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EEE BRANCH REVIEW

DATE: IN ______ OUT ______ FISH & WILDLIFE | IN 9/21/77 OUT 9/21/77 ENVIRONMENTAL CHEMISTRY | IN ______ OUT ______ EFFICACY

FILE OR REG. NO. 3125-131, 133, 146, 214 and GNA

PETITION OR EXP. PERMIT NO. 2F1244

DATE DIV. RECEIVED 9/20/76

DATE OF SUBMISSION ______

DATE SUBMISSION ACCEPTED 9/21/76 3C1D-2B-yes

TYPE PRODUCT(S): (I) D, H, F, N, R, S

PRODUCT MGR. NO. 12 — F. Sanders

PRODUCT NAME(S) Baygon 70% Wettable Powder, Baygon MOS

COMPANY NAME Mobay Chemical Corporation, Chemagro Agricultural Division

SUBMISSION PURPOSE For use on alfalfa and pasture grass to control mosquitoes.

CHEMICAL & FORMULATION 2-(1-methylethoxy)phenol methylcarbamate

1.0 Introduction

1.1 Baygon, O-isopropoxyphenyl methylcarbamate, ~~procarb~~, propoxur.

1.2 Percent active:
Baygon MOS : 12.8% (1 lb./gal.)
Baygon 70% Wettable Powder : 71.5%

1.3 For use on alfalfa and pasture grass.

1.4 Other environmental reviews:

3125-GNA	8/13/75
3125-ETE, 3125ETG	6/6/74
5719-AA	8/3/76
6720-EAU	8/4/76
3125-GNA	1/15/76
475-173	2/17/77

2.0 Directions for Use

2.1 Baygon MOS:

2.1.1 Do not contaminate water, food, or feed by storage, disposal, or cleaning of equipment.

2.1.2 Keep out of lakes, streams, ponds, tidal marshes, and estuaries.

2.1.3 Do not apply when weather conditions favor drift from target area.

2.1.4 Do not use or store near heat or open flame.

2.1.5 Shrubbery and vegetation around stagnant pools, marshy areas, ponds and shorelines may be treated.

2.1.6 Mosquito control on alfalfa and pasture grass: Apply Baygon MOS insecticide at rates below. Apply as necessary at 7 to 14 day intervals with no more than 10 applications per crop year. Applications may be made without removal of grazing cattle.

Non-thermal ULV (ultra-low volume) aerosol ground application:

Apply BAYGON MOS insecticide undiluted using 1-1/4 to 4 fluid ounces per acre or 3 to 9 pints per mile of front covering a swath 300 feet wide (36.4 acres).
NOTE: Rates less than 2 fluid ounces per acre or 4-1/2 pints per mile front may be used in Florida only. Use equipment specifically designed for ULV application of non-thermal aerosols (cold fogging). Repeat as necessary to maintain adequate control.
NOTE: Spray droplets should have a median droplet size range from 5 to 20 microns with a Mass Median Diameter (MMD) not to exceed 15 microns. Droplets 45 microns or larger may cause permanent damage to automobile paint finishes.

~~The method for determining the range and mass median diameter of the particles will be provided by the manufacturer upon request.~~

Use the following flow rates at the indicated vehicle speed to obtain the correct dosage per acre:

BAYGON MOS Flow Rate in Fluid Ounces per Minute		Vehicle Speed Miles per Hour
Urban and Open Field Areas (Florida Only)	(Other States)	
4 to 12	6 to 12	5
8 to 24	12 to 24	10
12 to 32	16 to 32	15

NOTE: Rates above 12 fluid ounces per minute require specially modified equipment. ~~(see your ULV equipment manufacturer for details).~~

2.1.7 Do not use ULV (ultra-low volume) non-thermal aerosol or space spray inside buildings or other enclosed or semi-enclosed areas such as animal barns.

2.1.8 Do not apply to humans or animals.

2.1.9 Do not use on food, feed, or forage crops.

2.1.10 Open dumping is prohibited. Pesticide, spray mixture, or rinsate that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies.

2.1.11 Container disposal: Triple rinse (or equivalent) and offer for recycling, reconditioning, or disposal in approved landfill or bury in a safe place.

2.2 Baygon 70% Wettable Powder:

Mist Spray for Adult Mosquitoes:

Apply 1 to 1-1/2 ounces (0.05 to 0.07 lbs. active) per acre. For mist-blower machines calibrated to deliver 100 gallons per hour traveling at a speed of 4 m.p.h. and covering a swath width of up to 350 feet, use 11-3/4 to 17-1/4 pounds wettable powder per 100 gallons of water to treat 170 acres.

Low-Volume Spray for Control of Adult Mosquitoes:

Apply 1 to 4 ounces BAYGON 70% Wettable Powder (0.05 to 0.175 lb. active) per acre in 1/2 to 1 gallon total volume of water suspension by air.

Mosquito control on alfalfa and pasture grass: Apply 1 to 1½ ounces (0.05 to 0.07 lbs. active) per acre of Baygon 70% Wettable Powder in a water emulsion as directed for mist spray or low volume aerial spray applications. Apply as necessary at 7 to 14 day intervals. Apply no more than 10 times per crop year. Applications may be made without removal of grazing cattle.

3.0 Discussion of Data

3.1 The following referenced 301D studies are not required by Environmental Chemistry:

Acute and Subacute Toxicity of Several Insecticides to Chicks - M. Sherman, E. Ross and MTY Chang, University of Hawaii, Honolulu, Hawaii,

Report # 16827, Accession # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Acute Toxicity of Pesticides - T. B. Gaines, National Communicable Disease Center, U. S. Dept. of Health, Education and Welfare, Atlanta, Georgia,

Report # 25529, Acc. # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

The Acute Oral and Dermal Toxicity of BAYGON 70% Wettable Powder - C. R. Crawford and R. H. Anderson, Research and Development, Chemagro, Kansas City, Missouri,

Report # 29708, Acc. # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

~~Report #31050, Acc. #224691,~~
~~EPA File Symbol 3125-GNA(306),~~
~~Supplement #1, dated Jan. 16, 1975.~~

Comparative Acute Oral Toxicity of Pesticides to Six Species of Birds - R. R. Tucker and M. A. Haegele, USDI, Bureau of Sport Fisheries and Wildlife, Denver, Colorado.

Report #31152, Accession #224691,
EPA File Symbol 3125-GNA(306),
Supplement #1, dated Jan. 16, 1975.

Toxicity of BAYGON 5.9% Granular on Turf to Bobwhite Quail and House Sparrows - D. W. Lamb, Research and Development, Chemagro, Kansas City, Missouri.

Report #31764, Acc. #224691,
EPA File Symbol 3125-GNA(306),
Supplement #1, dated Jan. 16, 1975.

Comparative Dietary Toxicities of Pesticides to Birds - R. G. Heath, J. W. Spann, E. F. Hill and J. F. Kreitzer, USDI, Bureau of Sport Fisheries and Wildlife, Laurel, Maryland,

Report #33423, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Laboratory Studies on the Susceptability of Mosquito Eating Fish, Lebistes Reticulatus and the Larvae of Culex Pipiens Fatigans to Insecticides - Pao-Shu Chen, Yi-Nan Lin and Chiao-Lin Chung, Taiwan Provincial Malaria Research Institute, Taiwan.

Report #34015, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Comparison of the Toxicity of BAYGON 2% Bait and BAYGON 5.9% Granular to Bobwhite Quail and English Sparrows - D. W. Lamb and R. E. Jones, Research and Development, Chemagro, Kansas City, Missouri.

Report #34038, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Acute Toxicity of BAYGON Technical to Bluegill - D. W. Lamb and D. J. Roney, Research and Development, Chemagro, Kansas City, Missouri.

Report #34039, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Effect of Age on Sensitivity: Acute Oral Toxicity of 14 Pesticides to Mallard Ducks of Several Ages - R. H. Hudson, R. K. Tucker and M. A. Haegele, USDI, Bureau of Sport Fisheries and Wildlife, Denver, Colorado.

Report #34567, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Bird Toxicity and Repellancy with Some Commercial Products of FFB - E. W. Schafer, USDI, Bureau of Sport Fisheries and Wildlife, Denver, Colorado.

Report #36055, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Wildlife Effects for Grasshopper Insecticides Sprayed on Short-Grass Range - L. C. McEwen, C. E. Knittle and M. L. Richmond, USDI, Bureau of Sport Fisheries and Wildlife, Denver, Colorado.

