termite infestations can go undetected for years, hidden behind walls, floor coverings, and other obstructions. Over time, significant damage can result. The small size, cryptic nature, and tenacious foraging habits of these insects also pose a formidible challenge to control efforts. Unlike other repair-oriented services, such as plumbing or electrical work, termites are living creatures. The most persistent control efforts may fail at times, reinforcing the need for alternative forms of management.

CONVENTIONAL (BARRIER) TREATMENT

For years, the standard method of controlling subterranean termites was to apply a liquid pesticide, known as a termiticide, to the soil. The goal was to create a continuous chemical barrier around and beneath the structure in order to block all potential routes of termite entry. Termites attempting to penetrate through the treated soil were either killed or repelled. In actual practice, there are many obstacles to achieving such a barrier. Many potential termite entry points are hidden behind walls, floor coverings, and other obstructions. Even where access for treatment is possible, it is hard to uniformly wet soil and achieve thorough coverage. A typical "barrier" treatment may involve hundreds of gallons of termiticide solution injected into the ground alongside the foundation, beneath concrete slabs, and within foundation walls. Considering that termites can tunnel through small untreated gaps as narrow as pencil lead in the soil, it is understandable why conventional liquid treatments sometimes fail to correct a termite problem.

Despite large amounts of pesticide applied, barrier treatments do little to reduce termite colonies or groups of termites foraging in the vicinity of a structure. Over a period of time, termites foraging randomly in the soil may encounter an untreated gap through which to penetrate, or termiticide residues in

the soil that are no longer effective. (For more information on this method of treatment, see *ENTFACT*-604; *Termite Control: Answers for the Homeowner).*

ALTERNATIVE APPROACH: TERMITE BAITS

Termite baits are a whole different concept. With this approach, small amounts of material are deployed like edible "smart missiles" to knock out populations of termites foraging in and around the structure. Some baits may even eradicate entire termite colonies. A comprehensive baiting program then seeks to maintain a termite-free condition on the customer's property through ongoing monitoring and rebaiting as needed.

Termite baits consist of paper, cardboard, or other "termite-friendly" food, combined with a slow-acting substance lethal to termites. The bait must be palatable enough that termites will readily consume it, even in the presence of competing tree roots, stumps, woodpiles and structural wood. If the bait kills too quickly, sick or dead termites may accumulate in the vicinity of the bait stations, increasing the chance of avoidance by other termites in the area. Delayed-action also enhances transmission of the lethal agent to other termites, including those that never fed on the bait. Theoretically, entire colonies could be eliminated in this manner, although total colony elimination may not be necessary to afford structural protection.

PATTERN OF USE

Various methods of termite baiting are now being employed by professional pest control firms. Some bait products are inserted below ground out in the yard, whereas others are installed above ground level on the inside of the structure. On some properties, baits may constitute the only form of treatment; on others, they may be supplemented with either a partial or complete liquid (barrier) application.

Installation Below ground- Baits are deployed below ground by enticing termites to feed on wooden stakes, cardboard, or some other cellulose-based material. The toxicant-laced bait can either be installed initially, or substituted after termites have been detected in an untreated monitoring device. Termites cannot see or smell the baits underground; they encounter them by chance during their random foraging activities. To increase the odds of discovery, the stations are installed at fixed intervals around the perimeter of the structure, and/or in suspected areas of termite activity (e.g., around woodpiles, stumps, moist areas, and adjacent to previous termite damage). With persistence and a little luck, the termites eventually find and feed upon one or more of the bait installations.

Perhaps the greatest difficulty in below-ground baiting is getting termites to find the baits in the first place. Bait discovery will vary from property to property, depending on such factors as termite foraging intensity, time of year, moisture, and food availability. On one infested property in Kentucky, more than a dozen monitoring devices were "hit" (attacked by termites) within two weeks of installation; on another home in the same neighborhood, no below-ground stations were attacked during a full year of intensive monitoring despite two concurrent termite swarms inside the home. Similar variances in bait detection have been reported elsewhere in the country. In temperate climates such as in Kentucky, bait discovery usually will be greatest during peak foraging periods in the spring and summer. Baiting during late-fall and winter is generally less fruitful, although termites are occasionally found in below ground stations when air temperatures are in the 30°F range.

The more below ground baits installed, the better the chances of locating termites. Installing more stations increases the odds of encountering multiple colonies, or weakly associated "satellite nests" of the same colony -- any of which could be of potential risk to the structure. Planning, patience and persistence are requisites for successfully using below-ground termite baits. *Regardless of which product is used, the homeowner must be prepared and willing to accept the possibility of a lengthy baiting process.*

Above-ground installation- Termite baits may also be installed above ground, in known areas of termite activity. Typically, the stations are installed directly in the path of active termite tunnels after the mud tubes have been broken. Effects tend to be more rapid with above-ground baiting, since the procedure does not depend upon "chance" termite encounters with the stations.

It is too soon to know whether structural infestations can routinely be "eliminated" with above ground baits alone. Manufacturers currently recommend that they be used in conjunction with other forms of treatment, such as in-ground baiting or conventional barrier treatments. Nonetheless, above-ground baits provide an excellent opportunity for introducing slow-acting toxicants directly into structural termite infestations.

COMMERCIAL BAIT PRODUCTS

Following is a description of the commercial bait products and programs being offered by a growing number of professional pest control companies. All of the products mentioned are still quite new, while others not listed are in various stages of development. Interested homeowners may need to call around to locate which companies are using which products. SENTRICON(TM) SYSTEM. This method of termite baiting has been the most extensively tested of those currently on the market. Consequently, it will be discussed in some detail. The *Sentricon Colony Elimination System* was developed by DowElanco (Indianapolis, IN; 800/686-6200), and is sold only through authorized pest control firms. The bait contains a slow-acting ingredient which disrupts the normal growth process in termites (i.e., termites die while attempting to molt).

Termite control with the Sentricon System(TM) entails a 3-step process: (1) initial monitoring to "pinpoint" termite activity, (2) delivery of the bait, and (3) subsequent monitoring to provide on-going protection (Figure 1.)

Step 1. Monitoring- Termites are detected by installing plastic monitoring stations around the perimeter of the building. The station housing is a hollow green plastic cylinder, about 10 inches long by 2 inches wide, with slits along the sides for termites to enter. Initially, each station is provisioned with two untreated pieces of wood, intended as monitoring devices for the presence of termites in the area.

The station is inserted into an augured hole in the ground, with the cover flush with the soil surface. Monitoring stations are installed around the outside perimeter of the building, at about 10 to 20 foot intervals alongside the foundation. Narrower intervals, while more effort to install and inspect, increase the odds that termites will encounter them during random foraging. Patios, driveways, and other paved areas are not a serious problem unless soil access is prevented around the majority of the structure. Oftentimes, stations can be installed farther out from the foundation, or in adjoining planter boxes.

As a supplement to installations along the foundation, additional stations are installed in suspected termite foraging areas, such as adjacent to pre-existing termite damage, stumps, woodpiles, or moist areas on the property. Periodically thereafter (monthly, bimonthly, etc.) the wood monitoring devices within each below-ground installation are inspected for termite presence.

Step 2. Bait Delivery- When termites are found in a monitoring device, the untreated wood pieces are replaced with a perforated plastic tube containing the bait -- white "paper toweling" treated with the slow-acting termite growth inhibitor (Recruit TM). To hasten the overall process, termites feeding on the wood pieces are carefully dislodged and placed within the Baitube. Eventually, these termites tunnel through and out of the perforated tube, reuniting with their nestmates in the soil. In doing so, they leave behind a colony-specific "scent" that promotes recruitment of other nestmates to the bait. In order to promote additional "hits," a pair of auxiliary monitoring stations, provisioned with wood pieces, are installed adjacent to stations receiving Baitubes.

Inspection of all Sentricon stations, with and without substituted bait tubes, continues until no more live termites are discovered. Empty, moldy or degraded baits are replaced, and additional auxiliary stations added as deemed necessary.

Step 3. Continued Monitoring- After termites are no longer found in installed Baitubes, the tubes are once again replaced with untreated wood pieces and monitoring continues. Even if the termite colony threatening the structure has been eliminated, termites from neighboring colonies can reinfest the area. Reinfestation can also occur if only part of the original colony or colonies was eliminated. Consequently, structures protected with the Sentricon System(TM) will need to be continually monitored to guard against reinvasion from new colonies or previously suppressed ones. Depending upon conditions, the pest control firm will continue to monitor at three- to four-month intervals *for an indefinite period*, after the termite population is deemed to have been eliminated.

Independent research studies, including some performed in Kentucky, indicate that the Sentricon(TM) *Colony Elimination System* can be an effective termite control option. A number of these studies involved structures with chronic termite infestations. Despite Sentricon's clearcut potential, thoroughness and persistence are requisites for success -- as is true for any termite management program.

FIRSTLINE(TM)- Another recently introduced product is the *FirstLine (TM) Termite Bait Station*, manufactured by FMC Corporation (Princeton, NJ) 1-800-321-1FMC. The product is intended for above-ground baiting of active termite tubes. The station consists of a semi-transparent plastic housing (4x4x1-inches) with open slots at the base. Contained within is corrugated cardboard treated with a slow-acting ingredient lethal to termites.

Installation is accomplished by securing the station at the leading edge of a previously broken, active termite tube. Termites construct such tubes as they travel over foundations, floor joists, and other exposed surfaces. FirstLine (TM) stations must be installed on flat surfaces, so that the base of the station meets the tube. Installation is completed by attaching the plastic housing to the surface (wood, masonry, etc.) using tamper-resistant screws. When the station is installed correctly, the termites rebuild the tube into the station and feed on the insecticide-treated cardboard. New stations may need to be substituted as baits are depleted.

It is too soon to know whether structural infestations can routinely be "eliminated" with this product alone. The manufacturer currently recommends that FirstLine(TM) Bait Stations be used in conjunction with other forms of treatment, such as in-ground baiting or conventional barrier treatments. Additional research and field experience with the product are needed to delineate effects against structural infestations.

Another formulation of Firstline (TM), *Firstline GT*, was recently introduced for below ground use ("GT" stands for ground treatment). Firstline GT Termite Bait Stations consist of 4 ½ by 1-inch clear plastic tubes containing the same active ingredient and corrugated cardboard food source as the above ground station. Additional "monitoring" tubes containing a piece of untreated slotted wood are installed in conjunction with the Firstline GT baits to help monitor for the presence of termites.

Baits and monitors are inserted into the ground flush with the surface, usually in groupings of two or three tubes per target area. Label directions emphasize placement in areas where termite activity is known or suspected. For example, near previous termite damage, around woodpiles and tree stumps, and in areas tending to stay consistently moist, e.g., around mulch beds, down spouts, sprinkler heads, and air conditioner units. Consequently, installation of Firstline GT may not entail placement of baits at fixed intervals around the entire perimeter of the building, as is done with the Sentricon baiting system. Moreover, Firstline GT baits may be installed in the soil initially, by-passing the unbaited monitoring step utilized with Sentricon.

As with the FirstLine(TM) Termite Bait Station for above ground use, it is too soon to predict how effective the below ground product will be in protecting structures from termites.

SUBTERFUGE(TM) SYSTEM- One other below-ground termite bait that will be marketed in the near future is *Subterfuge(TM)*, manufactured by American Cyanamid (Princeton, NJ). As of this writing, effectiveness of the product has not yet been demonstrated under Kentucky termite conditions.

BAITS OR BARRIERS...WHICH IS BETTER?

This is the most common question from homeowners trying to decide which form of treatment to purchase. The question is a difficult one, considering the industry's limited amount of experience with the new bait products. Liquid barrier treatments have been the standard method for controlling subterranean termites for decades. Not to say that there haven't been performance failures and other problems; but for the most part, barrier treatments have afforded adequate termite protection. Although baiting clearly has potential advantages (see below), the approach does not yet have a long-term track record on which to base its performance. Other factors to consider in the purchasing decision include:

1. ***Has the structure already been treated (unsuccessfully) using conventional methods?*** Some structures have construction features that interfere with conventional soil treatment methods, e.g., wells, cisterns, plenums, subslab heating ducts, drainage systems, inaccessible crawl spaces, stone foundations, etc. Buildings with hard-to-treat construction or chronic retreatment histories are logical candidates for termite baits. With baits, gaining access for treatment is seldom a problem since foraging termites are as likely to encounter below-ground bait stations around the foundation exterior as beneath the structure. In respect to contamination of wells, heat ducts, drainage systems, etc., baits are of negligible risk and can be used in the most sensitive treatment situations.

2. ***Are you opposed to having your floors drilled, and furniture/stored items/carpeting moved?*** Baiting requires fewer disruptions than does conventional barrier treatment. Installation and subsequent monitoring of bait stations generally does not even

require the technician to come indoors. Noise, drill dust, and similar disruptions associated with conventional treatment are avoided.

3. ***Are you strongly opposed to the use of pesticides around your home?*** Based on the current body of scientific research, conventional liquid termiticides pose no significant hazard to humans, pets or the environment when applied according to label directions. In spite of the negligible health risk from such treatments, some individuals are still apprehensive. Chemically-concerned homeowners may find the concept of baiting more attractive. With baits, the total amount of pesticide applied is minute in comparison to the high gallonages needed to achieve a thorough and effective soil barrier treatment.

4. ***How much are you willing to spend for termite protection?*** Termite treatments are rather expensive, ranging in price from about $500-$2000. Along with the initial treatment fee, homeowners are advised to purchase a renewable service agreement (warranty) in case the termites return. Depending upon the circumstances, a baiting program may end up costing more than a conventional treatment -- the reason being that baiting programs require multiple visits to the property for ongoing monitoring of bait stations. This is especially true in respect to purchase of the renewable service agreement. Whereas conventional treatments typically entail a single annual followup inspection, baiting contracts may require three or more visits per year, for as long as the agreement is in effect. (Thus the annual renewal fee for baiting typically will be as much as two to three times higher than for conventional treatment). Homeowners should consider both the initial treatment price and renewal fee in making their purchasing decision.

5. ***Assuming my home will be baited, should I also request a supplemental barrier treatment?*** The need for supplemental soil treatment depends on the circumstances. Property owners with a serious termite problem, or those involved in a real estate transaction, may not want to wait 2 to 6 months (sometimes longer) for baits to suppress or eliminate the infestation. With comprehensive baiting programs such as Sentricon, liquid applications (when deemed necessary) are usually made as partial treatments to infested areas, rather than to the entire structure. Other bait products (e.g., FirstLine) are more suited for spot-treatment of active tunnels, feeding galleries, and localized areas in the soil. Such products are typically used in conjunction with more extensive barrier treatments.

CLOSING REMARKS

As indicated throughout this publication, the "art" and "science" of termite baiting is in an evolutionary state. Many questions are still without answers. One thing we do know is that the products will not perform by simply hammering a few baits into the ground and walking away. Success will require thoughtful installation and diligent monitoring by an experienced service technician, backed by a responsible pest control firm.

Where trade names are used, no endorsement is intended, nor criticism implied of similar products not named.

For further information about the termite bait products mentioned in this publication, contact the manufacturer (see text for telephone numbers), your local termite control professional, state regulatory agency responsible for termiticide usage, or the cooperative extension office in your area.

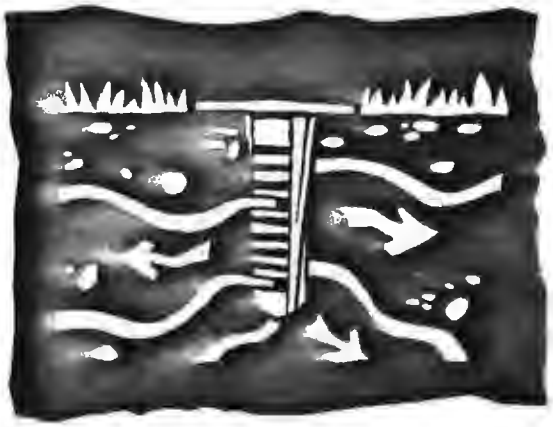
FIGURE 1. The Sentricon System (TM) of Termite Baiting

(1) Inspecting home for signs of termites

(2) Installing monitoring stations in the soil

(3) Inspecting wood monitoring pieces for presence of termites

(4) Transferring termites from wood monitors into baitube



(5) Termites tunnel out of baitube and recruit other colony members to the bait

(6) After termite population is eliminated, monitoring resumes using unbaited wood pieces

UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE ■ DEPARTMENT OF ENTOMOLOGY

ENTFACT- 604

TERMITE CONTROL: ANSWERS FOR THE HOMEOWNER

By
Mike Potter, Urban Extension Entomologist

The Entomology department receives more calls about termites than any other insect pest. Termites cause more damage to homes than all other natural disasters combined. While a structure may become infested at any time, presence of termites is of particular importance when buying or selling a home since a termite inspection/infestation report is normally a condition of sale. Answers to some of the most commonly asked questions about termites and termite control are provided below.

Q: Why are most termite problems discovered during March - May?

A: Spring is typically when large numbers of winged termites (known as "swarmers") emerge inside structures. This, along with other signs of termites noted during real estate inspections is what usually triggers the initial concern of homeowners.

In nature, termites swarm in order to disperse and start new colonies. After a colony reaches a critical size (typically requiring 5-8 years), winged reproductives are produced. In response to warmer temperatures and rainfall, the winged termites emerge from the colony and fly into the air. The swarmers then drop to the ground, shed their wings, pair off with a mate, and attempt to begin a new colony in the soil. Very few swarmers emerging outdoors survive to initiate new colonies. *Termite swarmers emerging inside a structure almost never survive* -- but indicate that an infestation is present. Swarmers and their shed wings can be removed with a vacuum cleaner.

Q: **How will I know if my home is infested?**

A: The presence of winged termites inside a home almost always indicates an infestation warranting treatment. Termite swarmers are attracted to light and often will be seen around windows, doors and light fixtures. They can be differentiated from winged ants by their straight antennae, uniform waist, and wings of equal size. Ants have elbowed antennae, constricted waists and forewings that are longer than the hind wings (Fig. 1).

Swarmers emerging from tree stumps, woodpiles, railroad ties and other outdoor locations are not necessarily cause for concern, and do not necessarily mean that the structure, itself, is infested.

Another indicator of a termite problem is pencil-wide mud foraging tubes extending over foundation walls, support piers, sill plates, floor joists, headers and subfloors (Fig. 2). Termites construct these mud "shelter" tubes as they travel between their underground colonies and the structure. Termite-damaged wood is usually hollowed out along the grain, with bits of dried mud or soil lining the feeding galleries. Wood damaged by moisture or other types of insects (e.g., carpenter ants) will not have this appearance.

There will often be no sign of the termites themselves -- small, creamy-white insects with an "ant-like" appearance. An infestation can go undetected for years, hidden behind drywall, paneling, floor coverings, insulation, and other obstructions. Termite feeding (and the resultant damage) can even progress undetected in wood that is exposed, because the outer surface is usually left intact. Confirmation of infestation often requires the keen eye of an experienced termite inspector. However, even the most experienced termite inspector can overlook damage which is hidden.

Q: Can I treat the house myself?

A: Ridding a home of termites requires extensive knowledge of building construction and an understanding of where termites are likely to enter.

Many of these potential entry points are hidden and difficult to access. Termite control also requires specialized equipment and the application of large amounts of *termiticide*. A typical termite job may require 200-plus gallons of termiticide solution injected into the soil, beneath concrete slabs, and within foundation walls.

Given the substantial financial investment of one's home, termite treatment is usually a job for professionals. A possible exception would be if a mailbox post, sandbox or similar outdoor wood object not attached to the structure was infested.

Q: **How do I choose a pest control firm? Why is there such a difference in price?**

A: These are complex questions. In brief, the company should be licensed by the Kentucky Department of Agriculture. Membership in the Kentucky Pest Control Association and/or National Pest Control Association suggest that the company is an established firm with access to technical and training information needed to do the job correctly. As with any service company, references are invaluable. Consider calling at least 2-3 companies. Requesting inspections and estimates from more than one company will substantiate the extent of your termite problem and allow you to compare services.

Companies offer different types of warranties or service agreements. Most offer retreatment of localized areas if the termites return. In rare instances, no warranty/service agreement may be offered if construction elements such as wells, cisterns, drainage systems, or inaccessible crawl spaces make it impossible to treat in accordance with industry standards.

Take your time when selecting a termite control company. Termites damage wood slowly enough that the amount of damage caused by an additional day, week or month of continued activity is seldom significant. Avoid firms that try to pressure you into signing a contract immediately with "specials" or scare tactics.

Q: How can I determine if I'm getting a proper treatment?

A: There are many elements to a quality termite job. The inspection should be thorough, with a diagram of the structure indicating location(s) of termite activity, observable damage, and types of treatment techniques that will be performed. Treatment techniques include soil trenching, rodding, and drilling of slabs and foundations.

Two of the most useful "quality assurance indicators" measurable by homeowners are amount (gallons) of termiticide applied, and spacing between holes drilled through concrete slabs. In order to achieve adequate dispersion of termiticide in the soil, gallonage must be high -- often requiring 150-200 gallons or more on an average-size home. Treatments using smaller amounts (e.g., 100 gallons or less) are less likely to provide a continuous barrier of protection in areas where termites can enter. Holes drilled through porches, patios, basement floors and concrete slabs should be spaced no more than 18 inches apart (12 inches is even better) to help provide continuous coverage when the termiticide solution is injected.

Ultimately, the quality of a termite job depends less on the person who sells the job than on the individual who does the work. A safe and effective treatment requires an experienced technician, not someone who was hired a few weeks ago.

Q: **How long will the treatment last? Which brand of termiticide is most effective?**

A: Studies conducted by the U.S. Dept. of Agriculture suggest that all of the registered termiticides should control termites for at least five years if the are applied at label concentrations and rates. The actual length of control, for a given structure, will depend on such factors as thoroughness of the application, the prevailing environmental conditions, and density of termites in the area. If termites continue to be present the year following treatment, it's probably not from degradation of the termiticide -- but because termites have found an untreated gap in the chemical barrier.

More important than the brand of termiticide, is that the treatment be performed by an experienced technician, backed by a responsible pest control firm.

Q: Will there be an odor after treatment?

A: Odor is one characteristic that *may* differ between termite control chemicals. Some products have more odor than others; in most cases, the odor is due to solvents in the formulation rather than the active ingredient. Odor can usually be alleviated by ventilating with fans during and after treatment. If odor is a significant concern, the homeowner should know that low-odor products are available.

Q: Will the termite chemical harm my family or pets?

A: Termiticides are tested extensively for adverse effects on health. Before a product can be used, numerous studies must be conducted by the manufacturer and independently evaluated by the U.S. Environmental Protection Agency. Based on the current body of research, these registered termiticides present no significant hazard to humans, pets or the environment when applied according to label directions. In spite of the negligible health risk from a termite treatment, people with lingering concerns should consult their physician.

Q: Does my entire house need to be treated -- or can I just pay for a "spot treatment" in areas where I see termites?

A: Subterranean termite colonies can be very large; a single colony may contain a million or more individuals. Termite workers (the lifestage doing the damage) can also forage considerable distances -- in some cases, the entire length of a football field. This means that the termite colony or colonies responsible for damage may actually be in a neighbor's yard, rather than beneath the house which is infested. For these reasons, localized or "spot" treatments are generally a gamble, except in cases of retreatment. Most reputable pest control firms will not warranty spot treatments, since it is likely that termites will eventually find other points of entry into the structure.

Q: Have I been "cheated" if termites continue to infest my house after treatment?

A: Not necessarily. Unlike other services such as plumbing or electrical work, termite control involves living creatures. The best efforts may fail at times because termites are able to find their way through small untreated gaps in the soil. The *intent* is to establish a continuous and impenetrable chemical barrier in the soil -- but this is almost impossible to achieve in actual practice. Termites can penetrate through untreated gaps as small as 1/64-inch (as narrows as pencil lead) in the soil..

The key, therefore, is to hire a pest control firm employing knowledgeable and thorough technicians. Companies will usually return and retreat affected area(s) at no additional charge provided the service agreement is purchased and maintained.

Q: Isn't there a new termite control procedure utilizing baits?

A: A small but growing number of companies have begun using termite baits as an alternative to conventional (barrier) treatments.
The baits consist of paper, cardboard, or other "termite-friendly" food, combined with a slow-acting substance lethal to termites.
Some bait products are installed below ground out in the yard, whereas others are placed within the structure in the vicinity of active termite shelter tubes. Foraging termites consume the bait and share it with their nestmates, resulting in a gradual decline in termite numbers. Some baits may even eradicate entire termite colonies. On some properties, baits may constitute the only form of treatment; on others, they may be supplemented with either a partial or complete liquid (barrier) application to the soil.

Termite baiting is a very complex subject. A detailed discussion of this important emerging technology is provided in the new Entomology Extension publication, *Entfact-639: Termite Baits: A Guide for Homeowners.*

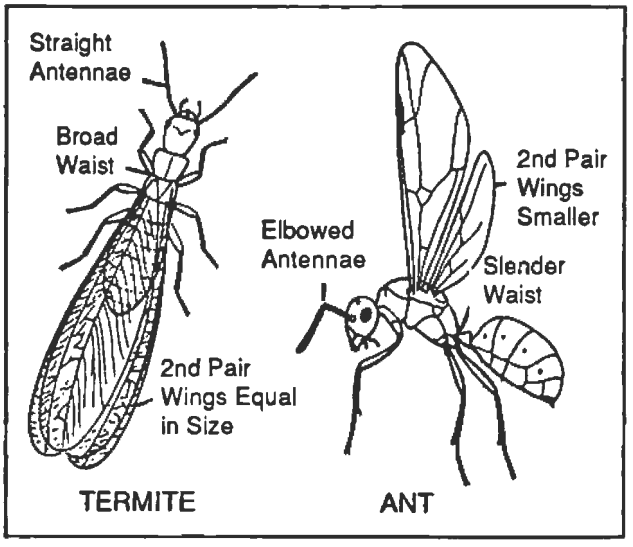


Fig. 1. Differentiating ants from termites

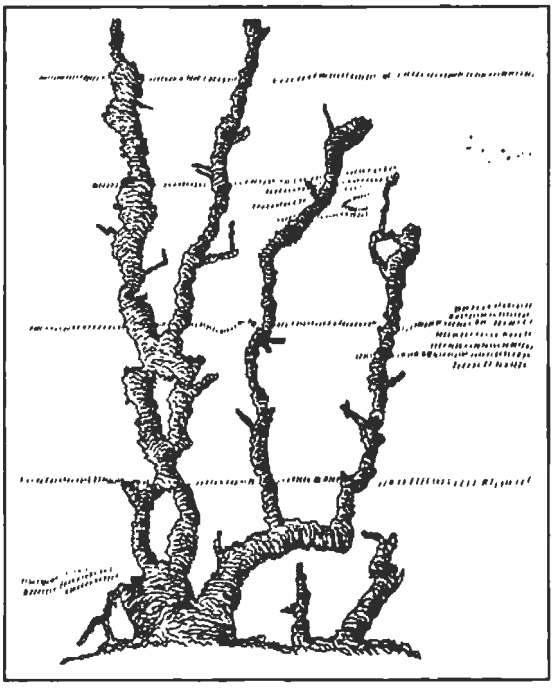


Fig. 2 Termite shelter tubes on foundation wall. tubes are usually brown and constructed from bits of soil or wood.

UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE ■ DEPARTMENT OF ENTOMOLOGY

ENTFACT - 605

PROTECTING YOUR HOME AGAINST TERMITES

By
Michael F. Potter, Extension Entomologist

The entomology department often receives calls from people wanting to know what can be done to protect their home from termites -- or if a certain practice or condition is likely to cause termite problems. Homeowners can reduce the risk of termite attack by following these suggestions.

1. Eliminate wood contact with the ground. Many termite infestations result from structural wood being in direct contact with the soil. Earth-to-wood contact provides termites with simultaneous access to food, moisture, and shelter, as well as direct, hidden entry into the structure. Wood siding, porch steps, latticework, door or window frames, posts and similar wood elements should be at least six inches above ground level. Eliminating wood-to-ground contact may require regrading or pulling soil or mulch back from the foundation, cutting the bottom off of wood latticework, or supporting steps or posts on a concrete base. Posts or stairs embedded in concrete are also vulnerable to termites since they usually extend all the way through the concrete to the soil. Contrary to popular belief, wood that has been pressure treated is not immune to termite attack; termites will enter pressure-treated wood through cut ends and cracks, and will also build tunnels over the surface.

2. Don't allow moisture to accumulate near the foundation. Termites are attracted to moisture and are more likely to enter a structure if the soil next to the foundation is consistently moist. Water should be diverted away from the foundation with properly functioning gutters, downspouts and splashblocks. Leaking faucets, water pipes and air conditioning units should be repaired, and the ground next to the foundation should be graded (sloped) so that surface water drains away from the building. Homes with poor drainage may need to have tiles or drains installed. Lawn sprinklers and irrigation systems should be adjusted to minimize water puddling near the foundation.

3. Reduce humidity in crawl spaces by providing adequate ventilation. Most building codes call for 1 square foot of vent opening per 150 square feet of crawlspace area. For crawlspaces equipped with a polyethylene vapor barrier (see below), the total vent area often can be reduced to 1 square foot per 300 to 500 square feet of crawlspace area. One vent should be within 3 feet of each exterior corner of the building. Shrubs, vines and other vegetation should not be allowed to grow over the vents since this will inhibit cross-ventilation. Moisture in crawl spaces can further be reduced by installing 4-6 ml polyethylene sheeting over about 75 percent of the soil surface .

4. Never store firewood, lumber, cardboard boxes, newspapers, or other cellulose materials against the foundation, or inside the crawl space. These materials attract termites and provide a convenient source of food. When stacked against the foundation they offer a hidden path of entry into the structure and allow termites to bypass any termiticide soil barrier that is present. Vines, trellises, and other dense plant material touching the house should also be avoided. Dead stumps and tree roots around and beneath the building should be removed (where practical), along with old form boards and grade stakes left in place after the building was constructed.

5. Use decorative wood chips and mulch sparingly, especially if you have other conditions conducive to termite problems. Any cellulose-containing materials, including mulch, can attract termites. Termites are especially drawn by the moisture-holding properties of the mulch. Where mulch is used, it should never be allowed to contact wood siding or framing of doors or windows. Crushed stone or pea gravel, though often considered less cosmetically appealing, is less attractive to termites. These materials also will reduce problems with other pests such as millipedes, pillbugs, earwigs and crickets.

6. Consider having the structure treated by a professional pest control firm. While the measures outlined above will make a house less attractive to termites, the best way to prevent infestation is to treat the soil around and beneath the building with a termiticide. Buildings have many natural openings through which termites can enter -- most of which are hidden. Soil treatment makes the ground around the foundation repellent and/or toxic to termites so that they will not penetrate through the treated layer. Termite-specific baits have also been developed recently, with the intent of eliminating termite foraging in the vicinity of the structure (See Entfact-639, Termite Baits: A Guide for Homeowners).

Preventively treating a home for termites is a reasonable investment, especially if the structure has no prior history of treatment. If the building was previously treated by a pest control firm, it's a good idea to maintain the service agreement by paying the annual renewal fee. Should termites reinfest the building (which can happen even if the initial treatment was performed correctly), the company will return and retreat the affected area at no additional charge.

Whether or not a person chooses to have their home treated, they should know the signs of termite infestation:

- pencil-wide mud foraging tubes extending over the inside and outside surfaces of foundation walls, piers, sills, joists, etc.

- the presence of winged (swarmer) termites, or their shed wings on window sills and along the edges of floors.

- damaged wood hollowed out along the grain and lined with bits of mud or soil.

Detecting hidden termite infestation requires a trained eye. Most pest control firms perform inspections free of charge and will alert the homeowner to any conditions they uncover that are conducive to termite attack.

inside EPA, DowElanco Reach Agreement On Dursban, pg. 86.

PCT
PEST CONTROL TECHNOLOGY

FEBRUARY • 1997 $3.00

Termite Control Issue

Termite Baits: A Status Report

By Dr. Michael Potter

TERMITE BAITS:

FirstLine Termite Bait Stations, from FMC Corp., feature the active ingredient sulfluramid.

American Cyanamid's Subterfuge termite bait system contains the active ingredient hydramethylnon.

By

Michael F. Potter

A

status re

DowElanco's Sentricon Colony Elimination System employs the insect growth regulator hexaflumuron.

As termite control continues to evolve, success will come to those willing to learn and adopt new technologies. Pictured is DowElanco's Prolinx™ Information System. (Photo by Michael F. Potter)

port

No topic has generated more excitement – or confusion – than termite baits. The excitement comes at the prospect of having an effective, consumer-friendly alternative to traditional barrier treatments. The confusion stems from widely varying performance claims, heard in meetings and coffee shops throughout the country. Depending on who's doing the talking, the new termite baits have been referred to in many ways, ranging from a "comprehensive stand-alone treatment," to "just another tool in the arsenal," to a "complete waste of money."

In the race to bring their own baits to market, manufacturers are sending conflicting messages, some with precious little data to back up their claims. Uncertainty abounds among regulatory officials – *"Just how reliable are these baits? Are they suitable as stand-alone treatments? Will the consumer be adequately protected?"* Perhaps most unnerving is the degree of uncertainty voiced by the research community. Termite researchers are the first to admit that, at the present time, they just don't have all the answers. One thing they *do know* is that the nature of each termite infestation is unique, making it hard to predict the outcome of one's baiting efforts from one account to the next – not to mention in different regions of the country.

Smack in the middle of all the confusion is the pest control operator. Too busy to read every article, attend every meeting, or "pick the brain" of every researcher, many PCOs feel as if they've been listening to a radio show with too much static. The intent of this article is to end some of the confusion, and deliver a clearer signal to those with the most to gain – or lose – as the baiting game plays itself out.

BAITS IN PERSPECTIVE. For 50 years, the standard method of controlling subterranean termites has been by barrier treatment. The soil around and beneath the structure was saturated with fast-acting toxicants, intended to keep termites from entering. The difficulties in creating such a barrier are known to all who perform treatments. Termite baits are a whole different story. With this approach, minuscule amounts of material are deployed like edible "smart missiles" to knock out colonies or

satellite groups of termites, foraging in and around structures. An aggressive baiting program then seeks to maintain a termite-free condition through ongoing monitoring and rebaiting as necessary.

For historical perspective, the discovery of termite baits actually pre-dates the use of chlordane as a barrier treatment. Researchers in the 1930s showed that termite colonies could be suppressed by injecting slow-acting arsenic dusts into the galleries. The toxic dust was spread throughout the termite population by social grooming. Mirex-laced wooden bait blocks buried in the soil also suppressed field populations of *Reticulitermes* spp., as did edible Mirex pastes applied directly into active feeding galleries within structures. Today's termite baits are being used in much the same manner.

The products being marketed, or under consideration, fall into three broad categories: (1) *slow-acting metabolic inhibitors and neurotoxicants*, such as hydramethylnon, sulfluramid, and abamectin; (2) *microbial pathogens*, such as fungi or bacteria; and (3) *insect growth regulators* (IGRs), such as hexaflumuron and pyriproxyfen. Other slow-acting compounds may also be effective, provided they're formulated at the proper concentration and incorporated into a food source attractive to termites. By the end of the decade, there could be almost as many termite baits as conventional liquid formulations.

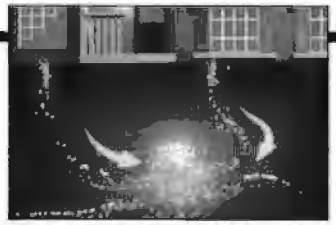


Figure 1. Slow-acting baits (such as the Sentricon Colony Elimination System pictured above), can destroy large numbers of termites foraging in the vicinity of a structure. (Illustration courtesy of DowElanco)

To be effective, the active ingredient in the bait must be nonrepellent and slow-acting. The formulation must also be palatable enough that termites will readily consume it, even in the presence of competing tree roots, stumps, woodpiles and structural wood. A palatable bait is also important so that foragers will recruit large numbers of other termites to the bait location. Researchers are continually looking for ways to improve the palatability and acceptance of termite baits. Products and procedures being utilized today will likely be somewhat different in the future.

The toxicant within the bait must be slow-acting, so that "intoxicated" termites die at random locations within their foraging territory. If the bait kills too quickly, sick or dead termites may accumulate in the vicinity of bait stations, increasing the likelihood of avoidance by other termites (17). Delayed action also enhances transmission of the toxicant (presumably via trophallaxis and/or grooming) to other termites, including those that never fed on the bait. Theoretically, entire termite colonies could be eliminated in this manner (Figure 1). The extent to which this is possible is still being debated by termite experts (see sidebar, *Colony Elimination or Suppression?*).

COLONY ELIMINATION OR SUPPRESSION?

As more baits reach the market, there is disagreement over which compounds are most effective — and whether entire termite colonies can or must be eliminated to achieve control. This question is especially important for below-ground baits since the pest control operator cannot directly assess the impact of the bait on active termites.

Some researchers are of the opinion that metabolic inhibitors (sulfluramid and hydramethylnon) cause lethal or sublethal effects too quickly to eliminate entire colonies. With such compounds, termites might "learn" to avoid feeding on the bait before it was thoroughly distributed among the termite population (14, 16, 17). (In human societies, this would be analogous to heading off an outbreak of food poisoning by shutting down the offending restaurant.) Moreover, because metabolic inhibitors and neurotoxicant-type baits are "dose-dependent" — the more termites eat, the faster they die — it is more difficult to delay onset of symptoms by altering the amount (concentration) of toxicant in the formulation (16).

Insect growth regulators (e.g. hexaflumuron) affect termites by disrupting their growth and development, so onset of symptoms tends to be slower. Death usually occurs several weeks or months after ingestion, and the time frame is "dose-independent" (15). As a result, IGR-based baits may be distributed more thoroughly among termite populations — in some cases, affecting entire colonies (12, 13). Others within the research community suggest that termite colonies may be too fragmented and functionally segregated to be eliminated with *any* termite bait (22).

Proponents of "non-IGR-type" baits (sulfluramid, hydramethylnon, etc.) contend that structural protection is possible without eliminating entire colonies, through suppression of localized foraging activity in critical areas. Long-term protection would be achieved by diligent monitoring and placement of additional baits as needed.

Obviously, there are many unresolved questions about termite bait optimization and performance. As with any new technology, companies should keep careful records of past successes and failures from their own experiences.

PATTERN OF USE. Termite baits can be used in various strategies, alone or in combination with other forms of treatment. Formulations are now available for both exterior and interior baiting, and for use below and above ground.

Installation Below Ground. Baits are deployed below ground by luring termites to feed on wooden stakes, cardboard, or some other cellulose-based material. The toxicant-laced bait can either be installed initially, or substituted after termites have been detected in an untreated monitoring device. Termites cannot see or smell the baits underground; they encounter them by chance during their random foraging activities (18). To increase the odds of discovery, the stations are installed at fixed intervals around the perimeter of the structure, and/or in suspected areas of termite activity (e.g. around wood-piles, stumps, moist areas, and adjacent to damage). With persistence and a little luck, the termites eventually find and feed upon one or more of the bait stations.

Perhaps the greatest difficulty in below-ground baiting is getting termites to find the baits in the first place. Bait discovery will vary from account to account, depending on such factors as foraging intensity, time of year, moisture and food availability. In one infested home in Kentucky, nearly half, or 14, of the monitoring devices were "hit" (attacked by termites) within two weeks of installation; on another home in the same neighborhood, no below-ground stations were attacked during a full year of intensive monitoring despite two concurrent swarming events. Similar variances in bait detection by termites have been reported elsewhere in the country.

In temperate climates, bait discovery usually will be greatest during peak foraging periods in the spring and summer. Baiting during late fall and winter is less fruitful, although we've occasionally found termites in below-ground stations when air temperatures were in the 30-degree Fahrenheit range. In some parts of the country (notably in the desert Southwest and California), pest control operators have had a hard time getting termites to find and feed consistently on below-ground baits regardless of the time of year or prevailing conditions. Relief may come with recent improvements in the palatability of baits and monitoring devices (10).

In recent meetings and workshops, some

manufacturers have noted that it may not be necessary to install baits or monitors around the entire perimeter of a structure – advocating instead the "directed placement of baits in areas where termites are likely to frequent." In a recent Louisiana study, termite monitors were indeed attacked more often when installed near stumps, wood piles, moisture sources, and other conducive conditions. But in our baiting studies with 22 test houses in the Midwest, there has been no apparent "rhyme or reason" to where the below-ground hits occur. Thus far we've observed no greater likelihood of termites encountering baits installed in areas of abundant moisture, mulch, heavy vegetation, or sun versus shade – nor even when stations are installed in the vicinity of termite damage (4). Once a desirable food source such as a decaying tree stump or sill plate is located, foraging termites may concentrate their efforts on these sites, ignoring other resources in the area. Dr. Barbara Thorne at the University of Maryland describes such behavior as being in a "highway mode," since the foraging pattern is a bit like traffic moving along a road with no exit ramps. This behavior may help to explain why it's often difficult getting hits, even when baits or monitors are installed in areas where termites are foraging.

The more baits you put out, the better your chances of locating termites. Installing more stations increases the odds of detecting multiple colonies, or weakly associated "satellite groups" of the same colony – any of which could be of imminent risk to the structure. Planning, patience and persistence are requisites for successfully using below-ground baits. Regardless of which product is used, client expectations must be tempered to accept the possibility of a lengthy baiting process.

One additional consideration with below-ground baiting involves ants, which occasionally invade stations and prey upon the termites. In such cases, termites often abandon the station, thus negating its potential. Where ants are a continual problem, it may be necessary to control them using ant baits or other methods.

Above-ground installation. Termite baits are also being installed above ground, in confirmed areas of termite activity. Typically, the stations are installed directly in the path of active tunnels after the mud tubes have been broken. Effects tend to be more rapid with above-ground baiting, since the procedure does not depend upon "chance" encounters with the stations.

It's too soon to know whether structural infestations can routinely be "eliminated" with these baits alone. Manufacturers generally maintain that they are to be used in conjunction with other forms of treatment, such as in-ground baiting systems or conventional termiticides. Nonetheless, above-ground baits provide an excellent opportunity for introducing slow-acting toxicants directly into structural infestations. They are especially useful where pavement or other obstructions limit opportunities for below-ground installation. Above-ground baits have great potential in callback situations, and give the PCO something substantially different to try on retreats. There's much to be said for having another treatment option that buys you a little more time with an angry customer.

Figure 2. Deformed termites displaying the effects of hexaflumuron. Several thousand of these dead and dying termites were discovered inside the basement of a home in Lexington, Ky., two months after being baited *on the outside* with Sentricon. (Photo by Tom Myers)

THE PRODUCTS. Several companies are developing termite baits. A small number are already being marketed, and many more are in various stages of development. All three categories of slow-acting agents (IGRs, metabolic inhibitors and microbial pathogens) are represented. As with other types of pesticides, some baits will perform better than others. The disparity in performance may prove to be greater than with other product categories, such as conventional liquid termiticides, or baits used in cockroach control.

Sentricon™System. On March 2, 1994, DowElanco (Indianapolis, Ind.) received EPA registration for hexaflumuron, the active ingredient in Recruit™ Termite Bait. Hexaflumuron is a slow-acting insect growth regulator which disrupts the molting process in termites (11). Termites, much like other insects, need to form a new outer body covering (exoskeleton) each time they molt. A key component of the exoskeleton is a material called *chitin.* When ingested, hexaflumuron disrupts the normal formation of chitin, causing the termite to die while attempting to molt. (Thus, hexaflumuron is often called a "chitin synthesis inhibitor.") Unlike most insects, termites continue to molt throughout their lives. Due to the time interval between molts, death occurs about one to two months after hexaflumuron bait is ingested (15). Since the effects of hexaflumuron are significantly delayed, the rest of the termite population does not learn to avoid the bait (Figure 2).

The technology developed for commercial use of hexaflumuron is called the Sentricon Colony Elimination System. Termite control with the Sentricon system is a three-step process involving (1) initial monitoring/detection of termite activity, (2) delivery of the bait-toxicant, and (3) subsequent monitoring to provide ongoing protection.

1) Monitoring. Termites are detected by installing plastic monitoring stations around the perimeter of the building. The station housing is a hollow green plastic cylinder, about 10 inches long by 2 inches wide, with slits along the sides for termites to enter. Initially, each station is provisioned with two untreated pieces of wood, intended as monitoring devices for the presence of termites in the area.

The station is inserted into an augured hole in the ground, with the cover flush with the soil surface. Monitoring stations are installed around the outside perimeter of the building, at about 10- to 20-foot intervals alongside the foundation. Narrower intervals, while more effort to install and inspect, increase the odds that termites will encounter them during random foraging. Stations are typically installed about 12 to 18 inches from the foundation, to avoid soil which may have received an earlier barrier treatment with a liquid termiticide. Patios, driveways, and other paved areas are not a serious problem unless soil access is prevented around the majority of the structure. Oftentimes, stations can be installed farther out from the foundation, or in adjoining planter boxes. In extreme situations, concrete cutters have been used to install stations directly beneath pavement (3).

As a supplement to perimeter installations, stations may be installed in suspected termite foraging areas, such as adjacent to pre-existing damage, stumps, woodpiles or moist areas on the customer's property. Periodically thereafter (monthly, bimonthly, etc.) the wood monitoring devices within each Sentricon station are inspected for termite presence.

DowElanco has made recent improvements to their wood monitoring device. The new wood pieces are more palatable to termites, resulting in more hits, greater recruitment of nestmates, and less abandonment of stations ("hit and runs") between inspections (10).

