FILES

Shaugh. No. 125401

EAB Log Out Date: JUL 02 1985

Init.:

To: Robert Taylor
Product Manager 25
Registration Division (TS-767)

From: Carolyn K. Offutt
Chief, Environmental Processes and Guidelines Section
Exposure Assessment Branch, HED (TS-769)

Attached, please find the estimated environmental concentration review of:

Reg./File No.: 279-GNLE, - GNLG, & -GNLU

Chemical: FMC 57020

Type Product: Herbicide

Product Name: COMMAND 4EC and 6EC

Company Name: FMC

Submission Purposes: EEC calculation.

Date In: 3/21/85

Action Code: 106

Date Completed: 6/5/85

EFB#: 5437-5439

TAIS (Level II)	Days
33	1.5

Deferrals To:

X Ecological Effects Branch

____ Residue Chemistry Branch

____ Toxicology Branch

XX 424

COMMAND

I. Chemical

Common Name: (none given; experimental name FMC 57020)
Trade Name: COMMAND 4EC and 6EC
Chemical Name: 2-(2-chlorophenyl)-methyl-4-4-dimethyl-3-isoxazolidinone

II. Test Material

FMC 57020

III. Study/Action Type

(a) FMC performed an estimated environmental concentration (EEC) calculation which was presented in an August 1984 registration package. The EEC portion of the package was not reviewed at that time and Ecological Effects Branch has requested that the FMC generated EEC be reviewed and if necessary, a new EEC developed. [See FMC letter (#1) of 19 March 1985.]

(b) FMC is requesting a 9-month crop rotation restriction interval for soybeans (?) to replace the present 10-month interval. [See FMC letter (#2) of 19 March 1985.]

(c) FMC is submitting vapor pressure and stability as requested by EAB. Also, FMC is submitting a revised data sheet on average residues where those residues below 0.02 ppm are indicated as "non-detected" (ND). [See FMC letter (#3) of 19 March 1985.] [The portion of the letter on residues was reviewed and a reply submitted as part of EAB review on COMMAND dated 6/17/85.]

IV. Study Identification

FMC. 1984. Estimated Environmental Concentration (EEC) in Water. [Part VIII of the Section H (?) of the 3 August 1984 submission] Acc. Nos. 072819 and 072820. Pages H-11 to H-15.

V. Reviewed by:

Robert W. Holst, Ph.D.
Plant Physiologist
Exposure Assessment Branch/HED/OPP
Date: 27 June 1985

Soobok Hong, Ph.D.
Chemist
Exposure Assessment Branch/HED/OPP
Date: 27 June 1985

VI. Approved by:

Carolyn K. Offutt
Chief, Environmental Process and Guidelines Section
Exposure Assessment Branch/HED/OPP
Date: 7/2/85

Samuel Creeger
Chief, Review Section 1
Exposure Assessment Branch/HED/OPP
Date: JUL 02 1985

425

118

VII. Conclusion

(a) FMC prepared a worst case runoff and water quality scenario using a pond 1 foot deep which resulted in peak pesticide concentrations upwards of 0.75 ppm. An analysis by EPA using similar environmental parameters for a pond provided peak pesticide water column concentrations of 0.25 ppm. The use of a more realistic pond depth (2 meters) gave maximum values of about 0.05 ppm in a model pond. Dissipation of the pesticide in the water column of the pond will be slow due to the moderate solubility and low degradation and slow dissipation.

A detailed EEC assessment by FMC using SWRRB or TOXIWASP was not included in the material submitted by FMC. Therefore, a detailed review of the assessment could not be made.

(b) EAB has no objection to the proposed 9-month rotational crop restriciton interval for soybeans.

(c) New photolysis studies are required with provisions for conducting the studies at 25°C and for trapping the volatile materials.

VIII. Recommendations:

FMC should submit the detailed modeling assessment referenced in the EEC analysis attached to their letter of 19 March 1985.

IX. Background (Pesticide Use Pattern)

COMMAND is a selective herbicide which may be used either preemergence surface applied or preplant incorporated for control of weeds in soybeans. It is applied by ground application only. The application is dependent upon the soil texture and organic content. Up to 1.25 lb ai./A can be applied to fine-heavy soils such as silty clays, clay loams, and other clayey soils. One lb ai./A is applied to medium soils such as loams, and up to 1 lb ai./A is applied to coarse light soils such as sands and sandy loams. An additional 0.25 lb ai./A can be applied to soils with organic contents above 3% not to exceed 1.25 lb ai./A.

X. Discussion

a. EEC Calculations

1. FMC EEC Calculation

FMC provided an EEC calculation based on the Simulator for Water Resources in Rural Basins (SWRRB) model and TOXIWASP. The detailed EEC assessment by FMC using SWRRB or TOXIWASP were not included in the material submitted by FMC. Therefore, a detailed review of the assessment could not be made. A copy of the FMC review is provided as an attachment to this review.

4/26

The river basin chosen for SWRRB was the Yazoo found in northcentral Mississippi. The K_d was 6.9; the soil half-life was 24 days; the application rate was 1.25 lb ai/A. (The timing of the application was not provided.) The 1974 runoff data was reported to be the greatest due to the heavy rains of that year. The total concentration in the runoff from the field for the year 1974 was reported as 0.488 lb./A. (Monthly or daily values were not given.)

The total output from SWRRB was used in TOXIWASP. This was used as a monthly load (?) (page H-13 of FMC report). The chemical/physical parameters used in the model were provided in the report and are provided in an addendum to this report. The estimated peak concentration in a one-acre pond, one-foot deep, was given as 0.740 mg/l and 0.0002 mg/l as the lowest EEC value.

2. EAB EEC Calculation

EAB also determined an EEC based on two models, SWRRB and the Exposure Analysis Modeling System (EXAMS).

The quantity of pesticide in the runoff water and sediment was calculated on a daily basis. The applications were made to soybeans at the common time of planting in late May. The K_d value used (4.0) (Table 1) is a little lower than that used by FMC (6.9), however, this should make little difference in the calculation. The K_d that was used was based on field adsorption/desorption studies provided by FMC and on soils that are normally found in the upper reaches of the Yazoo River. The soil half-life was a little longer again based on studies by FMC but which have not been found to be fully acceptable to the Agency.

1974 did provide the worst rainfall and resulting runoff for the basin. Pesticide runoff for individual runoff events ranged up to about 500 gm/ha during a major event the day after application (Table 2), and the total runoff for the year was about 700 gm/ha (0.620 lb/A) (Table 3).

This series of runoff event loadings (1974) were used in EXAMS (pulse-load mode 2 of EXAMS II) to determine the pesticide concentration in pond waters of the AERL model pond. The pond depth was modified to equal the 1 foot used by FMC in their modeling effort. The normal pond depth is 2 m (6 feet). The chemical parameters for EXAMS and TOXIWASP are similar (Table 4). The loadings from SWRRB were multiplied by 10 to simulate a 10 to 1, watershed (agronomic fields) to pond ratio. With the input of 4.95 kg (0.495 x 10) to the littoral zone of the pond, the maximum pesticide concentration achieved was about 0.25 ppm. This concentration remained fairly constant for 20 days due to pesticide runoff renewal (heavy and constant rain pattern in 1974) and slow dissipation (no hydrolysis and little degradation and photolysis) (Table 5 and Figure 1). The pesticide concentrations in a 2 m pond

would be 1/6 the quantities given (a maximum of about 0.05 ppm).

