PC 128712

Data Evaluation Report on the aquatic field dissipation of carfentrazone-ethyl

PMRA Submission Number {......} EPA MRID Number 46253901

Data Requirement: PMRA Data Code:
EPA DP Barcode: D304515
OECD Data Point:
EPA Guideline: 164-2

Test material: Carfentrazone-ethyl

End Use Product name: F8426 2 EW Herbicide **Concentration of a.i.:** 23.6%

Formulation type: Emulsifiable water-based concentrate.

Active ingredient

Common name:	Carfentrazone-ethyl
IUPAC name:	Ethyl (RS)-2-chloro-3-[2-chloro-5(4-(difluoromethyl-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl)-4-fluorophenyl]propionate.
CAS name:	Ethyl α,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoate.
CAS No:	128639-02-1.
Synonyms:	
SMILES string:	O=C(C(Cc1c(cc(c(c1)N1N=C(N(C1=O)C(F)F)C)F)Cl)Cl)OCC.

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CITATION: Dow, K.D. 2004. F8426 aquatic herbicide dissipation following treatment of a pond. Unpublished study performed, sponsored and submitted by FMC Corporation, Princeton, NJ. Study Number: 842E4203E1. Report Number: P-3657. Experiment initiated September 30, 2003 and completed November 26, 2003 (p. 11). Final report issued February 27, 2004.

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ABSTRACT

Field Dissipation - Aquatic

Carfentrazone-ethyl ((RS) -2-chloro-3-[2-chloro-5(4-(difluoromethyl-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl)-4-fluorophenyl]propionate; F8426; formulated as F8426 2 EW Herbicide containing 23.6% a.i.) was surface-applied once at the targeted maximum seasonal application rate of 0.3 lb. a.i./surface acre onto one-half of a Florida pond (0.56 acres, 5 feet deep) free of surface vegetation. Following application, water and sediment samples were collected for analysis of carfentrazone-ethyl and the transformation product F8426-ClPAc (α,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoic acid; carfentrazone-ethyl chloropropionic acid). Water and sediment samples were collected through 30 days posttreatment.

Water samples were analyzed for carfentrazone-ethyl and F8426-ClPAc. Aliquots were partitioned with hexane, and an aliquot of the hexane portion was analyzed for parent by GC/µECD or by evaporating the hexane, adding acetonitrile, and analyzing by GC/MSD or LC/MS/MS. The remaining aqueous portion was filtered and analyzed for F8426-ClPAc using LC/MS/MS. The limit of quantification (LOQ) for analytes was 5 ppb, and the limit of detection (LOD) was 1 ppb.

Sediment samples (5 g) were extracted three times with 70% acetone:deionized water (7:3, v:v), centrifuged, and the aqueous portion was partitioned with hexane. The aqueous portion was analyzed for F8426-ClPAc using LC/MS/MS. The hexane extract was passed through a silica solid phase extraction (SPE) cartridge and analyzed for parent by LC/MS/MS or GC/µECD. The LOQ was 5 ppb and LOD was 1 ppb for parent and F8426-ClPAc.

In the water, carfentrazone-ethyl dissipated with a registrant-calculated half-life of 0.3 days (6.2 hours; $r^2 = 0.9323$). The half-life for the total residue of parent and transformation product F8426-ClPAc in the water was 4.5 days ($r^2 = 0.5561$). Carfentrazone-ethyl was a mean concentration of 5.8 ppb at 1 hour, increased to a maximum of 6.5 ppb at 3 hours, and was last detected at 1.8 ppb at 8 hours posttreatment. Mean values are registrant-calculated averages of twelve replicate samples. F8426-ClPAc was a mean concentration of 1.6 ppb at 1 hour, 2.2-4.9 ppb at 3 hours through 1 day am, was a maximum of 6.8 ppb at 1 day pm, varied from 1.2-4.6 ppb at 2-7 days, and was last detected at 2.6 ppb at 7 days posttreatment.

In the sediment, carfentrazone-ethyl was not detected at any sampling interval or location. F8426-ClPAc detected four times at a maximum of 1.9 ppb at 30 days posttreatment. Mean values are registrant-calculated averages of four replicate samples.