Report # 40433, Acc., # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Avian Toxicity of Several Baychem Compounds - E. W. Schafer, Jr., USDI, Bureau of Sport Fisheries and Wildlife, Denver, Colorado.

Report # 41064, Acc. # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

3.2 Analytical Methods

BAYGON Residues in Soil - T. B. Waggoner, Research and Development, Chemagro, Kansas City, Missouri,

Report # 30445, Acc. # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Data are submitted on recoveries of Baygon from clay and silt loam soil.

Analytical Method 30447

Recovery from clay about 102 to 107% and from silt loam soil 92-96%.

~~Analytical Methods~~

BAYGON Residues in Soil - T. B. Waggoner, Research and Development, Chemagro, Kansas City, Missouri,

Report #30446, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Recovery of Baygon from soil-Confirmatory Column ~~(30446)~~

Analytical Method 30447

Recovery from clay 93.4 to 108.5% and silt loam 90.2 to 108.5%.

Conclusions : (30445-30446)

(1) Data indicate that the method may be questionable at least for clay soils. Unfortified sample gave peak area of 3.09 sq. in. while 0.1 ppm std. Gave area of 0.85 sq. in (30445).

BAYGON Residues in Soil - T. B. Waggoner, Research and Development, Chemagro, Kansas City, Missouri.

Report #30794, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Recovery of Baygon From Soils: ~~(30794)~~

The recovery of Baygon from sandy loam and silt loam soil at 0.5 and 1.0 ppm was studied. The analytical method described in report no. 30447 was used. The pesticide in acetone was added to blinder jar. Recoveries in four tests ranged from 88 to 117 per cent.

Conclusions:

(1) Recoveries may not apply to pesticide aged in soil. Data indicate that extraction may have begun soon after fortification.

A Gas Chromatographic Method of the Determination of BAYGON in Soils - C. W. Stanley, Research and Development, Chemagro, Kansas City, Missouri.

Report # 30447, Acc. # 224691, EPA File Symbol 3125-GNA (306), Supplement #1, dated Jan. 16, 1975.

An analytical method for Baygon in clay or silt loam soil was developed. The method involves inited extraction with a chloroform-methanol-water mixture, a Florisil column chromatography cleanup step, derivitization with trichloroacetyl chloride and quantitation by gas chromatography using an electron capture gas detector. Confirmation was by injection onto a second column prepared with a different packing.

Typical recoveries are given as 104% for clay fortified at 0.05 P.P.M. and 96% for silt loam fortified at 0.08P.P.M.

Conclusions:

(1) Method does not determine degradation products.

Gas Chromatographic Method for Residues of BAYGON and Metabolites in Plant Tissues - C. W. Stanley, J. S. Thornton and D. B. Katague, Research and Development, Chemagro, Kansas City, Missouri,

Report #30045, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Baygon and metabolite glycosides are separated from plant material by extraction with acetone and chloroform. Baygon is separated from water-soluble glycosides by a partition between chloroform and water.

After additional solvent partition and column cleanup, Baygon is hydrolyzed and derivatized with trichloroacetyl chloride. After final cleanup on a silica gel column, Baygon is quantitated by gas chromatographic analysis using an electron capture detector. Sensitivity of less than 0.05 ppm is claimed.

Water soluble metabolites are subjected to ~~enzyme~~ enzyme hydrolysis, solvent partition, column cleanup, derivatization with trichloroacetyl chloride and are quantitated by gas chromotagraphic analysis using electron capture detector. The o-hydroxy and M-methoxy metabolites are determined by this method at sensitivities of less than 0.10 ppm and 0.05 ppm respectively.

3.3 Hydrolysis

3.3.1 The Mobility and Persistence of BAYGON in Soil and Water - D. R. Flint and H. R. Shaw II, Research and Development, Chemagro, Kansas City, Missouri.

Report #30589, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

The stability and behavior of Baygon in three water systems was studied. In the first test Baygon at about 10 ppm was introduced into a plastic outdoor pool containing two inches of bottom silt and ten inches of water taken from a lake. The pool was protected from rainfall but otherwise exposed to air and light. The temperature range was 27-36°C with water PH 7. Half-life of parent compound is reported as 12.7 hours.

In a second system, Baygon (14C/3H) at about 20 ppm was introduced into vessels of lake water and silt nearly air-tight with quartz covers, held outdoors. One of the vessels was sterilized after assembly in a steam autoclave. Temperature range was 5-22°C and water PH of 7 in both cases. Half-life of parent compound in the sterile system was 80.8 hours and 54.9 in the non sterile system.

A third system consisted of phospate buffers of PH 5, 7 and 9 treated with Baygon (14C/3H) at 10 ppm and maintained in capped, amber bottles in constant temperature water baths at 30 and 50°C in the dark. Samples were taken for Baygon. Half-lives of parent compound at 30°C were: No measureable change after 31 days at PH 5, 725 hours at PH 7 and 1.2 h hours at PH 9. At 50°C half-lives were: 1655 hours at PH5, 23.0 hours at PH 7 and 0.1 hours at PH 9. O-isopropoxy phenol was indentified as a major hydrolysis product by GLC at PH 9.

Conclusion:

Conclusions:

(1) Baygon is relatively stable at acid and neutral PH and hydrolyzes in alkaline solution.

The hydrolysis of Baygon is PH and temperature dependent.

(2) Microbial action and photolysis both appear to participate in the degradation of Baygon in aqueous media.

(3) O-isopropoxy phenol is identified as a major hydrolysis product.

These studies appear in two different submissions and were reviewed on 6/6/74 and 8/13/75 and found acceptable.

Even though previously accepted, the following deficiencies based on current operating procedures are noted:

(a) Only one concentration (100 PPM) was studied. Two concentrations are needed to support the assumption that first order kinetics describe the hydrolysis reaction.

(b) Formulated material, a spray concentrate consisting of 1.5 lbs a.i/gallon, was used instead of active ingredient alone. Active ingredient alone should be used since formulation may affect hydrolysis.

(c) Material balance data are incomplete. A material balance is needed to determine recoverability of residues and to help in the identity process.

(d) It is not clear from the data, how long the hydrolyses were run, what were the sampling intervals and whether duplicate samples were taken.

(e) more complete analytical data are needed, eg. ~~R_f values and~~ chromatograms.

f.) Distilled water must be used to prohibit/limit other type degradations. We do not know if this condition was met.

3.3.2

Persistence of Pesticides in River Water - J. W. Eichelberger and T. J. Lichtenberg, Environmental Protection Agency, Water Quality Office, Cincinnati, Ohio.

Report #30592, Acc. #224691, EPA File Symbol 3125-GNA (306), Supplement #1, dated Jan. 16, 1975.

The persistence of 28 pesticides including Baygon was studied in raw river water over an eight week period at a concentration of 0.01 ppm. Baygon was 50% hydrolyzed to its coresponding phenol after two weeks, and 95% hydrolyzed after 8 weeks. No phenol was found, in the water after 8 weeks. Water PH varied from 7.3 to 8.0 during the test, which was carried out in sealed jars in sunlight or fluorescent light.

Conclusions:

(1) Baygon degraded almost completely in the raw river water under test conditions with half-life of about 2 weeks. The precise mode of breakdown whether hydrolytic, microbial or photolytic is not elucidated.

This study in raw river water is anallary.

3.3.3 Studies on the Persistence of Some Carbamate Insecticides in the Aquatic Environment - O. M. Aly and M. A. EL-Dib, National Research Center, Water Polution Department, Dokki, Cairo, U.A.R.

Report 34648, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

The hydrolysis of Baygon and other carbomate pesticides was studied in buffered alkaline solutions. Progress of the hydrolysis was followed by U.V. spectrophotometry by measuring the increase in absorption at 280 nm. The half-life of Baygon is 16 days at PH 8, 1.6 days at PH 9 and 0.17 days at PH 10. The temperature coefficients for the hydrolysis of these compounds lie in the range of 2.0-2.9. The hydrolysis rate is therefore temperature dependent and will increase 2-3 times for each 10°C rise.

Conclusions:

(1) The hydrolysis of Baygon is dependent on both PH and temperature. Hydrolysis rate increasing markedly with increased PH and temperature.

(2) Hydrolysis of carbomate esters generally proceeds with the formation of a hydroxy compound, an amine, and carbon dioxide.

The hydrolysis study in buffered NaOH solutions is ancillary.

3.4 Photodegradation

3.41 Sensitized Photodecomposition and Photosensitizer Activity of Pesticide Chemicals Exposed to Sunlight on Silica Gel Chromatoplates - G. W. Ivie and J. E. Casida, Division of Entomology, University of California, Berkeley, California.

