Data Evaluation Report on the adsorption-desorption of BAS 510 F in soil

PMRA Submission Number {.....} EPA MRID Number 45405216

Data Requirement: PMRA Data Code:
EPA DP Barcode: D278387
OECD Data Point:
EPA Guideline: 163-1

Test material:
Common name: BAS 510 F
Chemical name
IUPAC: 2-Chloro-*N*-(4'-chlorobiphenyl-2-yl)-nicotinamide.
CAS name: 2-Chloro-*N*-(4-chloro[1,1-biphenyl]-2-yl)-3-pyridinecarboxamide.
CAS No: 188425-85-6.
Synonyms: Nicobifen, ~~BAS 516 02 F~~
SMILES string:

Primary Reviewer: Dana Worcester
Dynamac Corporation

Signature: Dana Worcester
Date: 1/15/02

QC Reviewer: Joan Harlin
Dynamac Corporation

Signature: Joan L. Harlin
Date: 1/15/02

Secondary Reviewer: Cheryl Sutton
EPA

Signature: Cheryl Sutton
Date: 1/02

Company Code: [for PMRA]
Active Code: [for PMRA]
Use Site Category: [for PMRA]
EPA PC Code: 128008

CITATION: Seher, A. 1998. BAS 510 F - Soil adsorption/desorption study of 300 355. Unpublished study performed by BASF Aktiengellsellschaft, Limburgerhof, Germany. Sponsored by BASF Corporation, Research Triangle Park, NC. BASF Registration Document No. 1998/10513. Study initiated August 1997 and completed May 1998.

Data Evaluation Report on the adsorption-desorption of BAS 510 F in soil

PMRA Submission Number {.....} EPA MRID Number 45405216

EXECUTIVE SUMMARY:

The adsorption/desorption characteristics of [diphenyl-U-^{14}C]BAS 510 F (2-chloro-N-(4-biphenyl-2-yl)nicotinamide) was studied in a German sand/loamy sand soil [pH- 5.8, organic carbon - 2.5%], German sandy loam soil [pH - 7.5, organic carbon - 1.53%], and German loamy sand soil [pH - 6.5, organic carbon - 1.1%], a U.S. loamy sand soil [pH - 5.8, organic carbon - 0.4%] and U.S. loam soil [pH - 5.2, organic carbon - 0.5%], and a Canadian sandy clay loam soil [pH - 7.5, organic carbon - 3.4%] in a batch equilibrium experiment. The experiment was conducted in accordance with the U.S. EPA Pesticide Guidelines Subdivision N, 163-1; and OECD Guidelines for Testing of Chemicals, "Adsorption/Desorption," Guideline 106 (May, 1981); and in compliance with the GLP standard 40 CFR Part 160 and OECD-GLP. The adsorption phase of the study was carried out by equilibrating air-dried soil with BAS 510 F at nominal concentrations of 2.5, 0.5, 0.1, and 0.02 µg/mL at 22 ± 1°C for 24 hours in the dark. The equilibrating solution used was 0.01 M $CaCl_2$, with soil:solution ratios of 1:5 (w:v) for all six soils. The desorption phase of the study was carried out by replacing the adsorption solution with an equivalent volume of sterilized, pesticide-free 0.01 M $CaCl_2$ solution and equilibrating for 16 hours at 22 ± 1°C. The desorption phase was repeated once.

The supernatant solution after adsorption and desorption was separated by centrifugation, and duplicate aliquots were analysed for total radioactivity using LSC. Radioactivity in the soil residue after the second desorption step was determined by combustion. Aliquots (0.1 g) of soil were combusted and analyzed by LSC.

Mass balances were determined only at the highest concentration (2.5 µg/mL) for the six test soils, and were calculated by summing the total amount of BAS 510 F recovered in the adsorption and desorption solutions, the soil extracts, and unextracted soil residues. Mass balances ranged from 97.5% to 101.3%.