3. Comparison

The runoff values were similar for the Agency and FMC regardless of the minor changes in chemical parameters. The output from the aquatic simulation models were significantly different. The peak pesticide concentrations in the EXAMS pond was one-third that found in the TOXIWASP pond. A dissipation rate comparison for the two pond simulations could not be done because information was not provided on the rate of dissipation in the TOXIWASP pond.

4. Stream Concentrations

The pesticide concentrations in a stream that may drain a watershed of several hundred square kilometers will be at least one to two orders of magnitude less than that found in the pond. Also the dissipation rate will be greater due to the rate of flow of the stream.

b. Rotational Crop Restriction

FMC is requesting a reduction in the rotational crop restriction interval from 10 months to 9 months. EAB previously accepted (11/23/84) a 10-month crop restriction.

FMC's request is on the grounds that the data supporting the 10-month rotational crop restriction were generated using radiolabeled FMC 57020 at the rate of 2 lb ai/A, while the maximum rate in the proposed label is only 1.25 lb ai/A.

EAB has no objection to the proposed 9-month rotational crop restriction interval.

c. Vapor Pressure and Stability

To help understand the aqueous and soil photolysis studies, EAB requested volatility data. The reported vapor pressure of 1.44×10^{-4} mmHg reinforces our recommendation tht new photolysis studies be conducted with provisions for trapping of volatile materials and with provisions for conducting the studies at a constant temperature of about 25°C. Refer to the EAB 6/17/85 review.

XI. One Liner

See attached.

XII. CBI Information

None.

428

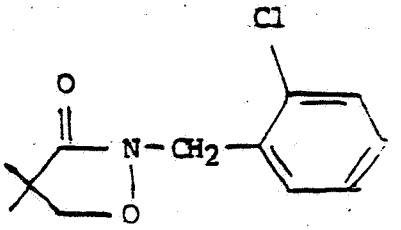
Date 5 June 1985

EXPOSURE ASSESSMENT BRANCH ONE LINER

EAB File No: 125401 TYPE PESTICIDE: Herbicide STRUCTURE

COMMON NAME: Pimethazone (FMC 57020)

CHEMICAL NAME: 2-(2-chlorophenyl)-methyl-4-4-dimethyl-3-isoxazolidinone



Formulation Types: 4EC & 6EC

Degradation Products: FMC 65317 (anaerobic)

CHEMICAL AND PHYSICAL PROPERTIES

Mole. Wt.	Aqueous Solubility	Vapor Pressure	K_{ow}	Henry's
239.7	1100.0(ppm) 20(°)	1.44E-4(torr) (°)	350	(atm/mol/m^3)

Soil Adsorption Coefficient

Soil Type	pH	% Soil O.M.	Kd	K_{om}	K_{oc}	Soil Column Leach. Stdy.	Soil TLC R_f Parent	Soil TLC R_f FMC65317
S Lm	6.8	3.2	2.82				0.30	0.55
Si Lm	4.8	2.1	6.85				0.31	0.68
Si Cl Lm	6.9	2.5	2.57				0.33	0.65
S (fine)	6.2	1.3	1.54				0.62	1.00

Hydrolysis

pH	Temp.	$T^1/_2$
4.64	25	∞
7.0	25	
9.25	25	∞

Photolysis

	pH	$T^1/_2$
Air:		
Soil:		
Water:	? N/A*	87d(?)EAB
	? N/A*	30d(?)FMC

Mobility Class

(1) Immobile
(2) Low
(3) Low to Mod.
(4) Moderate
(5) Mobile

Degradation — Laboratory Half-life

		OM%	$T^1/_2$
Soil Aerobic:	Si Lm	2.1	95.4d
	S Lm	3.2	28-55d
	Cl Lm	2.5	104-173d

Soil Anaerobic:	%OM	pH	$T^1/_2$
S Lm	3.0	7.0	13 d

Aquatic Aerobic:

Aquatic Anaerobic:

* N/A = EAB reviewed and unacceptable but only data available

429

EAB Chemical One-Liner
Chemical (FMC 57020)

Degradation - Field Half-life

	$T^1/_2$		$T^1/_2$
Terrestrial [Crop Site]		Forestry [Crop Site]	
Aquatic [Crop Site]		Other [Crop Site]	

ENVIRONMENTAL EXPOSURE

Found in Ground Water (Y/N)?_____

Site(s) _____ Level:_____

Reentry Interval Established?_____

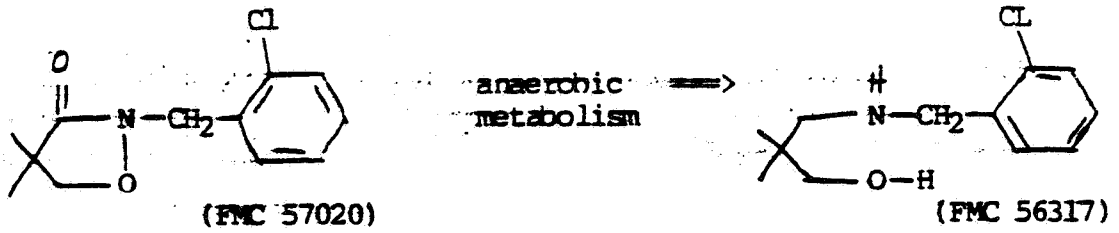
Rotational Crop Restrictions:_____

Fish Bioaccumulation Factors

Species	Tissue Edible	Tissue Viscera	Whole Fish	Duration (Half-life)
Bluegill sunfish	10 X	75 X	40 X	97-99% eliminated (3dy)
	X	X	X	
	X	X	X	

EXPOSURE ASSESSMENT:

Degradation Summary (including degradation product names and structures):



(FMC 57020) (FMC 56317)

aerobic metabolism

CO_2 + polar soil bound

Non-polar metabolites are minor

REFERENCES: EAB reviews (S. Hong)
One-Liner Writer: R.W. Holst

4/30

Table 1. SWRRB Pesticide Parameters for Command in Soybeans in the Yazoo River Basin, MS

ADSORPTION COEFFICIENT (KD)	4.0
FOLIAR HALF LIFE (DAYS)	30.0
SOIL DECAY CONSTANT (/DAYS)	0.01400
APPLICATION EFFICIENCY	0.75
INITIAL PESTICIDE ON FOLIAGE (KG/HA)	0.0
INITIAL PESTICIDE ON GROUND (KG/HA)	0.0
ENRICHMENT RATIOS FOR PESTICIDE	1.50

PESTICIDE APPLICATIONS

YEAR	MM	DD	JULI	KG/HA
1971	5	30	150	1.120
1972	5	30	150	1.120
1973	5	30	150	1.120
1974	5	30	150	1.120
1975	6	2	153	1.120
1976	5	31	151	1.120
1977	5	30	150	1.120
1978	5	25	145	1.120