Report # 41946, Acc. # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Sensitized photodecomposition and photosensitizer activity of pesticide chemicals exposed to sunlight on silica gel chromatoplates. (41946). Baygon was one of 23 radiolabeled pesticides exposed to sunlight for 1 hour on silica gel plates with 28 known photosensitizers including anthroquinone, acetophonone and anthracene. After exposure, plates were developed with ether-hexane (3:2) and analyzed by radioautography. No photosensitizing activity was shown against Baygon by any of the 28 sensitizing agents.

Conclusions:

(1) None of 28 photosensitizing agents affected the photodegradation of Baygon under conditions of the experiments.

The study of photodegradation on silica gel ~~si~~ Chromatoplates is ancillary.

3.4.2 Photodecomposition of Carbamate Insecticides -
D. G. Crosby, E. Liettis and W. L. Winterlin,
Agricultural Toxicology and Residue Research Laboratory, University of California, Davis, California.

Report #16458, Accession # 224691,
EPA File Symbol 3125-GNA(306),
Supplement #1, dated Jan. 16, 1975.

Baygon, along with other carbamate insecticides, in absolute ethanol or hexane was subjected to irradiation from U.V. sources or sunlight for 1 to 3 hours. The U.V. sources produced peak radiation at about 254 nm. Aliquots of irradiated or reference solutions were applied to TLC plates and developed with suitable solvent. Baygon did not photodegrade under sunlight exposure and was only slightly effected by U.V. irradiation.

Conclusions:

(1) Baygon did not photodegrade under sunlight and showed slight degradation under U.V. irradiation with peak wavelength at 254 nm. under conditions of the experiments.

(2) Results of studies on the photodegradation of Baygon in water and on soil will be needed.

The study of photodegradation in ethanol or hexane is ancillary.

3.5 Effect of Microbes on Pesticide

3.5.1 The Fate of BAYGON (2-Isopropoxyphenyl-N-methylcarbamate) in Soil - D. D. Church and D. R. Flint, Research and Development, Chemagro, Kansas City, Missouri.

Report #30590, Acc. #224691, EPA File Symbol 3125-GNA (306), Supplement #1 dated Jan. 16, 1975.

Three soil types (sandy loam, silt loam, and high organic silt loam) were fortified with 250 ppm of nonradiolabeled Baygon and later radiolabeled Baygon and kept at approximately 15% moisture in constant humidity chambers for up to 116 days. At the termination of the test, 88.9 to 98.7% of the applied activity was organosoluble and found to be parent Baygon by TLC.

A sample of silt loam soil was suspended in 75 ml. of sterile saline solution. Five ml. aliquots of supernatant were transferred to each of three flasks A, B and C. All were fortified with labeled Baygon at 2.5 ppm. Flask B was treated with 0.5g of D-Glucose. Flask C was boiled for 20 minutes before Baygon was added. Flasks were stoppered with sterile cotton, placed in a reciprocating shaker both at 30°C and agitated for up to 21 days. Apparent Baygon concentration changed little for nine days. Thereafter, flask A showed the greatest decline in applied Baygon to 52-59% of the original dosage V5 88 to 94% for the sterile control, Flask C. Decline in flask B was intermediate.

Five grams each of sandy loam, silt loam and high organic silt loam previously fortified with unlabeled Baygon (250 ppm) were suspended in 15 ml of sterile water. A sample of unfortified silt loam soil was treated similarly. Aliquots of the water supernatant were cultured on nutrient agar plates incubated at 30°C for 24 hours and sub-cultured into 10 ml of nutrient broth diluted to 1 mg/ml. Flasks were treated with 10 ppm 3H/14C Baygon and maintained under a variety of conditions: (dark, anaerobic, sterile, etc.). After 4 days, recoveries of 14C and 3H activity indicated a marked decline in Baygon content for all samples except a sterile sample and one tested under anaerobic conditions. Activity in these samples remained unchanged.

Conclusions:

(1) Soil microorganisms appear to participate in the breakdown of Baygon. However, the stability to metabolism shown in the first series of tests indicates that concentration or other factors may influence microbial breakdown.

This is essentially a study on the effects of soil microorganisms on Baygon. It was accepted on 8/13/75.

Even though previously accepted, the following deficiencies based on current operating procedures are noted:

(a) Formulated product and not active ingredient alone was used in most of the study. Active ingredient alone should be used since formulation may affect results.

b. Soil suspensions in water rather than bulk soils were used in two of the 3 studies. Bulk soils should be used to compare metabolic processes under sterile and nonsterile conditions. The soil should not be previously fortified with nonradiolabeled Baygon. The amount added should correspond to that added under actual use conditions. Preferred sampling intervals are 1, 3, 7, 14, 20, and 30 days.

c.
[redacted] No attempts were made to identify organisms responsible for pesticide degradation.
Organisms should include bacteria, algae, and/or fungi that are representative of the soil populations.

d. [redacted] Cation exchange capacity of the soil should be reported.
Metabolism may vary in different soils so soil characteristics are needed to define results.

3.5.2

The Degradation of Two Insecticides by Soil Micro-organisms - C. A. Moore, Mississippi State University, State College, Mississippi.

Report # 33364, Acc. # 224691, EPA File Symbol 3125-GNA (306), Supplement #1, dated Jan. 16, 1975.

Baygon was tested with several soil micro-organisms using dextrose broth, nutrient broth, a water-soil mixture, and moist soil as substrates. Insecticide residues were determined indirectly by measuring the inhibition of acetylcholinesterase. Beef brain homogenates were used as the source of acetylcholinesterase and the activity was measured colorimetrically. Soil micro-organisms substantially reduced the toxicity of cholinesterase inhibiting Baygon. Pure cultures of Aspergillus, Serratia and Pseudomonas species were the most active. All tests were run in a growth chamber at a temperature of 30°C with a twelve-hour photoperiod.

Conclusions:

(1) Several soil micro-organisms were found to be active in reducing Baygon toxicity based on the utilization of acetylcholinesterase inhibition as an assay method.

This study was reviewed 8/13/75 and found acceptable. It is essentially a study of the effects of microbes on Baygon and complements material in Report No. 30590.

Even though previously accepted, the following deficiencies based on current ~~guidelines~~ procedures are noted:

(a) Photographs of claimed pure cultures have not been submitted.

b. A radioisotope method should be used to detect Baygon and degradates rather than the indirect method of measuring acetylcholinesterase inhibition. Baygon should be labeled with ^{14}C on the benzene ring.

3.6 Effect of Pesticide on Microbes

3.6.1 Effect of BAYGON on Microbial Populations -

L. D. Houseworth and B. G. Tweedy, University of Missouri, Columbia, Missouri.

Report #35131, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Indiana clay loam and Commerce silt loam soils were treated with 50 and 250 mg/kg Baygon and maintained at 50% field capacity for 56 days. Samples were taken at intervals and assayed for populations of bacteria, fungi and actinomycetes by placing suitable dilutions of soil solutions on specific media. Inoculated plates were incubated for two to seven days at 28°C and the number of colonies per plate determined. No significant difference in population between control and treated samples were found for either soil type.

Conclusions:

(1). Baygon had minimal effect on soil microorganisms under the conditions of the experiment.

Study was reviewed and found acceptable 8/13/75.

Even though previously accepted, the following deficiencies based on current operating ~~guidelines~~ procedures are noted:

(a) Population studies ~~should~~ must be made on typical soil microorganisms identified by Linnaean name as well as common name. Microorganisms were not identified in the study submitted.

3.6.2 Primary Production: Depression of Oxygen Evolution in Algal Cultures by Organophosphorus Insecticides - S. B. Derby and E. Ruber, Northeastern University, Boston, Massachusetts,

Report # 31050, Acc. # 224691, EPA File Symbol 3125-GNA (306), Supplement #1, dated Jan. 16, 1975.

Summary of percentage reductions in oxygen production and tests of significance.

Pesticides (ppm)	Dunaliella euchlora		Phaeodactylum tricornutum		Skeletonema costatum		Cyclotella nana	
	%	t	%	t	%	t	%	t
Baygon								
1.0	25	4.5	23	1.9	30	4.3	53	11.0
0.1	32	4.6	28	2.5	23	2.1	13	0.9*
0.01	27	6.8	40	3.8	29	2.9	13	0.4*

% Percent reduction in oxygen production as compared with acetone controls.
t Value calculated by t-test from actual oxygen production values.
* Probability not significant, all other values are significant at least at the .05 level.

This study is ancillary.