After 24 hours of equilibration, 87.8-96.0%, 59.2-77.0%, 54.9-77.0%, 40.3-57.0%, 37.6-57.0%, and 89.6-99.0% of the applied BAS 510 F was adsorbed to the sand/loamy sand, sandy loam, loamy sand, loam, and sandy clay loam soils, respectively (reviewer-calculated). Freundlich adsorption K_{ads} values were 27.8, 7.6, 6.5, 3.9, 3.3, and 26.4 mL/g for the sand/loamy sand, sandy loam, loamy sand, loam, and sandy clay loam soils, respectively. Corresponding adsorption K_{oc} values ranged from 507 to 1110 mL/g. The coefficients of determination (r^2) for the relationships K_{ads} vs. organic carbon, K_{ads} vs. pH, and K_{ads} vs. clay content were 0.88, 0.09 and 0.09, respectively, indicating that adsorption was affected by organic carbon content. At the end of the desorption phase, 8.3-15.9%, 23.4-36.3%, 23.4-38.5%, 29.8-53.9%, 22.8-39.6%, and 3.0-7.2% of the adsorbed amount was desorbed from the sand/loamy sand, sandy loam, loamy sand, loam, and sandy clay loam soils, respectively (reviewer calculated). Following the second desorption step, Freundlich K_{des} values were 37.3, 18.6, 17.8, 8.9, 14.9, and 53.9 mL/g for the sand/loamy sand, sandy loam, loamy sand, loam, and sandy clay loam soils, respectively. Corresponding desorption K_{oc} values ranged from 1243 to 2977 mL/g. The Freundlich K_{des} and K_{oc} values were higher than those obtained for adsorption.

Data Evaluation Report on the adsorption-desorption of BAS 510 F in soil

PMRA Submission Number {.....} EPA MRID Number 45405216

Results Synopsis: Adsorption and desorption values determined using Freundlich isotherm equations

Soil type: Sand/loamy sand
Amount adsorbed: 87.79-96.00% of applied
Adsorption K_d: 27.761 (immobile)
Adsorption K_{oc}: 1110 (low mobility)
Amount desorbed: 8.33-15.92% of adsorbed amount
Desorption K_d: 37.309
Desorption K_{oc}: 1492

Soil type: Sandy loam
Amount adsorbed: 59.24-77.00%
Adsorption K_d: 7.610 (moderately mobile)
Adsorption K_{oc}: 507 (low mobility)
Amount desorbed: 23.38-36.28%
Desorption K_d: 18.643
Desorption K_{oc}: 1243

Soil type: Loamy sand
Amount adsorbed: 54.88-77.00%
Adsorption K_d: 6.538 (moderately mobile)
Adsorption K_{oc}: 594 (low mobility)
Amount desorbed: 23.38-38.47%
Desorption K_d: 17.848
Desorption K_{oc}: 1623

Soil type: Loamy sand
Amount adsorbed: 40.32-57.00%
Adsorption K_d: 3.947 (mobile)
Adsorption K_{oc}: 987 (low mobility)
Amount desorbed: 29.82-53.90%
Desorption K_d: 8.918
Desorption K_{oc}: 2229

Soil type: Loam
Amount adsorbed: 37.57-57.00%
Adsorption K_d: 3.277 (mobile)
Adsorption K_{oc}: 655 (low mobility)
Amount desorbed: 22.81-39.55%
Desorption K_d 14.855
Desorption K_{oc}: 2977

Soil type: Sandy clay loam
Amount adsorbed: 89.56-99.00%
Adsorption K_d: 26.385 (immobile)
Adsorption K_{oc}: 776 (low mobility)
Amount desorbed: 3.03-7.24%
Desorption K_d 53.841
Desorption K_{oc}: 1584

Study Acceptability: This study is classified as supplemental, and does not satisfy the guideline data requirement for an adsorption/desorption study in soil. Material balances were reported only for the soil:solution slurries treated at the highest test concentration. In order to allow the reviewer to determine the scientific validity of the study, material balances must be submitted for all soils at all test concentrations. This study may be upgraded to a classification of "acceptable" upon submission of data indicating that acceptable material balances were achieved at all test concentrations.

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED: The study was conducted according to U.S. EPA Pesticide Assessment Guidelines Subdivision N, Series 163-1 (October 1982) and the OECD Guideline for Testing of Chemicals, "Adsorption/Desorption," Guideline 106 (May 1981). No deviations affected the validity of the study.

COMPLIANCE: This study was conducted in compliance with 40 CFR Part 160, EPA GLP and OECD-GLP. Signed and dated GLP, Quality Assurance, Data Confidentiality, and Study Certification statements were provided.

A. MATERIALS:

Data Evaluation Report on the adsorption-desorption of BAS 510 F in soil

PMRA Submission Number {.....} EPA MRID Number 45405216

1. Test Material BAS 510 F

Chemical Structure:

Description: Solid

Purity: Analytical purity: Not provided. Lot/Batch No. Not provided.
Radiochemical purity: >99% Lot/Batch No. 641-1018
Specific activity: 3.23 MBq/mg
Locations of the label: Diphenyl-U-^{14}C

Storage conditions of test chemicals: Not reported

Physico-chemical properties of BAS 510 F:

Parameter	Values	Comments
Water solubility	6 mg/L in water at 20°C	
Vapour pressure	Not provided	
UV absorption	Not provided	
pK_a	Not provided	
K_{ow}	Not provided	
Stability of Compound at room temperature	Not provided	

Data obtained from p. 12 of the study report.