TABLE 2. SWRRB Daily Values for COMMAND use in Soybeans in the Yazoo Basin, MS

YR	MM	DD	DAY	RAIN (CM)	RUNOFF (CM)	SEDIMT (KG/HA)	PESTLCH (GM/HA)	PESTRNF (GM/HA)	DISPEST (GM/HA)	SORBPESR (GM/HA)
71	6	6	157	6.579	0.473	511.437	105.683	236.421	225.368	11.0539
71	6	8	159	2.642	0.000	325.021	5.639	109.972	16.163	93.8097
71	6	20	171	2.235	0.000	61.942	25.023	15.114	7.176	7.9388
71	7	16	197	3.785	0.032	136.041	24.925	11.906	9.958	1.9482
71	7	20	201	1.270	0.000	6.769	8.935	0.135	0.120	0.0156
71	7	24	205	1.600	0.000	5.268	10.291	0.309	0.282	0.0278
71	7	25	206	2.032	0.000	78.806	10.517	1.346	0.559	0.7874
71	7	26	207	1.930	0.000	209.547	6.179	2.042	0.431	1.6112
71	7	28	209	1.473	0.000	32.455	4.838	0.619	0.392	0.2279
71	7	29	210	1.168	0.000	60.237	2.965	0.551	0.266	0.2860
71	8	2	214	1.575	0.000	6.154	3.544	0.116	0.104	0.0128
71	8	3	215	1.321	0.000	1.517	2.783	0.128	0.125	0.0032
71	8	5	217	4.496	0.144	123.526	2.315	2.685	2.585	0.1015
71	9	19	262	4.216	0.100	16.782	0.492	0.316	0.314	0.0020
71	9	20	263	1.219	0.000	341.366	0.215	0.257	0.036	0.2210
71	11	18	322	2.184	0.000	35.689	0.086	0.008	0.005	0.0033
71	11	28	332	1.473	0.000	0.952	0.056	0.001	0.001	0.0007
71	12	5	339	2.819	0.000	54.877	0.037	0.014	0.007	0.0073
71	12	6	340	3.632	0.008	535.116	0.014	0.079	0.019	0.0606
71	12	12	346	1.626	0.000	28.435	0.002	0.005	0.003	0.0023
71	12	14	348	2.972	0.000	534.677	0.002	0.032	0.003	0.0297
71	12	15	349	0.356	0.000	26.964	0.001	0.002	0.001	0.0017
71	12	16	350	3.785	0.032	312.773	0.001	0.031	0.021	0.0108
71	12	17	351	2.108	0.000	144.885	0.001	0.011	0.003	0.0088

432

TABLE 2. (Con't)

YR	MM	DD	DAY	RAIN (CM)	RUNOFF (CM)	SEDIMT (KG/HA)	PESTLCH (GM/HA)	PESTRNF (GM/HA)	DISPEST (GM/HA)	SORBPEST (GM/HA)
72	1	1	1	5.283	0.268	421.798	0.001	0.008	0.007	0.0019
72	1	3	3	8.687	0.806	3472.267	0.000	0.011	0.009	0.0028
72	1	4	4	3.912	0.052	954.778	0.000	0.002	0.001	0.0018
72	1	10	10	3.810	0.036	418.735	0.000	0.001	0.001	0.0005
72	6	7	159	1.067	0.000	4.765	82.444	5.593	5.154	0.4394
72	6	14	166	2.464	0.000	468.472	29.197	75.183	8.028	67.1551
72	6	15	167	2.515	0.000	1339.696	12.492	117.472	4.713	112.7595
72	6	20	172	2.388	0.000	975.944	10.909	55.641	3.019	52.6214
72	6	25	177	1.397	0.000	31.617	8.596	10.846	6.932	3.9148
72	6	30	182	1.092	0.000	105.876	6.175	5.126	1.773	3.3528
72	7	3	185	3.988	0.064	681.038	4.610	32.659	21.988	10.6716
72	7	4	186	4.775	0.188	801.567	2.705	31.370	26.288	5.0850
72	8	24	237	1.676	0.000	13.325	1.729	0.083	0.067	0.0168
72	9	4	248	1.930	0.000	1.416	1.265	0.060	0.059	0.0021
72	9	17	261	1.727	0.000	9.648	0.778	0.023	0.020	0.0036
72	10	22	296	3.505	0.000	367.673	0.187	0.114	0.015	0.0999
72	10	26	300	1.753	0.000	17.045	0.062	0.019	0.015	0.0052
72	10	27	301	0.610	0.000	14.513	0.047	0.011	0.009	0.0028
72	11	1	306	2.159	0.000	38.254	0.015	0.028	0.017	0.0112
72	11	2	307	2.718	0.000	92.239	0.010	0.132	0.050	0.0822
72	11	3	308	0.152	0.000	3.976	0.006	0.001	0.001	0.0006
72	11	7	312	2.616	0.000	82.559	0.005	0.027	0.011	0.0160
72	11	13	318	6.248	0.421	461.120	0.004	0.086	0.082	0.0043
72	11	18	323	2.311	0.000	303.286	0.002	0.030	0.005	0.0261
72	11	28	333	3.480	0.000	89.548	0.002	0.012	0.005	0.0070
72	11	29	334	1.397	0.000	110.108	0.001	0.009	0.003	0.0063
72	12	4	339	1.194	0.000	21.829	0.001	0.002	0.002	0.0015
72	12	8	343	1.829	0.000	118.166	0.001	0.004	0.001	0.0026
72	12	9	344	0.432	0.000	28.287	0.001	0.001	0.001	0.0006
72	12	10	345	5.232	0.260	352.501	0.001	0.016	0.015	0.0016
72	12	12	347	1.270	0.000	127.863	0.000	0.002	0.001	0.0029
72	12	14	349	4.775	0.188	202.609	0.000	0.005	0.004	0.0004
72	12	20	355	2.946	0.000	147.967	0.000	0.002	0.001	0.0016
72	12	21	356	2.769	0.000	541.864	0.000	0.001	0.000	0.0014

TABLE 2. (con't)