3.7 Leaching

The Mobility and Persistence of BAYGON in Soil and Water - D. R. Flint and H. R. Shaw II, Research and Development, Chemagro, Kansas City, Missouri.

Report #30589, Acc. # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Baygon was applied to saturated leaching columns 45cm in length + 1.6cm diameter. The soils used are identified under "Adsorption experiments." The dosage rate of carbon-14 and tritium-labeled Baygon is given as 10 ppm but this is not fully explained. One void volume of tap water was added to the top of the columns and allowed to percolate through the soil until no more flow was observed. Ratios of 3H/14C were calculated in order to estimate possible degradation. No significant degradation was indicated using this method. After leaching columns were segmented and analyzed for radioactivity by LSC. The report states that the 'radioactivity traveled near the edge of the water!'

Report 30589 (Revised 8/75) provides the leaching data requested in an additional table V2. It is noted that Baygon added to the column was labelled; isopropoxy with tritium, carbamate with "14C". Analyses, indicating no change in 3H/14C ratios between the applied and column segments, indicates no significant degradation during the study.

Table Va (figures in micrograms)

Segment (cm)	*Col. #1	Col. #2	Col. #3
0 - 4	4.56	3.37	5.75
4 - 8	5.66	6.79	14.95
8 - 12	18.07	45.61	67.25
12 - 16	103.81	94.60	71.39
Column total	132.1	150.4	159.3
Eluate	13.8	0.5	0.6
Total	145.9	150.9	159.9
% **Recovery	97.2%	100.6%	106.6%

* Column 15 cm.
**The applied (0.15 mg) averaged 10 ppm through the column

Column #1: sandy loam
Column #2: silty clay loam
Column #3: high organic silty clay loam

Conclusion:

Baygon can leach in soil.

These studies ~~were~~ were reviewed 6/6/74, 8/13/75 and 1/15/76 and found acceptable. Aged leaching studies have not been submitted. Even though previously accepted, the following deficiencies based on current operating ~~procedures~~ procedures are noted:

(a) An aged leaching study has not been submitted. An ~~aged~~ study is needed to determine if soil residues leach.

(b) Only three soil types were studied while four are required. Four soils are needed to determine if leaching in four agricultural use areas may vary. Label restrictions may be needed depending on variance.

Soils are not completely characterized; ~~C.E.C.~~ cation exchange capacity values are not given. A soil with less than 1% organic matter was not studied as required.

Leaching may vary in different soils so soil characteristics are needed to define results.

(d) A formulated spray concentrate instead of active ingredient alone was used. Leaching may vary with pesticide formulation so active ingredient alone should be used.

e. Less than ~~the equivalent of~~ 20 inches of water was added to the columns.

f. Soil columns 30 cm. long are recommended rather than the ~~15~~ cm. columns used. Larger diameter columns are recommended to allow nonturbulent flow.

g. Celite Filter-Aid was mixed with the soil in the columns. Soils should be free of foreign matter.

3.8 Adsorption ~~test required for this guid~~

The Mobility and Persistence of BAYGON in Soil and Water - D. R. Flint and H. R. Shaw II, Research and Development, Chemagro, Kansas City, Missouri.

Report #30589, Acc. # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

The adsorptivity of Baygon for three soil types was determined - Soil Characteristics are given below:

Texture	% Sand	% Silt	% Clay	% Organic Matter	pH	Bulk Density
Loam	40	42	18	1.4	7.7	1.43
Silty Clay Loam	8	54	38	2.0	6.3	1.28
Silty Clay Loam	6	54	40	4.4	6.1	1.35

Ten ml. of aqueous 14C labeled (carbonyl) Baygon solution containing 0.065 to 1.044 ppm Baygon were equilibrated with 5 gram of soil by mechanical agitation. The equilibrium concentrations of Baygon found in water V5 soil were plotted. The slope of the resulting adsorption isotherm is measured yielding the adsorption coefficient. The coefficients (Kd) found are given as 0.62 for sandy loam, 0.49 for silty clay loam and 1.12 for high organic silty clay loam.

~~Note: Statement on page 13 that 5 grams of soil were used per test does not agree with statements on pages 22, 23, and 24 that only 1 gram was used.~~

Conclusions:

(1) Baygon does not appear to be strongly adsorbed to the soils tested.

~~(2) The apparent discrepancy in the data concerning the amount of soil used per test should be explained.~~

3.9 Field Soil Dissipation

See section 3.9.8 for deficiencies of field soil studies - 4 pages.

3.9.1 BAYGON Residues in Soil - C. B. Waggoner, Research and Development, Chemagro, Kansas City, Missouri,

Report #30533, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

A 5% granular formulation of Baygon was broadcast onto clay and silt loam plots in Stanley, Kansas, and rototilled into soil to a depth of 4 to 6 inches. Samples were taken to 372 days and analyzed for Baygon. Nominal application rate was 10.0 ppm based on assumption of 2×10^6 pounds of soil/acre (six inches deep). All samples were applied on 6/4/68. Total rainfall over the test period was 36.61 inches. Analysis was by method 30447.

Days Applic To Sampling	Analysis Date	Peak Area (sq. in.) Sample	0.1 ppm Standard	Control P.P.M.	Net Residue P.P.M.
Clay (control)	5/26/71	0.66	0.85	0.08	
1	5/27/71	93.0	0.83		11.12
35	6/08/71	42.88	0.69		6.13
93	6/08/71	0.35	0.69		<0.08
184	6/09/71	0.22	0.66		<0.08
372	6/08/71	0.33	0.66		<0.08
Silt Loam (control)	5/26/71	0.38	0.85	0.04	
1	5/27/71	90.0	0.83		10.79
35	6/01/71	48.0	0.86		5.54
94	6/01/71	8.2	0186		0.92
184	6/02/71	0.88	0.83		0.07
372	6/02/71	1.38	0.95		0.11

Conclusions:

(1) The reliability of method 30447 is questionable at least for clay soils.

2. Half-life of Baygon in field soil is less than 3 months.

3.9.2

BAYGON Residues in Soil - T. B. Waggoner, Research and Development, Chemagro, Kansas City, Missouri,

Report #30534, Acc. #224691, EPA File Symbol 3125-GNA (306), Supplement #1, dated Jan. 16, 1975.

A liquid formulation of Baygon (1.5 lb/gal.) was broadcast onto clay and silt loam plots in Stanley, Kansas, and rototilled into soil to a depth of 4 to 6 inches. Nominal application rate was 10.0 ppm based on assumption of 2×10^6 pounds of soil/acre (six inches deep). All samples were applied on 6/4/68. Total rainfall over the test period was 36.61 inches. Analysis was by Method 30447.

Application To Sampling (days)	Analysis Date	Peak Area (sq. in.) Sample	0.1 ppm Standard	Control P.P.M.	Net Residue P.P.M.
Clay (control)	5/26/71	0.66	0.85	0.08	
1	5/27/71	72.0	0.80		8.92
35	6/10/71	58.4	0.88		6.56
93	6/10/71	0.53	0.88		<0.08
184	6/10/71	0.51	0.98		<0.08
372	6/10/71	0.40	0.86		<0.08
Silt Loam (control)	5/26/71	0.38	0.85	0.04	
1	5/27/71	60.0	0.80		7.46
35	6/01/71	47.0	0.80		5.82
94	6/01/71	8.10	0.83		0.93
184	6/02/71	1.13	0.98		0.08
372	6/02/71	1.62	0.90		0.14

Conclusions:

Half-life of Baygon in field soils is less than 3 months.

3.9.3

BAYGON Residues in Soil - T. B. Waggoner, Research and Development, Chemagro, Kansas City, Missouri.

Report #30958, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Soil Persistence Study (Sandy Loam)

A 15% granular formulation of Baygon was broadcast and incorporated to a depth of 4-6 inches in a sandy loam. Soil characteristics were: Sand 49%, Silt 30%, Clay 21%. Organic matter 9.0%, PH 6.2, CEC 11meq/100gm., Field moisture Capacity 44%. Rainfall was 10.42 inches over the test period of 92 days. Analysis was for parent Baygon only by method 30447. Residues found were 16.81 ppm at 0 days, 11.43 ppm at 31 days and 2.15 ppm at 92 days.

Conclusion: Half-life of Baygon in field soils is less than 3 months.

3.9.4

BAYGON Residues in Soil - T. B. Waggoner, Research and Development, Chemagro, Kansas City, Missouri,

Report #30959, Acc. #224691, EPA File Symbol 3125-GNA (306), Supplement #1, dated Jan. 16, 1975.