2. Soil Characteristics

Table 1: Description of soil collection and storage.

Description	Sand/ loamy sand	Sandy loam	Loamy sand	Loamy sand	Loam	Sandy clay loam
Geographic location	Lufa, Germany	Limburgerhof, Germany	Limburgerhof, Germany	U.S.A.	U.S.A.	Canada
Pesticide use history at the collection site	Not provided	Not provided	Not provided	Not provided	Not provided	Not provided
Collection procedures	Not provided	Not provided	Not provided	Not provided	Not provided	Not provided
Sampling depth (cm)	Not provided	0-20	0-20	Not provided	Not provided	Not provided
Storage conditions	Not provided	Not provided	Not provided	Not provided	Not provided	Not provided
Storage length	Not provided	Collected May 13, 1997	Collected May 13, 1997	Not provided	Not provided	Not provided
Soil preparation	Sieved 2 mm	Sieved 2 mm	Sieved 2 mm	Sieved 2 mm	Sieved 2 mm	Sieved 2 mm

Data obtained from pp. 42-47 of the study report.

Table 2: Properties of the soils.

Property	Lufa Speyer 2.2 F 21997	Limburgerhof/ Bruch West	Limburgerhof/ Schlag Li 35b	USA 538-30-5	USA 538-31-2	Canada 95024 RCN 95012
Soil Texture	Sand/ loamy sand	Sandy loam	Loamy sand	Loamy sand	Loam	Sandy clay loam
% sand	86	73	83	83	44	49
% silt	9	17	10	9	43	28
% clay	5	10	7	8	13	23
pH ($CaCl_2$)	5.8	7.5	6.5	5.8	5.2	7.5
Organic carbon (%)	2.5	1.5	1.1	0.4	0.5	3.4
CEC (meq/100 g)	11.2	12.1	7.2	4	10	26
Moisture at 1/3 atm (%)	14.7	16.3	10.2	7.3	19.5	32.5
Bulk density (lb/cu ft^3)	Not provided	Not provided	Not provided	Not provided	Not provided	Not provided
Biomass (mg microbial C/100 g)	55.9	38.3	28.2	12.3	47.4	9.3
Soil taxonomic classification	Not provided	Not provided	Not provided	Not provided	Not provided	Not provided
Soil mapping unit (for EPA)						

Data obtained from pp. 42-47 of the study report.

B. STUDY DESIGN:

1. Preliminary study:

To determine whether the test substance adsorbed to centrifuge glass tubes, an aliquot (25 mL) of a solution containing 2.5 µg/mL of [^{14}C]BAS 510 F in 0.01M $CaCl_2$ was placed in a glass centrifuge tube, shaken for 24 hours, and analyzed by LSC (p. 14).

To determine the equilibration time to be used in the definitive study, samples were prepared by adding aliquots (25 mL) of a solution containing 2.5 µg/mL of [^{14}C]BAS 510 F in 0.01M

$CaCl_2$ to centrifuge glass tubes containing 5 g (dry weight equivalent) of test soil. Single samples were prepared for each test soil. A control was prepared by adding 5 g of soil and 25 mL of untreated 0.01M $CaCl_2$ solution to a glass centrifuge tube. All tubes were covered with parafilm and towels, and gently shaken on a mechanical shaker for 1, 2, 4, 8, 16, and 24 hours. The samples were centrifuged, the supernatants were decanted, and aliquots of the supernatants were analyzed for total radioactivity using LSC.

Based on the results of the preliminary studies, it was determined that no adsorption of the test substance occurred on the glass wall, and that the definitive study would be conducted using an equilibration period of 24 hours for each of the test soils.

2. Definitive study experimental conditions:

Table 3: Study design for the adsorption phase.

Parameters		**Sand/loamy sand**	**Sandy loam**	**Sand**	**Sandy loam**	**Clay loam**	**Sandy clay loam**
Condition of soil (air dried/fresh)		Air dried	Air dried	Air dried	Air dried	Air dried	Air dried
Have these soils been used for other laboratory studies ? (specify which)		No	No	No	No	No	No
Soil (g/replicate)		5 g	5 g	5 g	5 g	5 g	5 g
Equilibrium solution used (name and concentration; eg: 0.01N $CaCl_2$)		0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$
Control used (with salt solution only) (Yes/No)		No	No	No	No	No	No
Test material concen-trations	Nominal application rates (µg/mL)	2.5, 0.5, 0.1, 0.02	2.5, 0.5, 0.1, 0.02	2.5, 0.5, 0.1, 0.02	2.5, 0.5, 0.1, 0.02	2.5, 0.5, 0.1, 0.02	2.5, 0.5, 0.1, 0.02
	Analytically measured concen-trations (µg/mL)	2.537, 0.507, 0.102, 0.020	2.537, 0.507, 0.102, 0.020	2.537, 0.507, 0.102, 0.020	2.537, 0.507, 0.102, 0.020	2.537, 0.507, 0.102, 0.020	2.537, 0.507, 0.102, 0.020
Identity and concentration of co-solvent, if any		Methanol, 3.17 mg/mL	Methanol, 3.17 mg/mL	Methanol, 3.17 mg/mL	Methanol, 3.17 mg/mL	Methanol, 3.17 mg/mL	Methanol, 3.17 mg/mL
Soil:solution ratio		1:5	1:5	1:5	1:5	1:5	1:5