Study Acceptability: This study is classified **supplemental** and does not satisfy the guideline requirement for an aquatic field dissipation study because: (i) the application rate was not verified; (ii) the test substance appeared to have been applied at only half the maximum seasonal application rate; (iii) the test substance may have degraded in the tank mix prior to application; and (iv) freezer storage stability data for the parent and transformation product F8426-ClPAc in water and sediment samples were not provided.

MATERIALS AND METHODS

The aquatic field dissipation of carfentrazone-ethyl (ethyl, (RS) -2-chloro-3-[2-chloro-5(4-(difluoromethyl-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl)-4-fluorophenyl]propionate; F8426) formulated as F8426 2 EW Herbicide containing 23.6% a.i. (Lot No. PL03-0008; p. 16) was studied in a pond (0.56 acres, 5 feet deep) located at the Shongaloo Fisheries, Bradford County, Hampton, Florida (Appendix II, p. 88).

Carfentrazone-ethyl (F8426 EW Herbicide) was applied once on September 30, 2003 to one-half of the pond (0.28 acres) at the targeted maximum seasonal application rate of 0.3 lb a.i./surface acre (p. 17; Appendix II, pp. 90, 93). The pond had not been used for fishery production in the current year, was free of surface vegetation, and had no recent history of pesticide application (not further specified). In Spring 2002, glyphosate was applied to the pond banks, and fertilizers were applied to the pond (not further specified; Appendix II, p. 88).

The pond was divided into a treated and an untreated section using a floating rope which served as a guide during application of the test substance (Appendix II, pp. 88, 90-91). The test substance was surface-applied to the pond as evenly as possible using a Spraying Systems Gunjet handgun with one nozzle (#156) loaded on a johnboat that was maneuvered in a series of loops around the treated half of the pond. At the time of application, the air temperature was 67°F, the relative humidity was 66%, wind speed 1 mph, gusting to 4.4 mph, with a cloud cover of *ca.* 20%. Sampling stations were located in the approximate center of each half of the divided pond and marked with floating markers. The water depth at the sampling locations was at least 6 feet. Precipitation was measured on site and compared to the 30-year historical average rainfall (Appendix II, Table 3, p. 95). The onsite precipitation during the study was 166% of the 30-year average (Appendix II, pp. 92, 95).

Water quality was monitored continuously for temperature, pH, conductivity, dissolved oxygen and water depth (p. 18). Secchi disc transparency of the water was measured each day of sampling to measure the limit of visibility. Prior to treatment, sediment samples (*ca.* 1 kg) were collected at each sampling location and a water sample (*ca.* 2 liters) was collected from mid-depth at the pond center for physical characterization (Appendix II, pp. 88-89). A second water sample was collected at the end of the study for comparison. Samples were stored refrigerated (length of storage not specified) and shipped on ice to the laboratory for analysis.

was analyzed for the transformation product, carfentrazone-ethyl chloropropionic acid. The concentration of carfentrazone-ethyl chloropropionic acid in the tank mix was 79-84% (n = 2) of the theoretical application rate prior to and following test application (Table 4, p. 27).

The application rate was not verified. However, analysis of the tank mix showed that the average tank mix concentration was 83% of the theoretical value. The entire tank mix plus two tank rinses were sprayed onto the pond (pp. 22-23).

At each sampling interval, duplicate water and sediment samples were collected from the treated and untreated sampling stations at 1, 3, 6, and 8 hours after application, and in the morning and evening of day 1 and day 2, and at 3, 5, 7, 14, 21, and 30 days after application (p. 18). Duplicate water samples were collected from each of three sampling depths of *ca.* 6 inches, 2 feet, and 5 feet below the water surface (or about 6 inches above the bottom of the pond). Duplicate sediment samples were collected at each sampling station at each sampling interval. All samples were placed on ice during collection, maintained frozen onsite until overnight shipment to the laboratory, and then stored at *ca.* (p. 19). Samples collected after test application were stored frozen for <1 month prior to analysis (Table 6, p. 29).