2) Bait Delivery. When termites are found in a monitoring device, the untreated wood is replaced with a perforated plastic tube containing the bait-toxicant. To hasten the overall process, termites feeding on the wood pieces are carefully dislodged and placed in the top of the Baitube. Eventually, these termites tunnel through and out of the perforated tube, reuniting with their nestmates in the soil. In doing so, they leave

behind colony-specific odors (pheromones) that promote recruitment of other nestmates to the bait. Research studies indicated a two-fold increase in bait consumption when this "self-recruiting" procedure was used (13). In order to promote additional "hits," a pair of *auxiliary* monitoring stations (provisioned with wood pieces) are installed adjacent to stations receiving Baitubes.

Recent enhancements have likewise been made to the Baitube. The original bait formula contained "wood flour" impregnated with 0.1% hexaflumuron (Recruit). Baitubes are now filled with white "paper toweling" containing 0.5% hexaflumuron. This new, more concentrated formulation (Recruit II) has proven far more palatable to termites. Entire tubes may be emptied within a few weeks, resulting in more rapid dissemination of hexaflumuron within the colony.

Inspection of all Sentricon stations – with and without substituted bait tubes – continues until no more activity is noted. Empty, moldy or degraded baits are replaced, and additional auxiliary stations added as deemed necessary.

3) Continued Monitoring. After termites are no longer found in installed Baitubes, the tubes are once again replaced with untreated wood pieces and monitoring continues. Even if a colony has been eliminated, termites from neighboring colonies can reinvade a baited area. Reinfestation can also occur if only part of the original colony (or colonies) was eliminated. Consequently, structures protected with termite baits will need to be continually monitored by qualified service personnel to guard against re-invasion from new colonies or previously suppressed ones (13,19) (Figure 3).

Periodic inspections have always been necessary with conventional treatments. With baits, ongoing monitoring is even more critical because no residual pesticide is left in place when baiting is discontinued. Depending upon conditions, DowElanco recommends subsequent monitoring at three- to four-month intervals after the termite population is deemed to have been eliminated. A portable computer and bar code scanner (Prolinx™ Information System) is used to input data at the job site and track overall treatment performance.

Does Sentricon Really Work? Several independent research studies have now confirmed the effectiveness of Sentricon against subterranean termites. In field tests in southern Florida, six different infestations of eastern and Formosan subterranean termites (0.17 to 2.8 million foraging termites per colony) were eliminated (12,13). All but one of these trials involved structural infestations. Two additional *R. flavipes* and *C. formosanus* colonies (1.0 to 3.9 million termites) were also eliminated in Tampa, Fla., using the Sentricon System (19). In the above-mentioned trials, presumed colony elimination required two to nine months after the first Baitubes were installed.

Similar success with Sentricon was noted by researchers in Georgia (7,9). Four different *Reticulitermes* colonies (averaging 43,000 termites per colony) showed no further signs of activity after baiting. Three of the colonies, baited in June and July, became inactive within three months. The fourth colony, initially baited in September, remained active until the following April.

In Alabama, Mississippi and South Carolina, six different colonies (four – *R. flavipes*, one – *R. virginicus*, one – *C. formosanus*) were baited and eliminated with hexaflumuron (5). Time required for elimination ranged from two months to one year. As was the case in Georgia, colonies baited late in the year continued to be active through the following spring. Presumably, the delayed effect was due to reduced feeding and metabolic activity by termites during the fall and winter months (7).

The Sentricon System has also provided effective control of Formosan termite populations around buildings in Hawaii (8). At three different field sites (a condominium, single-family home and commercial building) termite populations estimated at 0.33, 0.94 and 5.4 million termites, respectively, were eliminated from the vicinity of each structure. No subsequent termite activity has been detected at the locations for 10 to 24 months.

In all of the aforementioned research studies, mark-release-recapture methods were used to estimate the population size and foraging territories of baited colonies. Elimination of the termite population from the vicinity of the structure was (indirectly) confirmed by determining the amount of wood consumed by termites feeding at unbaited monitoring sites before, during and after treatment. Such unbaited sites serve as undisturbed "windows" into the below-ground workings of the colony, and are essential for demonstrating a "sphere of influence" from one's baiting efforts. In a number of instances, the researchers also reported an absence of post-treatment termite swarms, some involving structures with chronic retreatment histories.

All investigators, nonetheless, emphasized the importance of continued monitoring after termite populations were deemed to be eliminated. In some cases, suppressed populations rebounded and needed to be rebaited; in others, new colonies invaded from an adjacent area. Despite the occasional resurgences, the majority of research sites baited with hexaflumuron have remained termite-free for a period of years.

Encouraging results are also being reported by pest control firms that began using Sentricon a few years ago on a trial basis. During the spring/summer of 1995, 11 companies installed Sentricon on 22 chronically-infested houses in Kentucky. Eighteen of the 22 houses (82%) had no swarms or other evidence of structural infestation the following year (1996). Four of the houses continued to have swarms in 1996, despite being baited with as many as six Baitubes early the previous year (4). While the majority of homes had no subsequent year swarm, 15 (68%) continued to have termites feeding in outside monitors – reinforcing the importance of subsequent monitoring to guard against reinfestation. According to DowElanco, PCOs in Florida are also having positive experiences with Sentricon (20). Time will tell how these structures will fare in the future.

DowElanco has also applied for registration of an above-ground hexaflumuron-containing bait (Recruit AG). The stations are designed to be installed inside infested structures directly over active mud tubes. The company intends for Recruit AG to be used as a complement to below-ground baiting, and anticipates registration by mid-1997.

The Availability Issue. DowElanco has a great deal at stake with Sentricon. The technology is a radical departure from how termite control has been performed for generations. By being first on the market, all eyes are upon them as they navigate uncharted territory. To minimize problems and help ensure a successful launch, the company has opted for a "managed introduction" of Sentricon to the industry. The incremental roll-out includes extensive hands-on training of operators, and adherence to rigid quality assurance standards and authorization agreements. The result – a slow, selective product introduction – has alienated many pest control operators in the industry. Many companies that have not yet been chosen to participate feel annoyed and frustrated; some who are participating, are displeased with the marketing agreements they were required to sign to become

Figure 3. Continuous monitoring is essential to the success of any termite baiting program. (Photo by M.F. Potter)

authorized Sentricon operators. Given the current situation, it should come as no surprise that PCOs are anxious to have other baits to choose from.

FirstLine.™ On April 18, 1996, FMC Corp. (Princeton, N.J.) received federal registration for their FirstLine™ Termite Bait Station, intended for above-ground baiting of active termite tubes. The ready-to-use station consists of a semi-transparent plastic housing (4x4x1 inches) with open slots at the base. Contained within is corrugated cardboard treated with 100 ppm sulfluramid. Sulfluramid is a slow-acting, stomach poison that interferes with the insects' ability to derive energy from food. When ingested by termites, mortality occurs in about one to three weeks, depending on concentration and amount eaten.

Installation is accomplished by (1) removing the station from the protective bag; (2) moistening the bait by lightly misting with water; and (3) installing the station at the leading edge of a previously broken, active termite tube. Continuous mud tubes, such as those extending from floor to ceiling, can be broken at any convenient location, and the station installed to form a "bridge" between the two broken ends. FirstLine stations must be installed on flat surfaces, so that the base of the station meets the tube (Figure 4). Installation is completed by attaching the plastic housing to the surface (wood, masonry, etc.) using tamper-resistant screws. When the station is installed correctly, the termites will rebuild the tube into the station and feed on the sulfluramid-treated cardboard.

The label specifies that stations be inspected every two to four weeks until the bait is consumed or activity ceases. New stations may need to be substituted as baits are depleted, or adjustments made in positioning of previously installed stations. FirstLine bait stations may be installed on both the interior and exterior of structures. One station should be installed for each active mud tube, not to exceed four stations per single-family structure or apartment unit.

Does FirstLine Work? FirstLine has produced high termite mortality in laboratory tests. Researchers in Louisiana also obtained excellent results when sulfluramid-treated cardboard was installed in telecommunications manholes infested with Formosan termites in New Orleans (6). Termites feeding on the bait die within a few weeks, but cessation of activity may take one to four months depending upon site-specific conditions.

According to the manufacturer, FirstLine Bait Stations are "an additional tool to help PCOs control difficult infestations, and (are) designed to be used in conjunction with a traditional termiticide." The label states that stations "are used to control local infestations of termites in and around structures." No claims are made of colony elimination or suppression of termite populations in the soil.

Figure 4. Typical above-ground placement of a FirstLine Termite Bait Station. (Photo by M.F. Potter)

It is too soon to predict how useful this product will be in protecting structures from termites. In order to use FirstLine, there must be active termite tunnels accessible for baiting. Thus installation will not always be possible or convenient. Very little research has been published confirming efficacy under a variety of field conditions. Lacking such data, pest control operators will need to assess the performance of FirstLine themselves. Companies should keep careful, long-term records and share their experiences. Above-ground baits such as FirstLine certainly have great potential; we'll know a lot more about the capabilities and limitations of this product after the coming swarm season.

FirstLine GT. FMC Corporation also recently received registration for a sulfluramid-containing *below-ground* bait station, FirstLine GT. Emphasis will be on directed placement of baits in areas where termite activity is known or suspected. Label instructions specify that no more than 14 bait stations per site be installed in residential areas. There is no specific mention of whether FirstLine GT can be used as a stand-alone treatment, in lieu of conventional termiticides.

Despite the imminent availability of this product, there is still much to learn about its performance. The FirstLine GT label states that stations "must be placed in close proximity to actively foraging termites so that the bait may be located by termites and ingested." As noted earlier (see Pattern of Use section, Installation Below ground), there is little evidence to suggest that the technician in the field will be able to pinpoint where termites are foraging below ground. Moreover, installing only three to 14 bait stations per structure, *as currently specified on the label*, limits the chance of termites encountering the baits even more. (The same would be true of a low number of *cockroach* bait placements, installed with the intent of intercepting foraging cockroaches.) Unless more baits or unbaited monitors are installed, it will be hard to determine if other "satellite" groups of termites are in the vicinity of the structure. If the installer is lucky enough to insert his or her handful of baits into the ground *precisely* where termites are gaining entry, perhaps they will be successful in affording structural protection. At this point in time, there have been no published studies with FirstLine GT (or other baits) suggesting this is possible.

At press time, FMC Corporation announced they have developed a monitoring station containing untreated pieces of slotted wood, to be used in conjunction with FirstLine GT. Supplemental labeling recommends that at least two bait stations be installed within 6 inches of each infested monitor (23).

One advantage FirstLine baits can claim is availability. No lengthy training program or authorization agreements are required; if a PCO wants to try FirstLine, all it takes is a phone call to their distributor.

Subterfuge™ System. Another termite bait that will be marketed in 1997 contains hydramethylnon, the same active ingredient in Siege and Maxforce. The effects are similar to sulfluramid – termites succumb within a few weeks after ingesting a lethal dose. American Cyanamid (Princeton, N.J.) has combined their slow-acting toxicant with a food source that is reportedly "preferred by termites" (2). Laboratory and field experiments suggest that the proprietary formulation is more readily consumed by *Reticulitermes* spp. than are pine wood stakes and other cellulose materials. Increased consumption occurs only after the bait has been found by termites during their random foraging activities, i.e. termites do not "sense" the bait from remote locations in the soil.

According to Subterfuge use directions, the bait can be used alone or in combination with other forms of treatment to control subterranean termite infestations. It can also be used preventively, to monitor for presence of termite activity. Subterfuge termite baits are installed in the soil *initially*, in effect, by-passing the unbaited monitoring step employed with Sentricon. And unlike the other below-ground baits, Subterfuge bait is poured into its perforated bait cartridge after the SubStation™ has been installed below ground. (The bait is dispensed from a bulk plastic container.)

Does Subterfuge Work? On three homes in New England, researchers obtained long-term suppression of termite activity with experimental hydramethylnon baits, installed below and above ground (1, 21). The ability to control structural infestations with the *current* Subterfuge Bait System still needs to be confirmed over a range of conditions. Similar to the FirstLine baits, there is very little published research data indicating that Subterfuge termite bait

will perform as advertised.

When judging performance of any termite bait, it's important to remember that bait consumption is no guarantee of control – just because termites find it and eat it, doesn't mean the structural infestation has been eliminated (Figure 5). As the growing tide of termite baits hit the market, PCOs should ask to see performance data; preferably data generated and compiled by independent sources. Yet, considering the crisis situation with termite control in this country, PCOs cannot afford to wait for researchers to provide all the answers. By keeping careful records of successes and failures, companies will learn much from their own experiences.

OPERATIONAL CONSIDERATIONS. Termite baits can be used in many ways by pest management professionals. Products such as Sentricon are being aggressively marketed as comprehensive, stand-alone treatments for control of existing infestations. Such baits can also be sold as an "insurance policy" against the continual threat of termites for millions of homeowners not currently covered by conventional barrier treatment warranties. Other bait formulations (e.g. FirstLine) are more suited for spot-treatment of active tunnels, feeding galleries, and localized areas in the soil. These products will typically be used in combination with barrier treatments and other management methods.

Supplemental barrier treatment will also be needed whenever rapid results are desired, such as when responding to swarmer complaints or real estate transactions. Many property owners with an existing termite problem will not want to wait three to six months (sometimes longer) for baits to suppress or eliminate infestations. Where comprehensive baiting programs are used, liquid or foam applications may be made as spot treatments to infested areas, rather than to entire structures. The decision to perform a spot treatment in conjunction with baiting often varies from account to account, depending on the circumstances.

Figure 5. Don't assume a structural infestation has been eliminated simply because termites have eaten the bait. Diligent monitoring extending into the following year is often needed to confirm that the baited structure is indeed "termite free." (Photo by M.F. Potter)

Baits can be a "lifesaver" in chronic retreatment situations, where other methods have been unsuccessful. Difficult construction features – wells, cisterns, plenums, subslab heating ducts, drainage systems, inaccessible crawl spaces, rigid board insulation, stucco below grade, rubble foundations – can all be treated with baits. With baits, gaining access for treatment is seldom a problem since foraging termites are as likely to encounter below-ground installations around the foundation exterior as beneath the structure. There will be fewer dirty crawl suits when using termite baits, although thorough inspections will perhaps be even more important than they are now. In respect to contamination, baits are of negligible risk and can be used in the most sensitive situations.

Chemically-concerned customers will find them especially attractive, and so will clients who do not want their carpeting pulled back, floors drilled, stored items moved, and other disruptions inherent in conventional termite treatments.

As versatile as baits can be, they will not work by simply hammering a few into the ground and walking away. Success will require a thoughtful approach, diligent monitoring, and ongoing surveillance by a service professional in the field.

As noted earlier, the first hurdle in using below-ground baits is getting the termites to find them in the first place. Bait installers should be prepared to add, move, or modify baits and monitoring devices as needed. This will be especially important in areas where foraging activity is less intense. In general, termite bait crews will need to know less of how buildings are constructed but much more about termite biology and foraging behavior. (In other words, they'll have to spend more time "thinking" like a termite – just as they have learned, over the years, to "think" like a cockroach.) Manipulating termites without crushing them (e.g. for self-recruitment with Sentricon), baiting broken ends of mud tubes, and recording data on a hand-held computer are foreign concepts to workers with years of experience applying barrier treatments.

Finally, personnel must be trained to answer a multitude of challenging questions from homeowners, realtors, and regulators. Despite an expanding knowledge base, many of these questions are still without answers. PCT

Dr. Michael Potter is an urban extension entomologist at the University of Kentucky.

REFERENCES

1. Anonymous. 1995. Shots heard 'round the world: a revolutionary termite treatment. Pest Control Technology. 23(8):54-55,58,91-92.
2. Anonymous. 1996. Subterfuge™ Termite Bait System. American Cyanamid Company. Parsippany, N.J. 16 pp.
3. Benson, E.P., J.K. Mauldin, and E.S. Bordes. 1996. Evaluation of subterranean termite baiting strategies in urban locations with minimal soil access. Ann. meeting Entomol. Soc. Am. Louisville, Ky.
4. Davis, K.D., and M.F. Potter. 1996. Foraging dynamics and bait detection in subterranean termites, *Reticulitermes* spp.: A midwest perspective. Ann. meeting Entomol. Soc. Am. Louisville, Ky.
5. DeMark, J.J., E.P. Benson, P.A. Zungoli, and B.M. Kard. 1995. Down To Earth, 50(1):20-26.
6. Felix, J., and G. Henderson. 1995. Debugging New Orleans' phone lines. Pest Control Technology. 23(10):76,78,151.
7. Forschler, B.T., and J.C. Ryder, Jr. 1996. Subterranean termite, *Reticulitermes* spp., (Isoptera: Rhinotermitidae) colony response to baiting with hexaflumuron using a prototype commercial baiting system. J. Entomol. Science. 341(2):143-151.
8. Grace, J.K., C.H.M. Tome, T.G. Shelton, R.J. Oshiro, and J.R. Yates III. 1996. Baiting studies and considerations with *Coptotermes formosanus* (Isoptera: Rhinotermitidae) in Hawaii. Sociobiology 28 (3) 10 pp.
9. Kletch, S. 1996. Georgia termite research program blazes new trails. Pest Control. 64(5):64-66.
10. Robertson, A.S., and J.J. DeMark. 1996. Field evaluation of alternative monitoring devices and a new termite bait formulation for the Sentricon Colony Elimination System. Ann. meeting Entomol. Soc. Am. Louisville, Ky.
11. Robertson, S.S., and N.-Y. Su. 1995. Discovery of an effective slow-acting insect growth regulator for controlling subterranean termites. Down To Earth. 50(1), pp. 1-7.
12. Su, N.-Y. 1993. Baits. Pest Control Technology. 21(7):7,73,76,78,80,114.
13. _____. 1994. Field evaluation of a hexaflumuron bait for population suppression of subterranean termites. (Isoptera:Rhinotermitidae). J. Econ. Entomol. 87:389-97.
14. Su, N.-Y. and R.H. Scheffrahn. 1991. Laboratory evaluation of two slow-acting toxicants against Formosan and eastern subterranean termites (Isoptera: Rhinotermitidae). J. Econ. Entomol. 84:170-175.
15. _____ 1993. Laboratory evaluation of two chitin synthesis inhibitors, hexaflumuron and diflubenzuron, as bait toxicants against the Formosan subterranean termite (Isoptera: Rhinotermitidae). J. Econ. Entomol. 86: 1453-1457.
16. Su, N.-Y., R.H. Scheffrahn, and P.M. Ban. 1995. Effects of sulfluramid-treated bait blocks on field colonies of the Formosan subterranean termite (Isoptera:Rhinotermitidae). J. Econ. Entomol. 88: 1343-1348.
17. Su, N.-Y., M. Tamashiro, J.R. Yates, and M.I. Haverty. 1982. Effects of behavior on the evaluation of insecticides for prevention of or remedial control of the Formosan subterranean termite. J. Econ. Entomol. 75:188-193.
18. _____. 1984. Foraging behavior of the Formosan subterranean termite (Isoptera: Rhinotermitidae). Environ. Entomol. 13:1466-1470.
19. Su, N.-Y., E.M. Thoms, P.M. Ban, and R.H. Scheffrahn. 1995. Monitoring/bait station to detect and eliminate foraging populations of subterranean termites (Isoptera:Rhinotermitidae) near structures. J.Econ. Entomol. 88(4):932-936.
20. Thoms, E.S. 1996. Results of commercial field trials of the Sentricon Colony Elimination System in Florida. Ann. meeting Entomol. Soc. Am. Louisville, Ky.
21. Thorne, B.L., and J.F.A. Traniello. 1994. Termites: Detection and control through baiting. Pest Management. 13(9):10-13,16-18.
22. Traniello, J.F.A., and B.L. Thorne. 1994. Termite baits in theory and practice. Proc. of the Natl' Conf. on Urban Entomology. (W.H. Robinson ed.), Atlanta, Ga., pp. 28-40.
23. Tech Update (FMC Corp. 1996). Monitoring properties for termite population management. 2 pp.

Reprinted with permission of PCT *magazine, February 1997.*

MINUTES OF THE ASPCRO REGISTERED TECHNICIAN COMMITTEE MEETING

The registered technician committee of ASPCRO met in New Orleans on July 31 - August 1, 1997. Present were the following:

Jim Harron - Georgia - Co-Chair
Sandy Wells - Oklahoma
Bob Wulfhorst - Ohio
Todd Thompson - Louisiana
Mary Grodner - Louisiana Extension
Roger Borgelt - Texas - Co-Chair
Greg Baumann - NPCA
George Saxton - Indiana (for Dave Scott)
Bobby Simoneaux - Louisiana
Jim Criswell - Oklahoma State University

July 31, 1997

After opening comments by Mr. Borgelt and Mr. Harron and introductions by everyone present the Committee began its discussions.

The minutes of the last meeting were discussed. Motion to accept the minutes as submitted was made by Dr. Criswell, seconded by Mr. Saxton and passed by the committee.

The committee then reviewed the final draft of the training program prepared by NPCA. After receiving comments, Mr. Baumann indicated that changes to the document would be made very quickly and then the revised document would be sent to the committee.

The preamble, written by Mr. Borgelt, was then discussed and revised.

The committee then adjourned for the day.

August 1, 1997

The committee reviewed its obligations under the terms of the grant and the status of the budget.

Mr. Borgelt and Mr. Harron suggested that the development of the required "train the trainer" manual be patterned after the EPA document "Protect Yourself From Pesticides - Training Notebook". This suggestion was accepted by the committee.

After discussion the committee agreed on the following:

1. Mr. Harron will take the comments from the committee and develop the general question and answer section.
2. Mr. Wulfhorst indicated that he has had discussions with Mr. Gene White concerning the development of general training guidelines. He will contact him to see if he will

prepare these guidelines for the committee. Also to be included in this section will be addresses for the SLA for each state and a list of state associations.

3. Mr. Borgelt will prepare a section addressing the training objectives and review questions and answers. The questions will be based on some of the work already prepared by NPCA.
4. All drafts will be sent out to the members by August 15, 1997, and any comments will be returned by August 21, 1997.
5. Mr. Borgelt and Mr. Harron will present this information to the ASPCRO Board of Directors on August 24, 1997. A full presentation to the ASPCRO members will be made during the meeting.

The committee then discussed individuals that might conduct the training sessions in 1998. The following suggestions were made:

1. Jim Criswell
2. Brian Forschler
3. Gene White
4. Fred Whitford
5. Joann Kick-Rack
6. Jack Root
7. Mike Potter

It was suggested that more than one individual may be employed to conduct these training sessions. The following 1998 meetings were suggested as possible locations to conduct the training:

1. NPCA
2. PCT Dialogue
3. Purdue
4. Texas PCA
5. Georgia PCA
6. Long Island PCA
7. Florida PCA
8. North West PCA

The committee decided to meet again on the afternoon of August 25, 1997 at the ASPCRO meeting. At that time a full meeting will be scheduled for later in the fall. During that time the committee will begin work on development of model regulations.

The meeting was then adjourned.

STRUCTURAL PEST CONTROL BOARD

1106 Clayton Lane Suite 100 LW
Austin, Texas 78723
Telephone: (512) 451-7200
FAX: (512) 451-9400

Benny M. Mathis, Jr.
Executive Director

March 26, 1997

Dr. John Impson
NPL Pesticide Application Training
USDA-CSREES/Plant Protection
AG Box 2220
Washington, D.C. 20250-2220

Dear Dr. Impson:

This letter is a follow-up to conversations you had with Jim Wright and Carl Falco of our association during the spring AAPCO meeting. As you may recall, ASPCRO is desirous of amending the grant we have through the Agricultural Research Institute.

We would like to expand our original effort to include the development of a national classroom training effort to do hands on training of technicians. We would also include development of testing materials to measure competency based on the training.

As you remember, our original grant was to develop the actual training materials to use for a model technician training program. We have learned that this effort, based on our outline, has essentially already been completed by a private entity (the National Pest Control Association). We therefore feel that our efforts would be better directed at expanding, not duplicating, that effort. The NPCA has given us authority to review and edit their text for completeness and correctness and we are comfortable with that authority. We do understand that the final NPCA product will be copyrighted material.

I have attached the grant amendment proposed by ASPCRO. It amends the project as described above, but does not change funding or timelines in any way. Please let me know at your earliest convenience if this is acceptable and what more needs to be done.

Sincerely,

Roger B. Borgelt
Co-Chair
ASPCRO Technician Training
Committee

RBB:sr

c: Benny Mathis, ASPCRO President
Carl Falco, Vice-President
Jim Wright
George Saxton
Jim Herron

MODEL PLAN FOR TRAINING QUALIFICATIONS FOR TECHNICIANS

GOAL

To develop a model plan for training of non-certified applicators of pesticides in the structural area which may be used as guidance for states interested in developing training programs for these individuals. Further, to develop and produce training sessions to be used to train technicians nationally and to develop testing measures which will measure the effectiveness of the training. The model plan thus developed will enhance in the implementation of the Worker Protection Standards for the structural pest control industry.

OBJECTIVES

1. Survey the existing training/testing programs which exist in the States and examine the types of training and/or testing being developed to ensure compliance with federal and state pesticide laws.

2. To qualify technicians and non-certified applicators by developing training and testing procedural guidelines and implementation and consistency nationwide. These guidelines will be developed by a working committee of Association of Structural Pest Control Regulatory Officials (ASPCRO) members and a member of American Association of Pesticide Safety Educators (AASPE) along with the federal and state representatives who have expertise in these areas. Technical writing and assistance will be needed to provide the finished product.

3. To ensure that employees will be informed about exposure to pesticides, the plan will include pesticide safety training for workers and handlers, access to labeling information for handlers of pesticides, and ensure specific information is readily available by emphasizing that a centrally located application list of pesticide treatments are available on the establishment.

4. After compiling the results of committee responses and guidelines, a plan will be devised for training these non-certified applicators which would be usable for commercial service technicians and non-commercial/janitorial type applicators of restricted and general-use pesticides. The final plan may be used by all states and will cover pertinent aspects of federal law such as:

1. federal/state interface
2. certification requirements
3. pesticide toxicity
4. pesticide registration
5. safety/worker protection
6. personal protective equipment
7. integrated pest management

8. pesticide labeling
9. reduced use/risk
10. pesticide mixing procedures
11. storage and disposal
12. recordkeeping

5. Using written training materials developed based on the final plan, we will develop a national program to do hands on training of technicians. This will include a demonstration training project.

6. Establish written testing criteria based on the training to be implemented. The testing will be designed to measure increases in competency based on the training.

LONG-TERM BENEFITS

The goal of providing model guidance in this area is an important part of the mission of ASPCRO. The enhancement of the level of expertise of technicians provides a major benefit to the public that would largely be absent without these programs. We view this as an opportunity for the states and EPA to meet the expectations of the public with regard to the regulation of the services they receive. A program of this type supports adequate training for persons making pesticide applications in the areas frequented by the vast majority of the American population. Adequate training will further the goal of reduced risk in pesticide applications and compliance assistance.

An additional benefit will be to provide consistency among the states, and encourage those states without standards to develop them. These training guidelines for non-certified individuals will help to protect the health and welfare of the citizens of the United States, protect the environment against the misuse of pesticides, and promote a more professional standard for the structural pest control industry.

NEEDS

ASPCRO is requesting $50,000 in federal funds to research the existing programs and develop the model training program and testing materials. The funding will be used to fund the expenses of the working committee, technical assistance and writing and administrative support. The funding will also pay for materials and travel which may be necessary to communicate with other ASPCRO officials and collect/disseminate information and assemble the final product. ASPCRO request authority to transfer such amounts as necessary, not to exceed 35%, between class categories except $25,000 budgeted for travel which shall not be exceeded without prior approval from the United States Environmental Protection Agency. This request is being made since it is difficult to estimate the exact costs between salaries, travel and materials.

FINAL PRODUCT

The final report will include the model training program, testing materials (hard copy and disk-format) and a complete copy of all results compiled by ASPCRO including a full report of trainings conducted. This model plan will enhance training programs for all states to use in order to improve the training capabilities of technicians and non-certified applicators. It will also enable ASPCRO to work hand in hand with the U.S. Environmental Protection Agency in the development of proposed guidelines and/or regulations. The final product would provide consistency in state regulations dealing with technicians and non-certified applicators who apply pesticides.

Association of
Structural
Pest
Control
Regulatory
Officials

March 26, 1997

Mr. David Scott
Department of Biochemistry
Purdue University
1154 Biochemistry Bldg.
West Lafayette, Indiana 47097

Dear Technician Training Committee Member:

The purpose of this letter is to thank you for your service to the ASPCRO Technician Training Committee and to inform you that due to actions taken by ASPCRO at its March Board of Directors Meeting, we are amending our grant with USDA and have charged and formed a new Committee.

It will now clearly focus on developing a national training and testing program for technicians, based on existing training materials which were developed based on the committee outline. Due to the change in the nature of the task to be accomplished, we have appointed a new committee to tackle the issues. The new committee, the ASPCRO Model Technician Training & Testing Program Committee will meet April 30 and May 1, 1997 in Atlanta, and will still be co-chaired by Roger Borgelt and Jim Herron.

Please let me know if you have any questions.

Sincerely,

Benny M. Mathis
President, ASPCRO

c: Carl Falco
Jim Wright
George Saxton
Roger Borgelt
Jim ~~Herron~~
HARRON

Association of Structural Pest Control Regulatory Officials

March 26, 1997

Dr. John Impson
NPL Pesticide Application Training
USDA-CSREES/Plant Protection
AG Box 2220
Washington, DC 20250-2220

Dear Dr. Impson:

You have been appointed to the newly formed ASPCRO Technician Training and Testing Program Committee. The purpose of this committee is to create and produce training sessions for technicians which can be used nationally, and to develop a testing procedure which will verify the effectiveness of the training.

The committee has been formed and charged based on an amendment to our EPA grant. We will be using a training text which was developed privately based on our ASPCRO outline. The Board felt that further ASPCRO effort would be better directed at expanding upon, rather than duplicating that product. The committee will still have the initial task of reviewing and editing the text before moving on to the expanded program. I truly appreciate your willingness to serve.

Please let me know of any questions you may have.

Sincerely,

Benny M. Mathis
President, ASPCRO

c: Carl Falco
George Saxton
Jim Wright
Roger Borgelt
Jim Herron

Association of
Structural
Pest
Control
Regulatory
Officials

April 9, 1997

Dr. John Impson
NPL Pesticide Application Training
USDA-CSREES/Plant Protection
AG Box 2220
Washington, DC 20250-2220

Dear Dr. Impson:

Enclosed is a revision of the grant language which I believe addresses your questions and suggestions.

Please let me know if you have any additional concerns.

Sincerely,

Roger B. Borgelt
Co-Chair, ASCPRO
Technician Training Committee

RBB:sr

Enclosure

c: Benny Mathis, ASPCRO President
Carl Falco, President Elect
Jim Wright, Past President
George Saxton, Treasurer
Jim Herron, Co-Chair

MODEL PLAN FOR TRAINING QUALIFICATIONS FOR TECHNICIANS

GOAL

To develop a model plan for training of non-certified applicators of pesticides in the structural area which may be used as guidance for states interested in developing training programs for these individuals. Further, to develop and produce train-the-trainer type training sessions to be used to train technicians nationally and to develop pre and post tests which will measure the effectiveness of the training. The meetings will be conducted by ASPCRO using grant funds. The model plan thus developed will enhance in the implementation of the Worker Protection Standards for the structural pest control industry.

OBJECTIVES

1. Survey the existing training/testing programs which exist in the States and examine the types of training and/or testing being developed to ensure compliance with federal and state pesticide laws.

2. To qualify technicians and non-certified applicators by developing training and testing procedural guidelines and implementation and consistency nationwide. These guidelines will be developed by a working committee of Association of Structural Pest Control Regulatory Officials (ASPCRO) members and a member of American Association of Pesticide Safety Educators (AASPE) along with the federal and state representatives who have expertise in these areas. Technical writing and assistance will be needed to provide the finished product.

3. To ensure that employees will be informed about exposure to pesticides, the plan will include pesticide safety training for workers and handlers, access to labeling information for handlers of pesticides, and ensure specific information is readily available by emphasizing that a centrally located application list of pesticide treatments are available on the establishment.

4. After compiling the results of committee responses and guidelines, a plan will be devised for training these non-certified applicators which would be usable for commercial service technicians and non-commercial/janitorial type applicators of restricted and general-use pesticides. The final plan may be used by all states and will cover pertinent aspects of federal law such as:

   1. federal/state interface
   2. certification requirements
   3. pesticide toxicity
   4. pesticide registration
   5. safety/worker protection
   6. personal protective equipment
   7. integrated pest management

8. pesticide labeling
9. reduced use/risk
10. pesticide mixing procedures
11. storage and disposal
12. recordkeeping

5. Using written training materials developed based on the final plan, we will develop a national program to do hands on training of technicians. This will include a demonstration training project.

6. Establish written testing criteria based on the training to be implemented. The testing will be designed to measure increases in competency based on the training.

LONG-TERM BENEFITS

The goal of providing model guidance in this area is an important part of the mission of ASPCRO. The enhancement of the level of expertise of technicians provides a major benefit to the public that would largely be absent without these programs. We view this as an opportunity for the states and EPA to meet the expectations of the public with regard to the regulation of the services they receive. A program of this type supports adequate training for persons making pesticide applications in the areas frequented by the vast majority of the American population. Adequate training will further the goal of reduced risk in pesticide applications and compliance assistance.

An additional benefit will be to provide consistency among the states, and encourage those states without standards to develop them. These training guidelines for non-certified individuals will help to protect the health and welfare of the citizens of the United States, protect the environment against the misuse of pesticides, and promote a more professional standard for the structural pest control industry.

NEEDS

ASPCRO is requesting $50,000 in federal funds to research the existing programs and develop the model training program and testing materials. The funding will be used to fund the expenses of the working committee, technical assistance and writing and administrative support. The funding will also pay for materials and travel which may be necessary to communicate with other ASPCRO officials and collect/disseminate information and assemble the final product. ASPCRO request authority to transfer such amounts as necessary, not to exceed 35%, between class categories except $25,000 budgeted for travel which shall not be exceeded without prior approval from the United States Environmental Protection Agency. This request is being made since it is difficult to estimate the exact costs between salaries, travel and materials.

FINAL PRODUCT

The final report will include the model training program, pre-and post-test testing materials (hard copy and disk-format) and a complete copy of all results compiled by ASPCRO including a full report of trainings conducted. This will include a fully developed train-the-trainer curriculum with step-by-step procedures on how to train technicians properly and effectively before they begin providing service. Also included will be suggested texts to use for training and model rules for implementation. We envision the final product as containing all the material necessary for business, extension or other persons to conduct their own technician training. This model plan will enhance training programs for all states to use in order to improve the training capabilities of technicians and non-certified applicators. It will also enable ASPCRO to work hand in hand with the U.S. Environmental Protection Agency in the development of proposed guidelines and/or regulations. The final product would be provided to the states free of charge to provide consistency in state regulations dealing with technicians and non-certified applicators who apply pesticides. We envision providing sufficient train-the-trainer sessions to address all geographic areas of the country one time with our initial training.

April 4, 1997

TO: Roger Borgelt
fax # 512: 451-9400

FROM: John W. Impson

REF: Grant amendment

Roger,

Following are suggested changes and questions concerning the amended grant language:

GOAL: Suggest in line 4, changes words *testing measures* which follow *develop* to *pre and post tests*

OBJECTIVES: note addition of # 5 - approved
note addition of # 6 - approved

FINAL PRODUCT: in Line 1, add words *pre and post test* just before *testing*

Questions: in **GOAL**: what do you mean by developing and producing training sessions?
> implication here is you will hold ? meetings, nationwide ?
> who pays?, out of grant?

in **FINAL PRODUCT**: implied is one report. Is report same as plan?
> will plan or report be provided to states?
> free of charge?
> what is relationship now with NPCA?
> To put it more succintly, what product, based on this grant, will you be able to provide to the states, for educational purposes, free of charge?

Roger,
could you get back to me soon, I'm on a fast track travel schedule until your committee meeting in Atlanta, this needs to be finalized before then.

thanks,

MEMORANDUM

DATE: August 14, 1997

TO: ASPCRO Service Technician Committee

FROM: Roger B. Borgelt RBB

RE: Drafts-Preamble and Sections 3-Objectives and Review Questions
Nashville Committee Meeting

Please review the draft sections which follow. I need your comments, if any, no later than close of business, Thursday, August 21, 1997. Also, we will meet briefly for lunch at 12:15 (or close of business) on Tucsday, August 26th in Nashville to review the Draft Train-the-Trainer Document. The committee will have a full meeting on October 20 and 21st in Minneapolis, Minnesota. Details to follow.

Thank you

RBB:sr

Attachments

ASPCRO
STRUCTURAL PEST CONTROL SERVICE TECHNICIAN
TRAIN-THE-TRAINER GUIDE

PREAMBLE

(ASPCRO)

The Association of Structural Pest Control Regulatory Officials has developed a minimum recommended curriculum for the purpose of training structural pest control service technicians and maintenance applicators performing structural pest control.

This project has been funded by EPA in cooperation with USDA and is intended primarily for the benefit of those states without training requirements and/or regulations regarding the services provided by these individuals. ASPCRO has developed this train-the-trainer guide for use by the pest control business owner or facility manager. It includes pre- and post-tests for the individuals who are trained.

will they know what this is?

We have received input from state regulatory officials, the pest control industry and the extension community in the development of these materials. We intend for it to be easily adaptable to meet specific state and company needs. ASPCRO has developed this material for use in the actual training and has included a comprehensive set of acceptable training references. We envision these materials will assist the trainer in determining what to teach, how much of it to teach and how to teach it.

• Should preamble state what ASPCRO is?

THE ASPCRO STRUCTURAL PEST CONTROL TECHNICIAN TRAIN-THE-TRAINER GUIDE

TRAINING OBJECTIVES AND REVIEW QUESTIONS-SECTION 3

Introduction

This section provides you with the training objectives and review questions for the ASPCRO Structural Pest Control Technician Train-the-Trainer Guide.

The statement of training objectives is information for both you and your employees. Going over the objectives of each section before you begin the section should focus the employees attention on the purpose of the information that you provide to them. The sequence of material presented is not mandatory, but all material should be covered.

The suggested review questions are for your use to reinforce the material that you presented. Getting correct answers from the employees indicates that you have achieved the objectives of the section.

SECTION I-INTRODUCTION, THE LABEL AND SAFETY

Objectives

After this section, service technicians should be able to-

1. Identify the basic elements of a pesticide label
2. Know proper use of personal protective equipment and how to identify symptoms of pesticide poisoning.
3. Know basic emergency requirements related to transportation of pesticides.
4. Identify what to do when a spill occurs.
5. Be familiar with basic concepts of pesticide formulation.
6. Be aware of pesticide risks with respect to children and pets, food areas and off target applications.

Review Questions

1. Q. A pesticide is any chemical used to control pests.

   A. True

2. Q. Insecticides come in many different forms called formulations.

   A. True

3. Q. Shipment of hazardous materials is regulated by what agency?

   A. Department of Transportation (DOT)

4. Q. The statement "It is a violation of federal law to use this product in a manner inconsistent with its labeling" can be found in what part of the label?

   A. Directions for use.

5. Q. The most serious risk of poisoning occurs when handling what kinds of pesticides?

   A. Concentrated pesticides

6. List five precautions a technician should take when applying pesticides.

   A. Read the label-the label is the law.
   Keep the pesticides in proper labeled containers
   Never smoke, eat or drink while handling pesticides
   Avoid inhaling spray or dust, and war protective clothing, goggles or respirators if required by the label, as well as whenever you feel it might be necessary
   Avoid getting sprays or dusts on skin or clothing. If accidental spills occur, remove clothing separately and thoroughly before wearing again
   Wash hands and face with soap and water immediately after handling pesticides. Bath and put on clean clothes at the end of each workday.
   If symptoms of illness occur during or shortly after using pesticides, call your supervisor or physician immediately.

SECTION II-RESIDENTIAL PEST MANAGEMENT

Objectives

After this section, service technicians should be able to-

1. Identify general pests-including cockroaches, ants, fleas, rodents and occasional invaders.

2. Know basic consumer rights-what to do when a customer says not to treat, how to handle complaints about service.

Review Questions

1. Before you can proceed with pest management treatments, you need to accurately identify the target pest(s).

   True False

2. What are the five (5) most common kinds of cockroaches found in urban areas in the United States? Please list your answers below. (see pg. 39)

   1. German Cockroach
   2. Brown Banded Cockroach
   3. American Cockroach
   4. Oriental Cockroach
   5. Smokey Brown Cockroach

3. Ants are social insects and live in colonies.

   True False

4. Please list three non-chemical measures for flea control.

   1. Thoroughly vacuuming daily
   2. Cleaning the kennel, pet bedding or pet box each week
   3. Lowering inside humidity
   4. Trapping and removing all feral (wild) animals from the structure

5. Please list seven of the nine signs of rodent infestation.

   1. Visual sightings
   2. droppings
   3. Sounds
   4. Rubbing or grease marks
   5. Tracks
   6. Gnawing
   7. Burrows
   8. Odor
   9. Runways

SECTION III-NON-RESIDENTIAL PEST MANAGEMENT

Objectives

After this section, service technicians should be able to-

1. Identify general pests-cockroaches, rodents, flies and stored product pests.
2. Know that there are special requirements for USDA facilities.

1. The most common means of fly entry into a structure is:

   a. **Through open doors**
   b. Through cracks in the walls
   c. Through ripped screens

2. Stored products can infest food from origin to final product including:

   a. Storage bins or granaries
   b. retail food stores
   c. home pantries and cupboards
   d. **all of the above**

3. Stored foods that are old are primary suspects for pest infestations.

   True False

4. Routing inspections, for most stored product pests, are best utilized with the help of pheromone traps.

   True False

5. What are five (5) things you or the client can do, to exclude rodents from a structure on a more permanent basis?

   1. Install metal shields on the bottom of doors to close the entry down to 1/4 inch.
   2. Fill holes in masonry walls or around utility pipes or lines with wire mesh and concrete
   3. Replace broken windows
   4. Put covers on drains and traps in sewer lines
   5. Close entry holes or cover wood with 26-gauge sheet steel or 1/4 inch hardware cloth or wire mesh.
   6. Cut down vines or trim back trees from the structure
   7. Place rat guards on utility wires
   8. Store all materials 18" of the ground
   9. Control weeds and grass

SECTION IV-WOOD DESTROYING ORGANISM MANAGEMENT

Objectives

After this section, service technicians should be able to-

1. Identify common wood destroying organisms, including-subterranean termites, powder post beetles, old house borers, wood destroying fungi, carpenter ants and carpenter bees
2. Be familiar with the concepts of treatment for the pests, including pre-and post-construction treatment, bait treatment and wood treatment
3. Know the basic environmental issues involved-treatment around wells and bodies of water, protection of ground water, pleniums and duct work
4. Have basic familiarity with construction concepts-including slab types, crawl spaces and veneers
5. Know something about other methods of treatment including borates, fumigation and mechanical removal

Review Questions

1. What are the three castes present in all termite colonies?

   1._____
   2._____

   Primary reproductives (King and Queen)
   Soldiers
   Workers

2. Name two castes used to commonly identify a termite species.

   1._____
   2._____

   Reproductive swarmers
   Soldiers

3. Drywood termites establish colonies in dry, sound wood with low levels of moisture, and do not require:

   a. Wood as food
   b. **Contact with the soil**
   c. Any moisture at all
   d. None of the above

4. Carpenter ants excavate wood for their colony, but do not ingest the wood as a food source.

True False

5. What are the five established strategies for termite control?

1._____
2._____
3._____
4._____
5._____

Mechanical Alterations
Soil Treatments
Foundation Treatments
Wood Treatments
Termite Baiting

SECTION V-INSPECTION

Objectives

After this section, service technicians should be able to-

1. Know the importance of a proper WDO inspection
2. Be familiar with conditions conducive to infestation
3. Know the basic state requirements for an inspection

Review Questions

1. Identification of Drywood termite damage is characterized by:

   a. Sandpaper smooth galleries in the wood
   b. Feeding across the grain of the wood
   c. Excavated chambers connected by small tunnels
   d. Dry, six sided fecal pellets found in the wood as well as in piles around infested wood
   e. **All of the above**

2. Wood heavily infested with powderpost beetles is riddled with holes and galleries packed with a dusty frass. Beetle frass is made of:

   a. **Wood that has passed through the digestive tract of beetle larvae**
   b. Soil brought into the wood by the beetle adults

c. Wood that has passed through the digestive tract of adult beetles
d. None of the above

3. Moisture problems in a structure and carpenter ants are usually not associated with one another.

True **False**

SECTION VI-SENSITIVE ACCOUNTS

Objectives

After this section, service technicians should be able to-

1. Know that there are special accounts that exist which may be sensitive and require special instruction from a supervisor

2. Be familiar with some of these accounts, such as day care centers, schools, health care facilities, and electronic equipment

Review Questions

1. A customer's impression of you and your company's work can be ruined by sloppy clean-up procedures after the job is done.

True False

2. Children may be more sensitive to pesticides, and so are more likely to become ill from improper application or excessive exposure than adults.

True False

3. What are seven guidelines to follow when applying pesticides in schools?

   1. Do not apply pesticides when school children are occupying a room or area
   2. Do not apply pesticides in classrooms, hallways, cafeterias and other common areas during school hours.
   3. Do not apply insecticide sprays or dusts in infirmaries, nursing stations, and other medical areas. If treatment is necessary, notify medical personnel in advance.
   4. Choose pesticide products that pose the least risk to people, particularly to children.
   5. Choose an insecticide application other than space application, general treatment, or spot applications.

6. Place rodenticides where children cannot get to them, or put rodenticides in tamper-resistant bait stations. Where possible, hide stations from view.
7. Follow notification and posting guidelines set by the school.

4. Please complete the following definitions:

Food handling Establishment-

Any facility other than a private residence where exposed food is held, processed, prepared or served.