Data Evaluation Report on the adsorption-desorption of BAS 510 F in soil

PMRA Submission Number {.....} EPA MRID Number 45405216

Parameters		Sand/loamy sand	Sandy loam	Sand	Sandy loam	Clay loam	Sandy clay loam
Initial pH of the equilibration solution, if provided		Not provided	Not provided	Not provided	Not provided	Not provided	Not provided
No. of replications	Controls	2	2	2	2	2	2
	Treatments	2	2	2	2	2	2
Equilibration	Time (hours)	24	24	24	24	24	24
	Temperature (°C)	22 ± 1	22 ± 1	22 ± 1	22 ± 1	22 ± 1	22 ± 1
	Darkness (Yes/No)	Yes	Yes	Yes	Yes	Yes	Yes
	Shaking method	Mechanical shaker	Mechanical shaker	Mechanical shaker	Mechanical shaker	Mechanical shaker	Mechanical shaker
	Shaking time (hours)	24	24	24	24	24	24
Method of separation of supernatant (eg., centrifugation)		Centrifugation	Centrifugation	Centrifugation	Centrifugation	Centrifugation	Centrifugation
Centrifugation	Speed (rpm)	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
	Duration (min)	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
	Method of separation of soil/solution	Centrifugation	Centrifugation	Centrifugation	Centrifugation	Centrifugation	Centrifugation

Data obtained from pp. 13-14 of the study report.

Table 4: Study design for the desorption phase.

Parameters		**Sand/ loamy sand**	**Sandy loam**	**Loamy sand**	**Loamy sand**	**Loam**	**Sandy clay loam**
Were the soil residues from the adsorption phase used? If not, describe the method for adsorption using a separate adsorption table		Yes	Yes	Yes	Yes	Yes	Yes
Amount of test material present in the adsorbed state/adsorbed amount (mg a.i./kg soil)	2.537 µg/mL	11.136	7.514	6.962	5.115	4.766	11.361
	0.507 µg/mL	2.296	1.744	1.692	1.338	1.145	2.355
	0.102 µg/mL	0.46	0.359	0.346	0.265	0.255	0.49
	0.020 µg/mL	0.096	0.077	0.077	0.057	0.057	0.099
No. of desorption cycles		2	2	2	2	2	2
Equilibration solution and quantity used per treatment for desorption (eg., 0.01M $CaCl_2$)		0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$	0.01M $CaCl_2$
Soil:solution ratio		1:5	1:5	1:5	1:5	1:5	1:5
Replications	Controls	2	2	2	2	2	2
	Treatments	2	2	2	2	2	2
Desorption equilibration	Time (hours)	16	16	16	16	16	16
	Temperature (°C)	22 ± 1	22 ± 1	22 ± 1	22 ± 1	22 ± 1	22 ± 1
	Darkness	Yes	Yes	Yes	Yes	Yes	Yes
	Shaking method	Mechanical shaker	Mechanical shaker	Mechanical shaker	Mechanical shaker	Mechanical shaker	Mechanical shaker

Parameters		Sand/ loamy sand	Sandy loam	Loamy sand	Loamy sand	Loam	Sandy clay loam
	Shaking time (hours)	16	16	16	16	16	16
Centrifugation	Speed (rpm or g)	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
	Duration (min)	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
	Method of separation of soil and solution	Centrifugation	Centrifugation	Centrifugation	Centrifugation	Centrifugation	Centrifugation
Second desorption	Indicate if the method is same as the first desorption cycle.	Same	Same	Same	Same	Same	Same

Data obtained from pp. 13-15; Table 4, p. 21 of the study report.

21

3. Description of analytical procedures:

Extraction/clean up/concentration methods:

Total ^{14}C measurement: Aliquots of the test solutions and supernatants were analyzed for total radioactivity using LSC. Following the second desorption step, the soil residue from the 2.5 µg/mL test solution was extracted by shaking with methanol on a mechanical shaker for one hour. The methanolic extract was centrifuged and analyzed using LSC. The extracted soils were dried at approximately 105°C and 12 mbar for 24 hours, and subsamples (0.1 g) were analyzed by LSC following combustion.