Water samples were analyzed for carfentrazone-ethyl (ethyl, (RS) -2-chloro-3-[2-chloro-5(4-(difluoromethyl-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl)-4-fluorophenyl]propionate (carfentrazone-ethyl; F8426) and α,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoic acid (carfentrazone-ethyl chloropropionic acid; F8426-ClPa; p. 19; Appendix III, p. 116). Aliquots (2 mL) were partitioned with hexane by vortexing (Figure 1, p. 42; Appendix IV, p. 117). An aliquot of the hexane portion was analyzed for the parent by GC/μECD under the following conditions: J&W DB-5 (5% phenyl methypolysiloxane) column (15 m x 0.539 mm, 1.5 μm) with a micro Ni^{63} electron capture detector using combined gas flows of the carrier He (*ca.* 14 mL/minute) and argon/methane (*ca.* 60 mL/minute; retention time *ca.* 3.4 minutes; Appendix V, p. 119). Another aliquot (1 mL) was evaporated, reconstituted with acetonitrile, and analyzed for the parent by GC/MSD under the following conditions: J&W DB-35MS (35% phenyl methypolysiloxane) column (15 m x 0.253 mm, 0.25 μm) with a mass selective detector in SIM mode using gas flows of the carrier He at *ca.* 1.0 mL/minute (retention time *ca.* 9.6 minutes, m/z = 312; Appendix V, pp. 120-121). Samples were also analyzed for the parent by LC/MS/MS under the following conditions: Zorbax Eclipse XDB-C8 column (150 mm x 4.6 mm, 5 μm packing) gradient solvent system [(A) water, (B) 0.2% acetic acid in acetonitrile, (C) 0.2% acetic acid, (D) methanol, 0-2 minutes 0:0:70:30, 4-8 minutes 0:0:0:100, 14-18 minutes 0:0:70:30], flow rate 0.4 mL/minute (retention time *ca.* 10.9 minutes; Appendix V, p. 122). The remaining aqueous portions were filtered and analyzed for the transformation product F8426-ClPAc using LC/MS/MS under the same conditions as the parent with the following exception to the gradient mobile phase [0 minutes 0:30:70:0, 3-10 minutes 0:95:0:5, 12-17 minutes 0:3:70:0], flow rate 0.4 mL/minute (retention time *ca.* 8.8 minutes; Appendix V, p. 123).

Sediment samples (5 g) were extracted three times with 70% acetone:deionized water (7:3, v:v; 40 mL), centrifuged, the solid pellet discarded, the acetone evaporated to near dryness, and the aqueous portion partitioned with hexane (Figure 1, p. 43; Appendix IV, p. 118). The hexane portion was cleaned with SI SPE cartridge pre-conditioned with 1 cv 10% EtOAc:hexane and 1 cv hexane, washed, and eluted with 10% EtOAc:hexane, evaporated under nitrogen to near dryness and reconstituted with acetonitrile before being analyzed for the parent by GC/μECD or

LC/MS/MS as previously described. The aqueous portion was analyzed for transformation product, F8426-ClPAc using LC/MS/MS as previously described.

The tank mix was analyzed for carfentrazone-ethyl and its transformation product, carfentrazone-ethyl chloropropionic acid in a similar manner as the water samples (p. 19; Figure 1, p. 44). An aliquot (1 mL) of the tank mix was diluted with deionized water (pH 7), partitioned with hexane by vortexing, evaporated to near dryness, reconstituted with acetonitrile and analyzed for the parent by GC/MSD as previously described (Appendix IV, p. 117; Appendix V, p. 121). The remaining aqueous portions were filtered and analyzed for the transformation product, F8426-ClPAc, by LC/MS/MS as previously described (Appendix V, p. 122).

The limit of quantitation (LOQ) for the water and sediment samples was 5 ppb for the parent and transformation product, and the limit of detection (LOD) was 1 ppb (p. 20). An additional experiment was conducted by spiking 10 control water and 10 control sediment samples at the LOD of 1 ppb and analyzing for carfentrazone-ethyl and F8426-ClPAc. Results showed that data between the LOD and the LOQ were reliable and accurate, with recoveries between 89% and 106% for carfentrazone-ethyl and F8426-ClPAc in water and sediment (p. 22; Table 5, p. 28). Method recoveries were established at the LOQ of 5 ppb for water and sediment and at 1, 2, 10, 20 and 25 ppb for water, and 1, 10 and 20 ppb for sediment (p. 21; Table 4, p. 27). In water, the average method recoveries were 106 ± 16% (n = 20) for carfentrazone-ethyl and 92 ± 13% (n = 28) for F8426-ClPAc. In sediment, the average method recoveries were 90 ± 15% (n = 11) for carfentrazone-ethyl and 93 ± 18% (n = 11) for F8426-ClPAc. Method recoveries for the tank mix averaged 82% (n = 2; residue analyzed was not reported).

