



AERIAL SPRAY FORMULATIONS OF FENITROTHION  
WITH DOWANOL TPM, CYCLO-SOL 63 AND  
NONYL PHENOL AS PRIMARY SOLVENTS

by

W. W. Hopewell

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Aerial Spray Formulations of Fenitrothion with Dowanol TPM,  
Cyclo-Sol 63 and Nonyl Phenol as Primary Solvents

In the early stages of planning for the 1978 spruce budworm operational aerial spray control program in Quebec, FPMI, Ottawa, was asked for recommendations for the spray mix (Telexes: Paquet to Green; Green to DeBoo, December 1977). The insecticides to be applied were:

Fenitrothion -- 2 oz AI/16 fl oz/ac. (140 g AI/1.2 l/ha).

Phosphamidon -- 2 oz AI/16 fl oz/ac. ( " " " ).

Matacil -- 0.75 oz AI/16 fl oz/ac. (42.5 g/ 1.12 l/ha).

There was some uncertainty for a time as to the volume to be applied per acre (12 fl oz in 1977) but this was later established at 16 fl oz Imp. (1.12 l/ha). It was taken for granted that the same primary and secondary solvents and diluents as used and found satisfactory in previous years would again be applied, and laboratory testing to determine satisfactory mixes was carried out accordingly. Formulations of two concentrations of fenitrothion (2.0 and 3.0 oz AI/16 fl oz) were developed and recommended, Table 1, (Telex: Hopewell to Paquet, 78-01-18). It had already been decided not to use phosphamidon.

In mid-February 1978, it was announced that use of fuel oils as components of aerial spray formulations was now banned because of their poly nuclear aromatic content. It was necessary to find acceptable substitutes for the primary and secondary solvents used in preparation of

fenitrothion mixes and for the diluent for the Matacil oil soluble concentrate. Dowanol TPM was chosen as the primary solvent which might be substituted in the least time, along with diesel fuel as diluent. Formulations found satisfactory after laboratory testing, (stable at temperatures down to ca 0°) are given in Table II.

Several candidate primary solvents for fenitrothion have been received since the initial testing and laboratory development of satisfactory formulations has been carried out on Cyclo-Sol 63 and nonyl phenol, which have already been used in the field and/or tentatively cleared by Health and Welfare. The secondary solvent or diluent chosen was diesel A which was widely available and most closely matches specifications proposed for an acceptable diluent (see Appendix). Results of laboratory tests of formulations of fenitrothion with the minimum required volumes of Cyclo-Sol and nonyl phenol to give cold stable (ca 0°C) mixes and which would also be suitable for use in Quebec are given in Table III.

The specifications for some of the components referred to are given as Appendices.

TABLE I

Originally Recommended Formulations of Fenitrothion  
and Aminocarb for Use in Quebec, 1978 -- Volume Percents

	Fenitrothion	
	2 oz/16 fl. oz.	3 oz/16 fl. oz.
Fenitrothion (tech.)	9.92	14.9
Arotex 3470	7.5	12.7
Fuel Oil No. 2	33.0	29.0
" " No. 4	49.6	43.4
Viscosity 25 <sup>o</sup> C (centipoise)	7.6	6.9
Density ca 20 <sup>o</sup> C (g/ml)	0.889	0.886

  

	Aminocarb	
	0.75 oz/16 fl. oz.	1.0 oz/16 fl. oz.
Matacil 1.8D (OSC)	26.0	34.7
Fuel Oil No. 2	51.8	52.2
" " No. 4	22.2	13.1
Viscosity 25 <sup>o</sup> (cp)	6.2	6.6
Density ca 20 <sup>o</sup> (g/ml)	0.889	0.886

TABLE II  
 Formulations Without Fuel Oil--Recommended for Use  
 in Quebec, 1978 -- Volume Percents

Fenitrothion		
	2 oz/16 fl. oz.	3 oz/16 fl. oz.
	Vol. %	Vol. %
Fenitrothion tech.	9.92	14.9
Dowanol TPM	25.0	35.0
Diesel A	65.1	50.1
Viscosity 25 <sup>o</sup> C (cp)	2.0	2.6
Density ca 22 <sup>o</sup> (g/ml)	0.899	0.940

  

Matacil		
	0.75 oz/16 fl. oz.	1.0 oz/16 fl. oz.
	Vol. %	Vol. %
Matacil 1.8 D (OSC)	26.0	34.7
Diesel AA or A or B	74.0	65.3
Viscosity 25 <sup>o</sup> (cp) AA	1.7	2.2
A	2.4	3.1
B	3.1	3.9

TABLE III

Fenitrothion Formulations Containing Cyclo-Sol 63 and Nonyl Phenol  
as Primary Solvents -- Volume Percents