Non-extractable residues, if any: Residues remaining in soil following desorption were determined by LSC following combustion.

Derivatization method, if used: A derivatization method was not employed

Identification and quantification of parent compound (briefly describe HPLC/GC/TLC/MS conditions; eg., column, mobile phase, detector etc.): For all the test soils, HPLC was conducted using the 2.5 µg/mL solution before and at the end of the study, the aqueous phase from the 2.5 µg/mL solution following adsorption, and the methanolic extracts from the 2.5 µg/mL solution following the second desorption step (p. 15). Identification and quantification of the parent compound were performed by radio-HPLC using the following operating conditions: Nucleosil, 100-5-C-18 column (4.0 x 250 mm), mobile phase of acetonitrile:water:phosphoric acid (85%) (500:500:2.5, v:v:v), flow rate 1.0 mL/minute. The identity of the parent compound was confirmed by chromatographic comparison of the HPLC retention time of a reference standard.

Identification and quantification of transformation products, if appropriate (briefly describe HPLC/GC/TLC/MS conditions; eg., column, mobile phase, detector etc.): Transformation products were not identified or quantified. (The parent compound was stable in the test system.)

Detection limits (LOD, LOQ) for the parent compound (indicate the criteria/reference, if provided): Detection limits for the parent compound were not reported.

Detection limits (LOD, LOQ) for the transformation products, if appropriate (indicate the criteria/reference, if provided): Transformation products were not identified or quantified.

II. RESULTS AND DISCUSSION

A. TEST CONDITIONS: It was not stated whether the desorption phase of the study was conducted in the dark. The stability of the test substance in solution at the beginning and end of the study, and in the aqueous and methanolic phases for the six test soils was confirmed, based on the results of radio-HPLC analysis (Table 7, p 24; Figures 1-17, pp. 26-41).

B. MASS BALANCE: Mass balances were determined only at the highest concentration (2.5 µg/mL) for the six test soils, and were calculated by summing the total amount of BAS 510 F recovered in the adsorption and desorption solutions, the soil extracts, and unextracted soil residues. Mass balances were 99.6, 99.0, 98.5, 99.2, 97.5, and 101.3% of the applied for the sand/loamy sand, sandy loam, loamy sand, loamy sand, loam, and sandy clay loam soils, respectively (p. 23).

Table 5: Recovery of BAS 510 F, expressed as percentage of applied radioactivity, in soil after adsorption/desorption (mean ± s.d.).*

Matrices	Sand/loamy sand	Sandy loam	Loamy sand	Loamy sand	Loam	Sandy clay loam
At the end of the adsorption phase						
Supernatant solution[1]	10.53 ± 2.9	32.36 ± 2.9	34.08 ± 2.9	49.77 ± 2.9	53.38 ± 2.9	10.60 ± 2.9
Solid phase (total ^{14}C)[¶]	90.86 ± 3.4	68.56 ± 3.4	66.38 ± 3.4	50.37 ± 3.4	47.23 ± 3.4	94.09 ± 3.4
Total recovery[2]	101.39 ± 2.6	100.92 ± 0.3	100.46 ± 0.1	100.14 ± 0.2	100.61 ± 0.1	104.7 ± 0.2
At the end of the desorption phase						
Supernatant solution[3]	5.73 ± 1.0	8.82 ± 0.9	7.45 ± 1.7	7.21 ± 1.7	5.43 ± 0.4	1.97 ± 1.1
Solid phase (extracted)[4]	69.0 ± 2.4	26.7 ± 2.5	19.7 ± 0.2	15.4 ± 1.2	11.2 ± 2.1	34.2 ± 3.7
Non-extractable residues in soil, if measured[4]	1.98 ± 1.4	9.5 ± 2.4	12.4 ± 0.4	2.4 ± 1.3	8.7 ± 2.6	46.0 ± 2.7
Total recovery[4]	99.7 ± 1.6	98.9 ± 0.4	98.6 ± 0.9	99.2 ± 1.3	97.6 ± 0..2	101.3 ± 0.9

Means and standard deviations were calculated by the reviewer using Excel.

1 Reviewer-calculated from data obtained from Attachments 8-13, pp. 49-54 of the study report. (e.g., Divide aqueous phase 0.3353 µg/mL by initial present 2.5366 µg/mL x 100 = 13.22%.

¶ Soils were extracted and combusted. Reviewer-calculated from data obtained from Attachments 8-13, pp. 49-54 of the study report (e.g., multiply initial applied 2.537 µg/mL by amount solution 25 mL = 63.415 µg/5 g = 12.68 µg/g applied. Divide amount adsorbed on soil 11.17561 µg/g by initial applied 12.68 µg/g x 100.