Field fortifications were prepared using duplicate control water (water collected prior to test material application; 50 mL each) and sediment samples (50 g) spiked with F8426 and F8426-ClPAc at two levels (20 and 10 ppb) on the day of application and at 7 days after application (p. 18). Samples were prepared in plastic-coated amber glass bottles (250 mL) and stored and shipped under the same conditions as the field samples. Water samples were spiked F8426 and F8426-ClPAc prior to treatment and analyzed within 6 days, had recoveries of ranging from 49-66%, and 7-32%, respectively (p. 23; Table 10, p. 36). Recoveries from water samples spiked with carfentrazone-ethyl and F8426-ClPAc at day 7 posttreatment and analyzed within 3 days ranged from 71-92%, and 14-86%, respectively. Recoveries from sediment samples ranged from 71-126% (n = 14), with the exception of two samples at 170% and 176% (p. 23; Table 11, p. 37).

To investigate the low recoveries of the field-fortified water, laboratory fortification of pre-application control water was conducted and samples analyzed after 1, 2, 5, 7 and 12 days after spiking (p. 23). Recoveries of laboratory-fortified samples ranged from 100-148% (n = 19; Table 12, p. 38). A second field fortification experiment was conducted about two months after the study was initiated. A bulk control water sample was collected from a pond adjacent to the treated pond, which had been used to fill the treated pond, and spiked with carfentrazone-ethyl and F8426-ClPAc, each at 10 and 20 ppb, the day after the water collection and 7 days after collection. In addition, a pre-application control water sample was spiked with carfentrazone-ethyl and F8426-ClPAc, each at 10 and 20 ppb, on day 1 and day 7 of the second field fortification experiment (p. 24). Samples were analyzed at 2, 3 or 7 days after spiking and recoveries ranged from 84-127% (Table 13, pp. 39-41).

Water and sediment samples were stored frozen immediately after sampling for no longer than 1 month. Therefore, the study author concluded that a storage stability study was not required (p. 22). Data from a previously reported aquatic field dissipation study showed that F8426-ClPa was stable for 4 months in water (Table 6, p. 29). Information about the storage stability of carfentrazone-ethyl was not reported.

RESULTS/DISCUSSION

Carfentrazone-ethyl ((RS) -2-chloro-3-[2-chloro-5(4-(difluoromethyl-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl)-4-fluorophenyl]propionate; F8426; formulated as F8426 2 EW Herbicide; 23.6% a.i.; Lot No. PL03-0008; p. 16) was surface-applied at the targeted maximum seasonal application rate of 0.3 lb. a.i./surface acre onto a Florida pond (0.56 acres, 5 feet deep) that was free of surface vegetation. In the water, carfentrazone-ethyl dissipated with a registrant-calculated half-life of 0.3 days (6.2 hours; $r^2 = 0.9323$). The total residue of carfentrazone-ethyl plus the transformation product F8426-ClPAc dissipated in the water with a half-life of 4.5 days ($r^2 = 0.5561$; p. 24; Figure 2, pp. 45-46). Carfentrazone-ethyl and F8426-ClPAc were generally not detected in the sediment.

In the water, carfentrazone-ethyl was a mean concentration of 5.8 ppb at 1 hour, increased to a maximum of 6.5 ppb at 3 hours, and was last detected at 1.8 ppb at 8 hours posttreatment (Table 7, pp. 30-32; Figure 2, p. 45). Mean values are registrant-calculated averages of twelve replicate samples. The transformation product, F8426-ClPAc (α,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoic acid; carfentrazone-ethyl chloropropionic acid), was a mean concentration of 1.6 ppb at 1 hour, 2.2-4.9 ppb between 3 hours and 1 day am, was a maximum of 6.8 ppb at 1 day pm, was 1.2-4.6 ppb between 2 days and 7 days, and was last detected at 2.6 ppb at 7 days posttreatment.