YR	MM	DD	DAY	RAIN (CM)	RUNOFF (CM)	SEDIMT (KG/HA)	PESTLCH (GM/HA)	PESTRNF (GM/HA)	DISPEST (GM/HA)	SORBPESR (GM/HA)
73	6	1	152	0.914	0.000	20.261	36.955	32.904	24.162	8.7423
73	6	5	156	0.508	0.000	5.598	25.307	7.414	6.740	0.6742
73	6	10	161	0.635	0.000	30.003	29.532	7.916	5.154	2.7628
73	6	12	163	1.194	0.000	219.607	21.734	37.173	7.553	29.6202
73	6	13	164	0.356	0.000	84.912	10.762	18.563	7.377	11.1867
73	6	17	168	0.229	0.000	0.003	11.328	0.011	0.011	0.0006
73	6	29	180	1.473	0.000	45.912	33.337	10.648	5.851	4.7977
73	6	30	181	2.667	0.000	719.930	12.861	64.991	4.691	60.3000
73	7	2	183	0.127	0.000	1.044	4.654	0.179	0.175	0.0038
73	7	4	185	4.013	0.068	322.041	6.542	58.375	48.011	10.3644
73	7	5	186	0.102	0.000	1.922	3.378	0.128	0.124	0.0048
73	7	6	187	0.305	0.000	56.978	2.811	1.858	0.921	0.9375
73	7	7	188	2.489	0.000	1282.713	3.016	26.602	1.113	25.4899
73	7	15	196	1.092	0.000	26.854	4.507	0.875	0.592	0.2843
73	7	17	198	1.016	0.000	54.519	2.138	1.017	0.516	0.5026
73	7	29	210	3.200	0.000	134.901	5.820	1.807	0.530	1.2773
73	7	30	211	0.483	0.000	14.538	3.322	0.100	0.080	0.0218
73	8	14	226	1.651	0.000	0.046	2.907	0.050	0.050	0.0007
73	8	18	230	1.143	0.000	0.007	1.864	0.003	0.003	0.0004
73	9	2	245	2.057	0.000	23.012	1.143	0.150	0.107	0.0443
73	9	3	246	1.295	0.000	135.550	0.657	0.182	0.053	0.1294
73	9	4	247	0.660	0.000	29.554	0.487	0.061	0.040	0.0213
73	9	5	248	0.711	0.000	30.141	0.426	0.046	0.030	0.0168
73	10	16	289	3.048	0.000	294.912	0.162	0.135	0.022	0.1138
73	10	31	304	1.930	0.000	5.952	0.121	0.009	0.008	0.0014
73	11	4	308	4.597	0.160	104.543	0.059	0.102	0.099	0.0032
73	11	7	311	0.914	0.000	20.217	0.009	0.018	0.013	0.0055
73	11	20	324	2.997	0.000	41.944	0.026	0.025	0.014	0.0110
73	11	23	327	0.559	0.000	7.231	0.004	0.002	0.002	0.0000
73	11	24	328	2.108	0.000	102.883	0.004	0.041	0.014	0.0269
73	11	25	329	0.432	0.000	21.619	0.003	0.006	0.004	0.0029
73	11	26	330	3.531	0.000	498.372	0.003	0.069	0.007	0.0627
73	11	27	331	6.401	0.445	902.196	0.002	0.056	0.051	0.0059
73	12	4	338	1.321	0.000	14.034	0.001	0.001	0.001	0.0006
73	12	19	353	2.007	0.000	44.542	0.004	0.001	0.000	0.0007
73	12	24	358	6.198	0.413	297.415	0.001	0.009	0.008	0.0003
73	12	25	359	0.991	0.000	151.080	0.000	0.001	0.000	0.0014
73	12	26	360	0.914	0.000	138.147	0.000	0.001	0.000	0.0012

TABLE 2. (Con't)

YR	MM	DD	DAY	RAIN (CM)	RUNOFF (CM)	SEDIMT (KG/HA)	PESTLCH (GM/HA)	PESTRNF (GM/HA)	DISPEST (GM/HA)	SORBPESR (GM/HA)
74	1	3	3	3.150	0.000	530.617	0.000	0.003	0.000	0.0035
74	1	6	6	1.880	0.000	105.504	0.000	0.001	0.000	0.0017
74	1	9	9	1.854	0.000	288.192	0.000	0.001	0.000	0.0012
74	1	23	23	4.597	0.160	624.257	0.000	0.001	0.001	0.0007
74	5	31	151	8.509	0.778	495.773	42.373	495.455	481.537	13.9185
74	6	1	152	1.321	0.000	177.756	9.925	36.689	8.789	27.8997
74	6	4	155	6.655	0.485	1835.291	5.564	124.234	106.036	18.1981
74	6	5	156	0.305	0.000	9.028	1.758	1.378	1.187	0.1918
74	6	7	158	1.930	0.000	233.041	1.692	16.652	3.226	13.4260
74	6	8	159	1.168	0.000	503.503	1.575	5.730	0.574	5.1568
74	6	9	160	0.838	0.000	108.319	1.022	4.764	1.623	3.1400
74	6	12	163	2.108	0.000	369.493	1.715	5.894	0.776	5.1183
74	6	15	166	5.842	0.357	1312.846	1.119	13.330	11.422	1.9075
74	6	18	169	2.769	0.000	201.822	0.427	2.839	0.617	2.2226
74	6	23	174	0.686	0.000	27.370	0.310	0.120	0.081	0.0408
74	7	9	190	5.969	0.377	1179.339	0.615	1.547	1.355	0.1925
74	7	11	192	0.533	0.000	153.152	0.078	0.115	0.031	0.0841
74	7	16	197	1.499	0.000	55.346	0.086	0.179	0.090	0.0894
74	7	23	204	1.067	0.000	4.450	0.171	0.004	0.004	0.0007
74	7	26	207	4.801	0.192	633.217	0.156	0.242	0.210	0.0329
74	7	30	211	1.016	0.000	2.513	0.064	0.002	0.002	0.0007
74	8	16	228	1.575	0.000	41.322	0.032	0.004	0.002	0.0023
74	8	29	241	3.404	0.000	46.619	0.032	0.012	0.006	0.0055
74	8	30	242	5.359	0.280	54.684	0.017	0.059	0.058	0.0017
74	8	31	243	1.930	0.000	88.046	0.007	0.013	0.005	0.0089
74	9	1	244	3.734	0.024	127.631	0.004	0.015	0.012	0.0030
74	9	2	245	1.549	0.000	54.931	0.002	0.005	0.003	0.0032
74	9	21	264	3.937	0.056	241.686	0.002	0.001	0.001	0.0007

435

TABLE 2. (Con't)

YR	MM	DD	DAY	RAIN (CM)	RUNOFF (CM)	SEDIMT (KG/HA)	PESTLCH (GM/HA)	PESTRNF (GM/HA)	DISPEST (GM/HA)	SORBPESR (GM/HA)
75	6	6	157	4.039	0.072	175.327	29.772	246.178	221.594	24.5852
75	6	9	160	1.321	0.000	79.491	11.386	59.729	24.687	35.0431
75	6	10	161	0.864	0.000	131.013	9.170	29.991	8.981	21.0100
75	6	11	162	0.635	0.000	32.760	7.881	17.449	11.009	6.4404
75	6	15	166	1.372	0.000	105.762	11.197	22.015	7.621	14.3930
75	6	19	170	2.286	0.000	690.017	8.322	34.961	2.624	32.3373
75	6	22	173	1.372	0.000	250.623	4.571	19.355	3.535	15.8201
75	7	10	191	2.083	0.000	134.498	12.167	3.591	1.056	2.5366
75	7	19	200	2.413	0.000	162.469	7.052	3.432	0.880	2.5520
75	7	24	205	2.057	0.000	127.051	5.049	1.343	0.411	0.9325
75	8	3	215	2.743	0.000	42.256	4.508	0.844	0.481	0.3635
75	8	17	229	9.169	0.882	675.497	1.932	4.402	4.255	0.1483
75	8	18	230	0.102	0.000	0.136	0.698	0.006	0.006	0.0001
75	9	5	248	2.184	0.000	7.596	0.533	0.046	0.040	0.0060
75	9	12	255	4.140	0.088	351.041	0.371	0.222	0.188	0.0340
75	9	16	259	2.438	0.000	123.046	0.109	0.076	0.024	0.0525
75	9	20	263	1.448	0.000	13.851	0.067	0.012	0.010	0.0020
75	10	25	298	3.937	0.056	35.801	0.061	0.034	0.033	0.0014
75	10	26	299	0.254	0.000	4.601	0.031	0.003	0.003	0.0000
75	11	3	307	5.309	0.272	228.357	0.023	0.039	0.037	0.0011
75	11	4	308	2.946	0.000	43.569	0.011	0.041	0.023	0.0189
75	11	6	310	5.588	0.317	427.919	0.003	0.043	0.041	0.0037
75	11	26	330	3.327	0.000	81.127	0.003	0.002	0.001	0.0015
75	11	30	334	4.343	0.120	345.699	0.000	0.005	0.005	0.0014
75	12	6	340	2.388	0.000	19.462	0.000	0.002	0.001	0.0013
75	12	25	359	3.150	0.000	52.771	0.001	0.001	0.000	0.0000