[2] Reviewer-calculated by adding percent in supernatant solution and solid phase.

[3] Measured in 2.5 µg/mL treatment group only; data obtained from desorption 2 Table 6, p. 23 of the study report.

[4] Measured in 2.5 µg/mL treatment group only; data obtained from Table 6, p. 23 of the study report..

Table 6: Concentration of BAS 510 F in the solid and liquid phases at the end of adsorption equilibration period (mean ± s.d.)

Concentration (µg a.i/mL)	Sand/loamy sand			Sandy loam			Loamy sand		
	on soil (mg a.i./kg)	in solution (µg a.i./mL)	% adsorbed*	on soil (mg a.i./kg)	in solution (µg a.i./mL)	% adsorbed	on soil (mg a.i./kg)	in solution (µg a.i./mL)	% adsorbed
2.5	11.136 ± 0.1	0.343 ± 0.0	87.8 ± 0.4	7.514 ± 0.0	1.053 ± 0.0	59.3 ± 0.3	6.962 ± 0.0	1.153 ± 0.0	54.9 ± 0.4
0.5	2.296 ± 0.0	0.055 ± 0.0	90.4 ± 0.5	1.744 ± 0.0	0.163 ± 0.0	68.6 ± 0.5	1.692 ± 0.1	0.171 ± 0.0	66.6 ± 4.4
0.1	0.46 ± 0.0	0.011 ± 0.0	90.6 ± 1.8	0.359 ± 0.0	0.031 ± 0.0	70.7 ± 1.2	0.346 ± 0.0	0.033 ± 0.0	68.1 ± 1.2
0.02	0.096 ± 0.0	0.001 ± 0.0	93.9 ± 0.6	0.077 ± 0.0	0.005 ± 0.0	75.1 ± 2.6	0.077 ± 0.0	0.005 ± 0.0	75.4 ± 2.1

Concentration (µg a.i/mL)	Loamy sand			Loam			Sandy clay loam		
	on soil (mg a.i./kg)	in solution (µg a.i./mL)	% adsorbed*	on soil (mg a.i./kg)	in solution (µg a.i./mL)	% adsorbed*	on soil (mg a.i./kg)	in solution (µg a.i./mL)	% adsorbed
2.5	5.115 ± 0.2	1.516 ± 0.0	40.3 ± 1.4	4.766 ± 0.1	1.594 ± 0.0	37.6 ± 1.0	11.361 ± 0.1	0.377 ±0.0	89.6 ±0.7
0.5	1.338 ± 0.0	0.24 ± 0.0	52.7 ± 1.2	1.145 ± 0.1	0.281 ± 0.0	45.1 ± 3.3	2.355 ± 0.1	0.06 ± 0.0	92.7 ± 3.1
0.1	0.265 ± 0.0	0.049 ± 0.0	52.1 ± 0.3	0.255 ± 0.0	0.051 ± 0.0	50.3 ± 0.7	0.49 ± 0.0	0.008 ± 0.0	96.4 ± 0.4
0.02	0.057 ± 0.0	0.009 ± 0.0	55.9 ± 0.7	0.057 ± 0.0	0.009 ± 0.0	55.6 ± 1.2	0.099 ± 0.0	0.002 ± 0.0	97.0 ± 1.4

Data obtained from Tables 4-5, pp. 21-22 and Attachments 8-13, pp. 49-54, of the study report. Standard deviations were calculated by the reviewer using Excel.
* % adsorbed as the % of the applied; reviewer-calculated by dividing total adsorbed by total applied x 100 (e.g., 11.17561 ÷ 12.68 x 100)

Table 7: Concentration of BAS 510 F in the solid and liquid phases at the end of desorption (total of all desorption phases)*.

Concentration (µg a.i/mL)	Sand/loamy sand			Sandy loam			Loamy Sand		
	on soil (mg a.i./kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed*	on soil (mg/kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed*	on soil (mg/kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed*
2.5	9.116	0.180	15.92	4.788	0.217	36.28	4.284	0.200	38.47
0.5	1.957	0.030	14.76	1.167	0.045	33.08	1.152	0.041	31.91
0.1	0.404	0.005	12.17	0.258	0.008	28.13	0.245	0.009	28.13
0.02	0.088	0.001	8.33	0.059	0.002	23.38	0.059	0.001	23.38

Concentration (µg a.i/mL)	Loamy sand			Loam			Sandy clay loam		
	on soil (mg/kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed*	on soil* (mg/kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed*	on soil (mg/kg)	in solution (µg a.i./mL)	% desorbed as % of the adsorbed*
0.04	2.358	0.216	53.9	2.881	0.135	39.55	10.538	0.077	7.24
0.2	0.793	0.043	40.73	0.736	0.028	35.72	2.214	0.012	5.99
1.04	0.17	0.007	35.85	0.179	0.006	29.8	0.47	0.002	4.08
5.16	0.04	0.001	29.82	0.044	0.001	22.81	0.096	0.0001	3.03

Data obtained from Table 5, p. 22, of the study report.