Food Area-Any area for receiving, storing, packing, preparing, or serving food.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

OFFICE OF PREVENTION, PESTICIDES AND TOXIC SUBSTANCES

SEP 25 1997

Fax-On-Demand
Telephone: (202) 401-0527
Item: 6104

PESTICIDE REGISTRATION (PR) NOTICE 97-8

NOTICE TO MANUFACTURERS, PRODUCERS, FORMULATORS AND REGISTRANTS OF PESTICIDE PRODUCTS

ATTENTION: Persons Responsible for the Registration of Pesticide Products

SUBJECT: Time Extension of PR Notice 96-7 - Termiticide Labeling

On October 1, 1996, the Agency issued PR Notice 96-7 concerning certain labeling statements and product performance for soil treatment termiticide products. PR Notice 96-7 was intended to bring uniformity to termiticide labeling. That Notice stated EPA's position that registrants and supplemental distributors should not distribute or sell product bearing labeling inconsistent with the Notice after October 1, 1997.

It has been brought to the Agency's attention that many registrants have stocks of termiticide product which are ready for distribution, but which will not comply with the labeling requirements by October 1, 1997 as required in PR Notice 96-7. The Agency also has been informed that registrants which have obtained an EPA approval for revised labels still do not have adequate time to relabel their products by the October 1, 1997. Lastly, a few registrants have submitted labeling in response to PR Notice 96-7 and have not received an EPA approved label.

For these reasons, and to prevent the potential for inadequate supplies of termiticide products in commerce, EPA intends to grant a 90-day extension to permit the distribution or sale of products not bearing labeling consistent with PR Notice 96-7. The Agency is therefore extending the effective date to January 1, 1998 for all products distributed or sold by registrants and supplemental registrants to bear approved labeling which is consistent with PR Notice 96-7 and complies with the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). This notice does not change any of the other labeling provision or effective dates in PR Notice 96-7.

If you wish further information on this notice, you may contact Linda G. Arrington,

If you wish further information on this notice, you may contact Linda G. Arrington, Ombudsman, Registration Division, at 703-305-5446, or by E-mail at Arrington.Linda@epamail.epa.gov.

James J. Jones
Acting Director
Registration Division

COPY

Association of Structural Pest Control Regulatory Officials

September 16, 1997

Jonathon Dykehouse
Jicarilla Apache Indian Tribe
P.O. Box
Dulce NM 87528

Dear Mr. Dykhouse:

Enclosed you will find an invoice for the Association of Structural Pest Control Regulatory Officials (ASPCRO) 1997 membership dues, as you requested.

We are registered with the Internal Revenue Service as a non-profit organization. Our tax identification number (also indicated on the invoice) is 85-0414239. If any state requires that a vendor number be established for ASPCRO, please forward the necessary forms to me at your earliest convenience. I will complete and return them as soon as possible.

Please mark PERSONAL on the envelope and mail payments for 1997 dues to:

George N. Saxton, Sec/Treasurer
ASPCRO
c/o Office of Indiana State Chemist
1154 Biochemistry Bldg.
West Lafayette, In 47907-1154

If you have any questions, you may contact me at the above address or by phone at 765-494-1585 or FAX at 765-494-4331.

Sincerely,

George N. Saxton

George N. Saxton
Secretary-Treasurer

Enclosure

GNS/pjp

NOTE: If this letter is not directed to the appropriate contact person, please let me know. Also please inform me if you know of someone who wants to be added or deleted from the mailing list.

COPY

Sent
9-29-97

Association of Structural Pest Control Regulatory Officials

DATE: 9/26/97

TO: ASPCRO Termiticide
Label Review Committee:
David Scott
Bud Paulson
Jim Wright
Brad Kard

FROM: George Saxton

RE: FMC Corporation

Enclosed is an application for registration from FMC Corporation. Also enclosed is a workbook, reference manual and video tape.

→ George Saxton

FMC Corporation

APG Specialty Products
PO Box 8
Princeton New Jersey 08543
1-800-321-1362

September 22, 1997

FMC

George T. LaRocca (PM-13)
United States Environmental Protection Agency
Office of Pesticide Programs
Registration Division (H7505C)
Document Processing Desk (APPL)
Room 266A, Crystal Mall 2
1921 Jefferson Davis Highway
Arlington, VA 22202

Dear Mr. LaRocca:

Subject: Dragnet® STC Termiticide
EPA File Symbol 279-GRIN

Application for Pesticide Registration
Response to USEPA letter dated August 12, 1997

FMC has received the USEPA letter referenced above and by means of this letter and the attached information will describe FMC's exclusive "Systematic Termite Control" SM (STC) program.

Systematic Termite Control SM (STC) is the name given to a "system" designed to provide structural protection against subterranean termites. Structural protection means a structure free of termites. STC consists of a system of elements each of which contributes to the control of termites. The elements are:

INSPECTION - The initial and subsequent inspections allow the Pest Control Operator (PCO) to generate a written record of the status of the property from a termite infestation standpoint. It consists of a graph of the structure and immediate surroundings (within 25 feet of the structure). It is a record of conditions conducive to termite infestation and serves as a scorecard by which the PCO can judge progress or lack of progress in his termite control efforts. It also serves as a historical record. The inspection is a critical piece of STC and just which element(s) of STC are used to obtain/maintain control of the termite populations usually flows from what is found during the inspection. Physical changes at the property are also recorded in the inspection as trees become tree stumps and additions to properties are added through time.

MOISTURE MANAGEMENT - The management of moisture around a property is critical in that moisture is one of the few termite attractants that exist. Long term moisture becomes a long term termite attractant. Moving water away from a structure is

critical to the long term management of termites around the structure. Without water, termites cannot survive in structures very long. The inspection reveals moisture sources such as: downspouts, air conditioner drip lines, low areas, mulch beds and dripping faucets. The property owner is advised of such moisture issues and advised to correct the problem as a part of STC.

FOOD MANAGEMENT - Keeping termites from their food supply is another element in STC. This is done by preventing cellulose sources from being in contact with the soil. Using pressure treated wood also deprives termites of a food source. Where wood is in contact with soil, the PCO advises the property owner to correct the situation. Mulch around a property also serves as a food source as does tree stumps, woodpiles, and untreated posts and poles. Although not a food source, rigid foam insulation is also readily penetrated by termites that often leads to structural wood and attack.

TERMITICIDES - The use of termiticides is encouraged, specially if the structure has active termites in or around it. Complete treatment may be made but the more reasonable approach is to spot treat areas of the structure that have active termites or are of high risk of having termites. The use of Premise is discouraged because of its unpredictable movement in soil that may result in contamination of termite bait stations.

TERMITICIDE FOAM - The use of foams in structures is also encouraged where the benefits of foam will result in better coverage and control of the termites. This use is typically spot treatment by definition.

TERMITE BAIT - Termite baits and or monitor stations are often helpful in the control of termites in and around the structure. FirstLine™ Termite Baits may be attached to active termite mud tubes. The termites feed upon the treated cardboard bait matrix and later die. The FirstLine™ GT Termite Bait Station may also be installed in termite infested wood or soil where termites enter the station and consume the treated cardboard matrix and die. In areas that do not contain active termites, monitor stations containing untreated slotted wood may be installed. When a monitor is infested, a pair of GT bait stations are installed within a few inches of the infested monitor.

Termite baits/monitors are installed in clusters of 2 or more stations in areas conducive to termite attack. Conducive areas include the areas identified under MOISTURE and FOOD MANAGEMENT listed above.

SYSTEMATIC TERMITE CONTROL℠ seeks to customize a program containing two or more of the above elements that make sense to use in the control of subterranean termites. The flexibility to build a program customized to any given structure is important because there are often issues that mitigate how to approach termite control

on a given structure, such as: well/pond/stream location, moisture/food sources, construction problems, wishes/concerns of the property owner, cost and time factors.

With this in mind, please find enclosed the following documentation to support this application and to process this request:

- Application for Pesticide: Amendment (EPA form 8570-1)
- Reference Manual -- FMC Systemic Termite Control℠
- Video -- Systemic Termite Control℠ The most advanced home security system for termites
- Workbook -- FMC Systemic Termite Control℠
- Tech Update -- The PCO firm's guide to the use of FirstLine™ GT Termite Bait Stations

With this submission to the Agency, FMC is concurrently sending 4 (four) sets of the proposed draft labeling, reference manual, video, workbook and tech update to the ASPRCO Termiticide Label Review Committee for their comments.

FMC trusts that this information is sufficient for the Agency to process this registration request. If for any reason the Agency requires any additional information or if there are any questions concerning this matter, please call me at 609/951-3608 or 800/321-1362 or email at George_Meindl@fmc.com.

Sincerely,

George Meindl

George L. Meindl
Associate Registration Specialist
APG Specialty Products

cc: ASPRCO Termiticide Review
c/o George Saxton
Office of the Indiana State Chemist
Purdue University
1154 Biochemistry Building
West Lafayette, IN 47907-1154
attn: Jim Wright

S:winword\regulato\permethr\1803d.doc
DR 50-0

Please read instructions on reverse before completing form.

Form Approved. OMB No. 2070-0060. Approval expires 05-31-98

EPA

United States
Environmental Protection Agency
Washington, DC 20460

☐ Registration
☐ Amendment
☐ Other

OPP Identifier Number: 244486

Application for Pesticide - Section I

1. Company/Product Number: 279-GRIN

2. EPA Product Manager: G. LaRocca

3. Proposed Classification: ☒ None ☐ Restricted

4. Company/Product (Name): Dragnet STC Termiticide

PM#: 13

5. Name and Address of Applicant *(Include ZIP Code)*
FMC Corporation
1735 Market St
Philadelphia, PA 19103
☐ *Check if this is a new address*

6. **Expedited Review.** In accordance with FIFRA Section 3(c)(3)(b)(i), my product is similar or identical in composition and labeling to:
EPA Reg. No. 279-3062
Product Name Dragnet FT Termiticide/Insecticide

Section - II

☐ Amendment - Explain below.
☒ Resubmission in response to Agency letter dated 8/12/97
☐ Notification - Explain below.
☐ Final printed labels in response to Agency letter dated
☐ "Me Too" Application.
☐ Other - Explain below.

Explanation: Use additional page(s) if necessary. (For section I and Section II.)
Responding to Agency letter - explanation of "STC program" with concurrent submission to ASPRO termiticide label review committee.

Section - III

1. Material This Product Will Be Packaged In:

Child-Resistant Packaging	Unit Packaging	Water Soluble Packaging	2. Type of Container
☐ Yes* ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Metal ☐ Plastic ☐ Glass ☐ Paper ☐ Other (Specify)
* *Certification must be submitted*	If "Yes" Unit Packaging wgt. / No. per container	If "Yes" Package wgt / No. per container	

3. Location of Net Contents Information: ☐ Label ☐ Container

4. Size(s) Retail Container

5. Location of Label Directions: ☐ On Label ☐ On Labeling accompanying product

6. Manner in Which Label is Affixed to Product: ☐ Lithograph ☐ Paper glued ☐ Stenciled ☐ Other

Section - IV

1. Contact Point *(Complete items directly below for identification of individual to be contacted, if necessary, to process this application.)*

Name: George Meindl
Title: Associate Registration Specialist
Telephone No. (Include Area Code): 609-951-3608

Certification

I certify that the statements I have made on this form and all attachments thereto are true, accurate and complete. I acknowledge that any knowingly false or misleading statement may be punishable by fine or imprisonment or both under applicable law.

2. Signature: George Meindl
3. Title: Associate Registration Specialist
4. Typed Name: George Meindl
5. Date: 9/22/97

6. Date Application Received (Stamped)

Code 1803

Dragnet®

STC Termiticide

For use by individuals/firms licensed or registered by the State to apply termiticide products. States may have more restrictive requirements regarding qualifications of persons using this product. Consult the structural pest control regulatory agency of your State prior to use of this product.

EPA Reg. NO. 279- **EPA Est. 279-**

Active Ingredient:

*Permethrin**	36.8%
Inert Ingredients*:**	63.2%
	100.0%

*(3-Phenoxyphenyl) methyl (±) *cis-trans* 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate
**cis/trans* ratio: Max. 55% (±) *cis* and min. 45% (±) *trans*

*** Contains petroleum distillates.

Contains 3.2 pounds permethrin per gallon.

U.S. Patent No. 4,024,163

KEEP OUT OF REACH OF CHILDREN

CAUTION

See other panels for additional precautionary information.

FMC®

FMC Corporation
Agricultural Products Group
Philadelphia PA 19103

Net Contents

7/97 STC Dft. 6

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center. Do not induce vomiting as it may cause aspiration pneumonia. Do not give anything by mouth to an unconscious person. Avoid alcohol.

IF INHALED: Remove victim to fresh air. If not breathing give artificial respiration, preferably mouth to mouth. Get medical attention.

IF ON SKIN: Wash with plenty of soap and water. Get medical attention if irritation persists.

IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.

Note to Physician: This product contains aromatic hydrocarbons which can produce a severe pneumonitis if aspirated, consideration should be given to gastric lavage with an endotracheal tube in place. Treatment is controlled removal of exposure followed by symptomatic and supportive care.

For Emergency Assistance Call: (800) 331-3148.

PRECAUTIONARY STATEMENTS

Hazards to Humans (and Domestic Animals)

CAUTION

Harmful if swallowed, inhaled or absorbed through the skin. Avoid contact with skin, eyes or clothing. Avoid breathing dust (vapor or spray mist). Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

All pesticide handlers (mixers, loaders and applicators) must wear long-sleeved shirt and long pants, socks, shoes and chemical-resistant gloves. After the product is diluted in accordance with label directions for use, shirt, pants, socks, shoes and waterproof gloves are sufficient. In addition, all pesticide handlers must wear a respiratory protection device (air-purifying respirator with NIOSH approved TC-23C pesticide cartridges) when handling the concentrate or when working in a non-ventilated space or applying termiticide by rodding or sub-slab injection.

When treating adjacent to an existing structure, the applicator must check the area to be treated, and immediately adjacent areas of the structure, for visible and accessible cracks and holes to prevent any leaks or significant exposures to persons occupying the structure. People present or residing in the structure during application must be advised to remove their pets and themselves from the structure if they see any signs of leakage. After application, the applicator is required to check for leaks. All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy contaminated areas of the structure until the clean-up is completed.

Environmental Hazards

This product is highly toxic to bees exposed to direct treatment or residues on crops or weeds. Do not apply this product or allow it to drift to crops or weeds on which bees are actively foraging. Additional information may be obtained from your Cooperative Extension Service.

This product is extremely toxic to fish and aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters. Do not apply when weather conditions favor drift from treated areas.

Physical/Chemical Hazards

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Shake Well Before Using

STORAGE AND DISPOSAL

Pesticide Storage

If crystals form, warm to room temperature 70°F (21°C) by room heating only for 24-48 hours and shake occasionally until crystals dissolve and product appears uniform. Do not use external source of heat for warming container.

Do not use or store near heat, open flame or hot surfaces.

Keep out of reach of children and animals. Store in original containers only. Store in a cool, dry place and avoid excess heat. Carefully open containers. After partial use, replace lids and close tightly. Do not put concentrate or dilute material into food or drink containers. Do not contaminate other pesticides, fertilizers, water, food, or feed by storage or disposal.

In case of spill, avoid contact, isolate area and keep out animals and unprotected persons. Confine spills. Call FMC: (800) 331-3148.

To confine spill: If liquid, dike surrounding area or absorb with sand, cat litter, commercial clay or gel absorbents. If dry material, cover to prevent dispersal. Place damaged package in a holding container. Identify contents.

Pesticide Disposal
Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Disposal
Plastic Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Metal Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities. Do not cut or weld metal containers.

Returnable/Refillable Sealed Container: Do not rinse container. Do not empty remaining formulated product. Do not break seals. Return intact to point of purchase.

General Information on the Use of This Product

Dragnet® STC Termiticide is intended to be used in the FMC Systematic Termite Control™ (STC) program. This program must start with inspection, use FirstLine Termite Baits and contain any one or more of the following elements: moisture management recommendations, wood management recommendations, termiticides and termiticide foam. The PCO must follow all applicable state recommendations.

The cornerstone of the STC program starts with a thorough inspection of the structure and the identification of conditions conducive to termite attack, moisture and food control. The structure must be thoroughly inspected and graphed prior to the start of the program. The graph must identify the location of indoor critical areas known to be favored by termites such as but not limited to locations in the foundation penetrated by utility services, cracks and expansion joints, bath traps and areas where concrete has been poured adjacent to other concrete such as stairs, patios, slab additions, and areas with moisture problems. In addition, outside critical areas near the structure such as downspouts, water faucets, sunken window wells, poorly drained or constantly moist areas, fence posts, stumps, stucco, brick veneer, rigid foam insulation, rubble or stone foundations or any conditions conducive to termite infestation, mulched areas and air conditioner water drains within a twenty five foot radius of the structure should be mapped.

Dragnet® may be used at 0.5% as a spot, partial or complete treatment. If the treatment is used on an active infestation of termites, then the site needs to be reinspected within 8 weeks after the initial and subsequent treatments. A copy of the records must be maintained and indicate this information.

The property must be reinspected at least every 12 months and the graph of the property updated to reflect changes in conditions which may influence termite infestations.

Note on the inspection report what and where control measures are applied.

Choice of appropriate procedures should include consideration of such variable factors as the design of the structure, location of heating, ventilation, and air conditioning (HVAC) systems, water table, soil type, soil compaction, grade conditions, and location and type of domestic water supplies and utilities.

For advice concerning current control practices with relation to the specific local conditions, consult resources in structural pest control and state cooperative extension and regulatory agencies.

SUBTERRANEAN TERMITE CONTROL

The use of this product prevents and controls termite infestations in and around structures and constructions.

The dilute insecticidal emulsion must be adequately dispersed in the soil to establish a barrier between the wood and the termites in the soil. As a good practice: 1) all non-essential wood and cellulose containing materials should be removed from around foundation walls, crawl spaces and porches; 2) termite access to moisture should be eliminated by repairing faulty plumbing and/or construction grade. Soil around untreated structural wood in contact with soil should be treated as described below.

To establish an effective insecticidal barrier with this product the service technician must be familiar with current termite control practices such as: trenching, rodding, sub-slab injection, coarse fan spraying of soil surfaces, crack and crevice (void) injection, excavated soil treatment, and brush or spray applications to infested or susceptible wood. These techniques must be correctly employed to prevent or control infestations by subterranean termites such as: *Amitermes, Coptotermes, Heterotermes, Reticulitermes* and *Zootermopsis*. The biology and behavior of the species involved should be considered by the service technician in determining which control practices to use to eliminate or prevent the termite infestation.

Important: Contamination of public and private water supplies must be avoided by following these precautions: Use anti-backflow equipment or procedures to prevent siphonage of insecticide into water supplies. Do not contaminate cisterns or wells. Do not treat soil that is water saturated or frozen. Do not treat while precipitation is occurring. Permethrin the active ingredient in Dragnet®, is extremely toxic to fish and aquatic invertebrates. Care should be used when making applications near bodies of water. As part of FMC's stewardship program, refer to available support literature on well water, ponds and stream concerns. Locate sources of water discharge from structures, such as french drains and sump systems. Turn off discharge pumps until after application is complete. Observe for any change in color or odor of effluent discharge. Consult state and local specifications for recommended distances of wells from treated areas, or if such regulations do not exist, refer to Federal Housing Administration Specifications (H.U.D.) for guidance.

Note: Crawlspaces are to be considered inside of the structure.

Critical Areas: Critical areas include areas where the foundation is penetrated by utility services, cracks and expansion joints, bath traps and areas where cement constructions have been poured adjacent to the foundation such as stairs, patios, and slab additions.

Structures with Wells/Cisterns Inside Foundations

Structures that contain wells or cisterns within the foundation of a structure can only be treated using the following techniques:

1. Do not treat soil while it is beneath or within the foundation or along the exterior perimeter of a structure that contains a well or cistern. The treated backfill method must be used if soil is removed and treated outside/away from the foundation. The treated backfill technique is described as follows:
   a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.
   b. Treat the soil at the rate of 4 gallons of dilute emulsion per 10 linear feet per foot of depth of the trench, or 1 gallon per 1.0 cubic feet of soil. See "Mixing Directions section of the label. Mix thoroughly into the soil taking care to contain the liquid and prevent runoff or spillage.
   c. After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.
2. Treat infested and/or damaged wood in place using an injection technique such as described in the "Control of Wood Infesting Insects" section of this label

Structures with Adjacent Wells/Cisterns and/or Other Water Bodies

Applicators must inspect all structures with nearby water sources such as wells, cisterns, surface ponds, streams, and other bodies of water and evaluate, at a minimum, the treatment recommendations listed below prior to making an application

1. Prior to treatment, if feasible, expose the water pipe(s) coming from the well to the structure, if the pipe(s) enter the structure within 3 feet of grade.
2. Prior to treatment, applicators are advised to take precautions to limit the risk of applying the termiticide into subsurface drains that could empty into any bodies of water. These precautions include evaluating whether application of the termiticide to the top of the footer may result in contamination of the subsurface drain. Factors such as depth

to the drain system and soil type and degree of compaction should be taken into account in determining the depth of treatment.

3. When appropriate (i.e., on the water side of the structure), the treated backfill technique (described above) can also be used to minimize off-site movement of termiticide.

Prior to using this technique near wells or cisterns, consult state, local or federal agencies for information regarding approved treatment practices in your area.

Application Rate: Use a 0.5% emulsion for subterranean termites.

Mixing Directions: Mix the termiticide use dilution in the following manner: Fill tank 1/4 to 1/3 full. Start pump to begin by-pass agitation and place end of treating tool in tank to allow circulation through hose. Add appropriate amount of Dragnet® STC termiticide. Add remaining amount of water. Let pump run and allow recirculation through the hose for 2 to 3 minutes.

Dragnet® may also be mixed into full tanks of water, but requires substantial agitation to insure uniformity of the emulsion.

To prepare a 0.5% water emulsion, ready to use, dilute 1.25 gallons of Dragnet® with 94.75 gallons of water.

Mixing: For the desired application rate, use the chart below to determine the amount of Dragnet® for a given volume of finished emulsion:

Amount of Dragnet STC (Gallons except where noted)			
Emulsion Concentration	**Amount of Dragnet FT**	**Amount of Water**	**Desired Gallons of Finished Emulsion**
0.5%	1⅔ fl. oz.	7.9 pints	1
	6⅔ fl. oz.	31.6 pints	4
	8⅓ fl. oz.	39.5 pints	5
	16⅔ fl. oz.	9.9	10
	0.25	18.75	19
	0.5	37.5	38
	0.75	57.25	58
	1.25	94.75	96
	2.5	189.5	192
1.0%*	1⅔ fl. oz.	62⅓ fl. oz.	0.5
	3⅓ fl. oz.	7.8 pints	1
	6⅔ fl. oz.	15.6 pints	2
	16⅔ fl. oz.	4.9	5
	33⅓ fl. oz.	9.7	10
	0.5	18.5	19
	1	37	38
	1.5	56.5	58
	2.5	91	96
	5	187	192
2.0*	1⅔ fl. oz.	30⅓ fl. oz.	.25
	6⅔ fl. oz.	7.6 pints	1
	33⅓ fl. oz.	4.74	5
	66⅔ fl. oz.	9.5	10
	1	18	19
	2	36	38
	3	55	58
	5	91	96
	10	182	192

Common units of measure:
1 pint = 16 fluid ounces (oz.)
1 gallon = 4 quarts = 8 pints = 128 fluid ounces (oz.)
*Use these rates in conjunction with the application volume adjustments as listed in the section below or in the foam application section.

Post-Construction Subterranean Termite Treatment

Application Volume: To provide maximum control and protection against termite infestation apply the specified volume of the finished water emulsion and active ingredient as set forth in the directions for use section of this label. If soil will not accept the labeled application volume, the volume may be reduced provided there is a corresponding increase in concentration so that the amount of active ingredient applied to the soil remains the same.

Note: Large reductions of application volume reduce the ability to obtain a continuous barrier. Variance is allowed when volume and concentration are consistent with label directed rates and a continuous barrier can still be achieved.

Where desirable for post construction treatments, the volume of the 1.0% emulsion may be reduced by ⅓ the labeled volume or a 2.0% emulsion may be applied at ¼ the labeled volume (see Volume Adjustment Chart). Volume adjustments at 2.0% are not recommended for subslab injection. See Volume Adjustment Chart below.

Note: When volume is reduced, the hole spacing for subslab injection and soil rodding may require similar adjustment to account for lower volume dispersal of the termiticide in the soil.

Volume Adjustment Chart			
Rate (% emulsion)	**0.5%**	**1.0%**	**2.0%**
Volume allowed			
Horizontal (gallons emulsion/10ft²)	1.0 gallons	0.5 gallons	0.25 gallons*
Vertical (gallons emulsion/10 lin. ft.)	4.0 gallons	2.0 gallons	1.0 gallons*

*Not recommended for subslab injection.

After Treatment: All holes in commonly occupied areas into which Dragnet® has been applied must be plugged. Plugs must be of a non-cellulose material or covered by an impervious, non-cellulose material.

Use a 0.5% emulsion for post-construction treatment. Post-construction soil applications shall be made by injection, rodding, and/or trenching or coarse fan spray with pressures not exceeding 25 p.s.i. at the nozzle. Care should be taken to avoid soil wash-out around the footing.

Do not apply emulsion until location of wells, radiant heat pipes, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these elements.

Foundations: For applications made after the final grade is installed, the applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to the top of the footing. When the footing is more than four (4) feet below grade, the applicator must trench and rod into the trench or trench along the foundation walls at the rate prescribed to a minimum depth of four feet. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.

Slabs: Vertical barriers may be established by sub-slab injection within the structure and rodding and/or trenching outside at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. Special care must be taken to distribute the treatment evenly. Treatment should not extend below the bottom of the footing.

Treat along the outside of the foundation and where necessary beneath the slab on the inside of foundation walls. Treatment may also be required beneath the slab along both sides of interior footing-supported walls, one side of interior partitions and along all cracks and expansion joints. Horizontal barriers may be established where necessary by long-rodding or by grid pattern injection vertically through the slab.

a. Drill holes in the slab and/or foundation to allow for the application of a continuous insecticidal barrier.

b. For shallow foundations (1 foot or less) dig a narrow trench approximately 6 inches wide along the outside of the foundation walls. Do not dig below the bottom of the footing. The emulsion should be applied to the trench and soil at 4 gallons of emulsion per 10 linear feet per foot of depth as the soil is replaced in the trench.

c. For foundations deeper than 1 foot follow rate for basement.

d. Exposed soil and wood in bath traps may be treated with a 0.5% emulsion.

Basements: Where the footing is greater than 1 foot in depth from grade to the bottom of the foundation, application can be made by trenching and/or rodding at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. When the footing is more than four feet below grade, the applicator may trench and/or rod along foundation walls at the rate prescribed for four feet of depth. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. However, in no case should a structure be treated below the footing. Sub-slab injection may be necessary along the inside of foundation walls, along cracks and partition walls, around pipes, conduits, piers, and along both sides of interior footing-supported walls.

Accessible Crawl Spaces: For crawl spaces, apply vertical termiticide barriers at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to the top of the footing, or if the footing is more than 4 feet below grade, to a minimum depth of 4 feet. Apply by trenching and rodding into the trench, or trenching. Treat both sides of foundation and around all piers and pipes. Where physical obstructions such as concrete walkways adjacent to foundation elements prevent trenching, treatment may be made by rodding alone. When soil type and/or conditions make trenching prohibitive, rodding may be used. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. Read and follow the mixing and use direction section of the label if situations are encountered where the soil will not accept the full application volume

1. Rod holes and trenches must not extend below the bottom of the footing.

2. Rod holes must be spaced so as to achieve a continuous termiticide barrier but in no case more than 12 inches apart.

3. Trenches must be a minimum of 6 inches deep or to the bottom of the

footing, whichever is less, and need not be wider than 6 inches. When trenching in sloping (tiered) soil, the trench must be stepped to ensure adequate distribution and to prevent termiticide from running off. The emulsion must be mixed with the soil as it is replaced in the trench.

4. When treating plenums or crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

Inaccessible Crawl Spaces: For inaccessible interior areas, such as areas where there is insufficient clearance between floor joists and ground surfaces to allow operator access, excavate if possible, and treat according to the instructions for accessible crawl spaces. Otherwise, apply one or a combination of the following two methods.

1. To establish a horizontal barrier, apply to the soil surface, 1 gallon of emulsion per 10 square feet overall using a nozzle pressure of less than 25 p.s.i. and a coarse application nozzle (e.g., Delavan Type RD Raindrop, RD-7 or larger, or Spraying Systems Co. 8010LP TeeJet or comparable nozzle). For an area that cannot be reached with the application wand, use one or more extension rods to make the application to the soil. Do not broadcast or powerspray with higher pressures.

2. To establish a horizontal barrier, drill through the foundation wall or through the floor above and treat the soil perimeter at a rate of 1 gallon of emulsion per 10 square feet. Drill spacing must be at intervals not to exceed 16 inches. Many States have smaller intervals, so check State regulations which may apply.

When treating plenums and crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

Masonry Voids: Drill and treat voids in multiple masonry elements of the structure extending from the structure to the soil in order to create a continuous treatment barrier in the area to be treated. Apply at the rate of 2 gallons of emulsion per 10 linear feet of footing, using a nozzle pressure of less than 25 p.s.i. When using this treatment, access holes must be drilled below the sill plate and should be as close as possible to the footing as is practical. Treatment of voids in block or rubble foundation walls must be closely examined; Applicators must inspect areas of possible runoff as a precaution against application leakage in the treated areas. Some areas may not be treatable or may require mechanical alteration prior to treatment.

All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy the contaminated areas of the structure until the clean-up is completed.

Note: When treating behind veneer care should be taken not to drill beyond the veneer. If concrete blocks are behind the veneer, both the blocks and the veneer may be drilled and treated at the same time.

Excavation Technique: If treatment must be made in difficult situations, along fieldstone or rubble walls, along faulty foundation walls, and around pipes and utility lines which lead downward from the structure to a well or pond, application may be made in the following manner:

a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material.

b. Treat the soil at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth of the trench. Mix the emulsion thoroughly into the soil taking care to prevent liquid from running off the liner.

c. After the treated soil has absorbed the liquid emulsion, replace the soil in the trench.

Foam Applications

Dragnet® STC termiticide emulsion, from 0.5 to 2.0%, may be converted to a foam with expansion characteristics from 2 to 40 times.

Localized Application

Foam Applications: The emulsion may be converted to a foam and the foam used to control or prevent termite infestations.

Depending on the circumstances, foam applications may be used alone or in combination with liquid emulsion applications. Applications may be made behind veneers, piers, chimney bases, into rubble foundations, into block voids or structural voids, under slabs, stoops, porches, or to the soil in crawlspaces, and other similar voids.

Foam and liquid application must be consistent with volume and active ingredient instructions in order to insure proper application has been made. The volume and amount of active ingredient are essential to an effective treatment. At least 75% of the labeled liquid emulsion volume of product must be applied, with the remaining percent delivered to appropriate areas using foam application. Refer to label and use recommendations of the foam manufacturer and the foaming equipment manufacturer.

Foam applications are generally a good supplement to liquid treatments in difficult areas, but may be used alone in difficult spots.

Note location of electrical sources prior to foaming voids to avoid possible shock hazard.

Application Under Slabs or to Soil in Crawlspaces to Prevent or Control Termites

Application may be made using Dragnet® foam alone or in combination with liquid emulsion. The equivalent of at least 4 gallons (6.4 ounces of Dragnet® concentrate) of 0.5% emulsion per 10 linear feet (vertical barrier), or at least 1 gallon (1.6 ounces of Dragnet® concentrate) of 0.5% emulsion per 10 square feet (horizontal barrier) must be applied either as emulsion, foam, or a combination of both. For a foam only application, apply Dragnet® concentrate in sufficient foam concentration and foam volume to deposit 6.4 ounces of concentrate per 10 linear feet or 1.6 ounces of concentrate per 10 square feet. For example, 1 gallon of 2% emulsion generated as foam to cover 10 linear feet is equal to the application of 4 gallons of 0.5% emulsion per 10 linear feet.

Sand Barrier Installation and Treatment

Termites can build mud tubes over treated surfaces as long as they have access to untreated soil and do not have to move Dragnet® treated soil. Fill in cracks and spaces with builder's or playbox sand and treat the sand with Dragnet®. The sand should be treated as soil following the termiticide rate listed on the Dragnet® label.

Retreatment for subterranean termites can only be performed if there is clear evidence of reinfestation or disruption of the barrier due to construction, excavation, or landscaping and/or evidence of the breakdown of the termiticide barrier in the soil. These vulnerable or reinfested areas may be retreated in accordance with application techniques described in this product's labeling. The timing and type of these retreatments will vary depending on factors such as termite pressure, soil types, soil conditions and other factors which may reduce the effectiveness of the barrier.

Annual retreatment of the structure is prohibited unless there is clear evidence that reinfestation or barrier disruption has occurred.

APPLICATION IN CONJUNCTION WITH THE USE OF FIRSTLINE TERMITE BAITS

As part of the Systematic Termite Control (STC) program for termite control, Dragnet FT may be applied to critical areas of the structure including plumbing and utility entry sites, bath traps, expansion joints, foundation cracks and areas with known or suspected infestations at a rate of 0.5% as a spot treatment or complete barrier treatment. Applications may be made as described in the Postconstruction treatment section of this label.

SPECIFIC PEST CONTROL APPLICATIONS

Underground services

Such as: wires, cables, utility lines, pipes, conduits, etc. Services may be within structures or located outside structures, in right-of-ways or to protect long range (miles) of, installations of services.

Soil treatment may be made using 0.5% to 1.0% Dragnet® FT emulsion to prevent attack by termites and ants.

Apply 2 to 4 gallons of emulsion per 10 linear feet to the bottom of the trench and allow to soak into the soil. Lay services on the treated soil and cover with approximately 2 inches of fill soil. Apply another 2 to 4 gallons per 10 linear feet over the soil surface to complete the treatment barrier. In wide trenches, only treat the soil in the area near the services. It is important to establish a continuous barrier of treated soil surrounding the services.

Where soil will not accept the above labeled volume, 1 to 2 gallons of 1.0% Dragnet FT may be used per 10 linear feet of trench both to the bottom of the trench and over the soil on top of the services.

Finish filling the trench with treated fill soil. The soil where each service protrudes from the ground may be treated by trenching/rodding of no more than 1 to 2 gallons of emulsion into the soil.

Precautions:

Do not treat electrically active underground services.

Posts, Poles, and Other Constructions

Create an insecticidal barrier in the soil around wooden constructions such as signs, fences and landscape ornamentation by applying a 0.5% emulsion.

Previously installed poles and posts may be treated by sub-surface injection or treated by gravity flow through holes made from the bottom of a trench around the pole or post. Treat on all sides to create a continuous insecticidal barrier around the pole. Use 1 gallon of emulsion per foot of depth for poles and posts less than six inches in diameter. For larger poles, use 1.5 gallons of emulsion per foot of depth. Apply to a depth of 6 inches below the bottom of the wood. For larger constructions, use 4 gallons per 10 linear feet per foot of depth.

Treatment of Wood-In-Place for Control of Wood-Infesting Insects

(Localized Areas in Structure)

For the control of insects such as termites, ants, carpenter ants, and wood-infesting beetles such as Old House Borer and Powder Post in

localized areas of infested wood in and around structures, apply a 0.5% emulsion to voids and galleries in damaged wood and in spaces between wooden members of a structure and between wood and foundations where wood is vulnerable. Paint on or fan spray applications may also be used. Plastic sheeting must be placed immediately below overhead areas that are spot treated except for soil surfaces in crawlspaces. Application may be made to inaccessible areas by drilling, and then injecting emulsion with a crack and crevice injector into the damaged wood or void spaces. This type of application is not intended to be a substitute for soil treatment, mechanical alteration or fumigation to control extensive infestation of wood-infesting insects.

Termite carton nests in trees or building voids may be injected with 0.5% to 1.0% emulsion. Multiple injection points to varying depths may be necessary. It is desirable to physically remove carton nest material from building voids when such nests are found.

> **Important:** Do not apply emulsion until location of heat pipes, ducts, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these structural elements. Do not apply into electrical fixtures, switches, or sockets.

Attention

Do not apply to pets, crops, or sources of electricity.

Do not allow people on treated surfaces until the spray has dried.

Firewood is not to be treated.

During any application to overhead areas of structure, Cover surfaces below with plastic sheeting or similar material (except where exempt).

Do not allow spray to contact food, foodstuffs, food contacting surfaces, food utensils or water supplies.

Thoroughly wash dishes and food handling utensils with soap and water if they become contaminated by application of this product.

Do not treat areas where food is exposed.

During indoor surface applications do not allow dripping or run-off to occur.

Do not apply this product in patient rooms or in any rooms while occupied by the elderly or infirm.

Do not apply when occupants are present in the immediate area in institutions such as libraries, sport facilities, etc.

Do not apply to classrooms when in use.

Do not touch treated surfaces until dry.

Do not use for Pretreatment application.

Termite Warranty

The Pest Control Firm utilizing Dragnet® STC termiticide as part of the Systematic Termite Control Program for structures must, so long as the property owner is maintaining the annual renewal inspection, provide the property owner with a warranty that structural damage caused by live termites after the initiation of the STC program will be repaired. Any such warranty shall be between the PCO Firm and the property owner. This paragraph neither creates nor confers any rights against FMC.

Dealers Should Sell In Original Packages Only.

Terms of Sale or Use: On purchase of this product buyer and user agree to the following conditions:

Warranty: FMC makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. Except as so warranted, the product is sold as is. Buyer and user assume all risk of use and/or handling and/or storage of this material when such use and/or handling and/or storage is contrary to label instructions.

Use of Product: FMC's recommendations for the use of this product are based upon tests believed to be reliable. The use of this product being beyond the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe practice.

Damages: Buyer's or user's exclusive remedy for damages for breach of warranty or negligence shall be limited to direct damages not exceeding the purchase price paid and shall not include incidental or consequential damages.

REVISIONS:

1.

Code 1803

Dragnet®

STC Termiticide

For use by individuals/firms licensed or registered by the State to apply termiticide products. States may have more restrictive requirements regarding qualifications of persons using this product. Consult the structural pest control regulatory agency of your State prior to use of this product.

EPA Reg. NO. 279- **EPA Est. 279-**

Active Ingredient:

*Permethrin**	36.8%
Inert Ingredients*:**	63.2%
	100.0%

*(3-Phenoxyphenyl) methyl (±) *cis-trans* 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate
***cis/trans* ratio: Max. 55% (±) *cis* and min. 45% (±) *trans*

*** Contains petroleum distillates.

Contains 3.2 pounds permethrin per gallon.

U.S. Patent No. 4,024,163

KEEP OUT OF REACH OF CHILDREN

CAUTION

See other panels for additional precautionary information.

FMC®

FMC Corporation
Agricultural Products Group
Philadelphia PA 19103

Net Contents

7/97 STC Dft. 6

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center. Do not induce vomiting as it may cause aspiration pneumonia. Do not give anything by mouth to an unconscious person. Avoid alcohol.

IF INHALED: Remove victim to fresh air. If not breathing give artificial respiration, preferably mouth to mouth. Get medical attention.

IF ON SKIN: Wash with plenty of soap and water. Get medical attention if irritation persists.

IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.

Note to Physician: This product contains aromatic hydrocarbons which can produce a severe pneumonitis if aspirated, consideration should be given to gastric lavage with an endotracheal tube in place. Treatment is controlled removal of exposure followed by symptomatic and supportive care.

For Emergency Assistance Call: (800) 331-3148.

PRECAUTIONARY STATEMENTS

Hazards to Humans (and Domestic Animals)

CAUTION
Harmful if swallowed, inhaled or absorbed through the skin. Avoid contact with skin, eyes or clothing. Avoid breathing dust (vapor or spray mist). Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

All pesticide handlers (mixers, loaders and applicators) must wear long-sleeved shirt and long pants, socks, shoes and chemical-resistant gloves. After the product is diluted in accordance with label directions for use, shirt, pants, socks, shoes and waterproof gloves are sufficient. In addition, all pesticide handlers must wear a respiratory protection device (air-purifying respirator with NIOSH approved TC-23C pesticide cartridges) when handling the concentrate or when working in a non-ventilated space or applying termiticide by rodding or sub-slab injection.

When treating adjacent to an existing structure, the applicator must check the area to be treated, and immediately adjacent areas of the structure, for visible and accessible cracks and holes to prevent any leaks or significant exposures to persons occupying the structure. People present or residing in the structure during application must be advised to remove their pets and themselves from the structure if they see any signs of leakage. After application, the applicator is required to check for leaks. All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy contaminated areas of the structure until the clean-up is completed.

Environmental Hazards

This product is highly toxic to bees exposed to direct treatment or residues on crops or weeds. Do not apply this product or allow it to drift to crops or weeds on which bees are actively foraging. Additional information may be obtained from your Cooperative Extension Service.

This product is extremely toxic to fish and aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters. Do not apply when weather conditions favor drift from treated areas.

Physical/Chemical Hazards

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Shake Well Before Using

STORAGE AND DISPOSAL

Pesticide Storage

If crystals form, warm to room temperature 70°F (21°C) by room heating only for 24-48 hours and shake occasionally until crystals dissolve and product appears uniform. Do not use external source of heat for warming container.

Do not use or store near heat, open flame or hot surfaces.

Keep out of reach of children and animals. Store in original containers only. Store in a cool, dry place and avoid excess heat. Carefully open containers. After partial use, replace lids and close tightly. Do not put concentrate or dilute material into food or drink containers. Do not contaminate other pesticides, fertilizers, water, food, or feed by storage or disposal.

In case of spill, avoid contact, isolate area and keep out animals and unprotected persons. Confine spills. Call FMC: (800) 331-3148.

To confine spill: If liquid, dike surrounding area or absorb with sand, cat litter, commercial clay or gel absorbents. If dry material, cover to prevent dispersal. Place damaged package in a holding container. Identify contents.

Pesticide Disposal
Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Disposal
Plastic Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Metal Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities. Do not cut or weld metal containers.

Returnable/Refillable Sealed Container: Do not rinse container. Do not empty remaining formulated product. Do not break seals. Return intact to point of purchase.

General Information on the Use of This Product

Dragnet® STC Termiticide is intended to be used in the FMC Systematic Termite Control™ (STC) program. This program must start with inspection, use FirstLine Termite Baits and contain any one or more of the following elements: moisture management recommendations, wood management recommendations, termiticides and termiticide foam. The PCO must follow all applicable state recommendations.

The cornerstone of the STC program starts with a thorough inspection of the structure and the identification of conditions conducive to termite attack, moisture and food control. The structure must be thoroughly inspected and graphed prior to the start of the program. The graph must identify the location of indoor critical areas known to be favored by termites such as but not limited to locations in the foundation penetrated by utility services, cracks and expansion joints, bath traps and areas where concrete has been poured adjacent to other concrete such as stairs, patios, slab additions, and areas with moisture problems. In addition, outside critical areas near the structure such as downspouts, water faucets, sunken window wells, poorly drained or constantly moist areas, fence posts, stumps, stucco, brick veneer, rigid foam insulation, rubble or stone foundations or any conditions conducive to termite infestation, mulched areas and air conditioner water drains within a twenty five foot radius of the structure should be mapped.

Dragnet® may be used at 0.5% as a spot, partial or complete treatment. If the treatment is used on an active infestation of termites, then the site needs to be reinspected within 8 weeks after the initial and subsequent treatments. A copy of the records must be maintained and indicate this information.

The property must be reinspected at least every 12 months and the graph of the property updated to reflect changes in conditions which may influence termite infestations.

Note on the inspection report what and where control measures are applied.

Choice of appropriate procedures should include consideration of such variable factors as the design of the structure, location of heating, ventilation, and air conditioning (HVAC) systems, water table, soil type, soil compaction, grade conditions, and location and type of domestic water supplies and utilities.

For advice concerning current control practices with relation to the specific local conditions, consult resources in structural pest control and state cooperative extension and regulatory agencies.

SUBTERRANEAN TERMITE CONTROL

The use of this product prevents and controls termite infestations in and around structures and constructions.

The dilute insecticidal emulsion must be adequately dispersed in the soil to establish a barrier between the wood and the termites in the soil. As a good practice: 1) all non-essential wood and cellulose containing materials should be removed from around foundation walls, crawl spaces and porches; 2) termite access to moisture should be eliminated by repairing faulty plumbing and/or construction grade. Soil around untreated structural wood in contact with soil should be treated as described below.

To establish an effective insecticidal barrier with this product the service technician must be familiar with current termite control practices such as: trenching, rodding, sub-slab injection, coarse fan spraying of soil surfaces, crack and crevice (void) injection, excavated soil treatment, and brush or spray applications to infested or susceptible wood. These techniques must be correctly employed to prevent or control infestations by subterranean termites such as: *Amitermes, Coptotermes, Heterotermes, Reticulitermes* and *Zootermopsis*. The biology and behavior of the species involved should be considered by the service technician in determining which control practices to use to eliminate or prevent the termite infestation.

Important: Contamination of public and private water supplies must be avoided by following these precautions: Use anti-backflow equipment or procedures to prevent siphonage of insecticide into water supplies. Do not contaminate cisterns or wells. Do not treat soil that is water saturated or frozen. Do not treat while precipitation is occurring. Permethrin the active ingredient in Dragnet®, is extremely toxic to fish and aquatic invertebrates. Care should be used when making applications near bodies of water. As part of FMC's stewardship program, refer to available support literature on well water, ponds and stream concerns. Locate sources of water discharge from structures, such as french drains and sump systems. Turn off discharge pumps until after application is complete. Observe for any change in color or odor of effluent discharge. Consult state and local specifications for recommended distances of wells from treated areas, or if such regulations do not exist, refer to Federal Housing Administration Specifications (H.U.D.) for guidance.

Note: Crawlspaces are to be considered inside of the structure.