	2 oz. AI/16 fl.oz.	3 oz. AI/16 fl.oz.	3 oz./20 fl.oz.
Fenitrothion (tech.) 96%	9.92	14.90	11.91
Cyclo-Sol 63	30.0	35.0	30.0
Diesel A	60.1	50.1	58.1
Viscosity 25° (cp)	1.4	1.6	1.5
Density ca 22° (g/ml)	0.884	0.914	0.893
Fenitrothion (tech.)	9.92	14.9	
Nonyl phenol	12.5	17.5	
Diesel A	77.6	67.6	
Viscosity (cp) 25°	2.4	3.4	
" 20°		4.00	
" 10°		5.5	
" 2.5°		7.6	
Density 20° (g/ml)	0.881 (25°)	0.916	

APPENDIX I

AROTEX A SPECIFICATIONS\*

Grade	3470	3458
Source	Montreal	Port Credit*
Appearance	Clear & Bright	Clear & Bright
Gravity, °A.P.I., Max	19.0	--
Flash, Pm, °F, Min.	150	150
Corrosion, Copper Strip 3 Hrs. at 122°F, Max.	1 B Strip	1 B Strip
Aniline Point, °F, Max.	60.1	60
Aromatics, %, Min.	95	95
Distillation °F		
Initial Boiling Point, Min.	340	340
10% Recovered, min.	380	--
50% Recovered, max.	500	500
End Point, max.	700	700
Density 15°C (g/ml)	0.940	
Viscosity, 25° (centipoise)	1.9	

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\* Product of Texaco Canada, Ltd.

APPENDIX II

TPM\*

TYPICAL PROPERTIES

Molecular Weight	206.3
Boiling Point	
760 mm Hg	242.4°C
10 mm Hg	116.0°C
Vapor Pressure, 25°C	.022
Pour Point	-108°F    -78°C
Sp. Gravity 25/25°C	.965
Pounds/Gallon (U.S.)	8.03
Viscosity, 25°C	5.8 ctk
60°C	2.3 ctk
Flash Point	230°F    110°C
Fire Point	260°F    127°C
Surface Tension, 25°C	30 dynes/cm
75°C	25.3 dynes/cm

\* Dowanol TPM -- Product of Dow Chemical Co., Sarnia, Ontario



APPENDIX III

PROPOSED SPECIFICATIONS

INSECTICIDE DILUENT - 585

1. VIRGIN DISTILLATE	% MIN.	100
2. DISTILLATION END POINT	MAX.	585°F (307.2°C)
3. CLOUD POINT	MAX.	0°F (-17.8°C)
4. POUR POINT	MAX.	-10°F (-23.3°C)
5. FLASH POINT	MIN.	125°F (51.7°C)
6. KINEMATIC VISCOSITY	100°F (37.8°C) Cst	1.4 - 3.0
7. CORROSION, COPPER STRIP	3 hr. at 212°F (100°C) MAX.	No. 1
8. SULPHUR	% BY WT. MAX.	0.25
9. MERCAPTAN SULPHUR	PPM MAX.	10
10. TOTAL ACID NO.	% MAX.	0.5
11. STRONG ACID NO.		0
12. STRONG BASE NO.		0

APPENDIX IV

SPECIFICATIONS - CYCO-SOL 63\*

	<u>SPEC.</u>	<u>TYPICAL</u>
I. B. P.	350°F Min.	357°F
10%	--	362
50%	370-385	374
90%	375 Min.	392
95%	--	394
E. P.	410 Max.	405
ANILINE POINT MAX. °F	63	
AROMATIC CONTENT %	99.89	
FLASH POINT °F	135 Min.	138
VISCOSITY Cs at 100°F	1.5	
CRACKED STOCK CONTENT %	0	
SPECIFIC GRAVITY	0.89	
COLOUR	Water White	

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\* Available from Shell Oil Co., Canada

APPENDIX V

TECHNICAL DATA SHEET

NONYLPHENOL\*

COMPOSITION

Nonylphenol is manufactured by the alkylation of phenol with propylene trimer. Although the product is predominantly the para isomer, appreciable quantities of other isomers are present.

MOLECULAR WEIGHT: 220 Nominal

EMPIRICAL FORMULA:  $C_{15}H_{24}O$

DESCRIPTION

APPEARANCE:	Clear, viscous, light-colored liquid.
COLOUR (AS IS) APHA	100 max.
ODOUR:	Phenolic
HYDROXYL NUMBER:	235 - 255, by acetylation.
DISTILLATION RANGE AT 760 mm. Hg	Min. 284°C at 5%. Max. 310°C at 95%.
REFRACTIVE INDEX:	1.509 - 1.511
MOISTURE:	0.1% max.
VISCOSITY AT 20°C:	Min. 600 cps. Spindle 2 Revolutions 30.
SPECIFIC GRAVITY AT 20°/20°C:	0.94 - 0.96
POUR POINT:	-6° to ½°C (21° - 31°F).
SOLUBILITY:	Insoluble in water, soluble in benzene xylene, Stoddard solvent, white mineral oil, kerosene, ethanol, carbon tetrachloride, ethylene glycol, and butyl "Cellosolve".

STORAGE

Darkens slightly in storage when exposed to air.

HAZARDS:

Caution: May cause skin irritation. Avoid prolonged contact with skin.

\* Available from: Chemical Developments of Canada Limited, 1720 Sismet Rd., Mississauga, Ontario.