Soil Persistence Study (Sandy Loam)

Baygon was spray broadcast and incorporated. Only parent Baygon was analyzed by method 30447. Residues found were 14.84 ppm at 0 days, 10.86 ppm at 31 days, and 1.35 ppm at 92 days.

Conclusion: Half-life of Baygon in field soil is less than 3 months.

3.9.5

BAYGON Residues in Soil - T. B. Waggoner, Research and Development, Chemagro, Kansas City, Missouri.

Report # 30960, Acc. # 224691, EPA File Symbol 3125-GNA (306), Supplement #1, dated Jan. 16, 1975.

Soil Persistence Study: (Silt Loam) ~~30960~~

A 70% W.P. formulation of Baygon was spray breadcast and incorporated to a depth of 4-6 inches is a silt loam. Soil characteristics were: Sand 31%, Silt 41%, Clay 27%, Organic matter 3.7%, PH 7.0, CEC 15 meq/100gr., Field moisture capacity 41%. Rainfall was 13.93 inches over the test period of 92 days. Analysis was for parent Baygon only by method 30447. Residues found were 17.56 ppm at 0 days, 13.28 at 31 days, and 1.08 ppm at 92 days.

Conclusion: Half-life of Baygon in field soil is less than 3 months.

3.9.6

BAYGON Residues in Soil - T. B. Waggoner, Research and Development, Chemagro, Kansas City, Missouri.

Report #30961, Acc. #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Soil persistence, Study: (Silt Loam) ~~30961~~

A 15% granular formulation of Baygon was broadcast and incorporated to a depth of 4-6 inches in a silt loam. Soil characteristics were: Sand 31%, Silt 41%, Clay 27%, Organic matter 3.7%, PH 7.0, CEC 15 meg-100 grams, Field moisture capacity 41%. Rainfall was 13.93 inches over the test period of 92 days. Analysis was for parent Baygon only by method 30447. Residues found were 16.88 ppm at 0 days, 14.91 ppm at 31 days and 2.68 ppm at 92 days.

Conclusion: Half-life of Baygon in field soil is less than 3 months.

3.9.7

A note on the Sorbtion of Insecticides on Tropical Soils - A. B. Hadawat and F. Barlow, Department of Technical Co-operation, Tropical Pesticides Research Unit, Porton, Wilts, England. (ORIGINAL)

Report # 13883, Accession # 224691, EPA File Symbol 3125-GNA (306), ~~dated Jan. 16, 1975~~ Supplement #1, dated Jan. 16, 1975.

Baygon is said to have a half-life of 21 to 33 days or longer on certain tropical soils (characteristics not given). Bioassays indicate that sorbed carbamates are biologically active. No data are given.

The study on typical soils is ancillary.

3.9.8 The field soil studies are not acceptable because of the following deficiencies:

1. Depth of soil was either not reported or only six inches. Dissipation may be due to leaching beyond the sampling zone. Soil should be sampled in increments to a depth of 12 inches.

2. No analyses were made for degradation products. ~~Identity and amounts of degradates which comprise more than 10% of applied are needed to assess potential for uptake by nontarget organisms~~

3. Soil characteristic of bulk density is not given ~~for any~~ for any report. Reports 30533 and 30534 also do not report percent sand, silt, and clay; percent organic matter, pH, and cation exchange capacity. Degradation varies in different soils so soil characteristics are needed to define results.

4. Four agricultural use areas are to be studied. When taken together, the field soil studies do not include 4 agricultural areas. Climate may affect degradation.

5. In reports #30533, 30958, and 30961, granular formulations were used. These differ from spray formulations under review. Actual use conditions should be met.

6. In reports 30533 and 30534, other deficiencies are noted:

a. Analyses were made approximately 2 years after sampling. ~~We need Data on sample history and analysis of control samples stored frozen under similar conditions.~~

b. Samples should be taken on day 0 so that the actual initial concentration is known.

3.10 Fish Accumulation

Accumulation and Persistence of Residues in Channel Catfish Exposed to Baygon - 14C, Report #44735, Acc. # 224694, EPA File Symbol 3125-GNA (306), ~~dated 7/6/76.~~ submitted 7/6/76.

Baygon was ring-labelled; the aquaria, without soil, were the flow through type.

Baygon (ppm) calculated from "14C"

Day	Water (ppm)	Whole Fish (ppm)	Factor
0 (1 hr)	0.010	0.016	1.7
0 (6 hr)	0.011	0.034	3.6
1	0.011	0.018	1.6
4	0.012	0.014	1.2
7	0.011	0.013	1.2
14	0.010	0.011	1.1
21	0.010	0.012	1.2
28	0.01	0.013	1.2

Conclusion:

~~The data indicates accumulation in catfish will not be significant.~~

Accumulation in whole fish was 1.2 times at 28 days.

This study was reviewed 1/15/76 and ~~[illegible]~~ accepted. ~~Accumulation in whole fish was found to be 1.2X at 28 days.~~

Even though previously accepted, the following deficiencies based on current operating procedures are noted:

(a). An accumulation study on catfish in a static system using pesticide treated soil is needed to determine accumulation of residues from treated soil. The insecticide should be added to sandy loam soil at the use rate and allowed to age under aerobic conditions for 2 to 4 weeks before fish exposure.

(b) Catfish were used in the dynamic study submitted; ~~#~~ sunfish are preferred. ~~#~~

(c) Study was not extended to 30 days of exposure and did not include a 14 day depuration period. Samples were not taken at all of the recommended intervals ie 0, 1, 3, 7, 10, 14, 22 and 30 days of exposure and 0, 1, 3, 7, 10 and 14 days during depuration

(d.) In the submitted investigation, only water and whole body fish were sampled. ~~for~~ Amount and identity of residue in water, whole body fish, edible tissue, and viscera or carcass at each sample interval must be determined. Water should be sampled prior to fish exposure. (In the static system study, amount and identity of residue in soil at each sample interval and prior to fish exposure should also be determined.) The amount in edible tissue will help define possible intake by humans.

(e) The combustion method should be used in preparing fish tissue samples for radioassay.

(f) Representative raw data in ~~the~~ photographs ~~of TLC~~ or diagrams of TLC plates and sample calculations have not been submitted.

3.11
~~3.10~~ Runoff

The Mobility and Persistence of BAYGON in Soil and Water - D. R. Flint and H. R. Shaw II, Research and Development, Chemagro, Kansas City, Missouri.

Report #30589, Acc. # 224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Field runoff studies were conducted on three soil types (see Adsorption experiments for characteristics) to which Baygon was applied at the rate of 3.61 lbs. AI/Acre. Plots were inclined approximately one inch per foot. Pesticide was applied to the upper 10 feet while downslope untreated areas were 5, 10, and 20 feet in length. Runoff water was collected in troughs leading to recessed buchets. Watering was by irrigation. At day 35, six inch depth soil samples were taken and analyzed for Baygon only. Percent of applied Baygon found was 14.15% for sandy loam, 12.07% for silty clay loam and 32.89% for high organic silty clay loam. Data repeesenting total recoveries of Baygon residues in runoff water and soil on day 47 are given below:

Soil Type and Lane		Inches Of Irrigation	% of Applied BAYGON Recovered Runoff Water	Soil*	Total
Sandy Loam	5'	5.20	8.62	10.73	19.35
	10'	to	10.55	11.25	21.80
	20'	5.80	13.30	12.84	26.14
Silty Caly Loam	5'	4.50	15.25	5.63	20.88
	10'	to	14.82	6.99	21.81
	20'	5.25	17.91	3.76	21.67
High Organic Silty Clay Loam	5'	3.78	9.20	27.73	36.93
	10'	to	12.65	26.75	39.40
	20'	4.45	18.35	26.96	45.31

*Corrected to day 47

Note: Recovery values are for parent compound only. Analyses for metabolites was not successful.

Conclusions:

(1) Baygon may be expected to move laterally in the environment through runoff.

(2) The runoff angle (less than 5°) is relatively small. Runoff rates given by the data should be considered as minimal indications of what might occur in terrain that is not flat.

(3) There were no analyses for degradation products or metabolites. These might be quite significant in runoff water as indicated by the low total recoveries reported (19-45%).

3.12 Plant Metabolism

3.12.1

Plant Metabolism of BAYGON - L. J. Everett and R. R. Gronberg, Research and Development, Chemagro, Kansas City, Missouri.