Critical Areas: Critical areas include areas where the foundation is penetrated by utility services, cracks and expansion joints, bath traps and areas where cement constructions have been poured adjacent to the foundation such as stairs, patios, and slab additions.

Structures with Wells/Cisterns Inside Foundations

Structures that contain wells or cisterns within the foundation of a structure can only be treated using the following techniques:

1. Do not treat soil while it is beneath or within the foundation or along the exterior perimeter of a structure that contains a well or cistern. The treated backfill method must be used if soil is removed and treated outside/away from the foundation. The treated backfill technique is described as follows:
   a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.
   b. Treat the soil at the rate of 4 gallons of dilute emulsion per 10 linear feet per foot of depth of the trench, or 1 gallon per 1.0 cubic feet of soil. See "Mixing Directions section of the label. Mix thoroughly into the soil taking care to contain the liquid and prevent runoff or spillage.
   c. After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.
2. Treat infested and/or damaged wood in place using an injection technique such as described in the "Control of Wood Infesting Insects" section of this label

Structures with Adjacent Wells/Cisterns and/or Other Water Bodies

Applicators must inspect all structures with nearby water sources such as wells, cisterns, surface ponds, streams, and other bodies of water and evaluate, at a minimum, the treatment recommendations listed below prior to making an application

1. Prior to treatment, if feasible, expose the water pipe(s) coming from the well to the structure, if the pipe(s) enter the structure within 3 feet of grade.
2. Prior to treatment, applicators are advised to take precautions to limit the risk of applying the termiticide into subsurface drains that could empty into any bodies of water. These precautions include evaluating whether application of the termiticide to the top of the footer may result in contamination of the subsurface drain. Factors such as depth

to the drain system and soil type and degree of compaction should be taken into account in determining the depth of treatment.

3. When appropriate (i.e., on the water side of the structure), the treated backfill technique (described above) can also be used to minimize off-site movement of termiticide.

Prior to using this technique near wells or cisterns, consult state, local or federal agencies for information regarding approved treatment practices in your area.

Application Rate: Use a 0.5% emulsion for subterranean termites.

Mixing Directions: Mix the termiticide use dilution in the following manner: Fill tank 1/4 to 1/3 full. Start pump to begin by-pass agitation and place end of treating tool in tank to allow circulation through hose. Add appropriate amount of Dragnet® STC termiticide. Add remaining amount of water. Let pump run and allow recirculation through the hose for 2 to 3 minutes.

Dragnet® may also be mixed into full tanks of water, but requires substantial agitation to insure uniformity of the emulsion.

To prepare a 0.5% water emulsion, ready to use, dilute 1.25 gallons of Dragnet® with 94.75 gallons of water.

Mixing: For the desired application rate, use the chart below to determine the amount of Dragnet® for a given volume of finished emulsion:

Amount of Dragnet STC (Gallons except where noted)			
Emulsion Concentration	**Amount of Dragnet FT**	**Amount of Water**	**Desired Gallons of Finished Emulsion**
0.5%	1⅓ fl. oz.	7.9 pints	1
	6⅔ fl. oz.	31.6 pints	4
	8⅓ fl. oz.	39.5 pints	5
	16⅔ fl. oz.	9.9	10
	0.25	18.75	19
	0.5	37.5	38
	0.75	57.25	58
	1.25	94.75	96
	2.5	189.5	192
1.0%*	1⅓ fl. oz.	62⅓ fl. oz.	0.5
	3⅓ fl. oz.	7.8 pints	1
	6⅔ fl. oz.	15.6 pints	2
	16⅔ fl. oz.	4.9	5
	33⅓ fl. oz.	9.7	10
	0.5	18.5	19
	1	37	38
	1.5	56.5	58
	2.5	91	96
	5	187	192
2.0*	1⅓ fl. oz.	30⅓ fl. oz.	.25
	6⅔ fl. oz.	7.6 pints	1
	33⅓ fl. oz.	4.74	5
	66⅔ fl. oz.	9.5	10
	1	18	19
	2	36	38
	3	55	58
	5	91	96
	10	182	192

Common units of measure:
1 pint = 16 fluid ounces (oz.)
1 gallon = 4 quarts = 8 pints = 128 fluid ounces (oz.)
*Use these rates in conjunction with the application volume adjustments as listed in the section below or in the foam application section.

Post-Construction Subterranean Termite Treatment

Application Volume: To provide maximum control and protection against termite infestation apply the specified volume of the finished water emulsion and active ingredient as set forth in the directions for use section of this label. If soil will not accept the labeled application volume, the volume may be reduced provided there is a corresponding increase in concentration so that the amount of active ingredient applied to the soil remains the same.

Note: Large reductions of application volume reduce the ability to obtain a continuous barrier. Variance is allowed when volume and concentration are consistent with label directed rates and a continuous barrier can still be achieved.

Where desirable for post construction treatments, the volume of the 1.0% emulsion may be reduced by ½ the labeled volume or a 2.0% emulsion may be applied at ¼ the labeled volume (see Volume Adjustment Chart). Volume adjustments at 2.0% are not recommended for subslab injection. See Volume Adjustment Chart below.

Note: When volume is reduced, the hole spacing for subslab injection and soil rodding may require similar adjustment to account for lower volume dispersal of the termiticide in the soil.

Volume Adjustment Chart			
Rate (% emulsion)	**0.5%**	**1.0%**	**2.0%**
Volume allowed			
Horizontal (gallons emulsion/10ft²)	1.0 gallons	0.5 gallons	0.25 gallons*
Vertical (gallons emulsion/10 lin. ft.)	4.0 gallons	2.0 gallons	1.0 gallons*

*Not recommended for subslab injection.

After Treatment: All holes in commonly occupied areas into which Dragnet® has been applied must be plugged. Plugs must be of a non-cellulose material or covered by an impervious, non-cellulose material.

Use a 0.5% emulsion for post-construction treatment. Post-construction soil applications shall be made by injection, rodding, and/or trenching or coarse fan spray with pressures not exceeding 25 p.s.i. at the nozzle. Care should be taken to avoid soil wash-out around the footing.

Do not apply emulsion until location of wells, radiant heat pipes, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these elements.

Foundations: For applications made after the final grade is installed, the applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to the top of the footing. When the footing is more than four (4) feet below grade, the applicator must trench and rod into the trench or trench along the foundation walls at the rate prescribed to a minimum depth of four feet. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.

Slabs: Vertical barriers may be established by sub-slab injection within the structure and rodding and/or trenching outside at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. Special care must be taken to distribute the treatment evenly. Treatment should not extend below the bottom of the footing.

Treat along the outside of the foundation and where necessary beneath the slab on the inside of foundation walls. Treatment may also be required beneath the slab along both sides of interior footing-supported walls, one side of interior partitions and along all cracks and expansion joints. Horizontal barriers may be established where necessary by long-rodding or by grid pattern injection vertically through the slab.

a. Drill holes in the slab and/or foundation to allow for the application of a continuous insecticidal barrier.

b. For shallow foundations (1 foot or less) dig a narrow trench approximately 6 inches wide along the outside of the foundation walls. Do not dig below the bottom of the footing. The emulsion should be applied to the trench and soil at 4 gallons of emulsion per 10 linear feet per foot of depth as the soil is replaced in the trench.

c. For foundations deeper than 1 foot follow rate for basement.

d. Exposed soil and wood in bath traps may be treated with a 0.5% emulsion.

Basements: Where the footing is greater than 1 foot in depth from grade to the bottom of the foundation, application can be made by trenching and/or rodding at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. When the footing is more than four feet below grade, the applicator may trench and/or rod along foundation walls at the rate prescribed for four feet of depth. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. However, in no case should a structure be treated below the footing. Sub-slab injection may be necessary along the inside of foundation walls, along cracks and partition walls, around pipes, conduits, piers, and along both sides of interior footing-supported walls.

Accessible Crawl Spaces: For crawl spaces, apply vertical termiticide barriers at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to the top of the footing, or if the footing is more than 4 feet below grade, to a minimum depth of 4 feet. Apply by trenching and rodding into the trench, or trenching. Treat both sides of foundation and around all piers and pipes. Where physical obstructions such as concrete walkways adjacent to foundation elements prevent trenching, treatment may be made by rodding alone. When soil type and/or conditions make trenching prohibitive, rodding may be used. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. Read and follow the mixing and use direction section of the label if situations are encountered where the soil will not accept the full application volume

1. Rod holes and trenches must not extend below the bottom of the footing.

2. Rod holes must be spaced so as to achieve a continuous termiticide barrier but in no case more than 12 inches apart.

3. Trenches must be a minimum of 6 inches deep or to the bottom of the

footing, whichever is less, and need not be wider than 6 inches. When trenching in sloping (tiered) soil, the trench must be stepped to ensure adequate distribution and to prevent termiticide from running off. The emulsion must be mixed with the soil as it is replaced in the trench.

4. When treating plenums or crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

Inaccessible Crawl Spaces: For inaccessible interior areas, such as areas where there is insufficient clearance between floor joists and ground surfaces to allow operator access, excavate if possible, and treat according to the instructions for accessible crawl spaces. Otherwise, apply one or a combination of the following two methods.

1. To establish a horizontal barrier, apply to the soil surface, 1 gallon of emulsion per 10 square feet overall using a nozzle pressure of less than 25 p.s.i. and a coarse application nozzle (e.g., Delavan Type RD Raindrop, RD-7 or larger, or Spraying Systems Co. 8010LP TeeJet or comparable nozzle). For an area that cannot be reached with the application wand, use one or more extension rods to make the application to the soil. Do not broadcast or powerspray with higher pressures.

2. To establish a horizontal barrier, drill through the foundation wall or through the floor above and treat the soil perimeter at a rate of 1 gallon of emulsion per 10 square feet. Drill spacing must be at intervals not to exceed 16 inches. Many States have smaller intervals, so check State regulations which may apply.

When treating plenums and crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

Masonry Voids: Drill and treat voids in multiple masonry elements of the structure extending from the structure to the soil in order to create a continuous treatment barrier in the area to be treated. Apply at the rate of 2 gallons of emulsion per 10 linear feet of footing, using a nozzle pressure of less than 25 p.s.i. When using this treatment, access holes must be drilled below the sill plate and should be as close as possible to the footing as is practical. Treatment of voids in block or rubble foundation walls must be closely examined: Applicators must inspect areas of possible runoff as a precaution against application leakage in the treated areas. Some areas may not be treatable or may require mechanical alteration prior to treatment.

All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy the contaminated areas of the structure until the clean-up is completed.

Note: When treating behind veneer care should be taken not to drill beyond the veneer. If concrete blocks are behind the veneer, both the blocks and the veneer may be drilled and treated at the same time.

Excavation Technique: If treatment must be made in difficult situations, along fieldstone or rubble walls, along faulty foundation walls, and around pipes and utility lines which lead downward from the structure to a well or pond, application may be made in the following manner:

a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material.

b. Treat the soil at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth of the trench. Mix the emulsion thoroughly into the soil taking care to prevent liquid from running off the liner.

c. After the treated soil has absorbed the liquid emulsion, replace the soil in the trench.

Foam Applications

Dragnet® STC termiticide emulsion, from 0.5 to 2.0%, may be converted to a foam with expansion characteristics from 2 to 40 times.

Localized Application

Foam Applications: The emulsion may be converted to a foam and the foam used to control or prevent termite infestations.

Depending on the circumstances, foam applications may be used alone or in combination with liquid emulsion applications. Applications may be made behind veneers, piers, chimney bases, into rubble foundations, into block voids or structural voids, under slabs, stoops, porches, or to the soil in crawlspaces, and other similar voids.

Foam and liquid application must be consistent with volume and active ingredient instructions in order to insure proper application has been made. The volume and amount of active ingredient are essential to an effective treatment. At least 75% of the labeled liquid emulsion volume of product must be applied, with the remaining percent delivered to appropriate areas using foam application. Refer to label and use recommendations of the foam manufacturer and the foaming equipment manufacturer.

Foam applications are generally a good supplement to liquid treatments in difficult areas, but may be used alone in difficult spots.

Note location of electrical sources prior to foaming voids to avoid possible shock hazard.

Application Under Slabs or to Soil in Crawlspaces to Prevent or Control Termites

Application may be made using Dragnet® foam alone or in combination with liquid emulsion. The equivalent of at least 4 gallons (6.4 ounces of Dragnet® concentrate) of 0.5% emulsion per 10 linear feet (vertical barrier), or at least 1 gallon (1.6 ounces of Dragnet® concentrate) of 0.5% emulsion per 10 square feet (horizontal barrier) must be applied either as emulsion, foam, or a combination of both. For a foam only application, apply Dragnet® concentrate in sufficient foam concentration and foam volume to deposit 6.4 ounces of concentrate per 10 linear feet or 1.6 ounces of concentrate per 10 square feet. For example, 1 gallon of 2% emulsion generated as foam to cover 10 linear feet is equal to the application of 4 gallons of 0.5% emulsion per 10 linear feet.

Sand Barrier Installation and Treatment

Termites can build mud tubes over treated surfaces as long as they have access to untreated soil and do not have to move Dragnet® treated soil. Fill in cracks and spaces with builder's or playbox sand and treat the sand with Dragnet®. The sand should be treated as soil following the termiticide rate listed on the Dragnet® label.

Retreatment for subterranean termites can only be performed if there is clear evidence of reinfestation or disruption of the barrier due to construction, excavation, or landscaping and/or evidence of the breakdown of the termiticide barrier in the soil. These vulnerable or reinfested areas may be retreated in accordance with application techniques described in this product's labeling. The timing and type of these retreatments will vary depending on factors such as termite pressure, soil types, soil conditions and other factors which may reduce the effectiveness of the barrier.

Annual retreatment of the structure is prohibited unless there is clear evidence that reinfestation or barrier disruption has occurred.

APPLICATION IN CONJUNCTION WITH THE USE OF FIRSTLINE TERMITE BAITS

As part of the Systematic Termite Control (STC) program for termite control, Dragnet FT may be applied to critical areas of the structure including plumbing and utility entry sites, bath traps, expansion joints, foundation cracks and areas with known or suspected infestations at a rate of 0.5% as a spot treatment or complete barrier treatment. Applications may be made as described in the Postconstruction treatment section of this label.

SPECIFIC PEST CONTROL APPLICATIONS

Underground services

Such as: wires, cables, utility lines, pipes, conduits, etc. Services may be within structures or located outside structures, in right-of-ways or to protect long range (miles) of, installations of services.

Soil treatment may be made using 0.5% to 1.0% Dragnet® FT emulsion to prevent attack by termites and ants.

Apply 2 to 4 gallons of emulsion per 10 linear feet to the bottom of the trench and allow to soak into the soil. Lay services on the treated soil and cover with approximately 2 inches of fill soil. Apply another 2 to 4 gallons per 10 linear feet over the soil surface to complete the treatment barrier. In wide trenches, only treat the soil in the area near the services. It is important to establish a continuous barrier of treated soil surrounding the services.

Where soil will not accept the above labeled volume, 1 to 2 gallons of 1.0% Dragnet FT may be used per 10 linear feet of trench both to the bottom of the trench and over the soil on top of the services.

Finish filling the trench with treated fill soil. The soil where each service protrudes from the ground may be treated by trenching/rodding of no more than 1 to 2 gallons of emulsion into the soil.

Precautions:

Do not treat electrically active underground services.

Posts, Poles, and Other Constructions

Create an insecticidal barrier in the soil around wooden constructions such as signs, fences and landscape ornamentation by applying a 0.5% emulsion.

Previously installed poles and posts may be treated by sub-surface injection or treated by gravity flow through holes made from the bottom of a trench around the pole or post. Treat on all sides to create a continuous insecticidal barrier around the pole. Use 1 gallon of emulsion per foot of depth for poles and posts less than six inches in diameter. For larger poles, use 1.5 gallons of emulsion per foot of depth. Apply to a depth of 6 inches below the bottom of the wood. For larger constructions, use 4 gallons per 10 linear feet per foot of depth.

Treatment of Wood-In-Place for Control of Wood-Infesting Insects

(Localized Areas in Structure)

For the control of insects such as termites, ants, carpenter ants, and wood-infesting beetles such as Old House Borer and Powder Post in

localized areas of infested wood in and around structures, apply a 0.5% emulsion to voids and galleries in damaged wood and in spaces between wooden members of a structure and between wood and foundations where wood is vulnerable. Paint on or fan spray applications may also be used. Plastic sheeting must be placed immediately below overhead areas that are spot treated except for soil surfaces in crawlspaces. Application may be made to inaccessible areas by drilling, and then injecting emulsion with a crack and crevice injector into the damaged wood or void spaces. This type of application is not intended to be a substitute for soil treatment, mechanical alteration or fumigation to control extensive infestation of wood-infesting insects.

Termite carton nests in trees or building voids may be injected with 0.5% to 1.0% emulsion. Multiple injection points to varying depths may be necessary. It is desirable to physically remove carton nest material from building voids when such nests are found.

> **Important:** Do not apply emulsion until location of heat pipes, ducts, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these structural elements. Do not apply into electrical fixtures, switches, or sockets.

Attention

Do not apply to pets, crops, or sources of electricity.

Do not allow people on treated surfaces until the spray has dried.

Firewood is not to be treated.

During any application to overhead areas of structure, Cover surfaces below with plastic sheeting or similar material (except where exempt).

Do not allow spray to contact food, foodstuffs, food contacting surfaces, food utensils or water supplies.

Thoroughly wash dishes and food handling utensils with soap and water if they become contaminated by application of this product.

Do not treat areas where food is exposed.

During indoor surface applications do not allow dripping or run-off to occur.

Do not apply this product in patient rooms or in any rooms while occupied by the elderly or infirm.

Do not apply when occupants are present in the immediate area in institutions such as libraries, sport facilities, etc.

Do not apply to classrooms when in use.

Do not touch treated surfaces until dry.

Do not use for Pretreatment application.

Termite Warranty

The Pest Control Firm utilizing Dragnet® STC termiticide as part of the Systematic Termite Control Program for structures must, so long as the property owner is maintaining the annual renewal inspection, provide the property owner with a warranty that structural damage caused by live termites after the initiation of the STC program will be repaired. Any such warranty shall be between the PCO Firm and the property owner. This paragraph neither creates nor confers any rights against FMC.

Dealers Should Sell In Original Packages Only.

Terms of Sale or Use: On purchase of this product buyer and user agree to the following conditions:

Warranty: FMC makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. Except as so warranted, the product is sold as is. Buyer and user assume all risk of use and/or handling and/or storage of this material when such use and/or handling and/or storage is contrary to label instructions.

Use of Product: FMC's recommendations for the use of this product are based upon tests believed to be reliable. The use of this product being beyond the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe practice.

Damages: Buyer's or user's exclusive remedy for damages for breach of warranty or negligence shall be limited to direct damages not exceeding the purchase price paid and shall not include incidental or consequential damages.

Dragnet and FMC—FMC trademarks

REVISIONS:

1.

Code 1803

Dragnet®

STC Termiticide

For use by individuals/firms licensed or registered by the State to apply termiticide products. States may have more restrictive requirements regarding qualifications of persons using this product. Consult the structural pest control regulatory agency of your State prior to use of this product.

EPA Reg. NO. 279- **EPA Est. 279-**

Active Ingredient:

*Permethrin**	36.8%
Inert Ingredients*:**	63.2%
	100.0%

*(3-Phenoxyphenyl) methyl (±) *cis-trans* 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate
***cis/trans* ratio: Max. 55% (±) *cis* and min. 45% (±) *trans*

*** Contains petroleum distillates.

Contains 3.2 pounds permethrin per gallon.

U.S. Patent No. 4,024,163

KEEP OUT OF REACH OF CHILDREN

CAUTION

See other panels for additional precautionary information.

FMC®

FMC Corporation
Agricultural Products Group
Philadelphia PA 19103

Net Contents

7/97 STC Dft. 6

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center. Do not induce vomiting as it may cause aspiration pneumonia. Do not give anything by mouth to an unconscious person. Avoid alcohol.

IF INHALED: Remove victim to fresh air. If not breathing give artificial respiration, preferably mouth to mouth. Get medical attention.

IF ON SKIN: Wash with plenty of soap and water. Get medical attention if irritation persists.

IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.

Note to Physician: This product contains aromatic hydrocarbons which can produce a severe pneumonitis if aspirated, consideration should be given to gastric lavage with an endotracheal tube in place. Treatment is controlled removal of exposure followed by symptomatic and supportive care.

For Emergency Assistance Call: (800) 331-3148.

PRECAUTIONARY STATEMENTS

Hazards to Humans (and Domestic Animals)

CAUTION

Harmful if swallowed, inhaled or absorbed through the skin. Avoid contact with skin, eyes or clothing. Avoid breathing dust (vapor or spray mist). Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

All pesticide handlers (mixers, loaders and applicators) must wear long-sleeved shirt and long pants, socks, shoes and chemical-resistant gloves. After the product is diluted in accordance with label directions for use, shirt, pants, socks, shoes and waterproof gloves are sufficient. In addition, all pesticide handlers must wear a respiratory protection device (air-purifying respirator with NIOSH approved TC-23C pesticide cartridges) when handling the concentrate or when working in a non-ventilated space or applying termiticide by rodding or sub-slab injection.

When treating adjacent to an existing structure, the applicator must check the area to be treated, and immediately adjacent areas of the structure, for visible and accessible cracks and holes to prevent any leaks or significant exposures to persons occupying the structure. People present or residing in the structure during application must be advised to remove their pets and themselves from the structure if they see any signs of leakage. After application, the applicator is required to check for leaks. All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy contaminated areas of the structure until the clean-up is completed.

Environmental Hazards

This product is highly toxic to bees exposed to direct treatment or residues on crops or weeds. Do not apply this product or allow it to drift to crops or weeds on which bees are actively foraging. Additional information may be obtained from your Cooperative Extension Service.

This product is extremely toxic to fish and aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters. Do not apply when weather conditions favor drift from treated areas.

Physical/Chemical Hazards

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Shake Well Before Using

STORAGE AND DISPOSAL

Pesticide Storage

If crystals form, warm to room temperature 70°F (21°C) by room heating only for 24-48 hours and shake occasionally until crystals dissolve and product appears uniform. Do not use external source of heat for warming container.

Do not use or store near heat, open flame or hot surfaces.

Keep out of reach of children and animals. Store in original containers only. Store in a cool, dry place and avoid excess heat. Carefully open containers. After partial use, replace lids and close tightly. Do not put concentrate or dilute material into food or drink containers. Do not contaminate other pesticides, fertilizers, water, food, or feed by storage or disposal.

In case of spill, avoid contact, isolate area and keep out animals and unprotected persons. Confine spills. Call FMC: (800) 331-3148.

To confine spill: If liquid, dike surrounding area or absorb with sand, cat litter, commercial clay or gel absorbents. If dry material, cover to prevent dispersal. Place damaged package in a holding container. Identify contents.

Pesticide Disposal
Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Disposal
Plastic Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Metal Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities. Do not cut or weld metal containers.

Returnable/Refillable Sealed Container: Do not rinse container. Do not empty remaining formulated product. Do not break seals. Return intact to point of purchase.

General Information on the Use of This Product

Dragnet® STC Termiticide is intended to be used in the FMC Systematic Termite Control™ (STC) program. This program must start with inspection, use FirstLine Termite Baits and contain any one or more of the following elements: moisture management recommendations, wood management recommendations, termiticides and termiticide foam. The PCO must follow all applicable state recommendations.

The cornerstone of the STC program starts with a thorough inspection of the structure and the identification of conditions conducive to termite attack, moisture and food control. The structure must be thoroughly inspected and graphed prior to the start of the program. The graph must identify the location of indoor critical areas known to be favored by termites such as but not limited to locations in the foundation penetrated by utility services, cracks and expansion joints, bath traps and areas where concrete has been poured adjacent to other concrete such as stairs, patios, slab additions, and areas with moisture problems. In addition, outside critical areas near the structure such as downspouts, water faucets, sunken window wells, poorly drained or constantly moist areas, fence posts, stumps, stucco, brick veneer, rigid foam insulation, rubble or stone foundations or any conditions conducive to termite infestation, mulched areas and air conditioner water drains within a twenty five foot radius of the structure should be mapped.

Dragnet® may be used at 0.5% as a spot, partial or complete treatment. If the treatment is used on an active infestation of termites, then the site needs to be reinspected within 8 weeks after the initial and subsequent treatments. A copy of the records must be maintained and indicate this information.

The property must be reinspected at least every 12 months and the graph of the property updated to reflect changes in conditions which may influence termite infestations.

Note on the inspection report what and where control measures are applied.

Choice of appropriate procedures should include consideration of such variable factors as the design of the structure, location of heating, ventilation, and air conditioning (HVAC) systems, water table, soil type, soil compaction, grade conditions, and location and type of domestic water supplies and utilities.

For advice concerning current control practices with relation to the specific local conditions, consult resources in structural pest control and state cooperative extension and regulatory agencies.

SUBTERRANEAN TERMITE CONTROL

The use of this product prevents and controls termite infestations in and around structures and constructions.

The dilute insecticidal emulsion must be adequately dispersed in the soil to establish a barrier between the wood and the termites in the soil. As a good practice: 1) all non-essential wood and cellulose containing materials should be removed from around foundation walls, crawl spaces and porches; 2) termite access to moisture should be eliminated by repairing faulty plumbing and/or construction grade. Soil around untreated structural wood in contact with soil should be treated as described below.

To establish an effective insecticidal barrier with this product the service technician must be familiar with current termite control practices such as: trenching, rodding, sub-slab injection, coarse fan spraying of soil surfaces, crack and crevice (void) injection, excavated soil treatment, and brush or spray applications to infested or susceptible wood. These techniques must be correctly employed to prevent or control infestations by subterranean termites such as: *Amitermes, Coptotermes, Heterotermes, Reticulitermes* and *Zootermopsis*. The biology and behavior of the species involved should be considered by the service technician in determining which control practices to use to eliminate or prevent the termite infestation.

Important: Contamination of public and private water supplies must be avoided by following these precautions: Use anti-backflow equipment or procedures to prevent siphonage of insecticide into water supplies. Do not contaminate cisterns or wells. Do not treat soil that is water saturated or frozen. Do not treat while precipitation is occurring. Permethrin the active ingredient in Dragnet®, is extremely toxic to fish and aquatic invertebrates. Care should be used when making applications near bodies of water. As part of FMC's stewardship program, refer to available support literature on well water, ponds and stream concerns. Locate sources of water discharge from structures, such as french drains and sump systems. Turn off discharge pumps until after application is complete. Observe for any change in color or odor of effluent discharge. Consult state and local specifications for recommended distances of wells from treated areas, or if such regulations do not exist, refer to Federal Housing Administration Specifications (H.U.D.) for guidance.

Note: Crawlspaces are to be considered inside of the structure.

Critical Areas: Critical areas include areas where the foundation is penetrated by utility services, cracks and expansion joints, bath traps and areas where cement constructions have been poured adjacent to the foundation such as stairs, patios, and slab additions.

Structures with Wells/Cisterns Inside Foundations

Structures that contain wells or cisterns within the foundation of a structure can only be treated using the following techniques:

1. Do not treat soil while it is beneath or within the foundation or along the exterior perimeter of a structure that contains a well or cistern. The treated backfill method must be used if soil is removed and treated outside/away from the foundation. The treated backfill technique is described as follows:
   a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.
   b. Treat the soil at the rate of 4 gallons of dilute emulsion per 10 linear feet per foot of depth of the trench, or 1 gallon per 1.0 cubic feet of soil. See "Mixing Directions section of the label. Mix thoroughly into the soil taking care to contain the liquid and prevent runoff or spillage.
   c. After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.
2. Treat infested and/or damaged wood in place using an injection technique such as described in the "Control of Wood Infesting Insects" section of this label

Structures with Adjacent Wells/Cisterns and/or Other Water Bodies

Applicators must inspect all structures with nearby water sources such as wells, cisterns, surface ponds, streams, and other bodies of water and evaluate, at a minimum, the treatment recommendations listed below prior to making an application

1. Prior to treatment, if feasible, expose the water pipe(s) coming from the well to the structure, if the pipe(s) enter the structure within 3 feet of grade.
2. Prior to treatment, applicators are advised to take precautions to limit the risk of applying the termiticide into subsurface drains that could empty into any bodies of water. These precautions include evaluating whether application of the termiticide to the top of the footer may result in contamination of the subsurface drain. Factors such as depth

to the drain system and soil type and degree of compaction should be taken into account in determining the depth of treatment.

3. When appropriate (i.e., on the water side of the structure), the treated backfill technique (described above) can also be used to minimize off-site movement of termiticide.

Prior to using this technique near wells or cisterns, consult state, local or federal agencies for information regarding approved treatment practices in your area.

Application Rate: Use a 0.5% emulsion for subterranean termites.

Mixing Directions: Mix the termiticide use dilution in the following manner: Fill tank 1/4 to 1/3 full. Start pump to begin by-pass agitation and place end of treating tool in tank to allow circulation through hose. Add appropriate amount of Dragnet® STC termiticide. Add remaining amount of water. Let pump run and allow recirculation through the hose for 2 to 3 minutes.

Dragnet® may also be mixed into full tanks of water, but requires substantial agitation to insure uniformity of the emulsion.

To prepare a 0.5% water emulsion, ready to use, dilute 1.25 gallons of Dragnet® with 94.75 gallons of water.

Mixing: For the desired application rate, use the chart below to determine the amount of Dragnet® for a given volume of finished emulsion:

Amount of Dragnet STC (Gallons except where noted)			
Emulsion Concentration	**Amount of Dragnet FT**	**Amount of Water**	**Desired Gallons of Finished Emulsion**
0.5%	1⅔ fl. oz.	7.9 pints	1
	6⅔ fl. oz.	31.6 pints	4
	8⅓ fl. oz.	39.5 pints	5
	16⅔ fl. oz.	9.9	10
	0.25	18.75	19
	0.5	37.5	38
	0.75	57.25	58
	1.25	94.75	96
	2.5	189.5	192
1.0%*	1⅔ fl. oz.	62⅓ fl. oz.	0.5
	3⅓ fl. oz.	7.8 pints	1
	6⅔ fl. oz.	15.6 pints	2
	16⅔ fl. oz.	4.9	5
	33⅓ fl. oz.	9.7	10
	0.5	18.5	19
	1	37	38
	1.5	56.5	58
	2.5	91	96
	5	187	192
2.0*	1⅔ fl. oz.	30⅓ fl. oz.	.25
	6⅔ fl. oz.	7.6 pints	1
	33⅓ fl. oz.	4.74	5
	66⅔ fl. oz.	9.5	10
	1	18	19
	2	36	38
	3	55	58
	5	91	96
	10	182	192

Common units of measure:
1 pint = 16 fluid ounces (oz.)
1 gallon = 4 quarts = 8 pints = 128 fluid ounces (oz.)
*Use these rates in conjunction with the application volume adjustments as listed in the section below or in the foam application section.

Post-Construction Subterranean Termite Treatment

Application Volume: To provide maximum control and protection against termite infestation apply the specified volume of the finished water emulsion and active ingredient as set forth in the directions for use section of this label. If soil will not accept the labeled application volume, the volume may be reduced provided there is a corresponding increase in concentration so that the amount of active ingredient applied to the soil remains the same.

Note: Large reductions of application volume reduce the ability to obtain a continuous barrier. Variance is allowed when volume and concentration are consistent with label directed rates and a continuous barrier can still be achieved.

Where desirable for post construction treatments, the volume of the 1.0% emulsion may be reduced by ½ the labeled volume or a 2.0% emulsion may be applied at ¼ the labeled volume (see Volume Adjustment Chart). Volume adjustments at 2.0% are not recommended for subslab injection. See Volume Adjustment Chart below.

Note: When volume is reduced, the hole spacing for subslab injection and soil rodding may require similar adjustment to account for lower volume dispersal of the termiticide in the soil.

Volume Adjustment Chart			
Rate (% emulsion)	**0.5%**	**1.0%**	**2.0%**
Volume allowed			
Horizontal (gallons emulsion/10ft²)	1.0 gallons	0.5 gallons	0.25 gallons*
Vertical (gallons emulsion/10 lin. ft.)	4.0 gallons	2.0 gallons	1.0 gallons*

*Not recommended for subslab injection.

After Treatment: All holes in commonly occupied areas into which Dragnet® has been applied must be plugged. Plugs must be of a non-cellulose material or covered by an impervious, non-cellulose material.

Use a 0.5% emulsion for post-construction treatment. Post-construction soil applications shall be made by injection, rodding, and/or trenching or coarse fan spray with pressures not exceeding 25 p.s.i. at the nozzle. Care should be taken to avoid soil wash-out around the footing.

Do not apply emulsion until location of wells, radiant heat pipes, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these elements.

Foundations: For applications made after the final grade is installed, the applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to the top of the footing. When the footing is more than four (4) feet below grade, the applicator must trench and rod into the trench or trench along the foundation walls at the rate prescribed to a minimum depth of four feet. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.

Slabs: Vertical barriers may be established by sub-slab injection within the structure and rodding and/or trenching outside at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. Special care must be taken to distribute the treatment evenly. Treatment should not extend below the bottom of the footing.

Treat along the outside of the foundation and where necessary beneath the slab on the inside of foundation walls. Treatment may also be required beneath the slab along both sides of interior footing-supported walls, one side of interior partitions and along all cracks and expansion joints. Horizontal barriers may be established where necessary by long-rodding or by grid pattern injection vertically through the slab.

a. Drill holes in the slab and/or foundation to allow for the application of a continuous insecticidal barrier.

b. For shallow foundations (1 foot or less) dig a narrow trench approximately 6 inches wide along the outside of the foundation walls. Do not dig below the bottom of the footing. The emulsion should be applied to the trench and soil at 4 gallons of emulsion per 10 linear feet per foot of depth as the soil is replaced in the trench.

c. For foundations deeper than 1 foot follow rate for basement.

d. Exposed soil and wood in bath traps may be treated with a 0.5% emulsion.

Basements: Where the footing is greater than 1 foot in depth from grade to the bottom of the foundation, application can be made by trenching and/or rodding at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. When the footing is more than four feet below grade, the applicator may trench and/or rod along foundation walls at the rate prescribed for four feet of depth. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. However, in no case should a structure be treated below the footing. Sub-slab injection may be necessary along the inside of foundation walls, along cracks and partition walls, around pipes, conduits, piers, and along both sides of interior footing-supported walls.

Accessible Crawl Spaces: For crawl spaces, apply vertical termiticide barriers at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to the top of the footing, or if the footing is more than 4 feet below grade, to a minimum depth of 4 feet. Apply by trenching and rodding into the trench, or trenching. Treat both sides of foundation and around all piers and pipes. Where physical obstructions such as concrete walkways adjacent to foundation elements prevent trenching, treatment may be made by rodding alone. When soil type and/or conditions make trenching prohibitive, rodding may be used. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. Read and follow the mixing and use direction section of the label if situations are encountered where the soil will not accept the full application volume

1. Rod holes and trenches must not extend below the bottom of the footing.

2. Rod holes must be spaced so as to achieve a continuous termiticide barrier but in no case more than 12 inches apart.

3. Trenches must be a minimum of 6 inches deep or to the bottom of the

footing, whichever is less, and need not be wider than 6 inches. When trenching in sloping (tiered) soil, the trench must be stepped to ensure adequate distribution and to prevent termiticide from running off. The emulsion must be mixed with the soil as it is replaced in the trench.

4. When treating plenums or crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

Inaccessible Crawl Spaces: For inaccessible interior areas, such as areas where there is insufficient clearance between floor joists and ground surfaces to allow operator access, excavate if possible, and treat according to the instructions for accessible crawl spaces. Otherwise, apply one or a combination of the following two methods.

1. To establish a horizontal barrier, apply to the soil surface, 1 gallon of emulsion per 10 square feet overall using a nozzle pressure of less than 25 p.s.i. and a coarse application nozzle (e.g., Delavan Type RD Raindrop, RD-7 or larger, or Spraying Systems Co. 8010LP TeeJet or comparable nozzle). For an area that cannot be reached with the application wand, use one or more extension rods to make the application to the soil. Do not broadcast or powerspray with higher pressures.

2. To establish a horizontal barrier, drill through the foundation wall or through the floor above and treat the soil perimeter at a rate of 1 gallon of emulsion per 10 square feet. Drill spacing must be at intervals not to exceed 16 inches. Many States have smaller intervals, so check State regulations which may apply.

When treating plenums and crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

Masonry Voids: Drill and treat voids in multiple masonry elements of the structure extending from the structure to the soil in order to create a continuous treatment barrier in the area to be treated. Apply at the rate of 2 gallons of emulsion per 10 linear feet of footing, using a nozzle pressure of less than 25 p.s.i. When using this treatment, access holes must be drilled below the sill plate and should be as close as possible to the footing as is practical. Treatment of voids in block or rubble foundation walls must be closely examined: Applicators must inspect areas of possible runoff as a precaution against application leakage in the treated areas. Some areas may not be treatable or may require mechanical alteration prior to treatment.

All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy the contaminated areas of the structure until the clean-up is completed.

Note: When treating behind veneer care should be taken not to drill beyond the veneer. If concrete blocks are behind the veneer, both the blocks and the veneer may be drilled and treated at the same time.

Excavation Technique: If treatment must be made in difficult situations, along fieldstone or rubble walls, along faulty foundation walls, and around pipes and utility lines which lead downward from the structure to a well or pond, application may be made in the following manner:

a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material.

b. Treat the soil at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth of the trench. Mix the emulsion thoroughly into the soil taking care to prevent liquid from running off the liner.

c. After the treated soil has absorbed the liquid emulsion, replace the soil in the trench.

Foam Applications

Dragnet® STC termiticide emulsion, from 0.5 to 2.0%, may be converted to a foam with expansion characteristics from 2 to 40 times.

Localized Application

Foam Applications: The emulsion may be converted to a foam and the foam used to control or prevent termite infestations.

Depending on the circumstances, foam applications may be used alone or in combination with liquid emulsion applications. Applications may be made behind veneers, piers, chimney bases, into rubble foundations, into block voids or structural voids, under slabs, stoops, porches, or to the soil in crawlspaces, and other similar voids.

Foam and liquid application must be consistent with volume and active ingredient instructions in order to insure proper application has been made. The volume and amount of active ingredient are essential to an effective treatment. At least 75% of the labeled liquid emulsion volume of product must be applied, with the remaining percent delivered to appropriate areas using foam application. Refer to label and use recommendations of the foam manufacturer and the foaming equipment manufacturer.

Foam applications are generally a good supplement to liquid treatments in difficult areas, but may be used alone in difficult spots.

Note location of electrical sources prior to foaming voids to avoid possible shock hazard.

Application Under Slabs or to Soil in Crawlspaces to Prevent or Control Termites

Application may be made using Dragnet® foam alone or in combination with liquid emulsion. The equivalent of at least 4 gallons (6.4 ounces of Dragnet® concentrate) of 0.5% emulsion per 10 linear feet (vertical barrier), or at least 1 gallon (1.6 ounces of Dragnet® concentrate) of 0.5% emulsion per 10 square feet (horizontal barrier) must be applied either as emulsion, foam, or a combination of both. For a foam only application, apply Dragnet® concentrate in sufficient foam concentration and foam volume to deposit 6.4 ounces of concentrate per 10 linear feet or 1.6 ounces of concentrate per 10 square feet. For example, 1 gallon of 2% emulsion generated as foam to cover 10 linear feet is equal to the application of 4 gallons of 0.5% emulsion per 10 linear feet.

Sand Barrier Installation and Treatment

Termites can build mud tubes over treated surfaces as long as they have access to untreated soil and do not have to move Dragnet® treated soil. Fill in cracks and spaces with builder's or playbox sand and treat the sand with Dragnet®. The sand should be treated as soil following the termiticide rate listed on the Dragnet® label.

Retreatment for subterranean termites can only be performed if there is clear evidence of reinfestation or disruption of the barrier due to construction, excavation, or landscaping and/or evidence of the breakdown of the termiticide barrier in the soil. These vulnerable or reinfested areas may be retreated in accordance with application techniques described in this product's labeling. The timing and type of these retreatments will vary depending on factors such as termite pressure, soil types, soil conditions and other factors which may reduce the effectiveness of the barrier.

Annual retreatment of the structure is prohibited unless there is clear evidence that reinfestation or barrier disruption has occurred.

APPLICATION IN CONJUNCTION WITH THE USE OF FIRSTLINE TERMITE BAITS

As part of the Systematic Termite Control (STC) program for termite control, Dragnet FT may be applied to critical areas of the structure including plumbing and utility entry sites, bath traps, expansion joints, foundation cracks and areas with known or suspected infestations at a rate of 0.5% as a spot treatment or complete barrier treatment. Applications may be made as described in the Postconstruction treatment section of this label.

SPECIFIC PEST CONTROL APPLICATIONS

Underground services

Such as: wires, cables, utility lines, pipes, conduits, etc. Services may be within structures or located outside structures, in right-of-ways or to protect long range (miles) of, installations of services.

Soil treatment may be made using 0.5% to 1.0% Dragnet® FT emulsion to prevent attack by termites and ants.

Apply 2 to 4 gallons of emulsion per 10 linear feet to the bottom of the trench and allow to soak into the soil. Lay services on the treated soil and cover with approximately 2 inches of fill soil. Apply another 2 to 4 gallons per 10 linear feet over the soil surface to complete the treatment barrier. In wide trenches, only treat the soil in the area near the services. It is important to establish a continuous barrier of treated soil surrounding the services.

Where soil will not accept the above labeled volume, 1 to 2 gallons of 1.0% Dragnet FT may be used per 10 linear feet of trench both to the bottom of the trench and over the soil on top of the services.

Finish filling the trench with treated fill soil. The soil where each service protrudes from the ground may be treated by trenching/rodding of no more than 1 to 2 gallons of emulsion into the soil.

Precautions:

Do not treat electrically active underground services.

Posts, Poles, and Other Constructions

Create an insecticidal barrier in the soil around wooden constructions such as signs, fences and landscape ornamentation by applying a 0.5% emulsion.

Previously installed poles and posts may be treated by sub-surface injection or treated by gravity flow through holes made from the bottom of a trench around the pole or post. Treat on all sides to create a continuous insecticidal barrier around the pole. Use 1 gallon of emulsion per foot of depth for poles and posts less than six inches in diameter. For larger poles, use 1.5 gallons of emulsion per foot of depth. Apply to a depth of 6 inches below the bottom of the wood. For larger constructions, use 4 gallons per 10 linear feet per foot of depth.

Treatment of Wood-In-Place for Control of Wood-Infesting Insects

(Localized Areas in Structure)

For the control of insects such as termites, ants, carpenter ants, and wood-infesting beetles such as Old House Borer and Powder Post in

localized areas of infested wood in and around structures, apply a 0.5% emulsion to voids and galleries in damaged wood and in spaces between wooden members of a structure and between wood and foundations where wood is vulnerable. Paint on or fan spray applications may also be used. Plastic sheeting must be placed immediately below overhead areas that are spot treated except for soil surfaces in crawlspaces. Application may be made to inaccessible areas by drilling, and then injecting emulsion with a crack and crevice injector into the damaged wood or void spaces. This type of application is not intended to be a substitute for soil treatment, mechanical alteration or fumigation to control extensive infestation of wood-infesting insects.

Termite carton nests in trees or building voids may be injected with 0.5% to 1.0% emulsion. Multiple injection points to varying depths may be necessary. It is desirable to physically remove carton nest material from building voids when such nests are found.

> **Important:** Do not apply emulsion until location of heat pipes, ducts, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these structural elements. Do not apply into electrical fixtures, switches, or sockets.

Attention

Do not apply to pets, crops, or sources of electricity.

Do not allow people on treated surfaces until the spray has dried.

Firewood is not to be treated.

During any application to overhead areas of structure, Cover surfaces below with plastic sheeting or similar material (except where exempt).

Do not allow spray to contact food, foodstuffs, food contacting surfaces, food utensils or water supplies.

Thoroughly wash dishes and food handling utensils with soap and water if they become contaminated by application of this product.

Do not treat areas where food is exposed.

During indoor surface applications do not allow dripping or run-off to occur.

Do not apply this product in patient rooms or in any rooms while occupied by the elderly or infirm.

Do not apply when occupants are present in the immediate area in institutions such as libraries, sport facilities, etc.

Do not apply to classrooms when in use.

Do not touch treated surfaces until dry.

Do not use for Pretreatment application.

Termite Warranty

The Pest Control Firm utilizing Dragnet® STC termiticide as part of the Systematic Termite Control Program for structures must, so long as the property owner is maintaining the annual renewal inspection, provide the property owner with a warranty that structural damage caused by live termites after the initiation of the STC program will be repaired. Any such warranty shall be between the PCO Firm and the property owner. This paragraph neither creates nor confers any rights against FMC.

Dealers Should Sell In Original Packages Only.

Terms of Sale or Use: On purchase of this product buyer and user agree to the following conditions:

Warranty: FMC makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. Except as so warranted, the product is sold as is. Buyer and user assume all risk of use and/or handling and/or storage of this material when such use and/or handling and/or storage is contrary to label instructions.

Use of Product: FMC's recommendations for the use of this product are based upon tests believed to be reliable. The use of this product being beyond the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe practice.

Damages: Buyer's or user's exclusive remedy for damages for breach of warranty or negligence shall be limited to direct damages not exceeding the purchase price paid and shall not include incidental or consequential damages.

REVISIONS:

1.

Code 1803

Dragnet®

STC Termiticide

For use by individuals/firms licensed or registered by the State to apply termiticide products. States may have more restrictive requirements regarding qualifications of persons using this product. Consult the structural pest control regulatory agency of your State prior to use of this product.