TABLE 2. (Con't)

YR	MM	DD	DAY	RAIN (CM)	RUNOFF (CM)	SEDIMT (KG/HA)	PESTLCH (GM/HA)	PESTRNF (GM/HA)	DISPEST (GM/HA)	SORBPESR (GM/HA)
76	6	1	153	1.016	0.000	9.902	43.367	18.916	16.074	2.8429
76	6	16	168	2.718	0.000	182.509	47.171	69.202	16.248	52.9544
76	6	18	170	2.134	0.000	362.958	12.092	93.285	12.469	80.8161
76	6	23	175	0.838	0.000	11.749	11.668	4.698	3.883	0.8152
76	6	25	177	3.835	0.040	1039.815	10.110	72.023	32.860	39.1635
76	6	30	182	1.372	0.000	208.798	5.100	8.276	1.750	6.5267
76	7	3	185	0.254	0.000	0.024	3.077	0.027	0.027	0.0005
76	7	4	186	2.083	0.000	658.122	4.269	15.511	1.216	14.2959
76	9	3	247	1.829	0.000	6.491	3.467	0.288	0.258	0.0309
76	9	4	248	1.295	0.000	70.885	2.054	0.397	0.175	0.2227
76	9	8	252	2.718	0.000	152.203	1.516	0.933	0.251	0.6826
76	10	24	298	1.575	0.000	3.039	0.557	0.007	0.007	0.0009
76	10	25	299	1.930	0.000	13.506	0.297	0.075	0.060	0.0159
76	10	29	303	1.575	0.000	7.421	0.164	0.028	0.025	0.0037
76	11	26	331	1.905	0.000	7.010	0.155	0.009	0.008	0.0015
76	12	6	341	1.778	0.000	6.545	0.102	0.006	0.005	0.0019

YR	MM	DD	DAY	RAIN (CM)	RUNOFF (CM)	SEDIMT (KG/HA)	PESTLCH (GM/HA)	PESTRNF (GM/HA)	DISPEST (GM/HA)	SORBPESR (GM/HA)
77	1	13	13	2.134	0.000	51.676	0.030	0.005	0.002	0.0027
77	1	14	14	0.991	0.000	22.457	0.012	0.004	0.003	0.0013
77	2	23	54	2.438	0.000	12.503	0.013	0.003	0.002	0.0012
77	3	4	63	6.452	0.453	2030.929	0.005	0.019	0.016	0.0030
77	3	11	70	2.438	0.000	1438.548	0.000	0.005	0.000	0.0050
77	4	3	93	4.902	0.208	1911.191	0.000	0.005	0.003	0.0010
77	6	15	166	1.778	0.000	43.614	95.684	14.228	7.999	6.2303
77	6	16	167	3.886	0.048	41.355	28.606	134.602	129.499	5.1033
77	6	17	168	2.591	0.000	1034.201	13.052	88.942	4.569	84.3738
77	6	18	169	2.921	0.000	207.075	6.618	67.141	14.292	52.8498
77	6	26	177	0.914	0.000	28.178	5.625	1.612	1.072	0.5405
77	7	28	209	2.007	0.000	1.751	8.490	0.464	0.450	0.0149
77	8	14	226	2.997	0.000	366.678	4.830	1.311	0.174	1.1374
77	8	28	240	2.210	0.000	9.723	2.763	0.248	0.212	0.0377
77	9	13	256	1.422	0.000	0.271	1.380	0.005	0.005	0.0001
77	9	24	267	3.683	0.016	492.209	0.973	0.463	0.190	0.2739
77	9	30	273	4.445	0.136	112.762	0.233	0.588	0.567	0.0219
77	10	2	275	0.635	0.000	174.627	0.135	0.109	0.027	0.0835
77	10	7	280	2.921	0.000	6.117	0.110	0.129	0.116	0.0130
77	11	1	305	3.988	0.064	97.198	0.100	0.063	0.059	0.0049
77	11	16	320	3.962	0.060	108.292	0.053	0.036	0.033	0.0033
77	11	19	323	0.762	0.000	0.946	0.005	0.001	0.001	0.0009
77	11	21	325	1.270	0.000	9.568	0.004	0.007	0.006	0.0012
77	11	29	333	4.445	0.136	84.671	0.006	0.045	0.044	0.0015
77	11	30	334	4.445	0.136	113.590	0.002	0.058	0.056	0.0024
77	12	4	338	0.254	0.000	5.175	0.001	0.001	0.001	0.0005
77	12	8	342	1.397	0.000	34.661	0.001	0.003	0.002	0.0010
77	12	13	347	2.591	0.000	111.094	0.001	0.006	0.002	0.0048
77	12	16	350	0.381	0.000	29.112	0.001	0.001	0.001	0.0005

937

TABLE 2. (Con't)

YR	MM	DD	DAY	RAIN (CM)	RUNOFF (CM)	SEDIMT (KG/HA)	PESTLCH (GM/HA)	PESTRNF (GM/HA)	DISPEST (GM/HA)	SORBPESR (GM/HA)
78	1	7	7	3.531	0.000	330.574	0.003	0.004	0.001	0.0030
78	1	15	15	3.937	0.056	620.011	0.001	0.004	0.003	0.0023
78	1	24	24	3.962	0.060	114.948	0.000	0.004	0.003	0.0004
78	1	25	25	2.743	0.000	323.205	0.000	0.002	0.000	0.0021
78	5	28	148	0.686	0.000	1.608	47.454	0.913	0.888	0.0262
78	5	29	149	0.584	0.000	2.124	51.642	2.799	2.696	0.1023
78	6	1	152	2.388	0.000	115.316	31.470	98.658	32.249	66.4083
78	6	2	153	1.143	0.000	252.779	17.972	58.834	10.670	48.1649
78	6	6	157	0.381	0.000	12.419	10.571	4.516	3.696	0.8200
78	6	7	158	2.642	0.000	738.446	10.729	101.350	7.144	94.2067
78	7	25	206	1.422	0.000	0.302	16.136	0.070	0.070	0.0006
78	7	31	212	2.896	0.000	296.163	14.290	3.298	0.524	2.7738
78	8	10	222	4.191	0.096	391.812	7.192	5.578	4.705	0.8735
78	8	29	241	4.013	0.068	29.250	3.647	1.992	1.954	0.0385
78	10	13	286	2.642	0.000	21.791	0.891	0.160	0.115	0.0459
78	11	6	310	1.626	0.000	2.412	0.403	0.007	0.007	0.0007
78	11	16	320	3.277	0.000	123.043	0.185	0.141	0.044	0.0972
78	11	17	321	1.702	0.000	74.176	0.090	0.225	0.097	0.1281
78	11	22	326	1.626	0.000	13.202	0.043	0.017	0.013	0.0033
78	11	26	330	2.032	0.000	10.945	0.016	0.038	0.031	0.0068
78	12	3	337	10.566	1.103	326.381	0.016	0.375	0.370	0.0056
78	12	4	338	0.254	0.000	12.465	0.004	0.003	0.002	0.0015
78	12	6	340	0.737	0.000	76.761	0.003	0.014	0.006	0.0087
78	12	7	341	6.883	0.521	755.047	0.003	0.117	0.110	0.0073
78	12	29	363	2.413	0.000	59.986	0.003	0.004	0.002	0.0028
78	12	31	365	1.651	0.000	183.456	0.001	0.008	0.002	0.0062