Report #21746, Acc #224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Carbonyl and isopropoxy labeled Baygon were applied to leaf surfaces of actively growing plants (beans & corn). Losses of activity from leaf surfaces ranged from 57%-78% at 5 days. Up to 30% of remaining activity was not removeable from the plant surface. The beta-glucosides of o-hydroxyphenyl N-hydroxymethylcarbamate (I) and o-isopropoxyphenyl N-hydroxymethylcarbamate (II) were found to be metabolites by enzymatic hydrolysis. Downward translocation from leaves to root was not indicated.

Radiolabeled Baygon (carbonyl + isopropoxy) in tap water was applied to the roots of growing corn plants. There was a continuous increase in the concentration of metabolites on the leaf surface and in the water extractable fractions of the plants. The beta-glucosides of I and II were tentatively identified by co-chromatography with known standards.

Conclusions:

(1) Baygon in water solution is taken up from roots to leaves of corn plants.

(2) Two conjugates of hydroxy metabolites I and II have been identified in the corn plant.

(3) Downward movement of topically applied radiolabeled Baygon from leaves to roots is not significant.

3.12.2

Metabolism of BAYGON in Corn Plants - R. R. Gronberg, Research and Development, Chemagro, Kansas City, Missouri,

Report #29233, Acc.#224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Eighteen corn plants were placed in a wide mouth brown glass bottle containing 540 ml. of aqueous Baygon solution at a concentration of 15 microgram per milliliter containing both carbonyl 14C and isopropoxy 3H labels. The 3H/14C ratio was 17.5. The jar was closed with masking tape allowing only sufficient room for the stems. Plants were placed under fluorescent lamp operated on a 12 hour light/dark cycle. After 14 days, the corn plants were cut into small pieces, ground and extracted to give an organic fraction, an extracted water fraction, a solids fraction and a root water fraction. About 45% of applied activity was found to be Baygon in the organic fraction; 9.2% of applied Baygon was found in the root water. The extracted water fraction contained 16.7% of applied 14C activity as the beta-glucoside conjugate of o-hydroxyphenyl-*N*-methylcarbamate and 2.4% of the conjugate of applied 14C activity was lost. About 5.7% of 14C activity was found in solids and was not identified.

Conclusions:

(1) Considerable Baygon (about 45%) is taken up from root water into corn plants.

(2) Plant metabolism involves hydroxylation to o-hydroxy and N-hydroxy compounds and conjugation to form beta glucosides.

3,13

~~3,12~~ Animal Metabolism

The Metabolic Fate of BAYGON (o-Isopropoxyphenyl methylcarbamate) in the Rat - L. J. Everett and R. R. Gronberg, Research and Development, Chemagro, Kansas City, Missouri.

Report #28797, Acc.#224691, EPA File Symbol 3125-GNA(306), Supplement #1, dated Jan. 16, 1975.

Rats were treated orally with carbonyl 14C, isopropyl 14C and isopropyl 3H labeled Baygon. 85% of the applied activity was eliminated within 16 hours. 20-25% as volatile compounds (CO_2, and some acetone) and 50% in the urine as conjugates. Depropylation to 2-hydroxy-phenyl -N-methylcarbamate was a major metabolic route, as well as hydrolysis of the carbamate to give isopropoxy-phenol. At least five other metabolites were identified. All occured in conjugated form.

Conclusion:

(1) Baygon appears to be rapidly metabolized, conjugated and eliminated from the rat.

4.0 Conclusions

4.1 Hydrolysis

1. Baygon is relatively stable at acid and neutral pH and hydrolyzes in alkaline solution.
2. O-isopropoxyphenol is identified as a major hydrolysis product and would be present in the environment.

~~3. The hydrolysis study is [illegible] acceptable [illegible] recommendation. [illegible]~~

4.2 Effect of Microbes on Pesticides

1. Soil microorganisms appear to participate in the breakdown of Baygon in water suspensions but stability to metabolism in bulk soil tests indicates that concentration or other factors may influence microbial breakdown. ~~In the study using acetylcholinesterase as an assay method,~~ several microorganisms were found to reduce Baygon toxicity.

2. In the bulk soil tests after 116 days, 89 to 99% of the applied was parent Baygon.
~~3. The hydrolysis study is not acceptable. See recommendations for all cases.~~

4.3 Effect of Pesticides on Microbes

1. Baygon had minimal effect on soil microorganisms.
~~2. The study is not acceptable for recommendations.~~

4.4 Leaching

1. Baygon leaches in soil.
~~2. The leaching study is not acceptable. See recommendations for all cases.~~

4.5 Field Soil Dissipation

1. $T_{1/2}$ is less than 3 months.
~~2. The study is not acceptable. See recommendations.~~

2. The study is not acceptable. See recommendations.

4.6 Fish Accumulation

1. Accumulation in whole fish was 1.2X at 28 days.

~~2. The study is not acceptable for its recommendations at most.~~

5.0 Recommendations

5.1 No opinion is given.

5.2 Studies required but never submitted:

1. Aerobic Soil Metabolism
2. Anaerobic Soil Metabolism
3. Rotational Crops

An example of an acceptable protocol for an aerobic soil metabolism study is below:

§ Aerobic soil metabolism. Rate, type, and degree of metabolism of the pesticide residues are to be determined in a sandy loam, loam, silt loam, or other textured soil appropriate to the intended application sites. Radiolabeling in one or more positions in the pesticide molecule is required to assure adequate coverage of chemical transformations. Where radiolabeling will be of little benefit, comparable detection techniques are required. Residues comprising more than ten percent of initial application or 0.01 ppm should be identified. A material balance, including nonextractable residues, must be provided. The experimental dose rate must approximate field application rate. Treated soil must be maintained at temperatures of 18 to 30°C at or below 75% of 0.33 bar moisture content. Collect data until a ninety percent loss of the pesticide occurs and until patterns of formation and decline of metabolic products are established. Preferred sampling times are at pretreatment, 0,1,2, and 7 days, 2 and 3 weeks, and 1,2,3,4,6,9, and 12 months. The

study need not be conducted for more than one year for terrestrial crop and non-crop uses, and terrestrial/aquatic uses.

Characterization of soils must be reported including texture (percent sand, silt, and clay), percent organic matter, pH, cation exchange capacity, and bulk density.

An example of an acceptable protocol for an anaerobic soil metabolism study is below:

Anaerobic soil metabolism. ~~This study is required for field and vegetable crop uses to determine differences in rate and patterns of metabolism between aerobic and anaerobic soil conditions.~~ Terrestrial anaerobic soil studies should use the same soil as used in aerobic studies. Obtain an aliquot at the thirty day interval from the aerobic soil study, and establish anaerobicity by either waterlogging or purging with inert gases. Preferred sampling intervals are thirty and sixty days after anaerobicity has been established.

An example of an acceptable protocol for a rotational crops study is below:

Rotational crops. Studies are required to establish if pesticide residue uptake occurs in rotational crops, emergency replanting, or in situations where crops receive water from treated areas. The applicant must identify crops that can be rotated in the proposed use areas. Treat a sandy loam soil with radiolabeled pesticide at a rate equivalent to that expected under actual use conditions. Following treatment, age the pesticide aerobically for a time approximating the anticipated cultural practice; for example, one year for crops rotated the following year, 120 days for crops rotated immediately after harvest, and 30 days for assessing circumstances of crop failure. Plant a root crop, small grain, and leafy vegetable crop at the above times and periodically analyze to maturity. When residues are found, a field study using formulated products shall be undertaken to determine when residues would not occur in subsequent crops under actual use conditions. A crop residue study under actual use conditions is required for those practices where a subsequent crop is treated with the same active ingredient as the initial crop. This study is not required for a cover crop if typically plowed under and not grazed. A crop residue study under actual field use conditions is required where water from treated areas, including holding ponds or effluent and other discharges, is typically used to irrigate crops.

Note: Data which are to be reported from field tests include precipitation (accumulated from first application to each sampling), water table, grade (slope), and soil type. In addition, dates of planting and harvesting, application and sampling times; dates and stages of crop and pest development; application-to-harvest and application-to-sampling intervals for each treatment; and the depth, weight, or volume of each sample and the weights and volumes of aliquots taken for analysis must be reported. When water flow is measured in situ, flow meters or comparable techniques are required. (Data in gal/min or liters per minute will be acceptable).

Characterization of soils must be reported. including texture (percent sand, silt, and clay), percent organic matter, pH, cation exhange capacity, and bulk density.