Concentration of F8426 and F8426-ClPAc in ppb in water samples.

Time interval (hours and days)	Mean ppb (n = 12)[a]		
	F8426	F8426-ClPAc	Total Residue
Pre-application	ND	ND	ND
1 hour	5.8	1.6	7.3
3 hours	6.5	4.9	11.5
6 hours	4.1	3.1	7.2
8 hours	1.8	3.3	5.0
1 day - am (24 hours)	ND	2.2	2.2
1 day - pm (32 hours)	ND	6.8	6.8
2 days - am (48 hours)	ND	3.2	3.2
2 days - pm (55 hours)	ND	1.2	1.2
3 days (72 hours)	ND	2.8	2.8
5 days (120 hours)	ND	4.6	4.6
7 days (168 hours)	ND	2.6	2.6
14 days (336 hours)	NA	ND	ND
21 days (504 hours)	NA	ND	ND
30 days (720 hours)	NA	ND	ND

Data were obtained from Figure 2, p. 45; Table 7, pp. 30-32 of the study report.

[a] Average of twelve samples results from all sampling depths and both sampling locations. One-half of the LOD (or 0.5 ppb) was used for ND values when averaging.

ND = Not detected; <LOD (1 ppb).

NA = Not analyzed.

In the sediment, F8426 was not detected at any sampling interval or location. F8426-ClPAc detected 4 times above the LOD at a maximum of 1.9 ppb at 30 days posttreatment (Tables 8-9, pp. 33-35). Mean values are registrant-calculated averages of 4 replicate samples.

Concentration of F8426-ClPAc in ppb in sediment samples.*

Time interval (hours and days)	
	F8426-ClPAc
Pre-application	ND
1 hour	1.1
3 hours	ND
6 hours	ND
8 hours	ND
1 day - am (24 hours)	ND
1 day - pm (32 hours)	ND
2 days - am (48 hours)	ND
2 days - pm (55 hours)	ND
3 days (72 hours)	ND
5 days (120 hours)	1.0
7 days (168 hours)	1.0
14 days (336 hours)	ND
21 days (504 hours)	ND
30 days (720 hours)	1.9

Data were obtained from Table 8-9, pp. 33-35 of the study report.
* F8426 was not detected above the LOD at any sampling interval.
a Average of four sample results from both sampling locations.
ND = Not detected; <LOD (1 ppb).

DEFICIENCIES/DEVIATIONS

1. The application rate could not be verified, but was apparently less than the maximum application rate. The test substance, in the form of F8426 Aquatic Herbicide (F8426 2 EW herbicide; purity 23.6%), was applied at the targeted maximum seasonal label application rate of 0.3 lb a.i./surface acre to one-half of the 0.56 acre pond (p. 17; Table 3, p. 26). However, treated and untreated areas of the pond were separated only by a floating rope, so that the treated and untreated areas of the pond were not physically separated. As a result treated water mixed with untreated water throughout the entire 0.56 acre pond (Appendix II, pp. 88-91). The application rate, however, was calculated based on a treated area of 0.28 acres or approximately one-half of the pond area. Therefore, the application rate was approximately half of the application rate reported or 0.15 lb a.i./acre, if the entire pond area is taken into account. Samples collected from treated and untreated areas were averaged together in the results sections (n = 12), further indicating that the treated and untreated areas of the pond were indistinguishable (p. 22; Figure 2, p. 45).

2. Analysis of the tank mix indicated that 0% parent was present, and that the 83% of the test substance was in the form of the transformation product, F8426-ClPAc (Table 4, p. 27). The study author did not explain the lack of parent compound in the tank mix. These results may indicate that the parent was not stable in the tank mix and may have degraded at the time of application.

3. Storage stability data were not provided for treated water and sediment samples. The study author concluded that storage stability data were not required for the test water and soil samples, since they were stored for <1 month prior to analysis, and based on results of a previous storage stability data from another aquatic dissipation study, in which the transformation product F8426-ClPAc was stable in water for 4 months (p. 14; Table 6, p. 29). The data for the referenced study were not provided for review. For the present study, storage stability data should have been provided for water and sediment samples fortified with parent or F8426-C1PAc and stored for the longest interval that the field water and soil samples were stored frozen prior to analysis, which was <1 month.