*Reviewer-calculated by subtracting the initial adsorbed from the amount adsorbed after desorption and dividing by initial adsorbed x 100 (e.g., 11.136 - 9.116 = 2.02 ÷ 11.136 x 100).

Table 8: Freundlich adsorption and desorption constants of BAS 510 F in the soils.

Soil	Adsorption				Desorption			
	K_{ads}	1/n	r^2	K_{oc}	K_{des}	1/n	r^2	K_{oc}
Sand/loamy sand[1]	27.761	0.875	0.9983	1110	37.309	0.844	0.9992	1492
Sandy loam[1]	7.61	0.87	0.999	507	18.643	0.893	0.9996	1243
Loamy sand[1]	6.538	0.839	0.9979	594	17.848	0.879	0.9998	1623
U.S. Loamy sand	3.947	0.887	0.9977	987	8.918	0.809	0.9974	2229
U.S. Loam	3.277	0.86	0.9994	655	14.855	0.841	0.9988	2977
Canadian Sandy clay loam	26.385	0.851	0.9978	776	53.841	0.71	0.9894	1584

[1]German soil

Data obtained from Tables 4-5, pp. 21-22, and pp. 49-60 of the study report.

K - Freundlich adsorption and desorption coefficients; 1/N -Slope of Freundlich adsorption/desorption isotherms.

K_{oc} - organic carbon adsorption and desorption coefficients (K x 100/% organic carbon).

r^2 - coefficient of determination associated with the Freundlich equation.

C. ADSORPTION: After 24 hours of equilibration, 87.79-96.00%, 59.24-77.00%, 54.88-77.00%, 40.32-57.00%, 37.57-57.00% and 89.56-99.00% of the applied BAS 510 F was adsorbed from the sand/loamy sand, sandy loam, loamy sand, loamy sand, loam, and sandy clay loam soils, respectively (Table 4, p. 21). Freundlich K_{ads} values were 27.761, 7.610, 6.538, 3.947, 3.277, and 26.385 mL/g for the sand/loamy sand, sandy loam, loamy sand, loamy sand, loam, and sandy clay loam soils, respectively; corresponding K_{oc} values were 1110, 507, 594, 987, 655, and 776 mL/g, respectively. The coefficients of determination (r^2) for the relationships K_{ads} vs. organic carbon, K_{ads} vs. pH, and K_{ads} vs. clay content were 0.88, 0.09 and 0.09, respectively, indicating that adsorption was affected by organic carbon content.

D. DESORPTION: At the end of the desorption phase, 8.33-15.92%, 23.38-36.28%, 23.38-38.47%, 29.82-53.90%, 22.81-39.55%, and 3.03-7.24% of the adsorbed ^{14}C was desorbed from the sand/loamy sand, sandy loam, loamy sand, loamy sand, loam, and sandy clay loam soils, respectively (Table 5, p. 22). Following the second desorption step, Freundlich K_{des} values were 37.309, 18.643, 17.848, 8.918, 14.855, and 53.841 mL/g for the sand/loamy sand, sandy loam, loamy sand, loamy sand, loam, and sandy clay loam soils, respectively; corresponding desorption K_{oc} values were 1492, 1243, 1623, 2229, 2977, and 1584 mL/g, respectively.

III. STUDY DEFICIENCIES: The objective of this study was to study the sorptive behaviour of BAS 510 F in six soils with varying soil characteristics. Material balances were reported only for the soil:solution slurries treated at the highest test concentration. In order to allow the reviewer to determine the scientific validity of the study, material balances must be submitted for all soils at all test concentrations. The study cannot currently be used to fulfill Subdivision N

Guideline §163-1 data requirements, but may be upgraded to a classification of "acceptable" upon submission of data indicating that acceptable material balances were achieved at all test concentrations.

IV. REVIEWER'S COMMENTS:

1. Complete details of the experimental design were not reported. It was not stated whether desorption equilibration was conducted in the dark. The material used for the construction of the centrifuge tubes was not reported.

2. Four of the six soils were foreign soils (three from Germany and one from Canada). However, these soils were characterized according to the USDA soil textural classification system and were comparable to soils found in the United States. The EPA will accept data obtained from foreign soils for two of the four soils required.