5.3 Reentry data may be required if toxicology branch so indicates. An example of an acceptable protocol for a reentry study is below:

The reentry study consists of five parts:

a. Aerobic and anaerobic soil metabolism ~~[as described above]~~

b. Field dissipation ~~[as described above]~~

c. Vapor phase photolysis study.

d. Volatility of the pesticide under actual use conditions by monitoring of air samples at the same time intervals as specified in Dislodgable residue study [below].

e. Dislodgable residue part of reentry data requirement includes chemical analysis of dislodgable residues of the active ingredient applied to the crop. A dislodgable residues is easily removed from the plant surface by a simple wash, as distinguished from residues released from within the leaf or its surface waxes by more drastic means such as organic solvent entraction or homogenization (the latter normally are not critical under situations of worker exposure). Data from two collecting sites differing in climatic, crop-cultural and edaphic conditions must be selected. These sites may be same sites chosen for other environmental chemistry studies or for residue chemistry studies. Before application of the pesticide, the investigator should obtain the spray history of the plot to ensure

that pre-existing residues will not affect the experimental results. Actual application operation must be carefully supervised to ensure that quantities delivered are consistent with proposed or actual label recommendation. Furthermore, the application should be made in the growing season and at the frequency dictated by pest management practices. Residue samples are to be taken at zero time, 12 hours, 1 day, 2, 5, 7, 14, 21, and 30 days. A decline curve of the residues, including any plateau which may occur with time, must be determined. The final result of the analysis should be a measure of pesticide residue expressed in milligrams or micrograms per square centimeter of foliar leaf surface. In like manner, samples for residue analysis must also be collected from soil in the test plot and reported as milligrams or micrograms per square centimeter of soil surface. Meteorological data in the area containing the plot should be recorded daily during the study. If growth characteristics at the treated crop produce unique microenvironmental conditions such as shaded foliage or arboring then samples must be representative of the conditions.

5.4 The following studies were previously reviewed and are not being ~~reevaluated~~ at this time as mention in Rogoff's memo of August 12, 1977 pending ~~Ed. Cumpt's~~ Rogoff's to Dorfy Cumpt. concurrence. Data previously ~~accepted~~ ~~is not~~ reviewed again. ~~Even though~~ previously accepted, the following deficiencies based on current ~~operating~~ guidelines are noted:

1. Hydrolysis
Report # 30589:

(a) Only one concentration (100 PM) was studied. Two concentrations are needed to support the assumption that first order kinetics describe the hydrolysis reaction.

(b) Formulated material, a spray concentrate consisting of 1.5 lbs a.i/gallon, was used instead of active ingredient alone. Active ingredient alone should be used since formulation may ~~effect~~ affect hydrolysis.

(c) Material balance data are incomplete. A material balance is needed to determine recoverability of residues and to help in the identity process.

(d) It is not clear from the data, how long the hydrolyses were run, what were the sampling intervals and whether duplicate samples were taken.

(e) More complete analytical data are needed, eg. ~~Rf values and~~ chromatograms.

f.) Distilled water must be used to prohibit/limit other type degradations. We do not know if this condition was met.

An example of an acceptable protocol for a hydrolysis investigation is below:

~~(1)~~ Hydrolysis. ~~Pesticides may enter natural waters via direct application, mobility from treated areas, industrial discharge, and as a result of disposal and cleanup of containers and equipment. Hydrolysis data are required for all pesticides.~~ Studies are to be conducted in darkness using radioisotopic or other comparable detection techniques at different pH values (acidic, neutral, and basic) at two concentrations and two temperatures. Aliquots in duplicate should be taken at four sampling time intervals, with at least one observation made after one-half of the pesticide is hydrolyzed, or thirty days, whichever is shorter. A material balance ~~(accountability at the completion of an experiment of the pesticide introduced into a defined system including both identified and unidentified products)~~, half-life estimate, and identification of degradation products for the pesticide must be provided. Studies utilizing distilled water provide an upper limit estimate for persistence of pesticides in the aquatic environment. Hydrolysis in natural waters may be carried out to supplement studies in distilled water. Concentrations should approximate use rate and 10X use rate.

B. Effect of Microbes on Pesticide
Report # 30590:
(a) Formulated product and not active ingredient alone was used in most of the study. Active ingredient alone should be used since formulation may affect results
c. Soil suspensions in water rather than bulk soils were used in two of the 3 studies. Bulk soils should be used to compare metabolic processes under sterile and nonsterile conditions. The soil should not be previously fortified with nonradiolabeled Baygon. The amount added should correspond to that added under actual use conditions. Preferred sampling intervals are 1, 3, 7, 14, 20, and 30 days.

c. No attempts were made to identify organisms responsible for pesticide degradation. Organisms should include bacteria, algae, and/or fungi that are representative of the soil populations.

d. Cation exchange capacity of the soil should be reported. Metabolism may vary in different soils so soil characteristics are needed to define results.

Report # 33364:

(a) Photographs of claimed pure cultures have not been submitted.

b. A radioisotope method should be used to detect Baygon and degradates rather than the indirect method of measuring acetylcholinesterase inhibition. Baygon should be labeled with ^{14}C on the benzene ring.

An example of an acceptable protocol for an investigation of effects of microbes on pesticides is below:

Effects of microbes on ~~pe~~sticides. Impact of microbes on pesticide transformation is measured by comparisons of metabolic processes under sterile and non-sterile conditions during a thirty day period. Preferred sampling intervals are 1,3,7,14, ~~and~~ 20 ~~days~~, and 30 days, but other intervals may be appropriate. ~~[sec 162.79(d)(3)(iii)]~~. Acceptable soil sterilization methods are heat or high energy ionizing radiation. Attempts should be made to identify organisms responsible for degradation. For organisms which are difficult to identify, family names will be sufficient. Isolates that cannot be identified to family level must have descriptive characteristics which can be substituted for generic classification. Alternately, studies utilizing pure or defined and characterized mixed cultures of bacteria, algae, and/or fungi are adequate. ~~For~~

3. ~~#~~ Effect of Pesticides on Microbes.

(a) Population studies ~~should~~ must be made on ~~typical~~ soil microorganisms identified by Linnaean name as well as common name. Microorganisms were not identified in the study submitted.

An example of an acceptable protocol for an investigation of effects of pesticides on microbes is below:

Effects of pesticides on microbes. Data on effects of pesticides on microbes are obtained from studies of effects on microbial functions or microbial populations. Studies of effects on microbial functions constitute a more direct approach, and are preferred to studies of effects on populations. Some effects cannot be measured directly and population studies may be the only recourse. When the functional approach is chosen, data on the effects on nitrogen fixation, nitrification and degradation of cellulose, starch, and protein are required for terrestrial and aquatic uses, and for terrestrial/aquatic uses, an additional pectin degradation study is required. ~~A leaf litter degradation study may be substituted for~~

~~the cellulose, starch, protein, and pectin degradation studies (see Terrestrial/Aquatic 162.79(d)(5)(iv)).~~ When the population approach is chosen, effects on pure or mixed culture populations of representative microorganisms from soil or water or obtained from culture collections should be recorded for terrestrial/aquatic or aquatic uses. Appropriate organisms include free-living nitrogen-fixing bacteria and blue-green algae such as Azotobacter, Clostridium, and Nostoc, and nitrifiers such as Nitrosomonas and Nitrobacter. For cellulose, starch, pectin, protein, and similar degradation, include at least one each of soil bacteria, actinomycetes, and molds such as Bacillus, Pseudomonas, Arthrobacter, Cellulomonas, Cytophaga, Streptomyces, Penicillium, Flavobacterium, Trichoderma, Aspergillus, Chaetomium, and Fusarium. Animal or plant pathogens and indicators of fecal pollution are unsuitable.

4. Leaching

(a) An aged leaching study has not been submitted. An aged study is needed to determine if soil residues leach.

(b). Only three soil types were studied while four are required. Four soils are needed to determine if leaching in four agricultural use areas may vary. Label restrictions may be needed depending on variance.

c. Soils are not completely characterized; ~~cation exchange capacity~~ C.E.C. values are not given. A soil with less than 1% organic matter was not studied as required.

Leaching may vary in different soils as soil characteristics are needed to define results.

~~(d)~~ A formulated spray concentrate instead of active ingredient alone was used. Leaching may vary with pesticide formulation so active ingredient alone should be used.

e. ~~(f)~~ Less than ~~the specified~~ 20 ~~one~~ inches of water was added to the columns.

f. ~~(g)~~ Soil columns 30 cm. long are recommended rather than the ~~45~~ 15 cm. columns used. Larger diameter columns are recommended to allow nonturbulent flow.

g. Celite Filter-Aid was mixed with the soil in the columns. Soils should be free of foreign matter.