4. The study author did not provide an explanation for the low recoveries obtained for field-fortified water samples collected on the day of application and 7 days after application, and analyzed about 6 days after spiking with parent or F8426-ClPAc. Recoveries for field-fortified water samples from pre-application were only 49-66% for those spiked with parent compound, and 7-32% for water samples spiked with F8426-ClPAc (Table 10, p. 36). Recoveries for field-fortified water samples collected on day 7 were 71-92% for those spiked with parent compound, and 14-86% for samples spiked with F8426-ClPAc.

5. Water quality was monitored continuously for temperature, pH, conductivity, dissolved oxygen content, and water depth except from September 30-October 3, 2003 when the monitoring device failed and a new device was installed (p. 18).

6. The following physiochemical properties of carfentrazone-ethyl were reported: pH 5.8 (in 1% aqueous suspension), density 1.423 g/cm^3 at 25°C, water solubility 42 μg/mL at 25°C, soluble in acetone, ethanol, ethyl acetate and methylene chloride at 25°C, vapor pressure 1.2 x 10^{-7} mm Hg at 25°C, and octanol/water partition coefficient (log K_{ow}) 3.36 (Table 2, p. 26).

7. The expected concentration of test substance in the entire pond was 11.4 ppb, and that the actual average water residue concentration at 3 hours posttreatment was 11.5 ppb, as reported by the study author (p. 23).

8. Recovery data for water and soil samples from the first and second fortification experiments are summarized in Tables 10, 11, and 13 of the study report (pp. 36, 37, and 39-41, respectively), and are included as Attachment 1 of this DER.

ATTACHMENT 1
Tables cited in DER

THE FOLLOWING ATTACHMENT IS NOT AVAILABLE ELECTRONICALLY
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Table 10 – Recovery Data for Field Fortifications (Events 1 and 2) - Water

Sample ID Number[a,b]	Spike Level (ppb)	F8426 (ppb)	F8426-ClPAc (ppb)	Total (ppb)	% Recovered
Water					
Pre-Application					
FW-1	20	7.9	2.9	10.8	54
FW-2	20	9.8	3.4	13.2	66
FW-3	10	3.6	1.3	4.9	49
FW-4	10	4.1	1.5	5.6	56
Mean ± Std dev					**56 ± 7**
FW-5	20	NA[c]	6.3	6.3	32
FW-6	20	NA	1.3	1.3	7
FW-7	10	NA	2.2	2.2	22
FW-8	10	NA	3.1	3.1	31
Mean ± Std dev					**23 ± 12**
7 days Post-application					
FW-9	20	15.6	0	15.6	78
FW-10	20	14.1	0	14.1	71
FW-11	10	9.2	0	9.2	92
FW-12	10	8.8	0	8.8	88
Mean ± Std dev					**82 ± 10**
FW-13	20	NA	4.0	4.0	20
FW-14	20	NA	2.8	2.8	14
FW-15	10	NA	8.6	8.6	86
FW-16	10	NA	2.8	2.8	28
Mean ± Std dev					**37 ± 33**
Overall Mean					**49**
Std dev ±					**28**
n = 16					
Range					**7-92**

[a] FW-1-4 and FW-9-12 were spiked with F8426 and analyzed for parent and F8426-ClPAc (F8426-ClPAc was reported as parent equivalents to determine the recovery). The other samples were spiked with F8426-ClPAc.

[b] FW-1-8 were analyzed about 6 days after spiking and FW-9-16 were analyzed 3 days after spiking.