EPA Reg. NO. 279- **EPA Est. 279-**

Active Ingredient:

*Permethrin**	36.8%
Inert Ingredients*:**	63.2%
	100.0%

*(3-Phenoxyphenyl) methyl (±) *cis-trans 3-*(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate
***cis/trans* ratio: Max. 55% (±) *cis* and min. 45% (±) *trans*

*** Contains petroleum distillates.

Contains 3.2 pounds permethrin per gallon.

U.S. Patent No. 4,024,163

KEEP OUT OF REACH OF CHILDREN

CAUTION

See other panels for additional precautionary information.

FMC®

FMC Corporation
Agricultural Products Group
Philadelphia PA 19103

Net Contents

7/97 STC Dft. 6

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center. Do not induce vomiting as it may cause aspiration pneumonia. Do not give anything by mouth to an unconscious person. Avoid alcohol.

IF INHALED: Remove victim to fresh air. If not breathing give artificial respiration, preferably mouth to mouth. Get medical attention.

IF ON SKIN: Wash with plenty of soap and water. Get medical attention if irritation persists.

IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.

Note to Physician: This product contains aromatic hydrocarbons which can produce a severe pneumonitis if aspirated, consideration should be given to gastric lavage with an endotracheal tube in place. Treatment is controlled removal of exposure followed by symptomatic and supportive care.

For Emergency Assistance Call: (800) 331-3148.

PRECAUTIONARY STATEMENTS

Hazards to Humans (and Domestic Animals)

CAUTION

Harmful if swallowed, inhaled or absorbed through the skin. Avoid contact with skin, eyes or clothing. Avoid breathing dust (vapor or spray mist). Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

All pesticide handlers (mixers, loaders and applicators) must wear long-sleeved shirt and long pants, socks, shoes and chemical-resistant gloves. After the product is diluted in accordance with label directions for use, shirt, pants, socks, shoes and waterproof gloves are sufficient. In addition, all pesticide handlers must wear a respiratory protection device (air-purifying respirator with NIOSH approved TC-23C pesticide cartridges) when handling the concentrate or when working in a non-ventilated space or applying termiticide by rodding or sub-slab injection.

When treating adjacent to an existing structure, the applicator must check the area to be treated, and immediately adjacent areas of the structure, for visible and accessible cracks and holes to prevent any leaks or significant exposures to persons occupying the structure. People present or residing in the structure during application must be advised to remove their pets and themselves from the structure if they see any signs of leakage. After application, the applicator is required to check for leaks. All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy contaminated areas of the structure until the clean-up is completed.

Environmental Hazards

This product is highly toxic to bees exposed to direct treatment or residues on crops or weeds. Do not apply this product or allow it to drift to crops or weeds on which bees are actively foraging. Additional information may be obtained from your Cooperative Extension Service.

This product is extremely toxic to fish and aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters. Do not apply when weather conditions favor drift from treated areas.

Physical/Chemical Hazards

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Shake Well Before Using

STORAGE AND DISPOSAL

Pesticide Storage

If crystals form, warm to room temperature 70°F (21°C) by room heating only for 24-48 hours and shake occasionally until crystals dissolve and product appears uniform. Do not use external source of heat for warming container.

Do not use or store near heat, open flame or hot surfaces.

Keep out of reach of children and animals. Store in original containers only. Store in a cool, dry place and avoid excess heat. Carefully open containers. After partial use, replace lids and close tightly. Do not put concentrate or dilute material into food or drink containers. Do not contaminate other pesticides, fertilizers, water, food, or feed by storage or disposal.

In case of spill, avoid contact, isolate area and keep out animals and unprotected persons. Confine spills. Call FMC: (800) 331-3148.

To confine spill: If liquid, dike surrounding area or absorb with sand, cat litter, commercial clay or gel absorbents. If dry material, cover to prevent dispersal. Place damaged package in a holding container. Identify contents.

Pesticide Disposal
Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Disposal
Plastic Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Metal Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities. Do not cut or weld metal containers.

Returnable/Refillable Sealed Container: Do not rinse container. Do not empty remaining formulated product. Do not break seals. Return intact to point of purchase.

General Information on the Use of This Product

Dragnet® STC Termiticide is intended to be used in the FMC Systematic Termite Control™ (STC) program. This program must start with inspection, use FirstLine Termite Baits and contain any one or more of the following elements: moisture management recommendations, wood management recommendations, termiticides and termiticide foam. The PCO must follow all applicable state recommendations.

The cornerstone of the STC program starts with a thorough inspection of the structure and the identification of conditions conducive to termite attack, moisture and food control. The structure must be thoroughly inspected and graphed prior to the start of the program. The graph must identify the location of indoor critical areas known to be favored by termites such as but not limited to locations in the foundation penetrated by utility services, cracks and expansion joints, bath traps and areas where concrete has been poured adjacent to other concrete such as stairs, patios, slab additions, and areas with moisture problems. In addition, outside critical areas near the structure such as downspouts, water faucets, sunken window wells, poorly drained or constantly moist areas, fence posts, stumps, stucco, brick veneer, rigid foam insulation, rubble or stone foundations or any conditions conducive to termite infestation, mulched areas and air conditioner water drains within a twenty five foot radius of the structure should be mapped.

Dragnet® may be used at 0.5% as a spot, partial or complete treatment. If the treatment is used on an active infestation of termites, then the site needs to be reinspected within 8 weeks after the initial and subsequent treatments. A copy of the records must be maintained and indicate this information.

The property must be reinspected at least every 12 months and the graph of the property updated to reflect changes in conditions which may influence termite infestations.

Note on the inspection report what and where control measures are applied.

Choice of appropriate procedures should include consideration of such variable factors as the design of the structure, location of heating, ventilation, and air conditioning (HVAC) systems, water table, soil type, soil compaction, grade conditions, and location and type of domestic water supplies and utilities.

For advice concerning current control practices with relation to the specific local conditions, consult resources in structural pest control and state cooperative extension and regulatory agencies.

SUBTERRANEAN TERMITE CONTROL

The use of this product prevents and controls termite infestations in and around structures and constructions.

The dilute insecticidal emulsion must be adequately dispersed in the soil to establish a barrier between the wood and the termites in the soil. As a good practice: 1) all non-essential wood and cellulose containing materials should be removed from around foundation walls, crawl spaces and porches; 2) termite access to moisture should be eliminated by repairing faulty plumbing and/or construction grade. Soil around untreated structural wood in contact with soil should be treated as described below.

To establish an effective insecticidal barrier with this product the service technician must be familiar with current termite control practices such as: trenching, rodding, sub-slab injection, coarse fan spraying of soil surfaces, crack and crevice (void) injection, excavated soil treatment, and brush or spray applications to infested or susceptible wood. These techniques must be correctly employed to prevent or control infestations by subterranean termites such as: *Amitermes, Coptotermes, Heterotermes, Reticulitermes* and *Zootermopsis*. The biology and behavior of the species involved should be considered by the service technician in determining which control practices to use to eliminate or prevent the termite infestation.

Important: Contamination of public and private water supplies must be avoided by following these precautions: Use anti-backflow equipment or procedures to prevent siphonage of insecticide into water supplies. Do not contaminate cisterns or wells. Do not treat soil that is water saturated or frozen. Do not treat while precipitation is occurring. Permethrin the active ingredient in Dragnet®, is extremely toxic to fish and aquatic invertebrates. Care should be used when making applications near bodies of water. As part of FMC's stewardship program, refer to available support literature on well water, ponds and stream concerns. Locate sources of water discharge from structures, such as french drains and sump systems. Turn off discharge pumps until after application is complete. Observe for any change in color or odor of effluent discharge. Consult state and local specifications for recommended distances of wells from treated areas, or if such regulations do not exist, refer to Federal Housing Administration Specifications (H.U.D.) for guidance.

Note: Crawlspaces are to be considered inside of the structure.

Critical Areas: Critical areas include areas where the foundation is penetrated by utility services, cracks and expansion joints, bath traps and areas where cement constructions have been poured adjacent to the foundation such as stairs, patios, and slab additions.

Structures with Wells/Cisterns Inside Foundations

Structures that contain wells or cisterns within the foundation of a structure can only be treated using the following techniques:

1. Do not treat soil while it is beneath or within the foundation or along the exterior perimeter of a structure that contains a well or cistern. The treated backfill method must be used if soil is removed and treated outside/away from the foundation. The treated backfill technique is described as follows:
   a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.
   b. Treat the soil at the rate of 4 gallons of dilute emulsion per 10 linear feet per foot of depth of the trench, or 1 gallon per 1.0 cubic feet of soil. See "Mixing Directions section of the label. Mix thoroughly into the soil taking care to contain the liquid and prevent runoff or spillage.
   c. After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.
2. Treat infested and/or damaged wood in place using an injection technique such as described in the "Control of Wood Infesting Insects" section of this label

Structures with Adjacent Wells/Cisterns and/or Other Water Bodies

Applicators must inspect all structures with nearby water sources such as wells, cisterns, surface ponds, streams, and other bodies of water and evaluate, at a minimum, the treatment recommendations listed below prior to making an application

1. Prior to treatment, if feasible, expose the water pipe(s) coming from the well to the structure, if the pipe(s) enter the structure within 3 feet of grade.
2. Prior to treatment, applicators are advised to take precautions to limit the risk of applying the termiticide into subsurface drains that could empty into any bodies of water. These precautions include evaluating whether application of the termiticide to the top of the footer may result in contamination of the subsurface drain. Factors such as depth

to the drain system and soil type and degree of compaction should be taken into account in determining the depth of treatment.

3. When appropriate (i.e., on the water side of the structure), the treated backfill technique (described above) can also be used to minimize off-site movement of termiticide.

Prior to using this technique near wells or cisterns, consult state, local or federal agencies for information regarding approved treatment practices in your area.

Application Rate: Use a 0.5% emulsion for subterranean termites.

Mixing Directions: Mix the termiticide use dilution in the following manner: Fill tank 1/4 to 1/3 full. Start pump to begin by-pass agitation and place end of treating tool in tank to allow circulation through hose. Add appropriate amount of Dragnet® STC termiticide. Add remaining amount of water. Let pump run and allow recirculation through the hose for 2 to 3 minutes.

Dragnet® may also be mixed into full tanks of water, but requires substantial agitation to insure uniformity of the emulsion.

To prepare a 0.5% water emulsion, ready to use, dilute 1.25 gallons of Dragnet® with 94.75 gallons of water.

Mixing: For the desired application rate, use the chart below to determine the amount of Dragnet® for a given volume of finished emulsion:

Amount of Dragnet STC (Gallons except where noted)			
Emulsion Concentration	**Amount of Dragnet FT**	**Amount of Water**	**Desired Gallons of Finished Emulsion**
0.5%	1⅔ fl. oz.	7.9 pints	1
	6⅔ fl. oz.	31.6 pints	4
	8⅓ fl. oz.	39.5 pints	5
	16⅔ fl. oz.	9.9	10
	0.25	18.75	19
	0.5	37.5	38
	0.75	57.25	58
	1.25	94.75	96
	2.5	189.5	192
1.0%*	1⅔ fl. oz.	62⅓ fl. oz.	0.5
	3⅓ fl. oz.	7.8 pints	1
	6⅔ fl. oz.	15.6 pints	2
	16⅔ fl. oz.	4.9	5
	33⅓ fl. oz.	9.7	10
	0.5	18.5	19
	1	37	38
	1.5	56.5	58
	2.5	91	96
	5	187	192
2.0*	1⅔ fl. oz.	30⅓ fl. oz.	.25
	6⅔ fl. oz.	7.6 pints	1
	33⅓ fl. oz.	4.74	5
	66⅔ fl. oz.	9.5	10
	1	18	19
	2	36	38
	3	55	58
	5	91	96
	10	182	192

Common units of measure:
1 pint = 16 fluid ounces (oz.)
1 gallon = 4 quarts = 8 pints = 128 fluid ounces (oz.)
*Use these rates in conjunction with the application volume adjustments as listed in the section below or in the foam application section.

Post-Construction Subterranean Termite Treatment

Application Volume: To provide maximum control and protection against termite infestation apply the specified volume of the finished water emulsion and active ingredient as set forth in the directions for use section of this label. If soil will not accept the labeled application volume, the volume may be reduced provided there is a corresponding increase in concentration so that the amount of active ingredient applied to the soil remains the same.

Note: Large reductions of application volume reduce the ability to obtain a continuous barrier. Variance is allowed when volume and concentration are consistent with label directed rates and a continuous barrier can still be achieved.

Where desirable for post construction treatments, the volume of the 1.0% emulsion may be reduced by ½ the labeled volume or a 2.0% emulsion may be applied at ¼ the labeled volume (see Volume Adjustment Chart). Volume adjustments at 2.0% are not recommended for subslab injection. See Volume Adjustment Chart below.

Note: When volume is reduced, the hole spacing for subslab injection and soil rodding may require similar adjustment to account for lower volume dispersal of the termiticide in the soil.

Volume Adjustment Chart			
Rate (% emulsion)	**0.5%**	**1.0%**	**2.0%**
Volume allowed			
Horizontal (gallons emulsion/10ft²)	1.0 gallons	0.5 gallons	0.25 gallons*
Vertical (gallons emulsion/10 lin. ft.)	4.0 gallons	2.0 gallons	1.0 gallons*

*Not recommended for subslab injection.

After Treatment: All holes in commonly occupied areas into which Dragnet® has been applied must be plugged. Plugs must be of a non-cellulose material or covered by an impervious, non-cellulose material.

Use a 0.5% emulsion for post-construction treatment. Post-construction soil applications shall be made by injection, rodding, and/or trenching or coarse fan spray with pressures not exceeding 25 p.s.i. at the nozzle. Care should be taken to avoid soil wash-out around the footing.

Do not apply emulsion until location of wells, radiant heat pipes, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these elements.

Foundations: For applications made after the final grade is installed, the applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to the top of the footing. When the footing is more than four (4) feet below grade, the applicator must trench and rod into the trench or trench along the foundation walls at the rate prescribed to a minimum depth of four feet. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.

Slabs: Vertical barriers may be established by sub-slab injection within the structure and rodding and/or trenching outside at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. Special care must be taken to distribute the treatment evenly. Treatment should not extend below the bottom of the footing.

Treat along the outside of the foundation and where necessary beneath the slab on the inside of foundation walls. Treatment may also be required beneath the slab along both sides of interior footing-supported walls, one side of interior partitions and along all cracks and expansion joints. Horizontal barriers may be established where necessary by long-rodding or by grid pattern injection vertically through the slab.

a. Drill holes in the slab and/or foundation to allow for the application of a continuous insecticidal barrier.

b. For shallow foundations (1 foot or less) dig a narrow trench approximately 6 inches wide along the outside of the foundation walls. Do not dig below the bottom of the footing. The emulsion should be applied to the trench and soil at 4 gallons of emulsion per 10 linear feet per foot of depth as the soil is replaced in the trench.

c. For foundations deeper than 1 foot follow rate for basement.

d. Exposed soil and wood in bath traps may be treated with a 0.5% emulsion.

Basements: Where the footing is greater than 1 foot in depth from grade to the bottom of the foundation, application can be made by trenching and/or rodding at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. When the footing is more than four feet below grade, the applicator may trench and/or rod along foundation walls at the rate prescribed for four feet of depth. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. However, in no case should a structure be treated below the footing. Sub-slab injection may be necessary along the inside of foundation walls, along cracks and partition walls, around pipes, conduits, piers, and along both sides of interior footing-supported walls.

Accessible Crawl Spaces: For crawl spaces, apply vertical termiticide barriers at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to the top of the footing, or if the footing is more than 4 feet below grade, to a minimum depth of 4 feet. Apply by trenching and rodding into the trench, or trenching. Treat both sides of foundation and around all piers and pipes. Where physical obstructions such as concrete walkways adjacent to foundation elements prevent trenching, treatment may be made by rodding alone. When soil type and/or conditions make trenching prohibitive, rodding may be used. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. Read and follow the mixing and use direction section of the label if situations are encountered where the soil will not accept the full application volume

1. Rod holes and trenches must not extend below the bottom of the footing.

2. Rod holes must be spaced so as to achieve a continuous termiticide barrier but in no case more than 12 inches apart.

3. Trenches must be a minimum of 6 inches deep or to the bottom of the

footing, whichever is less, and need not be wider than 6 inches. When trenching in sloping (tiered) soil, the trench must be stepped to ensure adequate distribution and to prevent termiticide from running off. The emulsion must be mixed with the soil as it is replaced in the trench.

4. When treating plenums or crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

Inaccessible Crawl Spaces: For inaccessible interior areas, such as areas where there is insufficient clearance between floor joists and ground surfaces to allow operator access, excavate if possible, and treat according to the instructions for accessible crawl spaces. Otherwise, apply one or a combination of the following two methods.

1. To establish a horizontal barrier, apply to the soil surface, 1 gallon of emulsion per 10 square feet overall using a nozzle pressure of less than 25 p.s.i. and a coarse application nozzle (e.g., Delavan Type RD Raindrop, RD-7 or larger, or Spraying Systems Co. 8010LP TeeJet or comparable nozzle). For an area that cannot be reached with the application wand, use one or more extension rods to make the application to the soil. Do not broadcast or powerspray with higher pressures.

2. To establish a horizontal barrier, drill through the foundation wall or through the floor above and treat the soil perimeter at a rate of 1 gallon of emulsion per 10 square feet. Drill spacing must be at intervals not to exceed 16 inches. Many States have smaller intervals, so check State regulations which may apply.

When treating plenums and crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

Masonry Voids: Drill and treat voids in multiple masonry elements of the structure extending from the structure to the soil in order to create a continuous treatment barrier in the area to be treated. Apply at the rate of 2 gallons of emulsion per 10 linear feet of footing, using a nozzle pressure of less than 25 p.s.i. When using this treatment, access holes must be drilled below the sill plate and should be as close as possible to the footing as is practical. Treatment of voids in block or rubble foundation walls must be closely examined: Applicators must inspect areas of possible runoff as a precaution against application leakage in the treated areas. Some areas may not be treatable or may require mechanical alteration prior to treatment.

All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy the contaminated areas of the structure until the clean-up is completed.

Note: When treating behind veneer care should be taken not to drill beyond the veneer. If concrete blocks are behind the veneer, both the blocks and the veneer may be drilled and treated at the same time.

Excavation Technique: If treatment must be made in difficult situations, along fieldstone or rubble walls, along faulty foundation walls, and around pipes and utility lines which lead downward from the structure to a well or pond, application may be made in the following manner:

a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material.

b. Treat the soil at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth of the trench. Mix the emulsion thoroughly into the soil taking care to prevent liquid from running off the liner.

c. After the treated soil has absorbed the liquid emulsion, replace the soil in the trench.

Foam Applications

Dragnet® STC termiticide emulsion, from 0.5 to 2.0%, may be converted to a foam with expansion characteristics from 2 to 40 times.

Localized Application

Foam Applications: The emulsion may be converted to a foam and the foam used to control or prevent termite infestations.

Depending on the circumstances, foam applications may be used alone or in combination with liquid emulsion applications. Applications may be made behind veneers, piers, chimney bases, into rubble foundations, into block voids or structural voids, under slabs, stoops, porches, or to the soil in crawlspaces, and other similar voids.

Foam and liquid application must be consistent with volume and active ingredient instructions in order to insure proper application has been made. The volume and amount of active ingredient are essential to an effective treatment. At least 75% of the labeled liquid emulsion volume of product must be applied, with the remaining percent delivered to appropriate areas using foam application. Refer to label and use recommendations of the foam manufacturer and the foaming equipment manufacturer.

Foam applications are generally a good supplement to liquid treatments in difficult areas, but may be used alone in difficult spots.

Note location of electrical sources prior to foaming voids to avoid possible shock hazard.

Application Under Slabs or to Soil in Crawlspaces to Prevent or Control Termites

Application may be made using Dragnet® foam alone or in combination with liquid emulsion. The equivalent of at least 4 gallons (6.4 ounces of Dragnet® concentrate) of 0.5% emulsion per 10 linear feet (vertical barrier), or at least 1 gallon (1.6 ounces of Dragnet® concentrate) of 0.5% emulsion per 10 square feet (horizontal barrier) must be applied either as emulsion, foam, or a combination of both. For a foam only application, apply Dragnet® concentrate in sufficient foam concentration and foam volume to deposit 6.4 ounces of concentrate per 10 linear feet or 1.6 ounces of concentrate per 10 square feet. For example, 1 gallon of 2% emulsion generated as foam to cover 10 linear feet is equal to the application of 4 gallons of 0.5% emulsion per 10 linear feet.

Sand Barrier Installation and Treatment

Termites can build mud tubes over treated surfaces as long as they have access to untreated soil and do not have to move Dragnet® treated soil. Fill in cracks and spaces with builder's or playbox sand and treat the sand with Dragnet®. The sand should be treated as soil following the termiticide rate listed on the Dragnet® label.

Retreatment for subterranean termites can only be performed if there is clear evidence of reinfestation or disruption of the barrier due to construction, excavation, or landscaping and/or evidence of the breakdown of the termiticide barrier in the soil. These vulnerable or reinfested areas may be retreated in accordance with application techniques described in this product's labeling. The timing and type of these retreatments will vary depending on factors such as termite pressure, soil types, soil conditions and other factors which may reduce the effectiveness of the barrier.

Annual retreatment of the structure is prohibited unless there is clear evidence that reinfestation or barrier disruption has occurred.

APPLICATION IN CONJUNCTION WITH THE USE OF FIRSTLINE TERMITE BAITS

As part of the Systematic Termite Control (STC) program for termite control, Dragnet FT may be applied to critical areas of the structure including plumbing and utility entry sites, bath traps, expansion joints, foundation cracks and areas with known or suspected infestations at a rate of 0.5% as a spot treatment or complete barrier treatment. Applications may be made as described in the Postconstruction treatment section of this label.

SPECIFIC PEST CONTROL APPLICATIONS

Underground services

Such as: wires, cables, utility lines, pipes, conduits, etc. Services may be within structures or located outside structures, in right-of-ways or to protect long range (miles) of, installations of services.

Soil treatment may be made using 0.5% to 1.0% Dragnet® FT emulsion to prevent attack by termites and ants.

Apply 2 to 4 gallons of emulsion per 10 linear feet to the bottom of the trench and allow to soak into the soil. Lay services on the treated soil and cover with approximately 2 inches of fill soil. Apply another 2 to 4 gallons per 10 linear feet over the soil surface to complete the treatment barrier. In wide trenches, only treat the soil in the area near the services. It is important to establish a continuous barrier of treated soil surrounding the services.

Where soil will not accept the above labeled volume, 1 to 2 gallons of 1.0% Dragnet FT may be used per 10 linear feet of trench both to the bottom of the trench and over the soil on top of the services.

Finish filling the trench with treated fill soil. The soil where each service protrudes from the ground may be treated by trenching/rodding of no more than 1 to 2 gallons of emulsion into the soil.

Precautions:

Do not treat electrically active underground services.

Posts, Poles, and Other Constructions

Create an insecticidal barrier in the soil around wooden constructions such as signs, fences and landscape ornamentation by applying a 0.5% emulsion.

Previously installed poles and posts may be treated by sub-surface injection or treated by gravity flow through holes made from the bottom of a trench around the pole or post. Treat on all sides to create a continuous insecticidal barrier around the pole. Use 1 gallon of emulsion per foot of depth for poles and posts less than six inches in diameter. For larger poles, use 1.5 gallons of emulsion per foot of depth. Apply to a depth of 6 inches below the bottom of the wood. For larger constructions, use 4 gallons per 10 linear feet per foot of depth.

Treatment of Wood-In-Place for Control of Wood-Infesting Insects

(Localized Areas in Structure)

For the control of insects such as termites, ants, carpenter ants, and wood-infesting beetles such as Old House Borer and Powder Post in

localized areas of infested wood in and around structures, apply a 0.5% emulsion to voids and galleries in damaged wood and in spaces between wooden members of a structure and between wood and foundations where wood is vulnerable. Paint on or fan spray applications may also be used. Plastic sheeting must be placed immediately below overhead areas that are spot treated except for soil surfaces in crawlspaces. Application may be made to inaccessible areas by drilling, and then injecting emulsion with a crack and crevice injector into the damaged wood or void spaces. This type of application is not intended to be a substitute for soil treatment, mechanical alteration or fumigation to control extensive infestation of wood-infesting insects.

Termite carton nests in trees or building voids may be injected with 0.5% to 1.0% emulsion. Multiple injection points to varying depths may be necessary. It is desirable to physically remove carton nest material from building voids when such nests are found.

> **Important:** Do not apply emulsion until location of heat pipes, ducts, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these structural elements. Do not apply into electrical fixtures, switches, or sockets.

Attention

Do not apply to pets, crops, or sources of electricity.

Do not allow people on treated surfaces until the spray has dried.

Firewood is not to be treated.

During any application to overhead areas of structure, Cover surfaces below with plastic sheeting or similar material (except where exempt).

Do not allow spray to contact food, foodstuffs, food contacting surfaces, food utensils or water supplies.

Thoroughly wash dishes and food handling utensils with soap and water if they become contaminated by application of this product.

Do not treat areas where food is exposed.

During indoor surface applications do not allow dripping or run-off to occur.

Do not apply this product in patient rooms or in any rooms while occupied by the elderly or infirm.

Do not apply when occupants are present in the immediate area in institutions such as libraries, sport facilities, etc.

Do not apply to classrooms when in use.

Do not touch treated surfaces until dry.

Do not use for Pretreatment application.

Termite Warranty

The Pest Control Firm utilizing Dragnet® STC termiticide as part of the Systematic Termite Control Program for structures must, so long as the property owner is maintaining the annual renewal inspection, provide the property owner with a warranty that structural damage caused by live termites after the initiation of the STC program will be repaired. Any such warranty shall be between the PCO Firm and the property owner. This paragraph neither creates nor confers any rights against FMC.

Dealers Should Sell In Original Packages Only.

Terms of Sale or Use: On purchase of this product buyer and user agree to the following conditions:

Warranty: FMC makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. Except as so warranted, the product is sold as is. Buyer and user assume all risk of use and/or handling and/or storage of this material when such use and/or handling and/or storage is contrary to label instructions.

Use of Product: FMC's recommendations for the use of this product are based upon tests believed to be reliable. The use of this product being beyond the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe practice.

Damages: Buyer's or user's exclusive remedy for damages for breach of warranty or negligence shall be limited to direct damages not exceeding the purchase price paid and shall not include incidental or consequential damages.

REVISIONS:

1.

The PCO Firm's Guide to the use of FirstLine™ GT Termite Bait Stations

The use of FirstLine GT Termite Bait Stations is part of the Systematic Termite Control℠ program developed to assist PCO firms in controlling termite populations in and around structures. The level of success a firm will have is directly related to following a specific method of using the stations and diligent monitoring of the stations. The focus for the location of the stations is within conducive condition areas which are typically either moisture or food related. Some of the more important conducive condition areas would include: mulchbeds, downspouts, gutterless roof drip lines, dripping water faucets, air conditioner drip lines, consistently moist areas, tree stumps, soil to wood contact, and woodpiles.

You have two types of soil mounted stations to work with. The GT bait station contains sulfluramid treated cardboard while the monitoring station contains a piece of untreated slotted wood. Both stations are in transparent, sealed tube stations with transparent caps.

o Choose a place to always begin your graphing efforts, such as the front right corner of the structure, the back door, the front door, or where ever it is convenient. Always work left to right or right to left. The important point is to be consistent for easy relocation of structures on subsequent visits.

o Accurately graph the structure, to include features within 25 feet of the structure even if over the property line. A downspout on a neighboring structure can create a moisture problem for the structure you are trying to protect.

o Number the conducive conditions on the graph, and identify which, if any, have live termites at the time of the inspection. The location of 6-20 conducive sites would not be unusual.

o If termites are active, the PCO can perform complete termiticide application, or alternatively, complete spot treatment in areas currently termite active. Structures not currently termite active can be spot treated only if the structure was previously pretreated or post treated by any PCO or even the homeowner. Baits may be used without any termiticide treatment but this increases the potential for additional short term damage to the structure until the termites locate and feed upon baits.

o Within each numbered conducive site, install groups of 2 or more GT or monitoring stations. If the conducive site is termite active, install at least 2 GT stations (per label). In non infested conducive sites, install 2 or more monitoring stations. Remember to always stay at least 6 inches away from the foundation to avoid what we assume to always contain termiticide treated soil. A mixture of GT and monitoring stations is also appropriate as long as at least 2 GT are used in active sites, and 3-14 GT stations must be used per infested structure.

o Station installation methods depend upon soil types. In light soil, the stations can be hammered into the soil with a rubber hammer. Other devices include a hand trowel, bulb planter, a 1 inch diameter piece of pipe, or a foot powered custom made device manufactured by Really Innovations (800-940-8024). To install stations in clay or compacted soils, a power auger or drill may be required. Stations should be even with the soil surface but can be pushed below the surface if tampering might occur.

o The best approach for installing and later locating stations for inspection is for the PCO firm to adopt a standard station pattern for use within each conducive site. For example, the pattern could be a pair, a group of 3 in a triangle, a group of 4 in a square, or even a group of 5 or more in some standard pattern. The key is to pick a pattern and stick with it so that all your technicians are doing the same thing. The distance between stations within the site can also be standardized.

o If a monitoring station becomes infested, place two GT stations on either side (within a few inches) of the monitor. The monitor could also be pulled out of the soil and replaced directly with one GT station while a second GT station is placed a few inches away.

o Station location is easier if the graph is accurate and the PCO firm is installing stations in a pattern. Station relocation aids would include foundation marking such as with a dot of color or a bright colored object(such as a plant marker) pushed into the soil along the foundation. Every GT and monitoring station contains a metal ring for detection by sensative metal detectors. A metal disc (3 inch diameter) placed within the pattern of stations has also been effective when used with a less expensive (Radio Shack $99) metal detector. Rain has been found to interfere with metal detectors.

o Inspect GT stations every 2-4 weeks, adjusting the arrangement of stations as needed. To inspect, look down into the station through the transparent plastic cap. A flashlight may be needed. Look for food modification behavior such as soil in the top of the corrugated cardboard or in the slots of the wood. Disturbance should be minimized wherever possible thus pulling stations out of the soil for inspection purposes may disturb the termites and may cause delay in control.

o Be sure to record installation and inspection dates and results and file with your updated graphs. Keep property owners advised of your findings and the "adjustments" you make to the Systematic Termite Control[sm] program.

Just as too few gallons of termiticide can result in a non continuous termiticide barrier, too few GT/monitoring stations can result in a significant reduction in the ability to detect termites. **One station per conducive condition is not enough.** When you are "fishing for termite" you need as many "lines in the water" as practical to optimize your chances of catching termites.

Although termiticides and baits can be used separately, no Systematic Termite Control element alone is a "silver bullet". We recommend that the PCO integrate all the elements of the system in a manner that allows them the best opportunity for providing the highest level of customer satisfaction.

FirstLine GT and Systematic Termite Control are FMC Corporation marks

The PCO Firm's Guide to the use of FirstLine™ GT Termite Bait Stations

The use of FirstLine GT Termite Bait Stations is part of the Systematic Termite Control^{sm} program developed to assist PCO firms in controlling termite populations in and around structures. The level of success a firm will have is directly related to following a specific method of using the stations and diligent monitoring of the stations. The focus for the location of the stations is within conducive condition areas which are typically either moisture or food related. Some of the more important conducive condition areas would include: mulchbeds, downspouts, gutterless roof drip lines, dripping water faucets, air conditioner drip lines, consistently moist areas, tree stumps, soil to wood contact, and woodpiles.

You have two types of soil mounted stations to work with. The GT bait station contains sulfluramid treated cardboard while the monitoring station contains a piece of untreated slotted wood. Both stations are in transparent, sealed tube stations with transparent caps.

o Choose a place to always begin your graphing efforts, such as the front right corner of the structure, the back door, the front door, or where ever it is convenient. Always work left to right or right to left. The important point is to be consistent for easy relocation of structures on subsequent visits.

o Accurately graph the structure, to include features within 25 feet of the structure even if over the property line. A downspout on a neighboring structure can create a moisture problem for the structure you are trying to protect.

o Number the conducive conditions on the graph, and identify which, if any, have live termites at the time of the inspection. The location of 6-20 conducive sites would not be unusual.

o If termites are active, the PCO can perform complete termiticide application, or alternatively, complete spot treatment in areas currently termite active. Structures not currently termite active can be spot treated only if the structure was previously pretreated or post treated by any PCO or even the homeowner. Baits may be used without any termiticide treatment but this increases the potential for additional short term damage to the structure until the termites locate and feed upon baits.

o Within each numbered conducive site, install groups of 2 or more GT or monitoring stations. If the conducive site is termite active, install at least 2 GT stations (per label). In non infested conducive sites, install 2 or more monitoring stations. Remember to always stay at least 6 inches away from the foundation to avoid what we assume to always contain termiticide treated soil. A mixture of GT and monitoring stations is also appropriate as long as at least 2 GT are used in active sites, and 3-14 GT stations must be used per infested structure.

o Station installation methods depend upon soil types. In light soil, the stations can be hammered into the soil with a rubber hammer. Other devices include a hand trowel, bulb planter, a 1 inch diameter piece of pipe, or a foot powered custom made device manufactured by Really Innovations (800-940-8024). To install stations in clay or compacted soils, a power auger or drill may be required. Stations should be even with the soil surface but can be pushed below the surface if tampering might occur.

o The best approach for installing and later locating stations for inspection is for the PCO firm to adopt a standard station pattern for use within each conducive site. For example, the pattern could be a pair, a group of 3 in a triangle, a group of 4 in a square, or even a group of 5 or more in some standard pattern. The key is to pick a pattern and stick with it so that all your technicians are doing the same thing. The distance between stations within the site can also be standardized.

o If a monitoring station becomes infested, place two GT stations on either side (within a few inches) of the monitor. The monitor could also be pulled out of the soil and replaced directly with one GT station while a second GT station is placed a few inches away.

o Station location is easier if the graph is accurate and the PCO firm is installing stations in a pattern. Station relocation aids would include foundation marking such as with a dot of color or a bright colored object(such as a plant marker) pushed into the soil along the foundation. Every GT and monitoring station contains a metal ring for detection by sensative metal detectors. A metal disc (3 inch diameter) placed within the pattern of stations has also been effective when used with a less expensive (Radio Shack $99) metal detector. Rain has been found to interfere with metal detectors.

o Inspect GT stations every 2-4 weeks, adjusting the arrangement of stations as needed. To inspect, look down into the station through the transparent plastic cap. A flashlight may be needed. Look for food modification behavior such as soil in the top of the corrugated cardboard or in the slots of the wood. Disturbance should be minimized wherever possible thus pulling stations out of the soil for inspection purposes may disturb the termites and may cause delay in control.

o Be sure to record installation and inspection dates and results and file with your updated graphs. Keep property owners advised of your findings and the "adjustments" you make to the Systematic Termite Control^{sm} program.

Just as too few gallons of termiticide can result in a non continuous termiticide barrier, too few GT/monitoring stations can result in a significant reduction in the ability to detect termites. **One station per conducive condition is not enough.** When you are "fishing for termite" you need as many "lines in the water" as practical to optimize your chances of catching termites.

Although termiticides and baits can be used separately, no Systematic Termite Control element alone is a "silver bullet". We recommend that the PCO integrate all the elements of the system in a manner that allows them the best opportunity for providing the highest level of customer satisfaction.

FirstLine GT and Systematic Termite Control are FMC Corporation marks

The PCO Firm's Guide to the use of FirstLine™ GT Termite Bait Stations

The use of FirstLine GT Termite Bait Stations is part of the Systematic Termite Control℠ program developed to assist PCO firms in controlling termite populations in and around structures. The level of success a firm will have is directly related to following a specific method of using the stations and diligent monitoring of the stations. The focus for the location of the stations is within conducive condition areas which are typically either moisture or food related. Some of the more important conducive condition areas would include: mulchbeds, downspouts, gutterless roof drip lines, dripping water faucets, air conditioner drip lines, consistently moist areas, tree stumps, soil to wood contact, and woodpiles.

You have two types of soil mounted stations to work with. The GT bait station contains sulfluramid treated cardboard while the monitoring station contains a piece of untreated slotted wood. Both stations are in transparent, sealed tube stations with transparent caps.

o Choose a place to always begin your graphing efforts, such as the front right corner of the structure, the back door, the front door, or where ever it is convenient. Always work left to right or right to left. The important point is to be consistent for easy relocation of structures on subsequent visits.

o Accurately graph the structure, to include features within 25 feet of the structure even if over the property line. A downspout on a neighboring structure can create a moisture problem for the structure you are trying to protect.

o Number the conducive conditions on the graph, and identify which, if any, have live termites at the time of the inspection. The location of 6-20 conducive sites would not be unusual.

o If termites are active, the PCO can perform complete termiticide application, or alternatively, complete spot treatment in areas currently termite active. Structures not currently termite active can be spot treated only if the structure was previously pretreated or post treated by any PCO or even the homeowner. Baits may be used without any termiticide treatment but this increases the potential for additional short term damage to the structure until the termites locate and feed upon baits.

o Within each numbered conducive site, install groups of 2 or more GT or monitoring stations. If the conducive site is termite active, install at least 2 GT stations (per label). In non infested conducive sites, install 2 or more monitoring stations. Remember to always stay at least 6 inches away from the foundation to avoid what we assume to always contain termiticide treated soil. A mixture of GT and monitoring stations is also appropriate as long as at least 2 GT are used in active sites, and 3-14 GT stations must be used per infested structure.

o Station installation methods depend upon soil types. In light soil, the stations can be hammered into the soil with a rubber hammer. Other devices include a hand trowel, bulb planter, a 1 inch diameter piece of pipe, or a foot powered custom made device manufactured by Really Innovations (800-940-8024). To install stations in clay or compacted soils, a power auger or drill may be required. Stations should be even with the soil surface but can be pushed below the surface if tampering might occur.

o The best approach for installing and later locating stations for inspection is for the PCO firm to adopt a standard station pattern for use within each conducive site. For example, the pattern could be a pair, a group of 3 in a triangle, a group of 4 in a square, or even a group of 5 or more in some standard pattern. The key is to pick a pattern and stick with it so that all your technicians are doing the same thing. The distance between stations within the site can also be standardized.

o If a monitoring station becomes infested, place two GT stations on either side (within a few inches) of the monitor. The monitor could also be pulled out of the soil and replaced directly with one GT station while a second GT station is placed a few inches away.

o Station location is easier if the graph is accurate and the PCO firm is installing stations in a pattern. Station relocation aids would include foundation marking such as with a dot of color or a bright colored object(such as a plant marker) pushed into the soil along the foundation. Every GT and monitoring station contains a metal ring for detection by sensative metal detectors. A metal disc (3 inch diameter) placed within the pattern of stations has also been effective when used with a less expensive (Radio Shack $99) metal detector. Rain has been found to interfere with metal detectors.

o Inspect GT stations every 2-4 weeks, adjusting the arrangement of stations as needed. To inspect, look down into the station through the transparent plastic cap. A flashlight may be needed. Look for food modification behavior such as soil in the top of the corrugated cardboard or in the slots of the wood. Disturbance should be minimized wherever possible thus pulling stations out of the soil for inspection purposes may disturb the termites and may cause delay in control.

o Be sure to record installation and inspection dates and results and file with your updated graphs. Keep property owners advised of your findings and the "adjustments" you make to the Systematic Termite Control[sm] program.

Just as too few gallons of termiticide can result in a non continuous termiticide barrier, too few GT/monitoring stations can result in a significant reduction in the ability to detect termites. **One station per conducive condition is not enough.** When you are "fishing for termite" you need as many "lines in the water" as practical to optimize your chances of catching termites.

Although termiticides and baits can be used separately, no Systematic Termite Control element alone is a "silver bullet". We recommend that the PCO integrate all the elements of the system in a manner that allows them the best opportunity for providing the highest level of customer satisfaction.

The PCO Firm's Guide to the use of FirstLine™ GT Termite Bait Stations

The use of FirstLine GT Termite Bait Stations is part of the Systematic Termite Control℠ program developed to assist PCO firms in controlling termite populations in and around structures. The level of success a firm will have is directly related to following a specific method of using the stations and diligent monitoring of the stations. The focus for the location of the stations is within conducive condition areas which are typically either moisture or food related. Some of the more important conducive condition areas would include: mulchbeds, downspouts, gutterless roof drip lines, dripping water faucets, air conditioner drip lines, consistently moist areas, tree stumps, soil to wood contact, and woodpiles.

You have two types of soil mounted stations to work with. The GT bait station contains sulfluramid treated cardboard while the monitoring station contains a piece of untreated slotted wood. Both stations are in transparent, sealed tube stations with transparent caps.

o Choose a place to always begin your graphing efforts, such as the front right corner of the structure, the back door, the front door, or where ever it is convenient. Always work left to right or right to left. The important point is to be consistent for easy relocation of structures on subsequent visits.

o Accurately graph the structure, to include features within 25 feet of the structure even if over the property line. A downspout on a neighboring structure can create a moisture problem for the structure you are trying to protect.

o Number the conducive conditions on the graph, and identify which, if any, have live termites at the time of the inspection. The location of 6-20 conducive sites would not be unusual.

o If termites are active, the PCO can perform complete termiticide application, or alternatively, complete spot treatment in areas currently termite active. Structures not currently termite active can be spot treated only if the structure was previously pretreated or post treated by any PCO or even the homeowner. Baits may be used without any termiticide treatment but this increases the potential for additional short term damage to the structure until the termites locate and feed upon baits.

o Within each numbered conducive site, install groups of 2 or more GT or monitoring stations. If the conducive site is termite active, install at least 2 GT stations (per label). In non infested conducive sites, install 2 or more monitoring stations. Remember to always stay at least 6 inches away from the foundation to avoid what we assume to always contain termiticide treated soil. A mixture of GT and monitoring stations is also appropriate as long as at least 2 GT are used in active sites, and 3-14 GT stations must be used per infested structure.

o Station installation methods depend upon soil types. In light soil, the stations can be hammered into the soil with a rubber hammer. Other devices include a hand trowel, bulb planter, a 1 inch diameter piece of pipe, or a foot powered custom made device manufactured by Really Innovations (800-940-8024). To install stations in clay or compacted soils, a power auger or drill may be required. Stations should be even with the soil surface but can be pushed below the surface if tampering might occur.

o The best approach for installing and later locating stations for inspection is for the PCO firm to adopt a standard station pattern for use within each conducive site. For example, the pattern could be a pair, a group of 3 in a triangle, a group of 4 in a square, or even a group of 5 or more in some standard pattern. The key is to pick a pattern and stick with it so that all your technicians are doing the same thing. The distance between stations within the site can also be standardized.

o If a monitoring station becomes infested, place two GT stations on either side (within a few inches) of the monitor. The monitor could also be pulled out of the soil and replaced directly with one GT station while a second GT station is placed a few inches away.

o Station location is easier if the graph is accurate and the PCO firm is installing stations in a pattern. Station relocation aids would include foundation marking such as with a dot of color or a bright colored object(such as a plant marker) pushed into the soil along the foundation. Every GT and monitoring station contains a metal ring for detection by sensative metal detectors. A metal disc (3 inch diameter) placed within the pattern of stations has also been effective when used with a less expensive (Radio Shack $99) metal detector. Rain has been found to interfere with metal detectors.

o Inspect GT stations every 2-4 weeks, adjusting the arrangement of stations as needed. To inspect, look down into the station through the transparent plastic cap. A flashlight may be needed. Look for food modification behavior such as soil in the top of the corrugated cardboard or in the slots of the wood. Disturbance should be minimized wherever possible thus pulling stations out of the soil for inspection purposes may disturb the termites and may cause delay in control.

o Be sure to record installation and inspection dates and results and file with your updated graphs. Keep property owners advised of your findings and the "adjustments" you make to the Systematic Termite Control^{sm} program.

Just as too few gallons of termiticide can result in a non continuous termiticide barrier, too few GT/monitoring stations can result in a significant reduction in the ability to detect termites. **One station per conducive condition is not enough.** When you are "fishing for termite" you need as many "lines in the water" as practical to optimize your chances of catching termites.

Although termiticides and baits can be used separately, no Systematic Termite Control element alone is a "silver bullet". We recommend that the PCO integrate all the elements of the system in a manner that allows them the best opportunity for providing the highest level of customer satisfaction.

FirstLine GT and Systematic Termite Control are FMC Corporation marks

Association of Structural Pest Control Regulatory Officials

DATE: December 16, 1996

TO: ASPCRO Termiticide Label Review Committee:
Dave Scott(IN), Jim Wright(SC),
Bud Paulson(AZ)

FROM: George Saxton/Treasurer

RE: Draft Termiticide Label from Micro Flo

Enclosed is a copy of the Micro Flo amended draft label as submitted to the US EPA, for their termiticide product.

MICRO FLO
THE PLANT HEALTH AND PROTECTION COMPANY

P.O. Box 5948
Lakeland, FL 33807-5948
Ph.: (941) 647-3608
Fax: (941) 647-3412

Box 190
Sparks, Georgia 31647
(912) 549-8245

December 12, 1996

ASPCRO Termiticide Review
c/o George Saxton
Office of the Indiana State Chemist
Purdue University
1154 Biochemistry Building
West Lafayette, IN 47907-1154
ATTN: Jim Wright

Re: Micro Flo Company
Chlorpyrifos Termite Concentrate
EPA Reg.No. 51036-122

Dear Sirs:

Enclosed is a copy of Micro Flo Company's amended draft label as submitted to the U.S. EPA in response to PR Notice 96-7 on termiticides. Also enclosed is a copy of our current label (this specimen label reflects current production labeling). These are being sent to you as a courtesy in light of the Agency's comments in PR Notice 96-7. Please contact us if you have any questions.

Sincerely,

Lee Tharrington
Registrations Assistant

MICRO FLO
CHLORPYRIFOS TERMITE CONCENTRATE

For use by individuals/firms licensed or registered by the state to apply termiticide products. States may have more restrictive requirements regarding qualifications of persons using this product. Consult the structural pest control regulatory agency of your state prior to use of this product.