TABLE 3a. SWRRB Yearly Water Balance Data for YAZOO River Basin MS

YEAR	RAIN (CM)	MEAS RNF (CM)	PRED RNF (CM)	EVAP (CM)	PERC (CM)	SEDIMENT (KG/HA)
1971	105.105	1.244	38.960	74.002	0.489	4971.898
1972	164.363	3.015	89.204	71.330	0.483	17637.355
1973	157.581	3.561	79.003	78.942	0.453	12745.746
1974	181.635	4.559	97.726	83.384	0.381	19838.555
1975	147.065	2.230	62.929	84.029	0.396	8627.867
1976	89.204	0.988	29.888	62.478	0.393	6347.934
1977	99.009	1.255	30.990	65.266	0.462	8843.176
1978	116.713	2.648	52.482	62.528	0.376	9170.246
TOTAL	1060.673	19.500	481.183	581.958	3.434	88182.625

TABLE 3b. SWRRB Yearly Pesticide Balance Data for Command Use in Soybeans in The Yazoo River Basin, MS

YEAR	APPLIED (GM/HA)	DECAYED (GM/HA)	LEACHED (GM/HA)	TOT RUNOFF (GM/HA)	DIS.RUNOFF (GM/HA)	SORB.RNF (GM/HA)
1971	1120.000	218.284	239.578	382.096	263.939	118.157
1972	1120.000	240.035	265.387	334.575	78.295	256.280
1973	1120.000	264.798	303.644	271.524	114.128	157.400
1974	1120.000	46.520	84.196	709.286	617.647	91.640
1975	1120.000	166.277	229.883	443.819	287.541	156.278
1976	1120.000	271.317	284.653	283.680	85.317	198.364
1977	1120.000	258.491	271.688	310.102	159.402	150.703
1978	1120.000	262.378	298.469	279.129	65.404	213.726
TOTAL	8960.000	1728.101	1977.498	3014.212	1671.672	1342.548

TABLE 4: Chemistry Data for EXAMS with Comparison to TOXIWASP

EXAMS -- Exposure Analysis Modeling System -- V 2.9: Mode 1
Chemical: 1) COMMAND

Chemical input data for neutral molecule (Sp.#1).

MWT:	240
VAPR:	1.44E-04 torr
KOW:	350
SOL:	1100
KBACS:	1.40E-02 /day

TOXIWASP -- Chemistry Input Data (provided by FMC)

Monthly loads of pesticide runoff - (not given)
(Total concentration = 0.488 lb/A)

Koc = 608 (Dunkirk silt loam)

Kow = 350

Mole. Weight = 239.7

Solubility in water = 1100 ppm

Vapor Pressure = 1.44 x 10^{-4} mmHg

Hydrolysis or Oxidation = None

Photolysis half-life = 7 days

Extenction Coef. = 2/m

Pond Area = 1 acre

Pond depth = 1 foot

Watershed size = 10 acres

480

TABLE 5. Ecosystem: Pond - AERL Base, 0.33m Depth
Chemical: COMMAND - Yazoo MS 1974

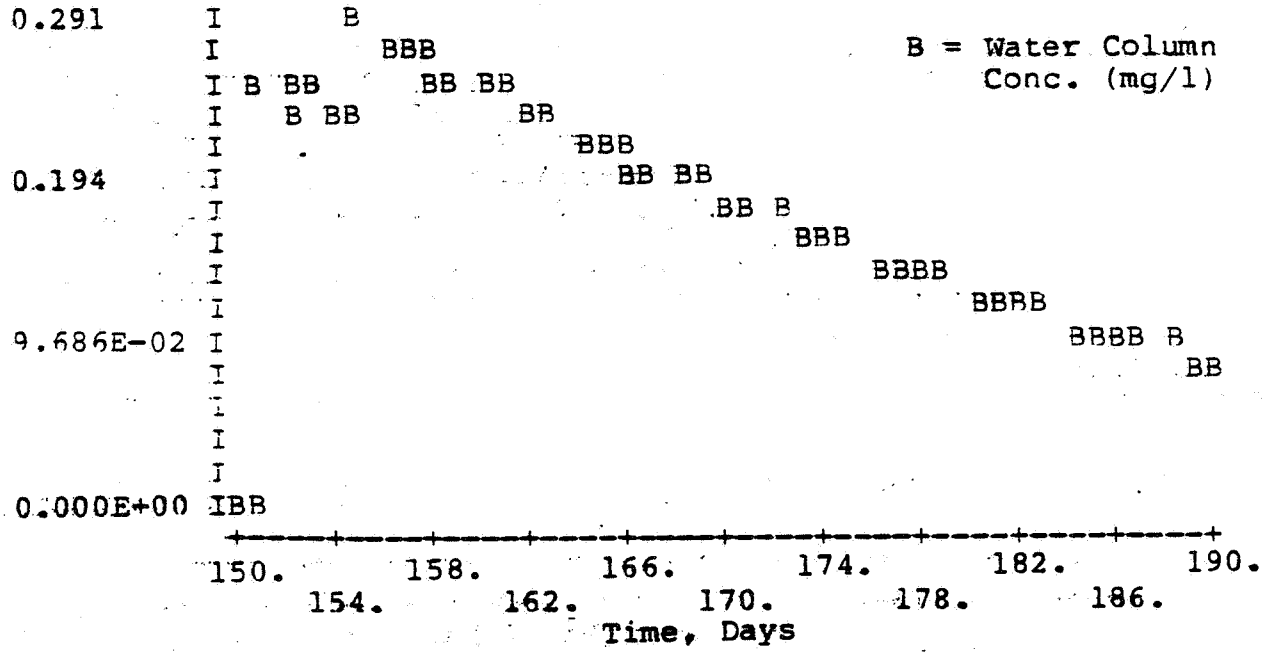
Summary time-trace of chemical concentrations