An example of an acceptable protocol for a leaching ~~hydrolysis~~ investigation is below:

A leaching study using radioisotopic or comparable techniques is required. A minimum of four soils are used, including soils such as sand (agricultural), sandy loam, silt loam, clay or clay loam having a pH range of 4 to 8 with at least one soil having an organic matter content less than one percent. The pesticide is added to soil corresponding to the highest recommended rate for a single application. Each soil is immediately leached with the equivalent of twenty acre-inches of water. In addition, one of the above treated soils is aged for 30 days under aerobic conditions prior to initiation of leaching, which is at the rate of equivalent one-half acre-inch of water per day for forty-five days. A material balance, depth of leaching, and quantity and identity of the pesticide and its degradation products or metabolites must be provided.

Characterization of soils must be reported including texture (percent sand, silt, and clay), percent organic matter, pH, cation exchange capacity, and bulk density.

5. Fish Accumulation

(a) An accumulation study on catfish in a static system using pesticide treated soil is needed to determine accumulation of residues from treated soil. The insecticide should be added to sandy loam soil at the use rate and allowed to age under aerobic conditions for 2 to 4 weeks before fish exposure.

(b) Catfish were used in the dynamic study submitted; sunfish are preferred.

(c) Study was not extended to 30 days of exposure and did not include a 14 day depuration period. Samples were not taken at all of the recommended intervals ie 0, 1, 3, 7, 10, 14, 22 and 30 days of exposure and 0, 1, 3, 7, 10 and 14 days during depuration

(d.) In the submitted investigation, only water and whole body fish were sampled. ~~for~~ Amount and identity of residue in water, whole body fish, edible tissue, and viscera or carcass at each sample interval must be determined. Water should be sampled prior to fish exposure. (In the static system study, amount and identity of residue in soil at each sample interval and prior to fish exposure should also be determined.) The amount in edible tissue will help define possible intake by humans.

(e) The combustion method should be used in preparing fish tissue samples for radioassay.

(f) Representative raw data in ~~the~~ photographs ~~of TLC~~ or diagrams of TLC plates and sample calculations have not been submitted.

The following is an example of an acceptable protocol for a fish accumulation study:

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Fish residue accumulation data using radioisotopic or comparable technique are required. Two exposure systems are required: flow-through (with constant concentration of aqueous solution of pesticide) and static (with ambient concentration of residues). ~~Bluegill~~ Sunfish are preferred in flow-through system and catfish required in the static system. For the static system treat water overlayering a sandy loam soil at the proposed application rate and allow system to "age" for 2 to 4 weeks prior to initiation of fish exposure.

Exposure duration is 30 days with suggested sampling times at 0, 1, 3, 7, 10, 14, 22, and 30 days of exposure; while fish and water samples are taken on 0, 1, 3, 7, 10, and 14 days of withdrawal of exposure. Obtain soil and water samples prior to fish exposure interval. Determine the amount and identity of the residue in water, soil, whole body fish, edible tissue, and viscera or carcass at each sample interval.

Characteristics of water must be reported including pH, temperature, and oxygen content.

5.5 The following studies are not acceptable and were not accepted previously:

1. ~~2.~~ Photodegradation

Studies on silica gel or in hexane or ethanol are ancillary. Studies in water and soil are required for this use. ~~Studies~~ A study in air may be required ~~by~~ if toxicology indicates that reentry data is needed.

An example of an acceptable protocol for a photodegradation study is below:

Photolysis. Conduct photodegradation studies using radioisotopic or comparable detection techniques at one concentration (approximately use rate) under natural or simulated greater than 280 nm (280×10^{-9} meters) wavelength sunlight. Such studies must provide a material balance, half-life estimate, and the identification of photoproducts. Rate studies are conducted in distilled or deionized water at pH of maximum stability, and sampling should continue up to twenty percent degradation with sampling for identification of photoproducts to half-life, or thirty days, whichever comes first. Yield of photoproducts may be increased by changing such conditions as wavelengths, concentration, photosensitizers,

and solvents other than water. ~~Supplemental rate and photo-product studies may be carried out in natural water for aquatic uses. Studies performed on the soil used in the soil metabolism studies are preferred but other soil textures will be acceptable.~~ The intensity of incident sunlight and time of exposure must be reported if sunlight is used as a source. Information on artificial light sources should contain type of source, intensity, wavelength, and time of exposure.

~~(5)~~ Photodegradation data must be supported by incident light intensity and percent transmission. Values for intensity in ~~candles and~~ lambert units are required for artificial light sources. Latitude, time of year, atmospheric cover, and other major variables which affect incident light are to be reported when natural sunlight is used.

Characteristics of water must be reported including pH, temperature, and oxygen content.

2. Field soil study

1. Depth of soil was either not reported or only six inches. Dissipation may be due to leaching beyond the sampling zone. Soil should be sampled in increments to a depth of 12 inches.

2. No analyses were made for degradation products. ~~Identity and amounts of degradates which comprise more than 10% of applied, are needed to assess potential for uptake by nontarget organisms.~~

3. Soil characteristic of bulk density is not given ~~Data~~ for any report. ~~Reports~~ 30533 and 30534 also do not report percent sand, silt, and clay; percent organic matter, pH, aeration, exchange capacity. Degradation varies in different soils so soil characteristics are needed to define results.

4. Four agricultural use areas are to be studied. When taken together, the field soil studies do not include 4 agricultural areas. Climate may affect degradation.

5. In reports #30533, 30958, and 30961, granular formulations were used. These differ from spray formulations under review. Actual use conditions should be met.

6. In reports 30533 and 30534, other deficiencies are noted:

a. Analyses ~~were~~ were made approximately 2 years after sampling. ~~We need Data on sample history and analysis of control samples stored similar under similar conditions.~~

b. Samples should be taken on day 0 so that the actual initial concentration is known.

the following is an example of an acceptable protocol for a field soil dissipation ~~investigation~~ study:

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A field dissipation study under actual use conditions is required. Analyses are continued until a ninety percent loss of the pesticide occurs or until patterns of formation and decline of degradation products are established or to a maximum test duration of eighteen months. Soil samples are taken in increments to a depth of 12 inches from sites in four agricultural use areas. Sampling times include preapplication, day of application, and shortly post-application. Succeeding samples are dependent upon degradation and metabolism characteristics.

Identification of residues comprising more than ten percent of initial application or 0.01 ppm is needed to construct decline curves of residues in soil.

Characterization of soils must be reported including texture (percent sand, silt, and clay), percent organic matter, pH, cation exhange capacity, and bulk density.

Precipitation to each sampling, water table, grade (slope), and depth and volume of each sample should also be reported.

5.6 See attached sheet for data requirements for different use patterns.

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Environmental Chemistry Section
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Table 1 - Summary of environmental chemistry data requirements by intended use pattern

Data Requirements * / Use Patterns	Terrestrial Uses					Aquatic Uses		Terrestrial/ Aquatic Uses	Aquatic Impact Uses			To Support Registration of:	
	Domestic Outdoor	Greenhouse	Non-crop	Tree Fruit-Nut Crop	Field-Veg. Crop	Aquatic Food Crop	Aquatic Non-Crop	Forest	Direct Discharge	Indirect Discharge	Wastewater Treatment	Manufacturing Use Product	Formulated Product
PHYSICO-CHEMICAL DEGRADATION													
Hydrolysis	X	X	X	X	X	X	X	X	X	X	X	X	X
Photodegradation			X	X	X	X	X	X	X				X
METABOLISM													
Aerobic soil	X	X	X	X	X			X					X
Anaerobic soil					X								X
Anaerobic aquatic						X	X	X	X				X
Aerobic aquatic						X	X		X				X
Effects of microbes on pesticides			X	X	X	X	X	X	X				X
Effects of pesticides on microbes			X	X	X	X	X	X[a]	X				X
Activated sludge										X	X	X	X
MOBILITY													
Leaching			X	X	X			X[b]					X
Volatility		X											X
Adsorption						X	X	X	X				X
Water dispersal						X	X		X				X
FIELD DISSIPATION													
Soil	X		X	X	X	X		X					X
Water						X	X	X[c]					X
Ecosystem (X[d] combined study with X[a], X[b], X[c])								X[d]					X
ACCUMULATION													
Rotational crop					X	X							X
Irrigated crop						X	X						X
Fish			X	X	X	X	X	X	X				X

Special Fish Study

* Data requirements cited in §162.60-29(c)(3), (f) and (g); §162.60-30(e); §162.60-31; and §162.60-32 are not included in this Table.