~~To Be Applied Only By Or Under The Supervision of Commercial Applicators Responsible For Insect Control Programs. Not Intended For Use By Homeowners.~~

ACTIVE INGREDIENT:
Chlorpyrifos (0,0-diethyl 0-(3,5,6-trichloro-2-pyridyl) phosphorothioate) 42.8%
INERT INGREDIENTS: 57.2%
TOTAL 100.0%

Contains 4 pounds of chlorpyrifos per gallon
Contains petroleum distillate

KEEP OUT OF REACH OF CHILDREN

WARNING AVISO

PRECAUCION AL USUARIO: Si usted no lee ingles, no use este producto hasta que le etiqueta haya sido explicada ampliamente.

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or get medical attention. Do not induce vomiting. Contains an aromatic petroleum solvent. Do not give anything by mouth to an unconscious person. Avoid alcohol.
IF IN EYES: Flush with plenty of water. Call a physician if irritation persists.
IF ON SKIN: Wash with plenty of soap and water. Get medical attention.
IF INHALED: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

EPA Reg. No. 51036-122 EPA Est. No. 51036-GA-1

Manufactured By
MICRO FLO COMPANY
P.O. Box 5948
Lakeland, FL 33807

PRECAUTIONARY STATEMENTS
Hazards To Humans And Domestic Animals

WARNING

May be fatal if swallowed. Harmful if absorbed through skin or clothing. Causes moderate eye irritation. Avoid contact with eyes, skin or clothing. Harmful if inhaled. Avoid breathing of vapors. Wash thoroughly with soap and water after handling and before eating, drinking or using tobacco. Remove contaminated clothing and wash before reuse. Keep away from food, feed stuffs and water supplies. **When treating adjacent to an existing structure, the applicator must check the area to be treated, and immediately adjacent areas of the structure, for visible and accessible cracks and holes to prevent any leaks or significant exposures to persons occupying the structure. People present or residing in the structure during application must be advised to remove their pets and themselves from the structure if they see any signs of leakage. After application, the applicator is required to check for leaks. All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy contaminated areas of the structure until the clean up is completed.**

NOTE TO PHYSICIAN: Chlorpyrifos is a cholinesterase inhibitor. Treat symptomatically. If exposed, plasma and red blood cell cholinesterase tests may indicate degree of exposure (baseline data are useful). Atropine, only by injection, is the preferable antidote. Oximes, such as 2-PAM/protopam, may be therapeutic if used early; however, use only in conjunction with atropine. In case of severe acute poisoning, use antidotes immediately after establishing an open airway and respiration. May pose an aspiration hazard.

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish, birds, and other wildlife. Do not apply directly to water. Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. Cover or incorporate spills. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

PHYSICAL OR CHEMICAL HAZARDS

COMBUSTIBLE! Do not use or store near heat or open flame. Do not cut or weld container.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE: Storage below 55 degrees F may result in formation of crystals. If product crystallizes out of solution, store at 72 degrees F to 90 degrees F and agitate to redissolve crystals.

PESTICIDE DISPOSAL: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

All pesticide handlers (mixers, loaders, and applicators) must wear long-sleeved coveralls worn over a minimum of short-sleeved shirt and short pants, socks, chemical-resistant footwear, chemical-resistant (such as nitrile or butyl) gloves, and protective eyewear. In addition, all pesticide handlers must wear a respiratory protection device (Dust/mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or Respirator with an organic-vapor removing cartridge and a prefilter approved for pesticides with MSHA/NIOSH approval number prefix TC-14G or Supplied-air respirator with MSHA/NIOSH approval number prefix TC-19C or self-contained breathing apparatus (SCBA) with MSHA/NIOSH approval number TC-13F) when handling the concentrate or when working in a non-ventilated space.

~~SAFE HANDLING PROCEDURES~~

~~Wear suitable protective clothing when using or handling this product to help avoid exposure to eyes and skin. As a minimum, chemical workers goggles, neoprene or natural rubber gloves and footwear, a long sleeved shirt and long legged pants or coveralls are recommended. To avoid breathing spray mist during application in confined areas, wear a mask or respirator of a type recommended by NIOSH for filtering spray mists and organic vapors.~~

SUBTERRANEAN TERMITES

Chlorpyrifos Termite Concentrate for soil treatment is used to establish a barrier which is lethal to termites. The chemical emulsion must be adequately dispersed in the soil to provide a barrier between the wood in the structure and the termite colonies in the soil.

It is important that the service technician be familiar with current control practices including trenching, rodding, subslab injection, and low pressure spray applications. These techniques must be correctly employed to prevent or control infestations by subterranean termite species of RETICULITERMES, ZOOTERMOPSIS, and COPTOTERMES. Choice of appropriate procedures includes consideration of such variable factors as the design of the structure, water table, soil type, soil compaction, grade conditions, and the location and type of domestic water supplies. The biology and behavior of the involved termite species are important factors to be known as well as suspected location of the colony and severity of the infestation within the structure to be protected. For advice concerning current control practices for specific local conditions, consult resources in structural pest control.

GENERAL USE PRECAUTIONS

Do not contaminate wells or cisterns. Contamination of public and private water supplies must be avoided by following these precautions:

1. Use antiback-flow equipment or procedures to prevent siphonage of pesticide back into water supplies.

2. Do not treat soil that is water saturated or frozen.

3. Consult state and local specifications for recommended distances of treatment areas from wells, and refer to Federal Housing Administration Specifications for further guidance.

STRUCTURES WITH WELLS/CISTERNS INSIDE FOUNDATIONS

Structures that contain wells or cisterns within the foundation of a structure can only be treated using the following techniques:

1. **Do not treat soil while it is beneath or within the foundation or along the exterior perimeter of a structure that contains a well or cistern. The treated backfill method must be used if soil is removed and treated outside/away from the foundation. The treated backfill technique is described as follows:**

   (a) **Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.**

   (b) **Treat the soil at the rate of 4 gallons of dilute emulsion per 10 linear feet per foot of depth of the trench, or 1 gallon per 1.0 cubic feet of soil. See "Dilution Directions" section of the label. Mix thoroughly into the soil taking care to contain the**

liquid and prevent runoff or spillage.

(c) After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.

2. Treat infested and/or damaged wood in place using an injection technique such as described in the "Control of Wood Infesting Insects" section of this label.

STRUCTURES WITH ADJACENT WELLS/CISTERNS AND/OR OTHER WATER BODIES

Applicators must inspect all structures with nearby water sources such as wells, cisterns, surface ponds, streams, and other bodies of water and evaluate, at a minimum, the treatment recommendations listed below prior to making an application.

1. Prior to treatment, if feasible, expose the water pipe(s) coming from the well to the structure, if the pipe(s) enter the structure within 3 feet of grade.

2. Prior to treatment applicators are advised to take precautions to limit the risk of applying the termiticide into subsurface drains that could empty into any bodies of water. These precautions include evaluating whether application of the termiticide to the top of the footer may result in contamination of the subsurface drain. Factors such as depth to the drain system and soil type and degree of compaction should be taken into account in determining the depth of treatment.

3. When appropriate (i.e., on the water side of the structure), the treated backfill technique (described above) can also be used to minimize off-site movement of termiticide.

~~Structures that contain wells or cisterns may be treated using the following guidelines:~~

~~1. Do not treat soil while it is beneath or within the foundation of a structure that contains a well or cistern. The treated backfill method may be used if the soil is removed and treated outside the foundation.~~

~~2. If treatment must be made along exterior foundation walls of structures containing wells or cisterns or other difficult situations such as near wells or cisterns, along fieldstone or rubble walls, along faulty foundation walls, around pipes and utility lines which lead downward from the structure to a well, pond, or other body of water, application may be made in the following manner:~~

~~EXCAVATION/TREATED BACKFILL TECHNIQUE~~

~~a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.~~

~~b. Treat the soil at the rate of 4 gallons of diluted emulsion per 10 linear feet per foot of depth of the trench or 1 gallon of dilution per 1.0 cubic feet (See Rate Determination Guideline below). An initial treatment using a 0.75 - 1.0 % dilution will provide effective optimum long term residual control. Mix thoroughly into the soil taking care to contain the liquid and prevent runoff or spillage.~~

~~c. After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.~~

~~3. Infested and/or damaged wood can be treated using an injection technique such as described in "Control of Wood Infesting Insects".~~

All nonessential wood and cellulose containing materials, including scrap wood and form boards, should be removed from around foundation walls, crawl spaces, and porches. This does not include existing structural soil contact wood that either has been or needs to be treated.

RATE DETERMINATION GUIDELINES

Consult the local extension agent or state entomologist for application rate recommendations.
An initial treatment using 0.75 - 1.0% dilution will provide effective, optimum long term residual control.
~~The 0.75% rate may also be used when making follow up or spot treatments with no reinspection restrictions.~~
A 2.0% dilution may be used to protect utility poles and fence posts.

Mixing Directions

It is important that the termiticide dilution be uniformly mixed in the spray tank before beginning the treatment. Once mixed, Chlorpyrifos TC will not settle out in the tank although the initial mixing will be enhanced by agitation, circulation through the treating hose, and the filling process.

1. Fill tank 1/4 to 1/3 full.

2. Start pump to begin by-pass agitation and place end of treating tool in tank to allow circulation through hose.

3. Add appropriate amount of Chlorpyrifos TC.

4. Add remaining amount of water.

5. Let pump run and allow recirculation through the hose for 2 to 3 minutes.

DILUTION DIRECTIONS

Gallons of Finished Dilution Desired	Chlorpyrifos Termite Concentrate Needed			
	0.5%	0.75%	1.0%	2.0%
1	1 1/3 fl oz	2 fl oz	2 2/3 fl oz	5 1/3 fl oz
5	6 2/3 fl oz	10 fl oz	13 1/3 fl oz	26 2/3 fl oz
10	13 1/3 fl oz	20 fl oz	26 2/3 fl oz	53 1/3 fl oz
24	1 qt	1 1/2 qt	1/2 gl	1 gl
48	1/2 gl	3 qt	1 gl	2 gl
97	1 gl	1 1/2 gl	2 gl	4 gl

Application Volume

To provide maximum control and protection against termite infestation apply the specified volume of the finished water emulsion and active ingredient as set forth in the directions for use section of this label. If soil will not accept the labeled application volume, the volume may be reduced provided there is a corresponding increase in concentration so that the amount of active ingredient applied to the soil remains the same. NOTE: Large reductions of application volume reduce the ability to obtain a continuous barrier. Variance is allowed when volume and concentration are consistent with label directed rates and a continuous barrier can still be achieved.

Do not treat soil that is water saturated or frozen. Do not treat while precipitation is occurring.

~~To ensure thorough and complete coverage in different soil types, it may become necessary to adjust the volume being applied. In situations such as heavy, clay type soils which will not accept large amounts of water, reduced volumes can be used which will deliver the appropriate concentrations of termiticide in the soil. This would also apply to sensitive areas and/or horizontal applications where less volume may be desirable. Minimum volumes will be specified in the appropriate use directions.~~

~~In light textured soils such as sand or gravel which accept larger amounts of water, increased volumes which deliver the appropriate concentration of termiticide in the soil may be used. Maximum volumes will be specified in the appropriate use directions.~~

PRECONSTRUCTION SUBTERRANEAN TERMITE TREATMENT

PRECONSTRUCTION TREATMENT: DO NOT APPLY AT A LOWER DOSAGE AND/OR CONCENTRATION THAN SPECIFIED ON THIS LABEL FOR APPLICATIONS PRIOR TO INSTALLATION OF THE FINISHED GRADE.

Prior to each application, applicators must notify the general contractor, construction superintendent, or similar responsible party, of the intended termiticide application and intended sites of application and instruct the responsible person to notify construction workers and other individuals to leave the area to be treated during application and until the termiticide is absorbed into the soil.

Effective preconstruction subterranean termite control requires the establishment of a unbroken vertical and/or horizontal chemical barrier between wood in the structure and the termite colonies in the soil. To meet F.H.A. termite proofing requirements, follow the latest edition of the Housing and Urban Development (H.U.D.) Minimum Property Standards. Follow state and local regulations to meet minimum treatment standards for preventive preconstruction treatments.

All holes in commonly occupied areas into which material has been applied must be plugged. Plugs must be of a non-cellulose material or covered by an impervious, non-cellulose material.

~~All holes drilled in construction elements for preconstruction treatments should be securely plugged following application.~~

See "Rate Determination Guidelines" and Table 1 for dilution directions

When treating foundations deeper than 4 feet, apply the termiticide as the backfill is being replaced, or if the construction contractor fails to notify the applicator to permit this, treat the foundation to a minimum depth of 4 feet after the backfill has been installed. The applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to a minimum depth of 4 feet. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.

1. For Horizontal barriers, applications shall be made using a

low pressure spray after grading is completed and prior to the pouring of the slab or footing.

a. For a 0.75% rate, apply 1 gallon of dilution per 10 square feet or use 2 fluid ounces of Chlorpyrifos TC per 10 square feet in sufficient water (not less than 1/2 or more than 2 gallons) to provide thorough and continuous coverage of the area being treated (see Application Volume section).

   For a 1.0% rate, apply 1 gallon of dilution per 10 square feet, or use 2 2/3 fluid ounces of Chlorpyrifos TC per 10 square feet in sufficient water (no less than 1/2 gallon or more than 2 gallons) to provide thorough and continuous coverage of the area being treated (See "Application Volume").

   If the fill is washed gravel or other coarse material, it is important that a sufficient amount of dilution be used to reach the soil substrate beneath the coarse fill.

b. If concrete slabs cannot be poured over the soil the same day it has been treated, a vapor barrier should be placed over the treated soil to prevent disturbance of the termiticide barrier.

2. For Vertical barriers, apply the 0.75-1.0% dilution at a rate of 4 gallons per 10 linear feet per foot of depth. Establish vertical barriers in areas such as around the base of foundations, plumbing lines, backfilled soil against foundation walls and other areas which may warrant more than just a horizontal barrier.

a. Rodding and/or trenching applications should be made to reach the top of the footing. Rod holes should be spaced to provide a continuous barrier.

b. Trenches need not be wider than 6 inches. Treat soil with the dilution as it is being replaced in the trench.

   For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 8 fluid ounces of Chlorpyrifos TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallon or more than 8 gallons) to ensure complete coverage.
   For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 10 2/3 fluid ounces of Chlorpyrifos TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to insure complete

coverage.

c. Hollow block foundations or voids of masonry can be treated to make a complete chemical barrier especially if the soil was not treated prior to pouring the footing. Apply the dilution at a rate of 2 gallons per 10 linear feet so that it reaches the top of the footing.

d. For crawl spaces, establish a vertical barrier on both sides of the foundation and around all piers and areas where underground utilities exit the soil. Do not apply the dilution to the entire surface area intended as the crawl.

3. For Plenum type structures which use a sealed underfloor space to circulate heated and/or cooled air throughout the structure, apply the dilution at the rate of 4 gallons per 10 linear feet per foot of depth. Soil adjacent to both sides of foundation walls, supporting piers, plumbing and conduits should be treated by trenching or rodding (where soil conditions permit) to a depth of 6 inches or, if less shallow, to the top of the footing. When conditions will not permit trenching or rodding, surface application adjacent to interior foundation walls may be made but the treated strip shall not exceed a width of 18 inches, horizontally, from the foundation walls, piers or pipes. The surface application should be made at a rate of 1 gallon per 10 square feet as a very coarse spray under low pressure (not to exceed 20 P.S.I. when measured at the treating tool). After soil treatment, a continuous vapor barrier of at least 6 mil polyethylene film or other suitable vapor barrier must be installed on the ground surface over the entire subfloor area and on the inside of the plenum walls, in accordance with the recommended practices for plenum type structures.

When treating plenums, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

POSTCONSTRUCTION TREATMENTS

For applications made after the final grade is installed, the applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to the top of the footing. When the footing is more than four (4) feet below grade, the applicator must trench and rod into the trench or trench along the foundation walls at the rate prescribed to a minimum depth of four feet. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing.

However, in no case should a structure be treated below the footing.

Use a 1% emulsion for subterranean termites. Mix 2 gallons of Chlorpyrifos Termite Concentrate in 98 gallons of water to produce a 1% water emulsion. Postconstruction applications shall be made by injection, rodding, and/or trenching (using low pressure spray). Do not apply emulsion until location of heat or air conditioning ducts, vents, water and sewer lines and electrical conduits are known and identified. Extreme caution must be taken to avoid contamination of these structural elements and airways.

1. For slab on ground construction apply at the rate of 4 gallons of emulsion per 10 linear feet. Applications may be made by sub-slab injection and/or trenching. Injectors should not exceed beyond the tops of the footings. Treat along the outside of the foundation and where necessary just beneath the slab along one side of interior partitions and along all cracks and expansion joints.

    a. Drill holes in the slab to provide a continuous chemical barrier.

    b. Where necessary, drill through the foundation walls from the outside and force the emulsion just beneath the slab either along the inside of the foundation or along all the cracks and expansion joints and other critical areas.

    c. For shallow foundations, 1 foot or less, dig a narrow trench approximately six inches wide along the outside of the foundation walls. Do not dig below the bottom of the foundation. The emulsion should be applied to the trench and the soil at 4 gallons per 10 linear feet as the soil is replaced in the trench. Cover the treated soil with a layer of untreated soil.

    d. For foundations deeper than 1 foot follow rates for basements.

2. **Drill and treat voids in multiple masonry elements of the structure extending from the structure to the soil in order to create a continuous treatment barrier in the area to be treated. Apply at the rate of 2 gallons of emulsion per 10 linear feet of footing using a nozzle pressure of less than 25 p.s.i. When using this treatment access holes must be drilled below the sill plate and should be as close as possible to the footing as is practical. Treatment of voids in block or rubble foundation walls must be closely examined: Applicators must inspect areas of possible runoff as a precaution against application leakage in the treated areas. Some areas may not be treatable or may require mechanical alteration prior to treatment. All leaks resulting in the**

deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy the contaminated areas of the structure until the clean up is completed.

Not for use in voids insulated with rigid foam.

~~Hollow block foundation or voids of masonry should be treated to make a continuous chemical barrier in voids. Apply at the rate of 2 gallons of emulsion per 10 linear feet.~~

3. For basements apply at the rate of 4 gallons of emulsion per 10 linear feet. Where footings are greater than 1 foot of depth from the grade to the bottom of the foundation application may be made by trenching and/or rodding at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. Treat outside of foundation walls, and if necessary beneath the basement floor along inside of foundation walls, along cracks in basement floors, along interior load bearing walls, around sewer pipes, conduits, and piers.

4. **A. Accessible Crawl Spaces**

For crawl spaces, apply vertical termiticide barriers at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to the top of the footing, or if the footing is more than 4 feet below grade, to a minimum depth of 4 feet. Apply by trenching and rodding into the trench or trenching. Treat both sides of foundation and around all piers and pipes. Where physical obstructions, such as concrete walkways adjacent to foundation elements, prevent trenching, treatment may be made by rodding alone. When soil type and/or conditions make trenching prohibitive, rodding may be used. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. Read and follow the mixing and use direction section of the label if situations are encountered where the soil will not accept the full application volume.

1). Rod holes and trenches must not extend below the bottom of the footing.

2). Rod holes must be spaced so as to achieve a continuous chemical barrier but in no case more than 12 inches apart.

3). Trenches must be a minimum of 6 inches deep or to the bottom of the footing, whichever is less, and need not be wider than 6 inches. When trenching in sloping (tiered) soil, the trench must be stepped to ensure

adequate distribution and to prevent termiticide from running off. The emulsion must be mixed with the soil as it is replaced in the trench.

4). When treating crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

B. Inaccessible Crawl Spaces

For inaccessible interior areas, such as areas where there is insufficient clearance between floor joists and ground surfaces to allow operator access, excavate, if possible, and treat according to the instructions for accessible crawl spaces. Otherwise, apply one, or a combination of the following two methods.

1). To establish a horizontal barrier, apply to the soil surface, 1 gallon of emulsion per 10 sq. ft. overall using a nozzle pressure of less than 25 p.s.i. and a coarse application nozzle (e.g., Delavan Type RD Raindrop, RD-7 or larger, or Spraying Systems Co. 8010LP TeeJet or comparable nozzle). For an area that cannot be reached with the application wand, use one or more extension rods to make the application to the soil. Do not broadcast or powerspray with higher pressures.

2). To establish a horizontal barrier, drill through the foundation wall or through the floor above and treat the soil perimeter at a rate of 1 gallon of emulsion per 10 square feet. Drill spacing must be at intervals not to exceed 16 inches. Many states have smaller intervals so check state regulations which may apply.

When treating crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

~~In crawl spaces apply at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to bottom of foundation. Application may be made by rodding and/or trenching (utilizing low pressure spray). Treat both sides of foundation and around all piers and pipes.~~

~~a. Rod holes should be spaced (about 1 foot) to provide a continuous chemical barrier.~~

~~b. Trench need not be wider than 6 inches nor below the foundation. The emulsion should be mixed with the soil as it is replaced in the trench. Cover the treated soil with a layer of untreated soil or other suitable barrier such as polyethylene sheeting.~~

~~c. For inaccessible crawl spaces, treat soil by an alternate method such as drilling and rodding through foundation walls from the outside.~~

All holes in commonly occupied areas into which material has been applied must be plugged. Plugs must be of a non-cellulose material or covered by an impervious, non-cellulose material.

~~All treatment holes drilled in construction elements of living areas of homes should be securely plugged.~~

5. In plenum type structures, which use a sealed underfloor space to circulate heated and/or cooled air within the structure, apply the 0.75% - 1.0% dilution at the rate of 4 gallons per 10 linear feet per foot of depth. Soil adjacent to both sides of foundation walls, supporting piers, plumbing and conduits should be treated by trenching or rodding (where soil conditions permit) to a depth of 6 inches or to the top of the footing. When conditions will not permit trenching or rodding, a surface application adjacent to interior foundation walls may be made, but the treated strip shall not exceed a width of 18 inches, horizontally, from the foundation piers or pipes. The surface application should be made at a rate of 1 gallon per square foot as a very coarse spray under low pressure (not to exceed 20 P.S.I. when measured at the treating tool). In order to properly calculate the amount of termiticide dilution needed, use the following guideline: A strip 18 inches wide and 6 feet 8 inches long is equal to 10 square feet. Before treatment, a barrier of at least 6 mil polyethylene film or other suitable vapor barrier must be present on this ground surface over the entire subfloor area in accordance with recommended practices for plenum type structures. Install a new vapor barrier if barrier is absent or deteriorated. The vapor barrier film on the ground and foundation walls must be folded back from the areas to be treated prior to treatment and replaced immediately following treatment. Structures should be ventilated during application and until treatment is dry.

   When treating plenums, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

6. **FOAM APPLICATIONS: The emulsion may be converted to a foam and the foam used to control or prevent termite infestations.**

   Depending on the circumstances, foam applications may be used alone or in combination with liquid emulsion applications. Applications may be made behind veneers, piers, chimney bases, into rubble foundations, into block voids or structural voids, under slabs, stoops, porches, or to the soil in crawl spaces, and other similar voids. Foam and liquid application must be

consistent with volume and active ingredient instructions in order to ensure proper application has been made. The volume and amount of active ingredient are essential to an effective treatment. At least 75% of the labeled liquid emulsion volume of product must be applied, with the remaining percent delivered to appropriate areas using foam application. Refer to label and use recommendations of the foam manufacturer and the foaming equipment manufacturer.

Foam applications are generally a good supplement to liquid treatments in difficult areas, but may be used alone in difficult spots.

~~Application using foam generating equipment: In situations where conventional application methods have not or are not likely to provide adequate coverage, foam generating equipment or similar machines can be used to provide a continuous barrier. Treatment of filled porches, chimney bases, soil under slabs and treatment of wall voids are examples where foam applications may be useful.~~

Foam Treatment Recommendations:
Refer to label of foaming adjuvant for proper amount of material to add per gallon of Chlorpyrifos TC dilution.

The following provides the amount of Chlorpyrifos TC required for a given area and volume range of the prefoamed termiticide dilution necessary for application of the product.

For a 0.75% rate, apply 8 fluid ounces of Chlorpyrifos TC per 10 linear feet using no less than 2 gallons, or more than 8 gallons, of prefoamed dilution.

For a 1% rate, apply 10 2/3 fluid ounces of Chlorpyrifos TC per 10 linear feet using no less than 2 gallons, or more than 8 gallons, of prefoamed dilution.

RETREATMENT RESTRICTIONS

Retreatment for subterranean termites can only be performed if there is clear evidence of reinfestation or disruption of the barrier due to construction, excavation, or landscaping and/or evidence of the breakdown of the termiticide barrier in the soil. These vulnerable or reinfested areas may be retreated in accordance with application techniques described in this product's labeling. The timing and type of these retreatments will vary, depending on factors such as termite pressure, soil types, soil conditions and other factors which may reduce the effectiveness of the barrier.

Annual retreatment of the structure is prohibited unless there is clear evidence that reinfestation or barrier disruption has

occurred.

~~1. Retreatment for subterranean termites should only be made when there is evidence of reinfestation subsequent to the initial treatment, or there has been a disruption of the chemical barrier in the soil due to construction, excavations, landscaping, etc.~~

~~2. Retreatments may be made to critical areas in accordance with the application techniques described above. This application should be made as a spot treatment to these areas. Routine retreatment of the entire premises should be avoided.~~

CONTROL OF WOOD INFESTING INSECTS

Dosage and Mixing Instructions:
Chlorpyrifos Termite Concentrate is recommended for use as an aqueous emulsion containing 0.5% or 1% Chlorpyrifos.

Advisements:
When spraying overhead interior areas of homes, apartment buildings, etc. to the point of runoff, cover all surfaces below the area being sprayed with plastic sheeting or other material which could be disposed of by placing in trash if contamination from dripping occurs. Sprayed surfaces should be avoided until the spray has totally dried.

Contact with treated surfaces should be avoided until spray has dried. Cover or remove exposed foods before treatment. Do not use in structures housing animals which are intended for or which produce products to be used for food purposes. Do not use for above ground control of wood infesting insects in food areas of food handling establishments, restaurants or other areas where food is commercially prepared or processed.

To control wood-infesting beetles such as powderpost beetles (LYCTIDAE), false powder post beetles (BOSTRICHIDAE), deathwatch beetles (ANOBIIDAE), old house borers (CERAMBYCIDAE) and ambrosia beetles (SCOLYTIDAE) in homes and other structures, treatment may be applied either as coarse sprays or by brushing the product onto targeted surfaces. Use a sufficient amount of spray to cover the area to the point of wetness but avoid runoff. Use the following guidelines to determine appropriate rates of application:

New Wood - (typically less than 10 years of age) apply approximately 1 gallon of dilution per 150 square feet as a coarse spray.
Old Wood - (typically greater than 10 years of age) apply approximately 1 gallon of dilution per 100 square feet as a coarse spray.

Treatment Directions

For control of carpenter ants in homes and other structures, apply dilution around doors and windows and other places where carpenter ants enter the premises and where they crawl and hide. Also spray into cracks and crevices or through openings or small newly drilled holes into wall voids where these ants or their nests are present. Use a sufficient amount of coarse spray to cover the area to the point of wetness but avoiding runoff.

For control of termites (localized areas of infested wood in structures), apply dilution to voids and channels in damaged wood and in spaces between members of a structure and between wood and foundations where termite infestation is likely to occur. Application may be made to inaccessible areas by drilling, and then injecting the emulsion. Use a sufficient amount of spray to cover the area to the point of wetness but avoiding runoff. Treatment of localized areas is intended to kill workers and winged reproductive forms of termites in the treated areas and to prevent infestations for a temporary period. This type of application is not intended to be a substitute for soil treatment or mechanical alteration to control subterranean termites.

PEST CONTROL ON OUTSIDE SURFACES AND AROUND BUILDINGS

To control ants, bees, carpenter ants, clover mites, cockroaches, crickets, earwigs, hornets, millipedes, scorpions, spiders, ticks, wasps and yellowjackets.

Outside surface: Apply Chlorpyrifos TC termiticide as a residual spray to outside surfaces of buildings including porches, window frames, eaves, patios, garages, refuse dumps and other areas where pests congregate or have been observed. Treatment may be repeated as needed to maintain effectiveness.

Perimeter sprays: To help prevent infestation of buildings, treat a band of soil and vegetation 6 to 10 feet wide around and adjacent to the building. Also, treat the building foundation to a height of 2 to 3 feet where pests are active and may find entrance. For scorpions, treat or remove accumulations of lumber, firewood, and other materials which serve as insect harborage sites.

Dosage and Mixing Instructions: Use Chlorpyrifos TC mixed as a 0.25% to 0.5% dilution as indicated in the following table:

Gallons of Finished Dilution Desired	Chlorpyrifos TC Required 0.25% Solution	0.5% Solution
1	2/3 fl oz	1 1/3 fl oz
5	3 1/3 fl oz	6 2/3 fl oz
10	6 2/3 fl oz	13 1/3 fl oz
24	16 fl oz	1 qt
48	1 qt	2 qt
97	2 qt	1 gal

Small amounts of solution mixed at 0.5% to 1.0% termiticide rates remaining in the spray tank can be diluted as indicated in the following table and used to treat surfaces or perimeter areas:

Concentration of Termiticide Dilution	Amount of Water to Add to Each Gallon of Termiticide Dilution to Provide a 0.25% Spray	Amount of Water to Add to Each Gallon of Termiticide Dilution to Provide a 0.5% Spray
0.5%	1 gallon	none
0.75%	2 gallons	0.5 gallons
1.0%	3 gallons	1 gallon

CONDITIONS OF SALE

All statements concerning the use of this product apply only when used as directed.
THE MANUFACTURER MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, CONCERNING THIS PRODUCT OR ITS USE, WHICH EXTEND BEYOND THE DESCRIPTION ON THE LABEL.

Read all directions carefully.

MICRO FLO
THE PLANT HEALTH AND PROTECTION COMPANY

CHLORPYRIFOS PRO TERMITE CONCENTRATE

To Be Applied Only By Or Under The Supervision of Commercial Applicators Responsible For Insect Control Programs. Not Intended For Use By Homeowners

ACTIVE INGREDIENT:
Chlorpyrifos (0,0-diethyl 0-(3,5,6-trichloro-2- pyridyl) phosphorothioate) 42.8%
INERT INGREDIENTS: 57.2%
TOTAL 100 0%

Contains 4 pounds of chlorpyrifos per gallon
Contains petroleum distillate

KEEP OUT OF REACH OF CHILDREN

WARNING AVISO

PRECAUCION AL USUARIO: Si usted no lee ingles, no use este producto hasta que le etiqueta haya sido explicada ampliamente.

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or get medical attention Do not induce vomiting. Contains an aromatic petroleum solvent. Do not give anything by mouth to an unconscious person Avoid alcohol.
IF IN EYES: Flush with plenty of water Call a physician if irritation persists.
IF ON SKIN: Wash with plenty of soap and water Get medical attention.
IF INHALED: Remove victim to fresh air If not breathing, give artificial respiration, preferably mouth-to-mouth Get medical attention

PRECAUTIONARY STATEMENTS
Hazards To Humans And Domestic Animals

WARNING

May be fatal if swallowed Harmful if absorbed through skin or clothing Causes moderate eye irritation Avoid contact with eyes, skin or clothing. Harmful if inhaled Avoid breathing of vapors. Wash thoroughly with soap and water after handling and before eating, drinking or using tobacco Remove contaminated clothing and wash before reuse Keep away from food, feed stuffs and water supplies
NOTE TO PHYSICIAN: Chlorpyrifos is a cholinesterase inhibitor Treat symptomatically If exposed, plasma and red blood cell cholinesterase tests may indicate degree of exposure (baseline data are useful). Atropine, only by injection, is the preferable antidote Oximes, such as 2-PAM/protopam, may be therapeutic if used early however, use only in conjunction with atropine In case of severe acute poisoning, use antidotes immediately after establishing an open airway and respiration May pose an aspiration hazard

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish, birds, and other wildlife Do not apply directly to water Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites Cover or incorporate spills Do not contaminate water by cleaning of equipment or disposal of equipment washwaters

PHYSICAL OR CHEMICAL HAZARDS

COMBUSTIBLE! Do not use or store near heat or open flame Do not cut or weld container

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.
STORAGE: Storage below 55 degrees F may result in formation of crystals If product crystallizes out of solution, store at 72 degrees F to 90 degrees F and agitate to redissolve crystals.
PESTICIDE DISPOSAL: Pesticide wastes are toxic Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.
CONTAINER DISPOSAL: Triple rinse (or equivalent) Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities

SAFE HANDLING PROCEDURES

Wear suitable protective clothing when using or handling this product to help avoid exposure to eyes and skin As a minimum chemical workers goggles neoprene or natural rubber gloves and footwear, a long-sleeved shirt and long-legged pants or coveralls are recommended To avoid breathing spray mist during application in confined areas, wear a mask or respirator of a type recommended by NIOSH for filtering spray mists and organic vapors

---

EPA Reg No 51036-122
AD 082196

Manufactured By
MICRO FLO COMPANY
P O Box 5948
Lakeland FL 33807

SUBTERRANEAN TERMITES

Chlorpyrifos Pro Termite Concentrate for soil treatment is used to establish a barrier which is lethal to termites. The chemical emulsion must be adequately dispersed in the soil to provide a barrier between the wood in the structure and the termite colonies in the soil.

It is important that the service technician be familiar with current control practices including trenching, rodding, subslab injection, and low pressure spray applications. These techniques must be correctly employed to prevent or control infestations by subterranean termite species of **RETICULITERMES, ZOOTERMOPSIS**, and **COPTOTERMES**. Choice of appropriate procedures includes consideration of such variable factors as the design of the structure, water table, soil type, soil compaction, grade conditions, and the location and type of domestic water supplies. The biology and behavior of the involved termite species are important factors to be known as well as suspected location of the colony and severity of the infestation within the structure to be protected. For advice concerning current control practices for specific local conditions, consult resources in structural pest control.

GENERAL USE PRECAUTIONS

Contamination of public and private water supplies must be avoided by following these precautions:

1 Use antiback-flow equipment or procedures to prevent siphonage of pesticide back into water supplies.

2 Do not treat soil that is water saturated or frozen.

3 Consult state and local specifications for recommended distances of treatment areas from wells, and refer toFederalHousing AdministrationSpecifications for further guidance.

Structures that contain wells or cisterns may be treated using the following guidelines:

1 Do not treat soil while it is beneath or within the foundation of a structure that contains a well or cistern.The treated backfill method may be used if the soil is removed and treated outside the foundation

2 If treatment must be made along exterior foundation walls of structures containing wells or cisterns or other difficult situations such as near wells or cisterns, along fieldstone or rubble walls, along faulty foundation walls, around pipes and utility lines which lead downward from the structure to a well, pond, or other body of water, application may be made in the following manner:

EXCAVATION/TREATED BACKFILL TECHNIQUE

a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.

b. Treat the soil at the rate of 4 gallons of diluted emulsion per 10 linear feet per foot of depth of the trench or 1 gallon of dilution per 1.0 cubic feet (See Rate Determination Guideline below). An initial treatment using a 0.75 -1.0 % dilution will provide effective optimum long term residual control. Mix thoroughly into the soil taking care to contain the liquid and prevent runoff or spillage.

c. After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.

3 Infested and/or damaged wood can be treated using an injection technique such as described in "Control of Wood Infesting Insects"

All nonessential wood and cellulose containing materials, including scrap wood and form boards, should be removed from around foundation walls, crawl spaces, and porches This does not include existing structural soil contact wood that either has been or needs to be treated.

RATE DETERMINATION GUIDELINES

Consult the local extension agent or state entomologist for application rate recommendations. An initial treatment using 0 75 - 1.0% dilution will prove effective, optimum long term residual control The 0.75% rate may also be used when making follow-up or spot treatments with no reinspection restrictions. A 2.0% dilution may be used to protect utility poles and fence posts.

DILUTION DIRECTIONS

Chlorpyrifos Pro Termite Concentrate Needed

Gallons of Finished Dilution Desired	0.75%	1.0%	2.0%
1	2 fl oz	2 2/3 fl oz	5 1/3 fl oz
5	10	13 1/3	26 2/3
10	20	26 2/3	53 1/3
24	1 1/2 qt	1/2 gl	1 gl
48	3 qt	1 gl	2 gl
97	1 1/2 gl	2 gl	4 gl

Mixing Directions

It is important that the termiticide dilution be uniformly mixed in the spray tank before beginning the treatment. Once mixed, Chlorpyrifos TC will not settle out in the tank although the initial mixing will be enhanced by agitation, circulation through the treating hose, and the filling process.

1 Fill tank 1/4 to 1/3 full

2 Start pump to begin by-pass agitation and place end of treating tool in tank to allow circulation through hose.

3 Add appropriate amount of Chlorpyrifos TC.

4 Add remaining amount of water

5 Let pump run and allow recirculation through the hose for 2 to 3 minutes

Application Volume

To ensure thorough and complete coverage in different soil types, it may become necessary to adjust the volume being applied. In situations such as heavy, clay-type soils which will not accept large amounts of water, reduced volumes can be used which will deliver the appropriate concentrations of termiticide in the soil. This would also apply to sensitive areas and/or horizontal applications where less volume may be desirable. Minimum volumes will be specified in the appropriate use directions

In light textured soils such as sand or gravel which accept larger amounts of water, increased volumes which deliver the appropriate concentration of termiticide in the soil may be used. Maximum volumes will be specified in the appropriate use directions.

PRECONSTRUCTION SUBTERRANEAN TERMITE TREATMENT

Effective preconstruction subterranean termite control requires the establishment of a unbroken vertical and/or horizontal chemical barrier between wood in the structure and the termite colonies in the soil. To meet F.H.A. termite proofing requirements, follow the latest edition of the Housing and Urban Development (H.U.D.) Minimum Property Standards. Follow state and local regulations to meet minimum treatment standards for preventive preconstruction treatments.

All holes drilled in construction elements for preconstruction treatments should be securely plugged following application.

See "Rate Determination Guidelines" and Table 1 for dilution directions

1. For Horizontal barriers, applications shall be made using a low pressure spray after grading is completed and prior to the pouring of the slab or footing.

   a. For a 0.75% rate, apply 1 gallon of dilution per 10 square feet or use 2 fluid ounces of Chlorpyrifos TC per 10 square feet in sufficient water (not less than 1/2 or more than 2 gallons) to provide thorough and continuous coverage of the area being treated (see Application Volume section). For a 1.0% rate, apply 1 gallon of dilution per 10 square feet, or use 2 2/3 fluid ounces of Chlorpyrifos TC per 10 square feet in sufficient water (no less than 1/2 gallon or more than 2 gallons) to provide thorough and continuous coverage of the area being treated (See "Application Volume"). If the fill is washed gravel or other coarse material, it is important that a sufficient amount of dilution be used to reach the soil substrate beneath the coarse fill.

   b. If concrete slabs cannot be poured over the soil the same day it has been treated, a vapor barrier should be placed over the treated soil to prevent disturbance of the termiticide barrier

2. For Vertical barriers, apply the 0.75-1.0% dilution at a rate of 4 gallons per 10 linear feet per foot of depth. Establish vertical barriers in areas such as around the base of foundations, plumbing lines, backfilled soil against foundation walls and other areas which may warrant more than just a horizontal barrier.

   a. Rodding and/or trenching applications should be made to reach the top of the footing. Rod holes should be spaced to provide a continuous barrier.

   b. Trenches need not be wider than 6 inches. Treat soil with the dilution as it is being replaced in the trench. For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 8 fluid ounces of Chlorpyrifos TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallon or more than 8 gallons) to ensure complete coverage. For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 10 2/3 fluid ounces of Chlorpyrifos TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to insure completecoverage.

   c. Hollow block foundations or voids of masonry can be treated to make a complete chemical barrier especially if the soil was not treated prior to pouring the footing. Apply the dilution at a rate of 2 gallons per 10 linear feet so that it reaches the top of the footing.

   d. For crawl spaces, establish a vertical barrier on both sides of the foundation and around all piers and areas where underground utilities exit the soil. Do not apply the dilution to the entire surface area intended as the crawl.

3. For Plenum type structures which use a sealed underfloor space to circulate heated and/or cooled air throughout the structure, apply the dilution at the rate of 4 gallons per 10 linear feet per foot of depth. Soil adjacent to both sides of foundation walls, supporting piers, plumbing and conduits should be treated by trenching or rodding (where soil conditions permit) to a depth of 6 inches or, if less shallow, to the top of the footing. When conditions will not permit trenching or rodding, surface application adjacent to interior foundation walls may be made but the treated strip shall not exceed a width of 18 inches, horizontally, from the foundation walls, piers or pipes. The surface application should be made at a rate of 1 gallon per 10 square feet as a very coarse spray under low pressure (not to exceed 20 P.S.I. when measured at the treating tool). After soil treatment, a continuous vapor barrier of at least 6 mil polyethylene film or other suitable vapor barrier must be installed on the ground surface over the entire subfloor area and on the inside of the plenum walls, in accordance with the recommended practices for plenum type structures.

POSTCONSTRUCTION TREATMENTS

Use a 1% emulsion for subterranean termites. Mix 2 gallons of Chlorpyrifos Pro Termite Concentrate in 98 gallons of water to produce a 1% water emulsion. Postconstruction applications shall be made by injection, rodding, and/or trenching (using low pressure spray). Do not apply emulsion until location of heat or air conditioning ducts, vents, water and sewer lines and electrical conduits are known and identified. Extreme caution must be taken to avoid contamination of these structural elements and airways.

1. For slab on ground construction apply at the rate of 4 gallons of emulsion per 10 linear feet. Applications may be made by sub-slab injection and/or trenching. Injectors should not exceed beyond the tops of the footings. Treat along the outside of the foundation and where necessary just beneath the slab along one side of interior partitions and along all cracks and expansion joints.

   a. Drill holes in the slab to provide a continuous chemical barrier

   b. Where necessary, drill through the foundation walls from the outside and force the emulsion just beneath the slab either along the inside of the foundation or along all the cracks and expansion joints and other critical areas.

   c. For shallow foundations, 1 foot or less, dig a narrow trench approximately six inches wide along the outside of the foundation walls. Do not dig below the bottom of the foundation The emulsion should be applied to the trench and the soil at 4 gallons per 10 linear feet as the soil is replaced in the trench Cover the treated soil with a layer of untreated soil.

   d. For foundations deeper than 1 foot follow rates for basements

2. Hollow block foundation or voids of masonry should be treated to make a continuous chemical barrier in voids. Apply at the rate of 2 gallons of emulsion per 10 linear feet.

3. For basements apply at the rate of 4 gallons of emulsion per 10 linear feet. Where footings are greater than 1 foot of depth from the grade to the bottom of the foundation application may be made by trenching and/or rodding at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. Treat outside of foundation walls, and if necessary beneath the basement floor along inside of foundation walls, along cracks in basement floors, along interior load bearingwalls, around sewer pipes, conduits and piers.

4. In crawl spaces apply at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to bottom of foundation Application may be made by rodding and/or trenching (utilizing low pressure spray) Treat both sides of foundation and around all piers and pipes.

   a. Rod holes should be spaced (about 1 foot) to provide a continuous chemical barrier

   b. Trench need not be wider than 6 inches nor below the foundation The emulsion should be mixed with the soil as it is replaced in the trench. Cover the treated soil with a layer of untreated soil or other suitable barrier such as polyethylene sheeting.

   c. For inaccessible crawl spaces, treat soil by an alternate method such as drilling and rodding through foundation walls from the outside.

All treatment holes drilled in construction elements of living areas of homes should be securely plugged

5. In plenum type structures, which use a sealed underfloor space to circulate heated and/or cooled air within the structure, apply the 0.75% - 1.0% dilution at the rate of 4 gallons per 10 linear feet per foot of depth Soil adjacent to both sides of foundation walls, supporting piers, plumbing and conduits should be treated by trenching or rodding (where soil conditions permit) to a depth of 6 inches or to the top of the footing.

When conditions will not permit trenching or rodding, a surface application adjacent to interior foundation walls may be made, but the treated strip shall not exceed a width of 18 inches, horizontally, from the foundation piers or pipes. The surface application should be made at a rate of 1 gallon per square foot as a very coarse spray under low pressure (not to exceed 20 P.S.I. when measured at the treating tool). In order to properly calculate the amount of termiticide dilution needed, use the following guideline:
A strip 18 inches wide and 6 feet 8 inches long is equal to10 square feet. Before treatment, a barrier of at least 6 mil polyethylene film or other suitable vapor barrier must be present on this ground surface over the entire subfloor area in accordance with recommended practices for plenum type structures. Install a new vapor barrier if barrier is absent or deteriorated. The vapor barrier film on the ground and foundation walls must be folded back from the areas to be treated prior to treatment and replaced immediately following treatment. Structures should be ventilated during application and until treatment is dry.

6. Application using foam generating equipment: In situations where conventional application methods have not or are not likely, to provide adequate coverage, foam generating equipment or similar machines can be used to provide a continuous barrier. Treatment of filled porches, chimney bases, soil under slabs and treatment of wall voids are examples where foam applications may be useful.

Foam Treatment Recommendations:
Refer to label of foaming adjuvant for proper amount of material to add per gallon of Chlorpynfos TC dilution.

The following provides the amount of Chlorpyrifos TC required for a given area and volume range of the prefoamed termiticide dilution necesary for application of the product.

For a 0.75% rate, apply 8 fluid ounces of Chlorpyrifos TC per 10 linear feet using no less than 2 gallons, or more than 8 gallons, of prefoamed dilution.

For a 1% rate, apply 10 2/3 fluid ounces of Chlorpyrifos TC per 10 linear feet using no less than 2 gallons, or more than 8 gallons, of prefoamed dilution.