Time	Average Chemical Concentrations				Total Chemical Mass	
Days.	Water Column		Benthic Sediments		Water Col	Benthic
	Free-mg/L	Sorb-mg/kg	Pore-mg/L	Sed-mg/kg	Total kg	Total kg
Initial Input .000001 kg						
150	5.00E-08	7.17E-07	0.00E+00	0.00E+00	1.00E-06	0.00E+00
151	4.81E-08	6.90E-07	1.40E-14	2.02E-13	9.62E-07	1.40E-13
Runoff Input 4.95455 kg						
151	0.25	3.6	1.40E-14	2.02E-13	5.0	1.40E-13
152	0.24	3.4	6.96E-08	9.98E-07	4.8	6.91E-07
Runoff Input 0.36689 kg						
152	0.26	3.7	6.96E-08	9.98E-07	5.1	6.91E-07
153	0.25	3.5	7.21E-08	1.03E-06	4.9	7.16E-07
154	0.24	3.4	6.94E-08	9.95E-07	4.8	6.89E-07
155	0.23	3.3	6.67E-08	9.58E-07	4.6	6.63E-07
Runoff Input 1.24234 kg						
155	0.29	4.2	6.67E-08	9.58E-07	5.8	6.63E-07
156	0.28	4.0	8.16E-08	1.17E-06	5.6	8.11E-07
Runoff Input 0.01378 kg						
156	0.28	4.0	8.16E-08	1.17E-06	5.6	8.11E-07
157	0.27	3.9	7.87E-08	1.13E-06	5.4	7.83E-07
158	0.26	3.7	7.58E-08	1.09E-06	5.2	7.53E-07
Runoff Input 0.16652 kg						
158	0.27	3.8	7.58E-08	1.09E-06	5.4	7.53E-07
159	0.26	3.7	7.52E-08	1.08E-06	5.2	7.48E-07
Runoff Input 0.05730 kg						
159	0.26	3.7	7.52E-08	1.08E-06	5.2	7.48E-07
160	0.25	3.6	7.32E-08	1.05E-06	5.0	7.27E-07
Runoff Input 0.04764 kg						
160	0.25	3.6	7.32E-08	1.05E-06	5.1	7.27E-07
161	0.24	3.5	7.11E-08	1.02E-06	4.9	7.06E-07
162	0.23	3.4	6.84E-08	9.81E-07	4.7	6.80E-07
163	0.23	3.2	6.58E-08	9.44E-07	4.5	6.54E-07
Runoff Input 0.05894 kg						
163	0.23	3.3	6.58E-08	9.44E-07	4.6	6.54E-07
164	0.22	3.2	6.41E-08	9.20E-07	4.4	6.37E-07
165	0.21	3.0	6.17E-08	8.85E-07	4.2	6.13E-07
166	0.20	2.9	5.94E-08	8.52E-07	4.1	5.90E-07
Runoff Input 0.13330 kg						
166	0.21	3.0	5.94E-08	8.52E-07	4.2	5.90E-07
167	0.20	2.9	5.90E-08	8.46E-07	4.0	5.86E-07
168	0.19	2.8	5.67E-08	8.14E-07	3.9	5.64E-07
169	0.19	2.7	5.46E-08	7.83E-07	3.7	5.43E-07

Days.	Water Column		Benthic Sediments		Water Col	Benthic
	Free-mg/L	Sorb-mg/kg	Pore-mg/L	Sed-mg/kg	Total kg	Total kg
Runoff Input		0.02839 kg				
169	0.19	2.7	5.46E-08	7.83E-07	3.8	5.43E-07
170	0.18	2.6	5.29E-08	7.59E-07	3.6	5.26E-07
171	0.17	2.5	5.09E-08	7.31E-07	3.5	5.06E-07
172	0.17	2.4	4.90E-08	7.03E-07	3.4	4.87E-07
173	0.16	2.3	4.71E-08	6.76E-07	3.2	4.68E-07
174	0.16	2.2	4.53E-08	6.51E-07	3.1	4.51E-07
Runoff Input		0.00120 kg				
174	0.16	2.2	4.53E-08	6.51E-07	3.1	4.51E-07
175	0.15	2.1	4.36E-08	6.26E-07	3.0	4.34E-07
176	0.14	2.1	4.20E-08	6.03E-07	2.9	4.17E-07
177	0.14	2.0	4.04E-08	5.80E-07	2.8	4.02E-07
178	0.13	1.9	3.89E-08	5.58E-07	2.7	3.86E-07
179	0.13	1.8	3.74E-08	5.37E-07	2.6	3.72E-07
180	0.12	1.8	3.60E-08	5.16E-07	2.5	3.58E-07
181	0.12	1.7	3.46E-08	4.97E-07	2.4	3.44E-07
182	0.11	1.6	3.33E-08	4.78E-07	2.3	3.31E-07
183	0.11	1.6	3.20E-08	4.60E-07	2.2	3.18E-07
184	0.11	1.5	3.08E-08	4.42E-07	2.1	3.06E-07
185	0.10	1.5	2.97E-08	4.26E-07	2.0	2.95E-07
186	9.77E-02	1.4	2.85E-08	4.09E-07	2.0	2.84E-07
187	9.40E-02	1.3	2.75E-08	3.94E-07	1.9	2.73E-07
188	9.04E-02	1.3	2.64E-08	3.79E-07	1.8	2.63E-07
189	8.70E-02	1.2	2.54E-08	3.65E-07	1.7	2.53E-07
190	8.37E-02	1.2	2.44E-08	3.51E-07	1.7	2.43E-07

FIGURE 1. COMMAND Concentration in the Water Column in the AERL Model Pond

System: Pond - AERL Base, 0.33m Depth
Chemical: COMMAND - Yazoo MS 1974



the recovered radiocarbon by 10 months following treatment. FMC 57020 was the only significant identifiable product recovered from soil at any sampling interval. No significant amounts of the anaerobic metabolite, FMC 65317, could be detected in soil (Reference 15).

B. Fish Accumulation (165-4)

Bluegill sunfish were exposed to methylene-^{14}C FMC 57020 at a concentration of 0.02 ppm for 28 days under dynamic (flow-through) conditions. Fish were sampled at 0, 1, 3, 7, 10, 14, 21 and 28 days following initiation of exposure. Remaining fish were placed in clean, untreated water and sampled at 1, 3, 7, 10, and 14 days.

Accumulation appeared to reach steady-state within one day of exposure. Bioconcentration factors (BCF) ranged from 27-40x, 8.8-16x and 54-105x in whole fish, edible (fillet) and non-edible (viscera) tissues, respectively. Residue levels ranged from 0.64-0.97 ppm, 0.21-0.36 ppm and 1.3-2.3 ppm in whole fish, edible, and non-edible fractions. A majority (64-88%) of the ^{14}C residues were eliminated in the first 24 hours following onset of depuration (Reference 16).

Over 90% of the ^{14}C residues in bluegill sunfish were extractable. Parent chemical was the significant product in the edible tissue-accounting for 59% and 53% of the total ^{14}C residues in fillet from fish samples after 14 and 28 days of exposure. In non-edible tissue(viscera) FMC 57020 amounted to 42% and 28% of the total radioactive residue in 14 and 28 day tissue samples. Nine minor degradation products, none exceeding 8% of the total ^{14}C residues, were observed in edible and non-edible tissues. These products resulted from oxidation, hydroxylation, opening of the heterocyclic ring, methylation, and decarboxylation processes. Additional levels of radioactive residue, 2-5% in fillet and 7-13% in viscera, were hexane soluble indicating some incorporation into fat, while 10-18% and 18-31% of the radioactive residues were incorporated into lipophilic and/or polar metabolite conjugates (Reference 17).

VIII. Estimated Environmental Concentration (EEC) in Water

THE EECs were determined via computer-based modeling techniques. The open literature on "pesticide concentrations in agricultural runoff" was also reviewed. The EECs generated from modeling were then evaluated in light of the open literature.