3. The 1/n values associated with the Freundlich K values for all of the test soils were below 0.9. The l/n values associated with the Freundlich K_{ads} values were 0.839-0.887 and the l/n values associated with the Freundlich K_{des} values were 0.710-0.893 (study report Tables 4 and 5, pp. 21-22). If the 1/n value is not within the range of 0.9 to 1.1, then the Freundlich isotherm may not adequately or accurately represent the adsorption of the compound across all concentrations.

4. Sample storage intervals and conditions were not reported.

5. The highest recommended label rate for a single application of the test substance was not reported. Subdivision N guidelines state that, if possible, one concentration should be roughly equivalent to the maximum proposed or registered field application rate of the parent compound.

6. In the preliminary experiment to establish an equilibration time for the definitive experiment, equilibrium was defined by the observation of values in two consecutive adsorption tests which were in agreement within approximately 10% (p. 17). For five of the test soils, the equilibrium plateau was reached after 24 hours. For the German Bruch West sandy loam soil, values were in agreement for the 8-and 16-hour tests, but not for the 16- and 24-hour tests; an equilibration time of 24 hours was selected for this soil.

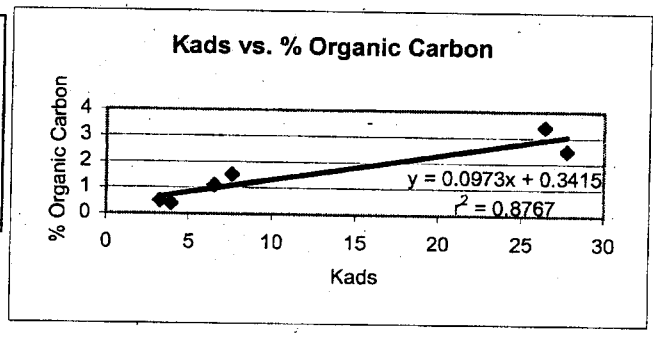
7. BAS 510 F chemical name 2-chloro-*N*-(4'-chlorobiphenyl-2-yl)-nicotinamide, as presented in the study report, was identified as the IUPAC name by the Compendium of Pesticide Common Names (http://www.hclrss.demon.co.uk/nicobifen.html). The CAS name 2-chloro-*N*-(4-chloro[1,1-biphenyl]-2-yl)-3-pyridinecarboxamide was also obtained from the Compendium of Pesticide Common Names. The following BAS 510 F synonyms were obtained from USEPA/OPP Chemical Databases (http://www.cdpr.ca.gov/cgi-bin/epa/chemidetriris.pl?pccode=128008 and (http://www.cdpr.ca.gov/cgi-bin/mon/bycode.pl?p_chemcode=5790): 2-chloro-*N*-(4'-chlorobiphenyl-2-yl)-nicotinamide, nicobifen, and BAS 516 02 F.

V. REFERENCES: References were not cited.

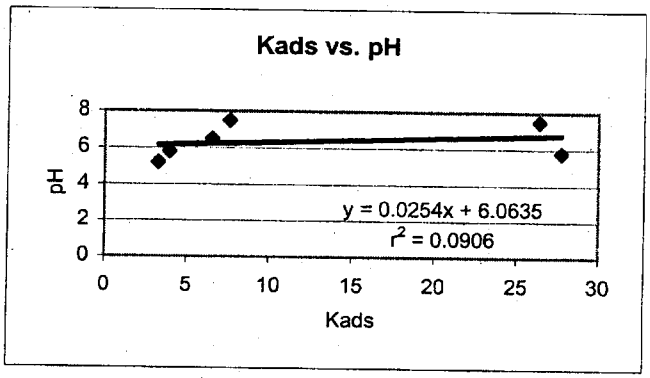
Attachment 1
Excel Workbook

Chemical Name	BAS 510F
PC Code	128008
MRID	45405216
Guideline No.	163-1

Soil	Kads	% Organic Carbon
Speyer 2.2	27.761	2.5
Burch West	7.61	1.5
Schlag Li 35 b	6.538	1.1
USA 538-30-5	3.947	0.4
USA 538-31-2	3.277	0.5
Canada 95024	26.385	3.4



Soil	Kads	pH
Speyer 2.2	27.761	5.8
Burch West	7.61	7.5
Schlag Li 35 b	6.538	6.5
USA 538-30-5	3.947	5.8
USA 538-31-2	3.277	5.2
Canada 95024	26.385	7.5



Soil	Kads	% Clay
Speyer 2.2	27.761	5
Burch West	7.61	10
Schlag Li 35 b	6.538	7
USA 538-30-5	3.947	8
USA 538-31-2	3.277	13
Canada 95024	26.385	23