RETREATMENT RESTRICTIONS

1. Retreatment for subterranean termites should only be made when there is evidence of reinfestation subsequent to the initial treatment, or there has been a disruption of the chemical barrier in the soil due to construction, excavations, landscaping, etc.

2. Retreatments may be made to critical areas in accordance with the application techniques described above. This application should be made as a spot treatment to these areas. Routine retreatment of the entire premises should be avoided.

CONTROL OF WOOD INFESTING INSECTS

Dosage and Mixing Instructions:
Chlorpyrifos Pro Termite Concentrate is recommended for use as an aqueous emulsion containing 0.5% or 1% Chlorpyrifos.

Advisements:
When spraying overhead interior areas of homes, apartment buildings, etc. to the point of runoff, cover all surfaces below the area being sprayed with plastic sheeting or other material which could be disposed of by placing in trash if contamination from dripping occurs. Sprayed surfaces should be avoided until the spray has totally dried.

Contact with treated surfaces should be avoided until spray has dried. Cover or remove exposed foods before treatment. Do not use in structures housing animals which are intended for or which produce products to be used for food purposes. Do not use for above ground control of wood infesting insects in food areas of food handling establishments, restaurants or other areas where food is commercially prepared or processed.

To control wood-infesting beetles such as powderpost beetles (LYCTIDAE), false powder post beetles (BOSTRICHIDAE), deathwatch beetles (ANOBIIDAE), old house borers (CERAMBYCIDAE) and ambrosia beetles (SCOLYTIDAE) in homes and other structures, treatment may be applied either as coarse sprays or by brushing the product onto targeted surfaces Use a sufficient amount of spray to cover the area to the point of wetness but avoid runoff. Use the following guidelines to determine appropriate rates of application:

New Wood - (typically less than 10 years of age) apply approximately 1 gallon of dilution per 150 square feet as a coarse spray.
Old Wood - (typically greater than 10 years of age) apply approximately 1 gallon of dilution per 100 square feet as a coarse spray.

Treatment Directions

For control of carpenter ants in homes and other structures, apply dilution around doors and windows and other places where carpenter ants enter the premises and where they crawl and hide. Also spray into cracks and crevices or through openings or small newly drilled holes into wall voids where these ants or their nests are present. Use a sufficient amount of coarse spray to cover the area to the point of wetness but avoiding runoff

For control of termites (localized areas of infested wood in structures), apply dilution to voids and channels in damaged wood and in spaces between members of a structure and between wood and foundations where termite infestation is likely to occur. Application may be made to inaccessible areas by drilling, and then injecting the emulsion Use a sufficient amount of spray to cover the area to the point of wetness but avoiding runoff. Treatment of localized areas is intended to kill workers and winged reproductive forms of termites in the treated areas and to prevent infestations for a temporary period. This type of application is not intended to be a substitute for soil treatment or mechanical alteration to control subterranean termites.

PEST CONTROL ON OUTSIDE SURFACES AND AROUND BUILDINGS

To control ants, bees, carpenter ants, clover mites, cockroaches, crickets, earwigs, hornets, millipedes, scorpions, spiders, ticks, wasps and yellowjackets.
Outside surface: Apply Chlorpyrifos TC termiticide as a residual spray to outside surfaces of buildings including porches, window frames, eaves, patios, garages, refuse dumps and other areas where pests congregate or have been observed. Treatment may be repeated as needed to maintain effectiveness.

Perimeter sprays: To help prevent infestation of buildings, treat a band of soil and vegetation 6 to 10 feet wide around and adjacent to the building. Also, treat the building foundation to a height of 2 to 3 feet where pests are active and may find entrance. For scorpions, treat or remove accumulations of lumber, firewood, and other materials which serve as insect harborage sites
Dosage and Mixing Instructions: Use Chlorpyrifos TC mixed as a 0 25% to 0 5% dilution as indicated in the following table:

Gallons of Finished Dilution Desired	Chlorpyrifos TC Required 0.25% Solution	0.5% Solution
1	2/3 fl oz	1 1/3 fl oz
5	3 1/3 fl oz	6 2/3 fl oz
10	6 2/3 fl oz	13 1/3 fl oz
24	16 fl oz	1 qt
48	1 qt	2 qt
97	2 qt	1 gal

Small amounts of solution mixed at 0 5% to 1 0% termiticide rates remaining in the spray tank can be diluted as indicated in the following table and used to treat surfaces or perimeter areas:

Concentration of Termiticide Dilution	Amount of Water to Add to Each Gallon of Termiticide Dilution to Provide a 0.25% Spray	Amount of Water to Add to Each Gallon of Termiticide Dilution to Provide a 0.5% Spray
0.05%	1 gallon	none
0.75%	2 gallons	0.5 gallons
1.00%	3 gallons	1 0 gallon

CONDITIONS OF SALE

All statements concerning the use of this product apply only when used as directed.
THE MANUFACTURER MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, CONCERNING THIS PRODUCT OR ITS USE, WHICH EXTEND BEYOND THE DESCRIPTION ON THE LABEL.

Read all directions carefully.

DowElanco
9330 Zionsville Road
Indianapolis, IN 46268-1054

Building 308/3E
800-892-6740
Contact Person: Renee Bartz

DowElanco

PRODUCT DATA SHEET

Dursban* TC

62719-047

EPA Accepted Date May 20, 1997

Comments:

Label booklet code: 900-004938

The following label changes were approved by the EPA on May 20, 1997, to comply with PR Notice 96-7 on termiticide labeling.

1. Revised Sale Copy.
2. Revised Active and Inert Ingredients.
3. Revised Precautionary Measures.
4. Added Personal Protective Equipment (PPE) to Precautionary Statements and Table of Contents.
5. Deleted Handling Procedures from Directions for Use and Table of Contents.
6. Revised General Information:

1) General Use Precautions
2) Application Volume
3) Addition of Treatment of Structures with Well, Cisterns or Other Bodies of Water Within or Adjacent to Treated Sites to General Information and Table of Contents
4) Preconstruction and Postconstruction Subterranean Termite Treatment
5) Utility Poles and Fence Posts

Additional note to record deletions done on 3-20-97 and 4-01-97 (revised pages sent to EPA):
deleted "Retreatment Statement" in table of contents
deleted "Retreatment Statement" under Utility Poles and Fence Posts
deleted statement on page 10 under Preconstruction applications are defined as those applications made prior to the finished grade being installed.: "To meet FHA termite proofing requirements, follow the latest edition of the Housing and Urban Development (HUD) Minimum Property Standards."

DowElanco™

Dursban* TC

For use by individuals/firms licensed or registered by the state to apply termiticide products. States may have more restrictive requirements regarding qualifications of persons using this product. Consult the structural pest control regulatory agency of your state prior to use of this product.

Active ingredient:

chlorpyrifos: O,O-diethyl O-(3,5,6-trichloro-2 pyridinyl) phosphorothioate	44.0%
Inert Ingredients	56.0%
Total Ingredients	100.0%

Contains 4 pounds of chlorpyrifos per gallon.

Precautionary Statements

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

WARNING AVISO

Precaucion al usuario: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.

May Be Fatal If Swallowed • Excessive Absorption Through Skin May Be Fatal • Causes Substantial But Temporary Eye Injury • May Cause Skin Irritation.

Do not get in eyes, on skin or clothing. Avoid breathing vapors and spray mist. Handle concentrate in a ventilated area. Wash thoroughly with soap and water after handling and before eating or smoking. Remove contaminated clothing and wash before reuse. Keep away from food, feedstuffs and water supplies.

Personal Protective Equipment (PPE)

Mixers and loaders must wear a minimum of long-sleeved shirt and long pants, chemical-resistant footwear, chemical-resistant gloves, and protective eyewear (goggles, a faceshield, or safety glasses with front, brow, and temple protection. **Mixers and loaders** who do not use a mechanical system (such as the Voyager* container or in-line injector) to transfer the contents of this container must wear coveralls or chemical-resistant apron in addition to other required PPE.

Pesticide applicators must wear long-sleeved shirt and long pants, socks, shoes, and chemical-resistant gloves.

Specialty Termiticide Concentrate

In addition, all pesticide handlers must wear a respiratory protection device (MSHA/NIOSH approved number TC-21C) and protective eyewear when working in a non-ventilated space and all pesticide applicators must wear protective eyewear when applying termiticide by rodding or sub-slab injection.

First Aid

If swallowed: Call a physician or Poison Control Center immediately. Do not induce vomiting. Contains an aromatic petroleum solvent. Do not give anything by mouth to an unconscious person.
If on skin: Immediately wash with plenty of soap and water. Get medical attention.
If in eyes: Flush with plenty of water for 15 minutes. Get medical attention.
If inhaled: Remove to fresh air if symptoms of cholinesterase inhibition appear and get medical attention immediately.
Note to physician: Chlorpyrifos is a cholinesterase inhibitor. Treat symptomatically. If exposed, plasma and red blood cell cholinesterase tests may indicate significance of exposure (baseline data are useful). Atropine, only by injection, is the preferable antidote. Oximes, such as 2-PAM/protopam, may be therapeutic if used early; however, use only in conjunction with atropine. In case of severe acute poisoning, use antidote immediately after establishing an open airway and respiration.

Environmental Hazards

This pesticide is toxic to birds and wildlife, and extremely toxic to fish and aquatic organisms. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. Cover or incorporate spills. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

Physical or Chemical Hazards

Do not use or store near heat or open flame.

Refer to label booklet for additional precautionary information and Directions for Use including Storage and Disposal.

Notice: Read the entire label. Use only according to label directions. **Before buying or using this product, read "Warranty Disclaimer" and "Limitation of Remedies" inside label booklet.**

In case of emergency endangering health or the environment involving this product, call collect 517-636-4400.
Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.

EPA Reg. No. 62719-47 EPA Est. 464-MI-1
900-004938 / 00014066

*Trademark of DowElanco
DowElanco • Indianapolis, IN 46268 U.S.A.

PEEL FILM HERE

BASE LABEL

DowElanco

Dursban* TC

For use by individuals/firms licensed or registered by the state to apply termiticide products. States may have more restrictive requirements regarding qualifications of persons using this product. Consult the structural pest control regulatory agency of your state prior to use of this product.

Active ingredient:
chlorpyrifos: O,O-diethyl O-(3,5,6-trichloro-2 pyridinyl) phosphorothioate..... 44.0%
Inert Ingredients 56.0%
Total Ingredients 100.0%

Contains 4 pounds of chlorpyrifos per gallon.

Keep Out of Reach of Children

WARNING AVISO

Precaucion al usuario: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.

Refer to inside of label booklet for additional precautionary information and Directions for Use including Storage and Disposal.

Notice: Read the entire label. Use only according to label directions. **Before buying or using this product, read "Warranty Disclaimer" and "Limitation of Remedies" inside label booklet.**

In case of emergency endangering health or the environment involving this product, call collect 517-636-4400.

Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.

EPA Reg. No. 62719-47 EPA Est. 464-MI-1
900-004938 / 00014066

DowElanco • Indianapolis, IN 46268 U.S.A.

Specialty Termiticide Concentrate

Cover

LABEL BOOKLET

Table of Contents Page

Precautionary Statements

Hazards to Humans and Domestic Animals

WARNING AVISO

Precaucion al usuario: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.

May Be Fatal If Swallowed • Excessive Absorption Through Skin May Be Fatal • Causes Substantial But Temporary Eye Injury • May Cause Skin Irritation.

Do not get in eyes, on skin or clothing. Avoid breathing vapors and spray mist. Handle concentrate in a ventilated area. Wash thoroughly with soap and water after handling and before eating or smoking. Remove contaminated clothing and wash before reuse. Keep away from food, feedstuffs and water supplies.

Personal Protective Equipment (PPE)

Mixers and loaders must wear a minimum of long-sleeved shirt and long pants, chemical-resistant footwear, chemical-resistant gloves, and protective eyewear (goggles, a faceshield, or safety glasses with front, brow, and temple protection. **Mixers and loaders** who do not use a mechanical system (such as the Voyager® container or in-line injector) to transfer the contents of this container must wear coveralls or chemical-resistant apron in addition to other required PPE.

Pesticide applicators must wear long-sleeved shirt and long pants, socks, shoes, and chemical-resistant gloves.

In addition, all pesticide handlers must wear a respiratory protection device (MSHA/NIOSH approved number TC-21C) and protective eyewear when working in a non-ventilated space and all pesticide applicators must wear protective eyewear when applying termiticide by rodding or sub-slab injection.

First Aid

If swallowed: Call a physician or Poison Control Center immediately. Do not induce vomiting. Contains an aromatic petroleum solvent. Do not give anything by mouth to an unconscious person.
If on skin: Immediately wash with plenty of soap and water. Get medical attention.
If in eyes: Flush with plenty of water for 15 minutes. Get medical attention.
If inhaled: Remove to fresh air if symptoms of cholinesterase inhibition appear and get medical attention immediately.

Note to physician: Chlorpyrifos is a cholinesterase inhibitor. Treat symptomatically. If exposed, plasma and red blood cell cholinesterase tests may indicate significance of exposure (baseline data are useful). Atropine, only by injection, is the preferable antidote. Oximes, such as 2-PAM/protopam, may be therapeutic if used early; however, use only in conjunction with atropine. In case of severe acute poisoning, use antidote immediately after establishing an open airway and respiration.

Environmental Hazards

This pesticide is toxic to birds and wildlife, and extremely toxic to fish and aquatic organisms. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. Cover or incorporate spills. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

Physical or Chemical Hazards

Do not use or store near heat or open flame.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read all Directions for Use carefully before applying.

Do not tank mix this product with products containing dichlorvos (DDVP).
Do not formulate this product into other end-use products.

Storage and Disposal

Do not contaminate water, food or feed by storage or disposal.
Storage: Store in original container in secured dry storage area. Prevent cross-contamination with other pesticides and fertilizers. Avoid storing above 122°F for extended periods of time. Storage below 40°F may result in formation of crystals. If product crystallizes,

Storage and Disposal (Cont.)

store at 55-75°F and shake occasionally to redissolve crystals. If container is damaged or spill occurs, use product immediately or dispose of product and damaged container as indicated below.
Pesticide Disposal: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of according to label instructions, contact your state pesticide or environmental control agency, or the hazardous waste representative at the nearest EPA regional office for guidance.
Container Disposal for Non-Refillable Containers: Triple rinse (or equivalent) then offer for recycling or reconditioning, or puncture and/or crush rinsed, empty container and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.
or
Triple rinse (or equivalent). Then dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.
Container Disposal for Refillable Containers: Replace the dry disconnect cap, if applicable, and seal all openings which have been opened during use. Return the empty container to a collection site designated by DowElanco. If the container has been damaged and cannot be returned according to the recommended procedures, contact DowElanco Customer Service Center at 1-800-258-1470 to obtain proper handling instructions.

General Information

Subterranean Termites

Dursban* TC termiticide concentrate for soil treatment is used to establish a barrier which is lethal to termites. In order to provide an effective barrier between the wood in the structure and

termite colonies in the soil, disperse the chemical emulsion so as to avoid untreated gaps in the barrier.

It is important that the service technician be familiar with current control practices including trenching, rodding, subslab injection and low pressure spray applications. These techniques must be correctly employed to prevent or control infestations by subterranean termite species of *Reticulitermes*, *Zootermopsis*, *Heterotermes* and *Coptotermes*. Choice of appropriate procedures includes consideration of such variable factors as the design of the structure, water table, soil type, soil compaction, grade conditions and the location and type of domestic water supplies. The biology and behavior of the involved termite species are important factors to be known as well as suspected location of the colony and severity of the infestation within the structure to be protected. For advice concerning current control practices for specific local conditions, consult resources in structural pest control.

General Use Precautions

All nonessential wood and cellulose containing materials, including scrap wood and form boards, should be removed from around foundation walls, crawl spaces, and porches. This does not include existing structural soil contact wood that has been treated.

When treating adjacent to an existing structure, the applicator must check the areas to be treated, and immediately adjacent areas of the structure for visible and accessible cracks and holes to prevent any leaks or significant exposures to persons occupying the structure. People present or residing in the structure during application must be advised to remove their pets and themselves from the structure if they see any signs of leakage. After application, the applicator is required to check for leaks.

All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy the contaminated areas of the structure until the cleanup is completed.

Retreatment for subterranean termites can only be performed if there is clear evidence of reinfestation or disruption of the barrier due to construction, excavation, or landscaping and/or evidence of the breakdown of the termiticide barrier in the soil. These vulnerable or reinfested areas may be retreated in accordance with application techniques described in this product's labeling. The timing and type of these retreatments will vary, depending on factors such as termite pressure, soil types, soil conditions and other factors which may reduce the effectiveness of the barrier.

Annual retreatment of the structure is prohibited unless there is clear evidence that reinfestation or barrier disruption has occurred.

Contamination of public and private water supplies must be avoided by following these minimum precautions:

1. Use anti-back flow equipment or procedures to prevent siphonage of pesticide back into water supplies.
2. Do not treat soil that is water saturated or frozen
3. Do not treat while precipitation is occurring.
4. Consult Federal, state and local specifications for information regarding approved treatment practices in your area.
5. Do not contaminate wells or cisterns. See specific "Treatment of Structures with Wells, Cisterns or Other Bodies of Water Adjacent to Treated Sites".

Rate Determination Guidelines

Consult the local extension agent or state entomologist for application rate recommendations.

An initial treatment using a 0.75-1.0% dilution will provide effective, optimum long term residual control.

A 2.0% dilution may be used to protect utility poles and fence posts.

Table 1 - Dilution Directions

Gallons of Finished Dilution Desired	Dursban TC Needed			
	0.5%	0.75%	1.0%	2.0%
1	1 1/3 fl oz	2 fl oz	2 2/3 fl oz	5 1/3 fl oz
5	6 2/3 fl oz	10 fl oz	13 1/3 fl oz	26 2/3 fl oz
10	13 1/3 fl oz	20 fl oz	26 2/3 fl oz	53 1/3 fl oz
24	1 qt	1 1/2 qt	1/2 gal	1 gal
48	1/2 gal	3 qt	1 gal	2 gal
97	1 gal	1 1/2 gal	2 gal	4 gal

Mixing Directions

It is important that the termiticide dilution be uniformly mixed in the spray tank before beginning the treatment. Once mixed, Dursban TC will not settle out in the tank although the initial mixing will be enhanced by agitation, circulation through the treating hose, and the filling process.

1. Fill tank 1/4 to 1/3 full.
2. Start pump to begin by-pass agitation and place end of treating tool in tank to allow circulation through hose.
3. Add appropriate amount of Dursban TC.
4. Add remaining amount of water.
5. Let pump run and allow recirculation through the hose for 2 to 3 minutes.

Application Volume

To provide maximum control and protection against termite infestation, apply the specified volume of the finished water emulsion and active ingredient as set forth in the Directions for Use section of this label. If soil will not accept the labeled application volume, such as heavy, clay-type soils, the volume may be reduced provided there is a corresponding increase in concentration so that the amount of active ingredient applied to the soil remains the same. This would also apply to sensitive areas and/or horizontal applications where less volume may be desirable. Minimum volumes will be specified in the appropriate use directions. In light textured soils such as sand or gravel which accept larger amounts of water, increased volumes which deliver the appropriate concentration of termiticide in the soil may be used. Maximum volumes will be specified in the appropriate use directions.

Note: Large reductions of application volume reduce the ability to obtain a continuous barrier. Variance is allowed when volume and concentration are consistent with label directed rates and a continuous barrier can still be achieved.

Treatment of Structures with Wells, Cisterns or Other Bodies of Water Within or Adjacent to Treated Sites

Do not contaminate wells or cisterns.

1. **Structures With Wells/Cisterns Inside Foundations:** Structures that contain wells or cisterns within the foundation of a structure can only be treated using the following techniques:
   a. Do not treat soil while it is beneath or within the foundation or along the exterior perimeter of a structure that contains a well or cistern. The treated backfill method may be used if soil is removed and treated outside/away from the foundation. The treated backfill technique is described as follows:
      (1) Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.
      (2) Treat the soil at the rate of 4 gallons of dilute emulsion per 10 linear feet per foot of depth of the trench, or 1 gallon per 1.0 cubic feet of soil. See "mixing Directions" section of this label. Mix thoroughly into the soil taking care to contain the liquid and prevent runoff or spillage.

(3) After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.

b. Infested and/or damaged wood in place may be treated using an injection technique such as described in the "Control of Wood Infesting Insects" section of this label.

2. **Structure With Adjacent Wells/Cisterns and/or Other Water Bodies:** Applicators must inspect all structures with nearby water sources such as walls, cisterns, surface ponds, streams, and other bodies of water and evaluate, at a minimum, the treatment recommendations listed below prior to making an application.

   a. Prior to treatment, if feasible, expose the water pipe(s) coming from the well to the structure, if they enter the structure within 3 feet of grade.

   b. Prior to treatment, applicators are advised to take precautions to limit the risk of applying the termiticide into subsurface drains that could empty into any bodies of water. These precautions include evaluating whether application of the termiticide to the top of the footer may result in contamination of the subsurface drain. Factors such as depth to the drain system and soil type and degree of compaction should be taken into account in determining the depth of treatment.

   c. When appropriate (i.e., on the water side of the structure), the treated backfill technique (described above) can also be used to minimize off-site movement of termiticide.

Preconstruction Subterranean Termite Treatment

Preconstruction applications are defined as those applications made prior to the finished grade being installed. Effective Preconstruction treatment for subterranean termite prevention requires the establishment of vertical and/or horizontal chemical barriers between wood in the structure and the termite colonies in the soil. Follow state and local regulations to meet minimum treatment standards for preventive Preconstruction treatments.

Do not apply at a lower dosage and/or concentration than specified on this label for applications prior to installation of the finished grade.

Prior to each application, applicators must notify the general contractor, construction superintendent, or similar responsible party, of the intended termiticide application and intended sites of application and instruct the responsible person to notify construction workers and other individuals to leave the area to be treated during application and until the termiticide is absorbed into the soil.

See "Rate Determination Guidelines" and "Table 1" for dilution directions.

1. For horizontal barriers, applications shall be made using a low pressure spray after grading is completed and prior to the pouring of the slab or footing.

   a. For a 0.75% rate, apply 1 gallon of dilution per 10 square feet or use 2 fluid ounces of Dursban TC per 10 square feet in sufficient water (not less than 1/2 or more than 2 gallons) to provide thorough and continuous coverage of the area being treated (see Application Volume section).

      For a 1.0% rate, apply 1 gallon of dilution per 10 square feet, or use 2 2/3 fluid ounces of Dursban TC per 10 square feet in sufficient water (no less than 1/2 gallon or more than 2 gallons) to provide thorough and continuous coverage of the area being treated (See "Application Volume").

      If the fill is washed gravel or other coarse material, it is important that a sufficient amount of dilution be used to reach the soil substrate beneath the coarse fill.

   b. If concrete slabs cannot be poured over the soil the same day it has been treated, a vapor barrier should be placed over the treated soil to prevent disturbance of the termiticide barrier.

2. **For vertical barriers, apply the 0.75-1.0% dilution at a rate of 4 gallons per 10 linear feet per foot of depth. Establish vertical barriers in areas such as around foundations, plumbing lines, backfilled soil against foundation walls and other areas which may warrant more than just a horizontal barrier.**

   a. **When treating foundations deeper than 4 feet, apply the termiticide as the backfill is being replaced, or if the construction contractor fails to notify the applicator to permit this, treat the foundation to a minimum depth of 4 feet after the backfill has been installed. The applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to a minimum depth of 4 feet. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.**

   b. **Trenches need not be wider than 6 inches. Treat soil with the dilution as it is being replaced in the trench.**

      For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 8 fluid ounces of Dursban TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage.

      For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 10$^{2}/_{3}$ fluid ounces of Dursban TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage.

   c. Hollow block foundations or voids of masonry can be treated to make a complete chemical barrier especially if the soil was not treated prior to pouring the footing. Apply the dilution at a rate of 2 gallons per 10 linear feet so that it reaches the top of the footing.

   d. For crawl spaces, establish a vertical barrier on both sides of the foundation and around all piers and areas where underground utilities exit the soil. Do not apply the dilution to the entire surface area intended as the crawl.

3. **For plenum type structures which use a sealed underfloor space to circulate heated and/or cooled air throughout the structure. Apply the dilution at the rate of 4 gallons per 10 linear feet per foot of depth. Soil adjacent to both sides of foundation walls, supporting piers, plumbing and conduits should be treated by trenching or rodding (where soil conditions permit) to a dept of 6 inches or, if less shallow, to the top of the footing. When conditions will not permit trenching or rodding, surface application adjacent to interior foundation walls may be made but the treated strip shall not exceed a width of 18 inches, horizontally, from the foundation walls, piers or pipes. The surface application should be made at a rate of 1 gallon per 10 square feet as a very coarse spray under low pressure (not to exceed 20 psi. when measured at the treating tool). After soil treatment, a continuous vapor barrier of at least 6 mil polyethylene film or other suitable vapor barrier must be installed on the ground surface over the entire subfloor area and on the inside of the plenum walls, in accordance with the recommended practices for plenum type structures.**

Postconstruction Treatments

Postconstruction applications are defined as those applications made after the final grade is installed.

See "Rate Determination Guidelines" and "Table 1" for dilution directions.

Precaution: Do not apply dilution until location of heat or air conditioning ducts, vents, water and sewer lines and electrical conduits are known and identified. Extreme caution must be taken to avoid contamination of these structural elements and airways.

All holes in commonly occupied areas into which material has been applied must be plugged. Plugs should be of a non-cellulose material or covered by an impervious, non-cellulose material.

1. For **slab-on-ground construction** applications may be made using techniques such as sub-slab injection, rodding and/or trenching. Injectors should not extend beyond the tops of the footings.

   a. Treat along the outside of the foundation to form a continuous termiticide barrier in the soil.

      For shallow foundations, 1 foot or less, dig a narrow trench approximately 6 inches wide along the outside of the foundation walls. Do not dig below the bottom of the footings. For foundations with exposed footings, dig a trench alongside the footing taking care not to undermine the footing. The dilution should be applied to the trench and mixed with the soil as it is replaced in the trench.

      For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet or use 8 fluid ounces of Dursban TC per 10 linear feet in sufficient water (not less than 2 gallons or more than 8 gallons) to provide thorough and complete coverage of the area being treated (see Application Volume section).

      For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet or use 10⅔ fluid ounces of Dursban TC per 10 linear feet in sufficient water (no less than 2 gallons or more than 8 gallons) to provide thorough and complete coverage of the area being treated (See "Application Volume").

      For foundations with footings deeper than 1 foot, apply the dilution at a rate of 4 gallons per 10 linear feet per foot of depth. For applications made after the final grade is installed, the applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements at the rate prescribed from grade to the top of the footing. When the footing is more than 4 feet below grade, the applicator must trench and rod into the trench or trench along the foundation wall at the rate prescribed to a minimum depth of 4 feet . The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.

   b. When treating cracks and expansion joints in the slab, along sidewalks or patios adjacent to the exterior foundation wall or other areas where holes are to be drilled to form a continuous termiticide barrier, the holes should be spaced at intervals up to 24 inches depending on soil type.

      Hard, dry soils typically allow good lateral (horizontal) dispersion. However, they may be slow in absorption or downward movement. Care must be taken when injecting through slabs into areas with this type of soil. Low pressures should be considered in this situation. This will help to avoid backsplashing from the injection hole, backflow from cracks and expansion joints, and unwanted emergence of the termiticide dilution from adjacent drill holes. A slow, low pressure application using the proper volume of termiticide dilution will allow the soil to absorb the liquid and provide an

adequate vertical barrier. The wider drill hole spacings (18 to 24 inches) can usually be used in this situation. Sand, loam, or gravel backfill materials are commonly found under slab foundations. The type of fill, amount of settling that has occurred, moisture content, etc., will determine drill hole spacing and amount of termiticide dilution to be injected through each hole. Highly absorptive soils or those with large pore spaces (gravel, coarse sand) will afford rapid downward (vertical) movement and limited lateral (horizontal) distribution of the termiticide dilution. In this situation, consider using a lateral dispersion tip on the sub-slab injector and place the drill holes closer together (12 to 18 inches).

For a 0.75-1.0% rate, apply 4 gallons of dilution per 10 linear feet.

c. It may be necessary to treat along one side of interior partition walls if there are cracks in the slab, plumbing entry points, existing termite infestations, or other conditions which would make treatment appropriate.

d. To complete the termiticide barrier under slab foundations, it may be necessary to drill and treat near plumbing and electrical entry areas, cracks, or other areas where termites might enter the structure. In this instance, one or more holes should be drilled in the slab as close to the entry point as is practical and termiticide placed in the fill. As a general rule, 3 to 5 gallons of dilution per entry point will usually give adequate coverage, however, the use of directional or lateral dispersion tips or foam delivery systems can give adequate coverage with lower volumes. Location of the drill hole in relation to the entry point, type of soil fill, presence or absence of a vapor barrier, application pressure and other considerations will affect the coverage and volume of termiticide needed to form a complete barrier. Precautions must be taken to avoid drilling into plumbing or electrical conduit.

e. When necessary, drill through the foundation walls from the outside and force the dilution just beneath the slab either along the inside of the foundation or along all the cracks and expansion joints and other critical areas.

f. **Bath traps:** Exposed soil or soil covered with tar or a similar type sealant beneath and around plumbing and/or drain pipe entry areas may be treated with a 0.75-1.0% dilution of Dursban TC.

An access door or inspection vent should be cut and installed, if not already present. After inspection and removal of any wood or cellulose debris, the soil can be treated by rodding or drenching the soil. A one square foot bath trap will usually require about 3 to 5 gallons of dilution for thorough and complete coverage.

2. **Hollow block foundations or voids in masonry** resting on the footing can be treated to make a continuous chemical barrier in the voids. If the void has direct contact with the soil, it should be treated. Drill and treat all voids in multiple masonry elements of the structure extending from the structure to the soil in order to create a continuous treatment barrier in the area to be treated. Apply at the rate of 2 gallons of emulsion per 10 linear feet of footing using a nozzle pressure of less than 25 psi. When using this treatment access holes must be drilled below the sill plate and should be as close as possible to the footing as is practical. Treatment of voids in block or rubble foundation walls must be closely examined. Applicators must inspect areas of possible runoff as a precaution against application leakage in the treated areas. Some areas may not be treatable of may require mechanical alteration prior to treatment.

Not for use in voids insulated with rigid foam.

3. For basements, apply at a rate of 4 gallons of dilution per 10 linear feet per foot of depth. Where footings are greater than 1 foot of depth from the grade to the top of the footing, application may be made by trenching and/or rodding at a rate of 4 gallons of dilution per 10 linear feet per foot of depth. When the footing is more than 4 feet below grade, the applicator must trench and rod into the trench or trench along the foundation wall at the rate prescribed to a minimum depth of 4 feet. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing. Treat outside of foundation walls, and if necessary beneath the basement floor along inside of foundation walls, along cracks in basement floors, along interior load bearing walls, around sewer pipes, conduits and piers.

4. **Accessible Crawl Spaces:** For crawl spaces, apply vertical termiticide barriers at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to top of footing, or if the footing is more than 4 feet below grade, to a minimum depth of 4 feet.

   For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 8 fluid ounces of Dursban TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage.

   For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or $10^2/_3$ fluid ounces of Dursban TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage.

   Apply by trenching and rodding into the trench, or trenching. Treat both sides of foundation and around all piers and pipes. Where physical obstructions, such as concrete walkways adjacent to foundation elements, prevent trenching, treatment may be made by rodding alone. When soil type and/or conditions make trenching prohibitive, rodding may be used. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. Read and follow the mixing and use direction section of the label if situations are encountered where the soil will not accept the full application volume.

   a. Rod holes and trenches shall not extend below the bottom of the footing.

   b. Rod holes shall be spaced so as to achieve a continuous chemical barrier but in no case more than 12 inches apart.

   c. Trenches shall be a minimum of 6 inches deep or to the bottom of the footing, whichever is less, and need not be wider than 6 inches. When trenching in sloping (tiered) soil, the trench shall be stepped to ensure adequate distribution and to prevent termiticide from running off. The emulsion must be mixed with the soil as it is replaced in the trench.

   d. When treating crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

5. **Inaccessible Crawl Spaces:** For inaccessible interior areas, such as areas where there is insufficient clearance between floor joists and ground surfaces to allow operator access, excavate if

possible, and treat according to the instructions for accessible crawl spaces. Otherwise, apply one or a combination of the following two methods.

For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet or 8 fluid ounces of Dursban TC per 10 linear feet in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage (See Application Volume section).

For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet or $10^2/s$ fluid ounces of Dursban TC per 10 linear feet in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage (See "Application Volume").

a. To establish a horizontal barrier, apply 1 gallon of emulsion per 10 sq. ft. to the soil surface. Use a nozzle pressure of less than 25 psi. and a coarse application nozzle (e.g., Delavan Type RD Raindrop, RD-7 or larger, or Spraying Systems Co. 8010LP TeeJet or comparable nozzle). For an area that cannot be reached with the application wand, use one or more extension rods to make the application to the soil. Do not broadcast or powerspray with higher pressures.

b. To establish a horizontal barrier, drill through the foundation wall or through the floor above and treat the soil perimeter at a rate of 1 gallon of emulsion per 10 square feet. Drill spacing must be at intervals not to exceed 16 inches. Many states have smaller intervals so check state regulations which may apply.

When treating crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

c. In the presence of unsupported termite tubes, mechanically destroy each tube and apply approximately 1 pint of 0.75-1.0% dilution to an area of no more than 18 inches in diameter where the tubes emerged from the soil.

6. In plenum type structures, which use a sealed underfloor space to circulate heated and/or cooled air within the structure, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil. Apply the 0.75-1.0% dilution at the rate of 4 gallons per 10 linear feet per foot of depth. Soil adjacent to both sides of foundation walls, supporting piers, plumbing and conduits should be treated by trenching or rodding (where soil conditions permit) to a depth of 6 inches or to the top of the footing. When conditions will not permit trenching or rodding, a surface application adjacent to interior foundation walls may be made, but the treated strip shall not exceed a width of 18 inches, horizontally, from the foundation piers or pipes. The surface application should be made at a rate of 1 gallon per 10 square feet as a very coarse spray under low pressure (not to exceed 20 psi. when measured at the treating tool). In order to properly calculate the amount of termiticide dilution needed, use the following guideline: A strip 18 inches wide and 6 feet 8 inches long is equal to 10 square feet. Before treatment, a barrier of at least 6 mil polyethylene film or other suitable vapor barrier must be present on this ground surface over the entire subfloor area in accordance with recommended practices for plenum type structures. Install a new vapor barrier if barrier is absent or deteriorated. The vapor barrier film on the ground and foundation walls must be folded back from the areas to be treated prior to treatment and replaced immediately following treatment. Structures should be ventilated during application and until treatment is dry.

7. **Application using foam generating equipment:** The emulsion may be converted to a foam and the foam used to control or prevent termite infestations.

   Depending on circumstances, foam applications may be used alone or in combination with liquid emulsion applications. Applications may be made behind veneers, piers, chimney bases, into rubble foundations, into block voids or structural voids, under slabs, stoops, porches, or to the soil in crawl spaces, and other similar voids.

   Foam and liquid application must be consistent with volume and active ingredient instructions in order to ensure proper application has been made. The volume and amount of active ingredient are essential to an effective treatment. At least 50 to 75% of the labeled liquid emulsion volume of product must be applied, with the remaining percent delivered to appropriate areas using foam application. Refer to the label and use recommendations of the foam manufacturer and the foaming equipment manufacturer for adjuvant rates to produce the needed expansion ratio with this product.

   Foam applications are generally a good supplement to liquid treatments in difficult areas, but may be used alone in difficult spots.

   The following provides the amount of Dursban TC required for a given area and volume range of the prefoamed termiticide dilution necessary for application of the product.

   For a 0.75% rate, apply 8 fluid ounces of Dursban TC per 10 linear feet using no less than 2 gallons, or more than 8 gallons, of prefoamed dilution.

   For a 1% rate, apply $10^{2}/_{3}$ fluid ounces of Dursban TC per 10 linear feet using no less than 2 gallons, or more than 8 gallons, of prefoamed dilution.

8. Application in conjunction with the use of the Sentricon* Colony Elimination System: As a part of the integrated pest management (IPM) program for subterranean termite control, Dursban TC may be applied to critical areas of the structure including plumbing and utility entry sites, bath traps, expansion joints, foundation cracks, and areas with known or suspected infestations at a rate of 0.75%-1.0% as a spot application or complete barrier treatment. Application may be made as described in the Postconstruction Treatment section of this label.

Underground Utility Cable and Conduit

Preventative Treatment for Use Only in Guam, Hawaii, and Other Pacific Islands: Use a 1.0% to 2.0% dilution (See "Rate Determination Guidelines" and "Table 1" for dilution directions). After digging the trench, place approximately 6 inches of backfill or sand at the bottom and apply 2 gallons of the dilution per 10 linear feet. Allow to dry then replace the cable backfill. Cover with an additional 6 inches of backfill or sand and apply another 2 gallons of emulsion per 10 linear feet. Finish filling trench with untreated soil.

Wherever cables emerge from the soil to enter poles, light frames, etc., treat the soil around the cable and pole or frame to establish a continuous 6 inch chemical barrier.

A continuous 6 inch chemical barrier must be established around the cable to insure protection from termite attack.

Utility Poles and Fence Posts

Preventative Treatment: Use a 1.0 to 2.0% dilution (See "Rate Determination Guidelines" and "Table 1" for dilution directions). After pole or post hole has been dug, mix the dilution with the soil as it is being replaced to a depth of approximately 10 inches. Place pole or post on top of this layer. The remaining soil fill and termiticide dilution should be mixed while backfilling the hole. The treated soil zone around the post or pole should be approximately

6 inches wide. Soil for the base layer and backfill of each pole or post should be treated at a rate of 4 gallons of dilution per 10 cubic feet of soil.

Remedial Treatment: To control existing infestations or to prevent infestation of posts and poles already in place, use a 1.0% to 2.0% dilution. The termiticide dilution should be injected into termite galleries or channels in the wood. For maximum protection, injection sites should be at or below grade.

Posts or poles may also be treated by rodding down to the base of the structure. Rod holes should be placed approximately 3 inches away from the pole and about 6 inches apart. Inject approximately 12 fluid ounces of dilution per foot of depth into each rod hole.

It may be appropriate to use one or both treatment techniques depending upon the specific circumstances at the work site e.g. soil type.

Control of Wood Infesting Insects

Dosage and Mixing Directions

Dursban TC is recommended for use as an aqueous emulsion containing 0.5% to 1.0% chlorpyrifos. See "Table 1" for dilution directions.

Advisements

When spraying overhead interior living areas of homes, apartment buildings, etc., cover surfaces below the area being sprayed with plastic sheeting or other material.

Contact with treated surfaces should be avoided until spray has dried. Cover or remove exposed foods before treatment. Do not use in structures housing animals which are intended for or which produce products to be used for food purposes. Do not use for above ground control of wood infesting insects in food areas of food handling establishments, restaurants or other areas where food is commercially prepared or processed.

To control wood infesting insects such as powderpost beetles (Lyctidae), false powderpost beetles (Bostrichidae), deathwatch beetles (Anobiidae), old house borers (Cerambycidae) and ambrosia beetles (Scolytidae) in homes and other structures, treatments may be applied either as coarse sprays or by brushing the product onto targeted surfaces. Use a sufficient amount of spray to cover the area to the point of wetness but avoiding runoff. Use the following guidelines to determine appropriate rates of application:

New Wood, (typically less than 10 years of age) apply approximately 1 gallon of dilution per 150 square feet as a coarse spray.

Old Wood, (typically greater than 10 years of age) apply approximately 1 gallon of dilution per 100 square feet as a coarse spray.

Treatment Directions

For control of carpenter ants in homes and other structures, apply dilution around doors and windows and other places where carpenter ants enter the premises and where they crawl and hide. Also spray into cracks and crevices or through openings or small newly drilled holes into wall voids where these ants or their nests are present. Use a sufficient amount of coarse spray to cover the area to the point of wetness but avoiding runoff.

For control of termites (localized areas of infested wood in structures), apply dilution to voids and channels in damaged wood and in spaces between members of a structure and between wood and foundations where termite infestation is likely to occur. Application may be made to inaccessible areas by drilling, and then injecting the emulsion. Use a sufficient amount of spray to cover the area to the point of wetness but avoiding runoff. Treatment of localized areas is intended to kill workers and winged reproductive forms of termites in the treated areas and to prevent infestations for a temporary period. This type of application is not intended to be a substitute for soil treatment or mechanical alteration to control subterranean termites.

Pest Control on Outside Surfaces and Around Buildings

To control ants, bees, carpenter ants, clover mites, cockroaches, crickets, earwigs, hornets, millipedes, scorpions, spiders, ticks, wasps and yellowjackets.

Outside surfaces: Apply Dursban TC termiticide as a residual spray to outside surfaces of buildings including porches, window frames, eaves, patios, garages, refuse dumps and other areas where pests congregate or have been observed. Treatment may be repeated as needed to maintain effectiveness.

Perimeter sprays: To help prevent infestation of buildings, treat a band of soil and vegetation 6 to 10 feet wide around and adjacent to the building. Also, treat the building foundation to a height of 2 to 3 feet where pests are active and may find entrance. For scorpions, treat or remove accumulations of lumber, firewood, and other materials which serve as insect harborage sites.

Dosage and Mixing Instructions: Use Dursban TC mixed as a **0.25% to 0.5% dilution** as indicated in the following table:

Gallons of Finished Dilution Desired	Dursban TC Required	
	0.25% Solution	0.5% Solution
1	$^{2}/_{3}$ fl oz	$1^{1}/_{3}$ fl oz
5	$3^{1}/_{3}$ fl oz	$6^{2}/_{3}$ fl oz
10	$6^{2}/_{3}$ fl oz	$13^{1}/_{3}$ fl oz
24	16 fl oz	1 qt
48	1 qt	2 qt
97	2 qt	1 gal

Small amounts of solution remaining in the spray tank can be diluted as indicated in the following table and used to treat outside surfaces or perimeter areas:

Concentration of Termiticide Dilution	Amount of Water to Add to Each Gallon of Termiticide Dilution to Provide a 0.25% Spray	Amount of Water to Add to Each Gallon of Termiticide Dilution to Provide a 0.5% Spray
0.75%	2 gallons	0.5 gallon
1.0%	3 gallons	1 gallon

Warranty Disclaimer

DowElanco warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. DowElanco MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Plant injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperature, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of DowElanco or the seller. All such risks shall be assumed by buyer.

Limitation of Remedies

The exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories), shall be limited to, at DowElanco's election, one of the following:

1. Refund of purchase price paid by buyer or user for product bought, or
2. Replacement of amount of product used

DowElanco shall not be liable for losses or damages resulting from handling or use of this product unless DowElanco is promptly notified of such loss or damage in writing. In no case shall DowElanco be liable for consequential or incidental damages or losses.

The terms of the "Warranty Disclaimer" above and this "Limitation of Remedies" cannot be varied by any written or verbal statements or agreements. No employee or sales agent of DowElanco or the seller is authorized to vary or exceed the terms of the "Warranty Disclaimer" or this "Limitation of Remedies" in any manner.

*Trademark of DowElanco
EPA-Accepted 05/20/97

CONFIDENTIAL

Association of Structural Pest Control Regulatory Officials

DATE: 9/9/97

TO: Termiticide Label Review Committee

FROM: George Saxton

RE: Dursban TC (EPA registration No. 62719-47)

Enclosed is a label from Robert D. Vatne of DowElanco regarding label changes to the above referenced label.

Association of Structural Pest Control Regulatory Officials

CONFIDENTIAL

DATE: 9/9/97

TO: Termiticide Label Review Committee

FROM: George Saxton

RE: Dursban TC (EPA registration No. 62719-47)

Enclosed is a label from Robert D. Vatne of DowElanco regarding label changes to the above referenced label.

DowElanco
9330 Zionsville Road
Indianapolis, IN 46268-1054

308/2E
September 3, 1997

DowElanco

ASPCRO Termiticide Review
c/o George Saxton
Office of the Indiana State Chemist
Purdue University
1154 Biochemistry Building
West Lafayette, IN 47907-1154

Attn: Jim Wright

DURSBAN TC (EPA REG. NO. 62719-47)
EPA PESTICIDE REGULATION (PR) NOTICE 96-7

DowElanco is submitting a copy of the recently amended Dursban* TC termiticide concentrate label for general review by the Termiticide Review Committee as established by Section XI of the subject PR notice. Although basic secrecy agreements with committee members are not completed at this time, no secrecy elements are involved with these label changes. The changes are almost exclusively mandated by PR-Notice 96-7. In addition to the mandated changes, the amendment provided for a slight change in the basic and alternate formulations of the product. This change involved only altering the ratio of inert ingredients (no new ingredients) which resulted in increasing the percent active ingredient in the product from 42.8 to 44.

Enclosed is a copy of the Dursban TC label (900-004938/00014066) which was approved by the Environmental Protection Agency on May 20,1997. A product data sheet, which is a cover page for the label, itemizes the changes from the previous Dursban TC label.

We trust that the Committee finds the above mentioned label acceptable. However, please contact us if there are suggested changes.

Sincerely,

Robert D. Vatne

Robert D. Vatne, Ph.D.
Product Registration Manager
(317) 337-4662
(317) 337-4736 (FAX)

rdv/caa

Enclosure

* Trademark of DowElanco

DowElanco
9330 Zionsville Road
Indianapolis, IN 46268-1054

Building 308/3E
800-892-6740
Contact Person: Renee Bartz

DowElanco

PRODUCT DATA SHEET

Dursban* TC

62719-047

EPA Accepted Date May 20, 1997

Comments:

Label booklet code: 900-004938

The following label changes were approved by the EPA on May 20, 1997, to comply with PR Notice 96-7 on termiticide labeling.