[c] NA = not applicable

Table 11 – Recovery Data for Field Fortifications (Events 1 and 2) - Sediment

Sample ID Number[a]	Spike Level (ppb)	F8426 (ppb)	F8426-ClPAc (ppb)	Total (ppb)	% Recovered
Sediment					
Pre-Application					
FS-1	20	1.1	14.7	15.8	79
FS-2	20	1.1	15.1	16.2	81
FS-3	10	0	9.6	9.6	96
FS-4	10	0	9.3	9.3	93
Mean ± Std dev					**87 ± 9**
FS-5	20	NA[b]	16.3	16.3	82
FS-6	20	NA	15.7	15.7	79
FS-7	10	NA	10.0	10.0	100
FS-8	10	NA	9.3	9.3	93
Mean ± Std dev					**88 ± 10**
7 days Post-application					
FS-9	20	6.9	18.3	25.2	126
FS-10	20	8.2	27.1	35.3	176
FS-11	10	3.9	13.0	17.0	170
FS-12	10	0	11.6	11.6	116
Mean ± Std dev					**147 ± 30**
FS-13	20	NA	19.3	19.3	97
FS-14	20	NA	19.7	19.7	99
FS-15	10	NA	11.6	11.6	116
FS-16	10	NA	7.1	7.1	71
Mean ± Std dev					**95 ± 19**
Overall Mean					**104**
Std dev ±					**31**
n = 16					
Range					**71-176**

[a] FS-1-4 and FS-9-12 were spiked with F8426 and analyzed for parent and F8426-ClPAc (F8426-ClPAc was reported as parent equivalents to determine the recovery). The other samples were spiked with F8426-ClPAc. The samples were analyzed 20 days after spiking.

[b] NA = not applicable

Table 13 – Recovery Data for Field Fortifications (Events 3 and 4) - Water

Sample ID Number[a,b]	Spike Level (ppb)	F8426 (ppb)	F8426-ClPAc (ppb)	Total (ppb)	% Recovered
Water					
FW-17	20	12.8	5.1	17.9	89
FW-18	20	13.7	5.0	18.7	93
FW-19	10	7.4	2.5	9.9	99
FW-20	10	7.0	3.2	10.2	102
Mean ± Std dev					**96 ± 6**
FW-21	20	NA[c]	20.3	20.3	102
FW-22	20	NA	20.1	20.1	100
FW-23	10	NA	12.4	12.4	124
FW-24	10	NA	12.6	12.6	126
Mean ± Std dev					**113 ± 14**
FW-25	20	18.7	2.0	20.7	103
FW-26	20	20.9	2.3	23.2	116
FW-27	10	11.6	0	11.6	116
FW-28	10	11.1	1.1	12.2	122
Mean ± Std dev					**114 ± 8**
FW-29	20	NA	20.0	20.0	100
FW-30	20	NA	20.2	20.2	101
FW-31	10	NA	11.5	11.5	115
FW-32	10	NA	11.7	11.7	117
Mean ± Std dev					**108 ± 9**

[a] FW-17-20 and FW-25-28 were spiked with F8426 and analyzed for parent and F8426-ClPAc (F8426-ClPAc was reported as parent equivalents to determine the recovery). The other samples were spiked with F8426-ClPAc.

[b] FW-17-32 were analyzed 2 days after spiking.

[c] NA - not applicable.

Table 13 – Recovery Data for Field Fortifications (Events 3 and 4) -Water (continued)

Sample ID Number[a,b,c]	Spike Level (ppb)	F8426 (ppb)	F8426-ClPAc (ppb)	Total (ppb)	% Recovered
FW-33	20	13.8	7.1	20.9	104
FW-34	20	13.8	5.9	19.7	98
FW-35	10	7.6	2.2	9.8	98
FW-36	10	6.9	3.0	9.9	99
Mean ± Std dev					**100 ± 3**
FW-37	20	NA[d]	21.6	21.6	108
FW-38	20	NA	21.0	21.0	105
FW-39	10	NA	11.4	11.4	114
FW-40	10	NA	12.1	12.1	121
Mean ± Std dev					**112 ± 7**
FW-41	20	14.8	5.2	20.0	100
FW-42	20	13.6	3.8	17.3	87
FW-43	10	6.5	1.8	8.4	84
FW-44	10	7.3	2.7	10.0	100
Mean ± Std dev					**93 ± 9**
FW-45	20	NA	21.8	21.8	109
FW-46	20	NA	23.3	23.3	116
FW-47	10	NA	12.4	12.4	124
FW-48	10	NA	12.7	12.7	127
Mean ± Std dev					**119 ± 8**

[a] FW-33-40 were spiked with newly-collected control pond water about two months after the initiation of the study. Samples FW-33-48 were analyzed 3 days after spiking.