A. Determination of EECs

A "loading" model and an "aquatic" model were used to develop estimated environmental concentrations (EECs) in water. The pesticide runoff simulator for water resources on rural basins (SWRRB; U.S. EPA, Athens, Georgia) is the "loading" model that was used. It is a modification of the Creams Hydrology Model-Option I which simulates pesticide runoff and adsorption into the soil of small agricultural basins in the U.S. This version is for application to basins from a few HA to several 1000Km^2. Surface runoff is computed with the SCS Curve Number using daily rainfall. SWRRB predicts daily runoff volume and peak rate, sediment yield, evapotranspiration, percolation, return flow and pesticide concentration in the runoff and sediment. Tests with data from watersheds in Texas, Nebraska, Georgia, Ohio, Oklahoma, Arizona, New Mexico, West Virginia, Mississippi, Iowa and Montana indicate that the model simulates runoff volumes and peak rates realistically.

The river basin data set characteristics/parameters used for SWRRB were from a watershed located in the Yazoo River Basin, Mississippi, which has one of the most significant rainfalls of all the watersheds. The input data on FMC 57020 technical that were used in this model are the following:

- K_d (24-hour soil binding potential) = 6.9
- Soil half-life (field data on sandy clay loam from Carolina) = 24 days
- Application rate = 1.25 lb ai/a

The output from SWRRB generated several years of data on a monthly basis. Since 1974 had the greatest rainfall and the highest total load (pesticide runoff) that may impact an aquatic system, data from this year was used in the "aquatic" model.

The "aquatic" model that was used is TOXIWASP (U.S. EPA, Athens, Georgia). It is a dynamic model for simulating the transport and fate of chemicals in water bodies. Two state variables are simulated: organic chemical and total sediment. TOXIWASP is suited to stratified lakes and reservoirs, large rivers, estuaries and coastal waters. Time-varying transport, including forcing and boundary processes, advection, dispersion and mass loading, are represented in this program. With TOXIWASP the user can perform simple dynamic simulations of potentially toxic organic chemicals, particularly pesticides, that enter the environment in pulses that cannot be simulated with steady-state models (e.g., EXAMS). Dynamic simulations allow the consideration of pulse loads, the prediction of peak events, and an estimate of time-varying chemical exposure. TOXIWASP was created for use in exposure assessment.

The input data on FMC 57020 technical that were used in this

model are the following:

- monthly loads of pesticide runoff (lb/A) from 1974 generated from SWRRB (Total concentration = 0.488 lb./A)
- organic carbon partition coefficient; Koc = 608 (from laboratory data on Dunkirk silt loam)
- octanol-water partition coefficient; Kow = 350
- molecular weight = 239.7
- solubility in water = 1100 ppm
- vapor pressure = 1.44×10^{-4} mmHg
- no hydrolysis or oxidation
- photolysis half-life = 7 days*
- extinction coefficient = 2/m (corresponds to a secchi depth of 2.3 feet)**
- 1 acre pond X 1 foot deep; with 10:1 ratio for agricultural to pond area***

The output data used for the EECs was the total dissolved concentration of material found in the water phase since this is the concentration which would be readily available for organismal uptake. The lowest EEC value was 0.0002 mg/l and the highest peak value was 0.740 mg/l. The latter value was therefore used as the EEC. It should be noted, however, that several data inputs on FMC 57020 technical (no hydrolysis or oxidation, 1 acre pond X 1 foot deep) created a "worst case" situation and as a result the actual EECs are probably much lower than the values that are used here.

*Photolytic half-lives (laboratory) in water are:

WATER TYPE (DISTILLED)	24-HOUR LIGHT DAY HALF-LIFE (DAYS)	12-HOUR LIGHT DAY HALF-LIFE (DAYS)
0.1% Acetone	3.51	7.02
2.0% Acetone	0.77	1.54
0 Acetone	>30	>30

** Equivalent to medium turbidity; effective half-life will be 12.5 days taking into account medium turbidity and photolysis half-life of 7 days.

*** Total quality or load of material in the runoff is therefore 10X the amount from a one acre field.

B. Pesticide Concentrations in Runoff

Samples from rivers and streams most often show pesticide concentrations to be much lower than those measured in runoff from agricultural watersheds and research plots. In all cases, most measured values were at least one order of magnitude lower than the reported maximums. The majority of the reported compounds are the now infrequently used organochlorine pesticides (e.g., DDT, benzene hexachloride). For example, in Ohio, runoff from 2 small watersheds (1.1 and 0.7 ha), in corn-wheat rotation, was sampled for dieldrin (soil-incorporated). On the larger watershed (sampled for 26 months) 13 runoff events yielded 0.07% of the applied dieldrin. On the smaller watershed (measured for 8 months) the soil was treated in a way to enhance erosion and still a total of 14 runoff events yielded only 2.2% of the applied dieldrin. It should be noted that higher runoff losses occur for surface-applied pesticides than for soil-incorporated pesticides.

As another example, concentrations of 2,4,5-T and picloram in runoff from a 1.2 ha grassed watershed (measured for 8 months) in Texas showed a total runoff loss for 10 events of 0.45% for both compounds. Furthermore, toxaphene concentrations in runoff from a 15.6 ha watershed planted with cotton in Mississippi showed an average yearly loss of less than 1% of that applied.

To effectively summarize the available data concerning pesticides in runoff the following statements may be made:

> For seasonal or long-term studies (1) wettable powders produce the greatest losses (up to 5% of applied, depending on slope), (2) water insoluble pesticides (applied as emulsions) show losses of 1% or less and (3) water soluble pesticides (applied as aqueous solutions) and soil-incorporated pesticides show losses of 0.5% or less. In the case of wettable powders and water soluble compounds, losses can increase 3-fold if runoff occurs within 2 weeks after application. In general, pesticide concentrations in runoff may vary by an order of magnitude, or more, within a single runoff event. If one considers this and all other factors which may reduce pesticide concentrations after runoff leaves a field, it is not surprising that concentration is a highly transient property.

One major point to emphasize is that large storms produce a significant amount of pesticide losses in runoff. In addition, as the use of short-lived pesticides continues, the edge-of-field concentrations of pesticides in agricultural runoff will become a function of the probability of rainfall and runoff occurring within a very

short-time after application. As a result, the acute effects of pesticides in aquatic systems will become more important than chronic effects in determining potential impact.

C. Relevancy of Background Literature to FMC's Determination of the EEC Via Computer-Based Modeling

In the modeling for the determination of the EEC's, the "load model" (SWRRB) generated a total concentration of 0.488 lb./A in the runoff for the year 1974 (highest significant rainfall). This represents a 40% loss in the runoff of the original applied amount (1.25 lb./A). FMC 57020 is a water-insoluble compound which may be applied as an emulsion and may in fact be soil incorporated. The literature review indicates that this type of compound should have a loss of 1.0% or less. This loss is 0.025 the loss (40%) used for the "aquatic model" (TOXIWASP) to derive the EECs. The "load" or quantity used for the aquatic model should be more realistically estimated at 0.0122 lb./A and not 0.488 lb./A. If this were indeed the case the lowest EEC of 0.0002 mg/l and the highest peak value of 0.740 mg/l for 1974 would be drastically reduced to 5.0×10^{-6} mg/l and 1.85×10^{-2} mg/l, respectively.