1. Revised Sale Copy.
2. Revised Active and Inert Ingredients.
3. Revised Precautionary Measures.
4. Added Personal Protective Equipment (PPE) to Precautionary Statements and Table of Contents.
5. Deleted Handling Procedures from Directions for Use and Table of Contents.
6. Revised General Information:

1) General Use Precautions
2) Application Volume
3) Addition of Treatment of Structures with Well, Cisterns or Other Bodies of Water Within or Adjacent to Treated Sites to General Information and Table of Contents
4) Preconstruction and Postconstruction Subterranean Termite Treatment
5) Utility Poles and Fence Posts

Additional note to record deletions done on 3-20-97 and 4-01-97 (revised pages sent to EPA):
deleted "Retreatment Statement" in table of contents
deleted "Retreatment Statement" under Utility Poles and Fence Posts
deleted statement on page 10 under Preconstruction applications are defined as those applications made prior to the finished grade being installed.: "To meet FHA termite proofing requirements, follow the latest edition of the Housing and Urban Development (HUD) Minimum Property Standards."

DowElanco™

Dursban* TC

For use by individuals/firms licensed or registered by the state to apply termiticide products. States may have more restrictive requirements regarding qualifications of persons using this product. Consult the structural pest control regulatory agency of your state prior to use of this product.

Active ingredient:

chlorpyrifos: O,O-diethyl O-(3,5,6-trichloro-2 pyridinyl) phosphorothioate	44.0%
Inert Ingredients	56.0%
Total Ingredients	100.0%

Contains 4 pounds of chlorpyrifos per gallon.

Precautionary Statements

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

WARNING AVISO

Precaucion al usuario: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.

May Be Fatal If Swallowed • Excessive Absorption Through Skin May Be Fatal • Causes Substantial But Temporary Eye Injury • May Cause Skin Irritation.

Do not get in eyes, on skin or clothing. Avoid breathing vapors and spray mist. Handle concentrate in a ventilated area. Wash thoroughly with soap and water after handling and before eating or smoking. Remove contaminated clothing and wash before reuse. Keep away from food, feedstuffs and water supplies.

Personal Protective Equipment (PPE)

Mixers and loaders must wear a minimum of long-sleeved shirt and long pants, chemical-resistant footwear, chemical-resistant gloves, and protective eyewear (goggles, a faceshield, or safety glasses with front, brow, and temple protection. **Mixers and loaders** who do not use a mechanical system (such as the Voyager* container or in-line injector) to transfer the contents of this container must wear coveralls or chemical-resistant apron in addition to other required PPE.

Pesticide applicators must wear long-sleeved shirt and long pants, socks, shoes, and chemical-resistant gloves.

Specialty Termiticide Concentrate

In addition, all pesticide handlers must wear a respiratory protection device (MSHA/NIOSH approved number TC-21C) and protective eyewear when working in a non-ventilated space and all pesticide applicators must wear protective eyewear when applying termiticide by rodding or sub-slab injection.

First Aid

If swallowed: Call a physician or Poison Control Center immediately. Do not induce vomiting. Contains an aromatic petroleum solvent. Do not give anything by mouth to an unconscious person.
If on skin: Immediately wash with plenty of soap and water. Get medical attention.
If in eyes: Flush with plenty of water for 15 minutes. Get medical attention.
If inhaled: Remove to fresh air if symptoms of cholinesterase inhibition appear and get medical attention immediately.
Note to physician: Chlorpyrifos is a cholinesterase inhibitor. Treat symptomatically. If exposed, plasma and red blood cell cholinesterase tests may indicate significance of exposure (baseline data are useful). Atropine, only by injection, is the preferable antidote. Oximes, such as 2-PAM/protopam, may be therapeutic if used early; however, use only in conjunction with atropine. In case of severe acute poisoning, use antidote immediately after establishing an open airway and respiration.

Environmental Hazards

This pesticide is toxic to birds and wildlife, and extremely toxic to fish and aquatic organisms. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. Cover or incorporate spills. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

Physical or Chemical Hazards

Do not use or store near heat or open flame.

Refer to label booklet for additional precautionary information and Directions for Use including Storage and Disposal.

Notice: Read the entire label. Use only according to label directions. **Before buying or using this product, read "Warranty Disclaimer" and "Limitation of Remedies" inside label booklet.**

In case of emergency endangering health or the environment involving this product, call collect 517-636-4400.
Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.

EPA Reg. No. 62719-47 EPA Est. 464-MI-1
900-004938 / 00014066

*Trademark of DowElanco
DowElanco • Indianapolis, IN 46268 U.S.A.

PEEL FILM HERE

BASE LABEL

DowElanco

Dursban* TC

For use by individuals/firms licensed or registered by the state to apply termiticide products. States may have more restrictive requirements regarding qualifications of persons using this product. Consult the structural pest control regulatory agency of your state prior to use of this product.

Active ingredient:
chlorpyrifos: O,O-diethyl O-(3,5,6-trichloro-2 pyridinyl) phosphorothioate 44.0%
Inert Ingredients 56.0%
Total Ingredients 100.0%

Contains 4 pounds of chlorpyrifos per gallon.

Keep Out of Reach of Children

WARNING AVISO

Precaucion al usuario: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.

Refer to inside of label booklet for additional precautionary information and Directions for Use including Storage and Disposal.

Notice: Read the entire label. Use only according to label directions. **Before buying or using this product, read "Warranty Disclaimer" and "Limitation of Remedies" inside label booklet.**

In case of emergency endangering health or the environment involving this product, call collect 517-636-4400.

Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.

EPA Reg. No. 62719-47 EPA Est. 464-MI-1
900-004938 / 00014066

*Trademark of DowElanco

DowElanco • Indianapolis, IN 46268 U.S.A.

Specialty Termiticide Concentrate

Cover

LABEL BOOKLET

Table of Contents Page

Precautionary Statements

Hazards to Humans and Domestic Animals

WARNING AVISO

Precaucion al usuario: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.

May Be Fatal If Swallowed • Excessive Absorption Through Skin May Be Fatal • Causes Substantial But Temporary Eye Injury • May Cause Skin Irritation.

Do not get in eyes, on skin or clothing. Avoid breathing vapors and spray mist. Handle concentrate in a ventilated area. Wash thoroughly with soap and water after handling and before eating or smoking. Remove contaminated clothing and wash before reuse. Keep away from food, feedstuffs and water supplies.

Personal Protective Equipment (PPE)

Mixers and loaders must wear a minimum of long-sleeved shirt and long pants, chemical-resistant footwear, chemical-resistant gloves, and protective eyewear (goggles, a faceshield, or safety glasses with front, brow, and temple protection. **Mixers and loaders** who do not use a mechanical system (such as the Voyager* container or in-line injector) to transfer the contents of this container must wear coveralls or chemical-resistant apron in addition to other required PPE.

Pesticide applicators must wear long-sleeved shirt and long pants, socks, shoes, and chemical-resistant gloves.

In addition, all pesticide handlers must wear a respiratory protection device (MSHA/NIOSH approved number TC-21C) and protective eyewear when working in a non-ventilated space and all pesticide applicators must wear protective eyewear when applying termiticide by rodding or sub-slab injection.

First Aid

If swallowed: Call a physician or Poison Control Center immediately. Do not induce vomiting. Contains an aromatic petroleum solvent. Do not give anything by mouth to an unconscious person.
If on skin: Immediately wash with plenty of soap and water. Get medical attention.
If in eyes: Flush with plenty of water for 15 minutes. Get medical attention.
If inhaled: Remove to fresh air if symptoms of cholinesterase inhibition appear and get medical attention immediately.

Note to physician: Chlorpyrifos is a cholinesterase inhibitor. Treat symptomatically. If exposed, plasma and red blood cell cholinesterase tests may indicate significance of exposure (baseline data are useful). Atropine, only by injection, is the preferable antidote. Oximes, such as 2-PAM/protopam, may be therapeutic if used early; however, use only in conjunction with atropine. In case of severe acute poisoning, use antidote immediately after establishing an open airway and respiration.

Environmental Hazards

This pesticide is toxic to birds and wildlife, and extremely toxic to fish and aquatic organisms. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. Cover or incorporate spills. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

Physical or Chemical Hazards

Do not use or store near heat or open flame.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read all Directions for Use carefully before applying.

Do not tank mix this product with products containing dichlorvos (DDVP).
Do not formulate this product into other end-use products.

Storage and Disposal

Do not contaminate water, food or feed by storage or disposal.
Storage: Store in original container in secured dry storage area. Prevent cross-contamination with other pesticides and fertilizers. Avoid storing above 122°F for extended periods of time. Storage below 40°F may result in formation of crystals. If product crystallizes,

Storage and Disposal (Cont.)

store at 55-75°F and shake occasionally to redissolve crystals. If container is damaged or spill occurs, use product immediately or dispose of product and damaged container as indicated below.
Pesticide Disposal: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of according to label instructions, contact your state pesticide or environmental control agency, or the hazardous waste representative at the nearest EPA regional office for guidance.
Container Disposal for Non-Refillable Containers: Triple rinse (or equivalent) then offer for recycling or reconditioning, or puncture and/or crush rinsed, empty container and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.
or
Triple rinse (or equivalent). Then dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.
Container Disposal for Refillable Containers: Replace the dry disconnect cap, if applicable, and seal all openings which have been opened during use. Return the empty container to a collection site designated by DowElanco. If the container has been damaged and cannot be returned according to the recommended procedures, contact DowElanco Customer Service Center at 1-800-258-1470 to obtain proper handling instructions.

General Information

Subterranean Termites

Dursban* TC termiticide concentrate for soil treatment is used to establish a barrier which is lethal to termites. In order to provide an effective barrier between the wood in the structure and

termite colonies in the soil, disperse the chemical emulsion so as to avoid untreated gaps in the barrier.

It is important that the service technician be familiar with current control practices including trenching, rodding, subslab injection and low pressure spray applications. These techniques must be correctly employed to prevent or control infestations by subterranean termite species of *Reticulitermes*, *Zootermopsis*, *Heterotermes* and *Coptotermes*. Choice of appropriate procedures includes consideration of such variable factors as the design of the structure, water table, soil type, soil compaction, grade conditions and the location and type of domestic water supplies. The biology and behavior of the involved termite species are important factors to be known as well as suspected location of the colony and severity of the infestation within the structure to be protected. For advice concerning current control practices for specific local conditions, consult resources in structural pest control.

General Use Precautions

All nonessential wood and cellulose containing materials, including scrap wood and form boards, should be removed from around foundation walls, crawl spaces, and porches. This does not include existing structural soil contact wood that has been treated.

When treating adjacent to an existing structure, the applicator must check the areas to be treated, and immediately adjacent areas of the structure for visible and accessible cracks and holes to prevent any leaks or significant exposures to persons occupying the structure. People present or residing in the structure during application must be advised to remove their pets and themselves from the structure if they see any signs of leakage. After application, the applicator is required to check for leaks.

All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site. Do not allow people or pets to contact contaminated areas or to reoccupy the contaminated areas of the structure until the cleanup is completed.

Retreatment for subterranean termites can only be performed if there is clear evidence of reinfestation or disruption of the barrier due to construction, excavation, or landscaping and/or evidence of the breakdown of the termiticide barrier in the soil. These vulnerable or reinfested areas may be retreated in accordance with application techniques described in this product's labeling. The timing and type of these retreatments will vary, depending on factors such as termite pressure, soil types, soil conditions and other factors which may reduce the effectiveness of the barrier.

Annual retreatment of the structure is prohibited unless there is clear evidence that reinfestation or barrier disruption has occurred.

Contamination of public and private water supplies must be avoided by following these minimum precautions:

1. Use anti-back flow equipment or procedures to prevent siphonage of pesticide back into water supplies.
2. Do not treat soil that is water saturated or frozen
3. Do not treat while precipitation is occurring.
4. Consult Federal, state and local specifications for information regarding approved treatment practices in your area.
5. Do not contaminate wells or cisterns. See specific "Treatment of Structures with Wells, Cisterns or Other Bodies of Water Adjacent to Treated Sites".

Rate Determination Guidelines

Consult the local extension agent or state entomologist for application rate recommendations.

An initial treatment using a 0.75-1.0% dilution will provide effective, optimum long term residual control.

A 2.0% dilution may be used to protect utility poles and fence posts.

Table 1 - Dilution Directions

Gallons of Finished Dilution Desired	Dursban TC Needed			
	0.5%	0.75%	1.0%	2.0%
1	1 1/3 fl oz	2 fl oz	2 2/3 fl oz	5 1/3 fl oz
5	6 2/3 fl oz	10 fl oz	13 1/3 fl oz	26 2/3 fl oz
10	13 1/3 fl oz	20 fl oz	26 2/3 fl oz	53 1/3 fl oz
24	1 qt	1 1/2 qt	1/2 gal	1 gal
48	1/2 gal	3 qt	1 gal	2 gal
97	1 gal	1 1/2 gal	2 gal	4 gal

Mixing Directions

It is important that the termiticide dilution be uniformly mixed in the spray tank before beginning the treatment. Once mixed, Dursban TC will not settle out in the tank although the initial mixing will be enhanced by agitation, circulation through the treating hose, and the filling process.

1. Fill tank 1/4 to 1/3 full.
2. Start pump to begin by-pass agitation and place end of treating tool in tank to allow circulation through hose.
3. Add appropriate amount of Dursban TC.
4. Add remaining amount of water.
5. Let pump run and allow recirculation through the hose for 2 to 3 minutes.

Application Volume

To provide maximum control and protection against termite infestation, apply the specified volume of the finished water emulsion and active ingredient as set forth in the Directions for Use section of this label. If soil will not accept the labeled application volume, such as heavy, clay-type soils, the volume may be reduced provided there is a corresponding increase in concentration so that the amount of active ingredient applied to the soil remains the same. This would also apply to sensitive areas and/or horizontal applications where less volume may be desirable. Minimum volumes will be specified in the appropriate use directions. In light textured soils such as sand or gravel which accept larger amounts of water, increased volumes which deliver the appropriate concentration of termiticide in the soil may be used. Maximum volumes will be specified in the appropriate use directions.

Note: Large reductions of application volume reduce the ability to obtain a continuous barrier. Variance is allowed when volume and concentration are consistent with label directed rates and a continuous barrier can still be achieved.

Treatment of Structures with Wells, Cisterns or Other Bodies of Water Within or Adjacent to Treated Sites

Do not contaminate wells or cisterns.

1. **Structures With Wells/Cisterns Inside Foundations:** Structures that contain wells or cisterns within the foundation of a structure can only be treated using the following techniques:
   a. Do not treat soil while it is beneath or within the foundation or along the exterior perimeter of a structure that contains a well or cistern. The treated backfill method may be used if soil is removed and treated outside/away from the foundation. The treated backfill technique is described as follows:
      (1) Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.
      (2) Treat the soil at the rate of 4 gallons of dilute emulsion per 10 linear feet per foot of depth of the trench, or 1 gallon per 1.0 cubic feet of soil. See "mixing Directions" section of this label. Mix thoroughly into the soil taking care to contain the liquid and prevent runoff or spillage.

(3) After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.

b. Infested and/or damaged wood in place may be treated using an injection technique such as described in the "Control of Wood Infesting Insects" section of this label.

2. **Structure With Adjacent Wells/Cisterns and/or Other Water Bodies:** Applicators must inspect all structures with nearby water sources such as walls, cisterns, surface ponds, streams, and other bodies of water and evaluate, at a minimum, the treatment recommendations listed below prior to making an application.

   a. Prior to treatment, if feasible, expose the water pipe(s) coming from the well to the structure, if they enter the structure within 3 feet of grade.

   b. Prior to treatment, applicators are advised to take precautions to limit the risk of applying the termiticide into subsurface drains that could empty into any bodies of water. These precautions include evaluating whether application of the termiticide to the top of the footer may result in contamination of the subsurface drain. Factors such as depth to the drain system and soil type and degree of compaction should be taken into account in determining the depth of treatment.

   c. When appropriate (i.e., on the water side of the structure), the treated backfill technique (described above) can also be used to minimize off-site movement of termiticide.

Preconstruction Subterranean Termite Treatment

Preconstruction applications are defined as those applications made prior to the finished grade being installed. Effective Preconstruction treatment for subterranean termite prevention requires the establishment of vertical and/or horizontal chemical barriers between wood in the structure and the termite colonies in the soil. Follow state and local regulations to meet minimum treatment standards for preventive Preconstruction treatments.

Do not apply at a lower dosage and/or concentration than specified on this label for applications prior to installation of the finished grade.

Prior to each application, applicators must notify the general contractor, construction superintendent, or similar responsible party, of the intended termiticide application and intended sites of application and instruct the responsible person to notify construction workers and other individuals to leave the area to be treated during application and until the termiticide is absorbed into the soil.

See "Rate Determination Guidelines" and "Table 1" for dilution directions.

1. For **horizontal barriers**, applications shall be made using a low pressure spray after grading is completed and prior to the pouring of the slab or footing.

   a. For a 0.75% rate, apply 1 gallon of dilution per 10 square feet or use 2 fluid ounces of Dursban TC per 10 square feet in sufficient water (not less than 1/2 or more than 2 gallons) to provide thorough and continuous coverage of the area being treated (see Application Volume section).

      For a 1.0% rate, apply 1 gallon of dilution per 10 square feet, or use 2 2/3 fluid ounces of Dursban TC per 10 square feet in sufficient water (no less than 1/2 gallon or more than 2 gallons) to provide thorough and continuous coverage of the area being treated (See "Application Volume").

      If the fill is washed gravel or other coarse material, it is important that a sufficient amount of dilution be used to reach the soil substrate beneath the coarse fill.

   b. If concrete slabs cannot be poured over the soil the same day it has been treated, a vapor barrier should be placed over the treated soil to prevent disturbance of the termiticide barrier.

2. For **vertical barriers**, apply the 0.75-1.0% dilution at a rate of 4 gallons per 10 linear feet per foot of depth. Establish vertical barriers in areas such as around foundations, plumbing lines, backfilled soil against foundation walls and other areas which may warrant more than just a horizontal barrier.
   a. When treating foundations deeper than 4 feet, apply the termiticide as the backfill is being replaced, or if the construction contractor fails to notify the applicator to permit this, treat the foundation to a minimum depth of 4 feet after the backfill has been installed. The applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to a minimum depth of 4 feet. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.
   b. Trenches need not be wider than 6 inches. Treat soil with the dilution as it is being replaced in the trench.

      For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 8 fluid ounces of Dursban TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage.

      For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 10⅔ fluid ounces of Dursban TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage.
   c. Hollow block foundations or voids of masonry can be treated to make a complete chemical barrier especially if the soil was not treated prior to pouring the footing. Apply the dilution at a rate of 2 gallons per 10 linear feet so that it reaches the top of the footing.
   d. For crawl spaces, establish a vertical barrier on both sides of the foundation and around all piers and areas where underground utilities exit the soil. Do not apply the dilution to the entire surface area intended as the crawl.
3. For **plenum type structures** which use a sealed underfloor space to circulate heated and/or cooled air throughout the structure. Apply the dilution at the rate of 4 gallons per 10 linear feet per foot of depth. Soil adjacent to both sides of foundation walls, supporting piers, plumbing and conduits should be treated by trenching or rodding (where soil conditions permit) to a dept of 6 inches or, if less shallow, to the top of the footing. When conditions will not permit trenching or rodding, surface application adjacent to interior foundation walls may be made but the treated strip shall not exceed a width of 18 inches, horizontally, from the foundation walls, piers or pipes. The surface application should be made at a rate of 1 gallon per 10 square feet as a very coarse spray under low pressure (not to exceed 20 psi. when measured at the treating tool). After soil treatment, a continuous vapor barrier of at least 6 mil polyethylene film or other suitable vapor barrier must be installed on the ground surface over the entire subfloor area and on the inside of the plenum walls, in accordance with the recommended practices for plenum type structures.

Postconstruction Treatments

Postconstruction applications are defined as those applications made after the final grade is installed.

See "Rate Determination Guidelines" and "Table 1" for dilution directions.

Precaution: Do not apply dilution until location of heat or air conditioning ducts, vents, water and sewer lines and electrical conduits are known and identified. Extreme caution must be taken to avoid contamination of these structural elements and airways.

All holes in commonly occupied areas into which material has been applied must be plugged. Plugs should be of a non-cellulose material or covered by an impervious, non-cellulose material.

1. For slab-on-ground construction applications may be made using techniques such as sub-slab injection, rodding and/or trenching. Injectors should not extend beyond the tops of the footings.

   a. Treat along the outside of the foundation to form a continuous termiticide barrier in the soil.

      For shallow foundations, 1 foot or less, dig a narrow trench approximately 6 inches wide along the outside of the foundation walls. Do not dig below the bottom of the footings. For foundations with exposed footings, dig a trench alongside the footing taking care not to undermine the footing. The dilution should be applied to the trench and mixed with the soil as it is replaced in the trench.

      For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet or use 8 fluid ounces of Dursban TC per 10 linear feet in sufficient water (not less than 2 gallons or more than 8 gallons) to provide thorough and complete coverage of the area being treated (see Application Volume section).

      For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet or use 10²/₃ fluid ounces of Dursban TC per 10 linear feet in sufficient water (no less than 2 gallons or more than 8 gallons) to provide thorough and complete coverage of the area being treated (See "Application Volume").

      For foundations with footings deeper than 1 foot, apply the dilution at a rate of 4 gallons per 10 linear feet per foot of depth. For applications made after the final grade is installed, the applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements at the rate prescribed from grade to the top of the footing. When the footing is more than 4 feet below grade, the applicator must trench and rod into the trench or trench along the foundation wall at the rate prescribed to a minimum depth of 4 feet. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.

   b. When treating cracks and expansion joints in the slab, along sidewalks or patios adjacent to the exterior foundation wall or other areas where holes are to be drilled to form a continuous termiticide barrier, the holes should be spaced at intervals up to 24 inches depending on soil type.

      Hard, dry soils typically allow good lateral (horizontal) dispersion. However, they may be slow in absorption or downward movement. Care must be taken when injecting through slabs into areas with this type of soil. Low pressures should be considered in this situation. This will help to avoid backsplashing from the injection hole, backflow from cracks and expansion joints, and unwanted emergence of the termiticide dilution from adjacent drill holes. A slow, low pressure application using the proper volume of termiticide dilution will allow the soil to absorb the liquid and provide an

adequate vertical barrier. The wider drill hole spacings (18 to 24 inches) can usually be used in this situation. Sand, loam, or gravel backfill materials are commonly found under slab foundations. The type of fill, amount of settling that has occurred, moisture content, etc., will determine drill hole spacing and amount of termiticide dilution to be injected through each hole. Highly absorptive soils or those with large pore spaces (gravel, coarse sand) will afford rapid downward (vertical) movement and limited lateral (horizontal) distribution of the termiticide dilution. In this situation, consider using a lateral dispersion tip on the sub-slab injector and place the drill holes closer together (12 to 18 inches).

For a 0.75-1.0% rate, apply 4 gallons of dilution per 10 linear feet.

c. It may be necessary to treat along one side of interior partition walls if there are cracks in the slab, plumbing entry points, existing termite infestations, or other conditions which would make treatment appropriate.

d. To complete the termiticide barrier under slab foundations, it may be necessary to drill and treat near plumbing and electrical entry areas, cracks, or other areas where termites might enter the structure. In this instance, one or more holes should be drilled in the slab as close to the entry point as is practical and termiticide placed in the fill. As a general rule, 3 to 5 gallons of dilution per entry point will usually give adequate coverage, however, the use of directional or lateral dispersion tips or foam delivery systems can give adequate coverage with lower volumes. Location of the drill hole in relation to the entry point, type of soil fill, presence or absence of a vapor barrier, application pressure and other considerations will affect the coverage and volume of termiticide needed to form a complete barrier. Precautions must be taken to avoid drilling into plumbing or electrical conduit.

e. When necessary, drill through the foundation walls from the outside and force the dilution just beneath the slab either along the inside of the foundation or along all the cracks and expansion joints and other critical areas.

f. **Bath traps:** Exposed soil or soil covered with tar or a similar type sealant beneath and around plumbing and/or drain pipe entry areas may be treated with a 0.75-1.0% dilution of Dursban TC.

An access door or inspection vent should be cut and installed, if not already present. After inspection and removal of any wood or cellulose debris, the soil can be treated by rodding or drenching the soil. A one square foot bath trap will usually require about 3 to 5 gallons of dilution for thorough and complete coverage.

2. **Hollow block foundations or voids in masonry** resting on the footing can be treated to make a continuous chemical barrier in the voids. If the void has direct contact with the soil, it should be treated. Drill and treat all voids in multiple masonry elements of the structure extending from the structure to the soil in order to create a continuous treatment barrier in the area to be treated. Apply at the rate of 2 gallons of emulsion per 10 linear feet of footing using a nozzle pressure of less than 25 psi. When using this treatment access holes must be drilled below the sill plate and should be as close as possible to the footing as is practical. Treatment of voids in block or rubble foundation walls must be closely examined. Applicators must inspect areas of possible runoff as a precaution against application leakage in the treated areas. Some areas may not be treatable of may require mechanical alteration prior to treatment.

Not for use in voids insulated with rigid foam.

3. For basements, apply at a rate of 4 gallons of dilution per 10 linear feet per foot of depth. Where footings are greater than 1 foot of depth from the grade to the top of the footing, application may be made by trenching and/or rodding at a rate of 4 gallons of dilution per 10 linear feet per foot of depth. When the footing is more than 4 feet below grade, the applicator must trench and rod into the trench or trench along the foundation wall at the rate prescribed to a minimum depth of 4 feet. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing. Treat outside of foundation walls, and if necessary beneath the basement floor along inside of foundation walls, along cracks in basement floors, along interior load bearing walls, around sewer pipes, conduits and piers.

4. **Accessible Crawl Spaces:** For crawl spaces, apply vertical termiticide barriers at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to top of footing, or if the footing is more than 4 feet below grade, to a minimum depth of 4 feet.

   For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 8 fluid ounces of Dursban TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage.

   For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or $10^2/_3$ fluid ounces of Dursban TC per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage.

   Apply by trenching and rodding into the trench, or trenching. Treat both sides of foundation and around all piers and pipes. Where physical obstructions, such as concrete walkways adjacent to foundation elements, prevent trenching, treatment may be made by rodding alone. When soil type and/or conditions make trenching prohibitive, rodding may be used. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. Read and follow the mixing and use direction section of the label if situations are encountered where the soil will not accept the full application volume.

   a. Rod holes and trenches shall not extend below the bottom of the footing.

   b. Rod holes shall be spaced so as to achieve a continuous chemical barrier but in no case more than 12 inches apart.

   c. Trenches shall be a minimum of 6 inches deep or to the bottom of the footing, whichever is less, and need not be wider than 6 inches. When trenching in sloping (tiered) soil, the trench shall be stepped to ensure adequate distribution and to prevent termiticide from running off. The emulsion must be mixed with the soil as it is replaced in the trench.

   d. When treating crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

5. **Inaccessible Crawl Spaces:** For inaccessible interior areas, such as areas where there is insufficient clearance between floor joists and ground surfaces to allow operator access, excavate if

possible, and treat according to the instructions for accessible crawl spaces. Otherwise, apply one or a combination of the following two methods.

For a 0.75% rate, apply 4 gallons of dilution per 10 linear feet or 8 fluid ounces of Dursban TC per 10 linear feet in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage (See Application Volume section).

For a 1.0% rate, apply 4 gallons of dilution per 10 linear feet or 10⅔ fluid ounces of Dursban TC per 10 linear feet in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage (See "Application Volume").

a. To establish a horizontal barrier, apply 1 gallon of emulsion per 10 sq. ft. to the soil surface. Use a nozzle pressure of less than 25 psi. and a coarse application nozzle (e.g., Delavan Type RD Raindrop, RD-7 or larger, or Spraying Systems Co. 8010LP TeeJet or comparable nozzle). For an area that cannot be reached with the application wand, use one or more extension rods to make the application to the soil. Do not broadcast or powerspray with higher pressures.

b. To establish a horizontal barrier, drill through the foundation wall or through the floor above and treat the soil perimeter at a rate of 1 gallon of emulsion per 10 square feet. Drill spacing must be at intervals not to exceed 16 inches. Many states have smaller intervals so check state regulations which may apply.

When treating crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

c. In the presence of unsupported termite tubes, mechanically destroy each tube and apply approximately 1 pint of 0.75-1.0% dilution to an area of no more than 18 inches in diameter where the tubes emerged from the soil.

6. In plenum type structures, which use a sealed underfloor space to circulate heated and/or cooled air within the structure, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil. Apply the 0.75-1.0% dilution at the rate of 4 gallons per 10 linear feet per foot of depth. Soil adjacent to both sides of foundation walls, supporting piers, plumbing and conduits should be treated by trenching or rodding (where soil conditions permit) to a depth of 6 inches or to the top of the footing. When conditions will not permit trenching or rodding, a surface application adjacent to interior foundation walls may be made, but the treated strip shall not exceed a width of 18 inches, horizontally, from the foundation piers or pipes. The surface application should be made at a rate of 1 gallon per 10 square feet as a very coarse spray under low pressure (not to exceed 20 psi. when measured at the treating tool). In order to properly calculate the amount of termiticide dilution needed, use the following guideline: A strip 18 inches wide and 6 feet 8 inches long is equal to 10 square feet. Before treatment, a barrier of at least 6 mil polyethylene film or other suitable vapor barrier must be present on this ground surface over the entire subfloor area in accordance with recommended practices for plenum type structures. Install a new vapor barrier if barrier is absent or deteriorated. The vapor barrier film on the ground and foundation walls must be folded back from the areas to be treated prior to treatment and replaced immediately following treatment. Structures should be ventilated during application and until treatment is dry.

7. **Application using foam generating equipment:** The emulsion may be converted to a foam and the foam used to control or prevent termite infestations.

   Depending on circumstances, foam applications may be used alone or in combination with liquid emulsion applications. Applications may be made behind veneers, piers, chimney bases, into rubble foundations, into block voids or structural voids, under slabs, stoops, porches, or to the soil in crawl spaces, and other similar voids.

   Foam and liquid application must be consistent with volume and active ingredient instructions in order to ensure proper application has been made. The volume and amount of active ingredient are essential to an effective treatment. At least 50 to 75% of the labeled liquid emulsion volume of product must be applied, with the remaining percent delivered to appropriate areas using foam application. Refer to the label and use recommendations of the foam manufacturer and the foaming equipment manufacturer for adjuvant rates to produce the needed expansion ratio with this product.

   Foam applications are generally a good supplement to liquid treatments in difficult areas, but may be used alone in difficult spots.

   The following provides the amount of Dursban TC required for a given area and volume range of the prefoamed termiticide dilution necessary for application of the product.

   For a 0.75% rate, apply 8 fluid ounces of Dursban TC per 10 linear feet using no less than 2 gallons, or more than 8 gallons, of prefoamed dilution.

   For a 1% rate, apply 10⅔ fluid ounces of Dursban TC per 10 linear feet using no less than 2 gallons, or more than 8 gallons, of prefoamed dilution.

8. Application in conjunction with the use of the Sentricon® Colony Elimination System: As a part of the Integrated pest management (IPM) program for subterranean termite control, Dursban TC may be applied to critical areas of the structure including plumbing and utility entry sites, bath traps, expansion joints, foundation cracks, and areas with known or suspected infestations at a rate of 0.75%-1.0% as a spot application or complete barrier treatment. Application may be made as described in the Postconstruction Treatment section of this label.

Underground Utility Cable and Conduit

Preventative Treatment for Use Only in Guam, Hawaii, and Other Pacific Islands: Use a 1.0% to 2.0% dilution (See "Rate Determination Guidelines" and "Table 1" for dilution directions). After digging the trench, place approximately 6 inches of backfill or sand at the bottom and apply 2 gallons of the dilution per 10 linear feet. Allow to dry then replace the cable backfill. Cover with an additional 6 inches of backfill or sand and apply another 2 gallons of emulsion per 10 linear feet. Finish filling trench with untreated soil.

Wherever cables emerge from the soil to enter poles, light frames, etc., treat the soil around the cable and pole or frame to establish a continuous 6 inch chemical barrier.

A continuous 6 inch chemical barrier must be established around the cable to insure protection from termite attack.

Utility Poles and Fence Posts

Preventative Treatment: Use a 1.0 to 2.0% dilution (See "Rate Determination Guidelines" and "Table 1" for dilution directions). After pole or post hole has been dug, mix the dilution with the soil as it is being replaced to a depth of approximately 10 inches. Place pole or post on top of this layer. The remaining soil fill and termiticide dilution should be mixed while backfilling the hole. The treated soil zone around the post or pole should be approximately

6 inches wide. Soil for the base layer and backfill of each pole or post should be treated at a rate of 4 gallons of dilution per 10 cubic feet of soil.

Remedial Treatment: To control existing infestations or to prevent infestation of posts and poles already in place, use a 1.0% to 2.0% dilution. The termiticide dilution should be injected into termite galleries or channels in the wood. For maximum protection, injection sites should be at or below grade.

Posts or poles may also be treated by rodding down to the base of the structure. Rod holes should be placed approximately 3 inches away from the pole and about 6 inches apart. Inject approximately 12 fluid ounces of dilution per foot of depth into each rod hole.

It may be appropriate to use one or both treatment techniques depending upon the specific circumstances at the work site e.g. soil type.

Control of Wood Infesting Insects

Dosage and Mixing Directions

Dursban TC is recommended for use as an aqueous emulsion containing 0.5% to 1.0% chlorpyrifos. See "Table 1" for dilution directions.

Advisements

When spraying overhead interior living areas of homes, apartment buildings, etc., cover surfaces below the area being sprayed with plastic sheeting or other material.

Contact with treated surfaces should be avoided until spray has dried. Cover or remove exposed foods before treatment. Do not use in structures housing animals which are intended for or which produce products to be used for food purposes. Do not use for above ground control of wood infesting insects in food areas of food handling establishments, restaurants or other areas where food is commercially prepared or processed.

To control wood infesting insects such as powderpost beetles (Lyctidae), false powderpost beetles (Bostrichidae), deathwatch beetles (Anobiidae), old house borers (Cerambycidae) and ambrosia beetles (Scolytidae) in homes and other structures, treatments may be applied either as coarse sprays or by brushing the product onto targeted surfaces. Use a sufficient amount of spray to cover the area to the point of wetness but avoiding runoff. Use the following guidelines to determine appropriate rates of application:

New Wood, (typically less than 10 years of age) apply approximately 1 gallon of dilution per 150 square feet as a coarse spray.

Old Wood, (typically greater than 10 years of age) apply approximately 1 gallon of dilution per 100 square feet as a coarse spray.

Treatment Directions

For control of carpenter ants in homes and other structures, apply dilution around doors and windows and other places where carpenter ants enter the premises and where they crawl and hide. Also spray into cracks and crevices or through openings or small newly drilled holes into wall voids where these ants or their nests are present. Use a sufficient amount of coarse spray to cover the area to the point of wetness but avoiding runoff.

For control of termites (localized areas of infested wood in structures), apply dilution to voids and channels in damaged wood and in spaces between members of a structure and between wood and foundations where termite infestation is likely to occur. Application may be made to inaccessible areas by drilling, and then injecting the emulsion. Use a sufficient amount of spray to cover the area to the point of wetness but avoiding runoff. Treatment of localized areas is intended to kill workers and winged reproductive forms of termites in the treated areas and to prevent infestations for a temporary period. This type of application is not intended to be a substitute for soil treatment or mechanical alteration to control subterranean termites.

Pest Control on Outside Surfaces and Around Buildings

To control ants, bees, carpenter ants, clover mites, cockroaches, crickets, earwigs, hornets, millipedes, scorpions, spiders, ticks, wasps and yellowjackets.

Outside surfaces: Apply Dursban TC termiticide as a residual spray to outside surfaces of buildings including porches, window frames, eaves, patios, garages, refuse dumps and other areas where pests congregate or have been observed. Treatment may be repeated as needed to maintain effectiveness.

Perimeter sprays: To help prevent infestation of buildings, treat a band of soil and vegetation 6 to 10 feet wide around and adjacent to the building. Also, treat the building foundation to a height of 2 to 3 feet where pests are active and may find entrance. For scorpions, treat or remove accumulations of lumber, firewood, and other materials which serve as insect harborage sites.

Dosage and Mixing Instructions: Use Dursban TC mixed as a 0.25% to 0.5% dilution as indicated in the following table:

Gallons of Finished Dilution Desired	Dursban TC Required	
	0.25% Solution	0.5% Solution
1	2/3 fl oz	1 1/3 fl oz
5	3 1/3 fl oz	6 2/3 fl oz
10	6 2/3 fl oz	13 1/3 fl oz
24	16 fl oz	1 qt
48	1 qt	2 qt
97	2 qt	1 gal

Small amounts of solution remaining in the spray tank can be diluted as indicated in the following table and used to treat outside surfaces or perimeter areas:

Concentration of Termiticide Dilution	Amount of Water to Add to Each Gallon of Termiticide Dilution to Provide a 0.25% Spray	Amount of Water to Add to Each Gallon of Termiticide Dilution to Provide a 0.5% Spray
0.75%	2 gallons	0.5 gallon
1.0%	3 gallons	1 gallon

Warranty Disclaimer

DowElanco warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. DowElanco MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Plant injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperature, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of DowElanco or the seller. All such risks shall be assumed by buyer.

Limitation of Remedies

The exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories), shall be limited to, at DowElanco's election, one of the following:

1. Refund of purchase price paid by buyer or user for product bought, or
2. Replacement of amount of product used

DowElanco shall not be liable for losses or damages resulting from handling or use of this product unless DowElanco is promptly notified of such loss or damage in writing. In no case shall DowElanco be liable for consequential or incidental damages or losses.

The terms of the "Warranty Disclaimer" above and this "Limitation of Remedies" cannot be varied by any written or verbal statements or agreements. No employee or sales agent of DowElanco or the seller is authorized to vary or exceed the terms of the "Warranty Disclaimer" or this "Limitation of Remedies" in any manner.

EPA-Accepted 05/20/97

MINUTES OF THE ASPCRO BOARD OF DIRECTORS CONFERENCE CALL
NOVEMBER 19, 1997

Members Participating:	Carl Falco (NC)	President
	Jim Haskins (MS)	Vice-President
	John McCauley (KY)	Secretary
	George Saxton (IN)	Treasurer
	Benny Mathis (TX)	Immediate Past Pres.
	Robert Wulfhorst (OH)	At-Large (98-99)
	Todd Thompson (LA)	At-Large (97-98)
	Dennis Howard (MD)	At-Large (97-98)
	Bud Paulson (AZ)	
	Roger Borgelt (TX)	

Old Business:

Review of Dursban Paper by Gerry Blondell - Recent reports from the Blue Ribbon Panel (that DowElanco convened at the request of EPA) addressed the criteria used in the paper and rejected several of the key criteria Gerry Blondell used. It was Carl Falco's understanding that the full paper from that committee is out now. Bud Paulson had a copy of Insight, Vol. 1, Issue 2, (DowElanco Paper) which states "expert panel concludes Dursban is no concern to public health." Carl Falco suggested holding off on this until it could be determined what DowElanco has done. John McCauley said he did not have paperwork on all of the reviews relating to this. Carl said before we decide not to get a review done, we need to see what has been done and what opinions other people have published. John said he would attempt to put the information together and mail packets to the Board for their review. The issue will be revisited in March. Anyone with information should forward it to John.

Indoor Air/Pest Control Update - Benny Mathis said he had not received anything concerning this since the last meeting and had tried unsuccessfully to contact Ed White who was putting it all together. Since Jim Haskins planned to go to the SFIREG meeting, Carl suggested he should touch base with Tina or Susan Lewis, who were the contacts, or Jim Jones to find out the status and let them know we have not been called for any additional working group meetings. Benny said he would contact Susan Lewis and then let Jim know if he needed to look into this further at the SFIREG meeting.

Registered Technician Training Update - Roger Borgelt reported the ASPCRO/ NPCA Basic Training Manual is out, and EPA is supposed to mail copies to the State Lead Agencies. Contracted with Larry Pinto to write Section 2 which is Effective Methods for Training Your Employees. Committee will meet December 10 & 11 in Austin to finalize the draft and have it close to publication. Roger said that Larry was aware that what he writes will not be copyrighted. Roger also reported that Jim Criswell has agreed to conduct most, if not all, train the trainer sessions in 1998. There will be a train the trainer presentation at the Eastern Association Conference on June 30, 1998, in Cherry Hill, New Jersey, and also plan to be on the NPCA agenda for Nashville next year and whatever other conferences that we can get on the

agenda. This will be a topic of discussion for the December meeting.

FTC/NAAG Investigation Update - Carl Falco reported that Orkin and Terminix had received a Civil Investigative Demand and each had until mid-November to respond but he felt that would be renegotiated. The New Technology/Efficacy Working Group sent a letter on November 5 to DowElanco concerning Sentricon but this has not become public knowledge. They have received a comprehensive CID, and it was Carl's understanding that Sears might also have received one. Carl felt FTC would probably take action in less than a year. Also, Carl said he would fax to the Board a copy of a press release from the Attorney General in Florida where they entered into a consent agreement with Sears to pay $200,000 for the cost of the investigation. Carl said he and Jim Harron are helping with the Pre-Treat Work Group. He was asked if he would like a copy of the pre-treat guidelines to review, and he said yes. The FTC sting operation in Maryland was discussed briefly. Carl said FTC is encouraging every Attorney General that's involved to get with their state. John McCauley said Kentucky's Attorney General has contacted him and asked him to sit on the work groups, specifically looking at Orkin and Terminix. He said KY is still working on the 1994 consent agreement with Terminix and is almost two year's deep in the investigation against Orkin. Attorneys General need to let us know what's going on so we can work aggressively with them. Suggestion was made that there are a lot of states that do not know what's going on, and if they knew, they might change their whole approach to working with Attorneys General. If you are not already working with your Attorney General, you should be advised as to what committee your Attorney General is working on. A list of working groups will be sent to the Board.

New Business:

IPM in Schools - EPA sent copies of the Region 9 Manual to all states; however, they do not endorse it. Headquarters paid Biointegral Resource Center to write this, and they set ground rules. The rules were violated, and Headquarters refused to endorse it. Region 9 paid Burke to publish it and sent it to Headquarters to okay it. Headquarters said no. Region 9 published it anyway. ASPCRO needs to take a position to get it off the shelves. It has an EPA # on it. If the Agency is going to put out something official that reflects issues close to ASPCRO, there has to be an agreement to put these things out. Headquarters will make public that they do not support this publication.

Possible PR Notice 97-6 Outreach Efforts - Bob Wulfhorst said they had put together a format compatible with transparencies and put a package together that any of his staff people could present to any meeting involving the pest control industry. He will be using it first at the statewide association meeting in two weeks, and it will be used as a format to let them know what's happening and will add an additional package in terms of compliance activity that will supplement it. Carl said another piece of the outreach is working with your state or local Homebuilders Association since it will change what they get when they deal with PCOs on pre-

treats. Some of the same pieces of outreach material could be used with them. It was suggested that sometime between now and the next meeting information could be developed for those individuals based on ASPCRO background. Carl asked Bob to send him what he has, and he would get the presentation set up on a disk and maybe ASPCRO could float a slide set around that people could reproduce on their own. He could make up one set of slides and one set of overheads and the states could adapt them to their needs. It was suggested this be an agenda item for the next Board meeting in March. It was discussed that homebuilders need to be made aware of ASPCRO's Home Page so they can find us and know where to look and ASPCRO needs to get actively involved with the Homebuilders Association. Bud Paulson said he may be able to get a list of the Executive Secretaries for all the Homebuilders Associations in the country. The Rigid Foam Issue and the 99 Issue were discussed. It is clearly stated in the 99A and 99B Hud Pre-Treat Form that the builder is fully responsible for termites in the property now, and there is no expressed or implied liability on the part of the PCO. Not only is the builder responsible, he is obligated to have a pre-treat done if necessary. Any suggestions on preparing brochures and outreach material should be e-mailed to Carl.

1998 ASPCRO Meeting Topics - Board meeting will be held late on Saturday. Suggestions for meeting topics: (1) Termite Baiting System; (2) Update for membership on FTC investigation (bring in whole group); IPM in Schools; Indoor Air/Pest Control Update; How to reach the construction industry. The next Board meeting is scheduled for Wednesday afternoon, March 11, after the AAPCO meeting.

SFIREG Issues - Benny Mathis, Bob Wulfhorst, and Dennis Howard will work on this.

Electronic Recertification Training - Benny Mathis said it has been discussed in Texas but has not been allowed. Bud Paulson said there is a college course on the Internet that has been approved for recertification but there were some questions such as how would you know who is actually on the keyboard and taking the test. It seems industry wants to go ahead with this, and the states should find a means to validate such a program.

Tribal/Territorial/International Membership - Need to review the Constitution to see what it says regarding tribes, territories, international membership, etc. Roger Borgelt will review the Constitution and draft the necessary documents to bring to the March meeting.

Hall of Fame Nominations - George Saxton is coordinating this.

Life Membership Retirees - Should be truly retired and not still working. Suggestion was made to contact the secretary of the Feed, Fertilizer, and Pesticide Association to see how they handle this issue.

Expense Accounts - Carl Falco made a motion to make per diem $42 per day regardless of where

you go, based on quarters. Dennis Howard seconded. John McCauley made a motion to make reimbursement for mileage 31.5 cents per mile. Todd Thompson seconded. Hotel expenses will be reimbursed for actual rate but should be kept as low as possible. ASPCRO will pay for Board members only if the State will not pay. ASPCRO has been paying for travel if it was necessary on any issues the Board is involved in. Carl will use his judgment to pay or not on issues ASPCRO has identified.

John McCauley requested any information on regulating termite baiting systems be sent to him.

It was agreed that the conference calls are a good idea. The conference call was adjourned.