[b] FW-41-48 were spiked about two months after the initiation of the study with the control water collected prior to application.

[c] FW-33-36 and FW-41-44 were spiked with F8426 and analyzed for parent and F8426-ClPAc (F8426-ClPAc was reported as parent equivalents to determine the recovery). All other samples were spiked with F8426-ClPAc.

[d] NA - not applicable.

Table 13 – Recovery Data for Field Fortifications (Events 3 and 4) - Water (continued)

Sample ID Number[a,b]	Spike Level (ppb)	F8426 (ppb)	F8426-ClPAc (ppb)	Total (ppb)	% Recovered
FW-49	20	12.7	6.4	19.1	96
FW-50	20	12.4	5.7	18.1	90
FW-51	10	5.9	3.8	9.8	98
FW-52	10	7.4	2.0	9.4	94
Mean ± Std dev					**94 ± 3**
FW-53	20	NA[c]	20.7	NA	104
FW-54	20	NA	20.3	NA	102
FW-55	10	NA	11.8	NA	118
FW-56	10	NA	11.6	NA	116
Mean ± Std dev					**110 ± 8**
Overall Mean ± Std dev (FW-17-56)					**106 ± 11**
n = 40					
Range					**84-127**

a FW-49-56 were spiked with newly collected control pond water about two months after the initiation of the study. Samples FW-49-56 were analyzed 7 days after spiking.

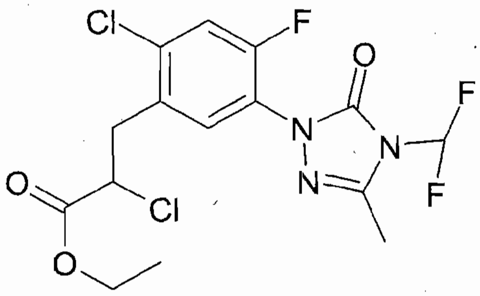
b FW-49-52 were spiked with F8426 and analyzed for parent and F8426-ClPAc (F8426-ClPAc was reported as parent equivalents to determine the recovery). All other samples were spiked with F8426-ClPAc.

c NA – not applicable.

ATTACHMENT 2
Structures of Parent and Transformation Products

Carfentrazone-ethyl (F8426)

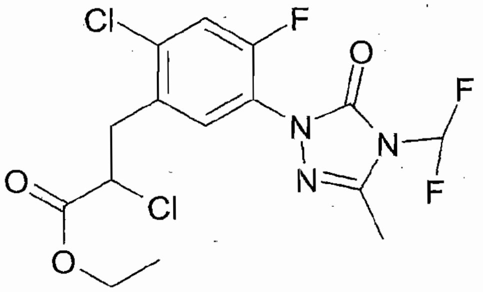
IUPAC name:	Ethyl (RS)-2-chloro-3-[2-chloro-5(4-(difluoromethyl-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl)-4-fluorophenyl]propionate.
CAS name:	Ethyl α,2-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoate.
CAS No:	128639-02-1.
SMILES string:	O=C(C(Cc1c(cc(c(c1)N1N=C(N(C1=O)C(F)F)C)F)Cl)Cl)OCC.



Identified compounds

Carfentrazone-ethyl (F8426)

IUPAC name:	Ethyl (RS)-2-chloro-3-[2-chloro-5(4-(difluoromethyl-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl)-4-fluorophenyl]propionate.
CAS name:	Ethyl α,2-Dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoate.
CAS No:	128639-02-1.
SMILES string:	O=C(C(Cc1c(cc(c(c1)N1N=C(N(C1=O)C(F)F)C)F)Cl)Cl)OCC.



Carfentrazone (F8426-chloropropionic acid or F8426-ClPAc)

IUPAC name:	(RS)-2-chloro-3-{2-chloro-5-[4-difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl]-4-fluorophenyl}propionic acid.
CAS name:	α,2-Dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoic acid.
CAS No:	128621-72-7.
SMILES string:	ClC(Cc1c(cc(c(c1)N1N=C(N(C1=O)C(F)F)C)F)Cl)C(=O)O.