

161-1 Hydrolysis

Radiolabeled fomesafen, at a nominal concentration of 0.25 µg a.i./ml, was stable in HCL (pH=3) solution and NaOH (pH=11) solution in the dark at 40°C for 31 days (Accession No. 071059). The minor degradation product 5-[2-chloro-4-trifluoromethylphenoxy]-2-nitrobenzoic acid (Compound II) was detected in the acidic solution.

161-2 Photodegradation in Water

Radiolabeled fomesafen, at a nominal concentration of 0.2 µg a.i./ml, had a first-order half-life of 49 days in unbuffered distilled water when irradiated with natural sunlight in England. Fomesafen was stable in the dark controls (Accession No. 071059).

No transformation products were identified except for unidentified polar degradation products (24.5% of applied radioactivity) and non-polar degradation products (11.1% of applied radioactivity).

Radiolabeled fomesafen, at a concentration of 0.10 mg a.i./L, had a first-order half-life of 144.4 days (continuous light) or 289 days (12 hour photoperiod) in pH 7 buffer solution when irradiated with UV-filtered xenon lamp for 14 days (MRID 40451101). Fomesafen was stable in the dark controls. No degradation products were identified in the study.

161-3 Photodegradation on Soil Surfaces

Radiolabeled fomesafen in the nitrophenyl and halophenyl moieties, at 500 g ai /ha, had a photodegradation half-life of 66 days in coarse sandy loam soil irradiated under natural sunlight and temperature (8.1 to 21.8°C). No degradation was detected in the dark control. Identified minor phototransformation products included 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy)-N-methylsulphonylanthranilamide (fomesafen amine), 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy)-2-nitrobenzoic acid (fomesafen acid), and 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy)-2-nitrobenzamide. Unidentified non-polar compounds accounted for a maximum of 14% of applied radioactivity.

162-1 Degradation in Soil

Radiolabeled fomesafen, at 1 kg a.i./ha, had first order half-lives of 9 weeks ($r^2=0.8254$) in 18 Acre sandy loam, 26.8 weeks ($r^2=0.9549$) in Frensham loamy sand, and 49.9 weeks ($r^2=0.8919$) in Gore silty clay loam when incubated at 25°C at 40% soil water holding capacity (Accession No. 071059). No degradation products except CO₂ were identified.

Radiolabeled fomesafen, at 0.5 kg a.i./ha, had first order half-lives of 99 weeks ($r^2=0.9163$) in 18 Acre sandy loam, 90.0 weeks ($r^2=0.8882$) in Frensham loamy sand, 75.3 weeks ($r^2=0.9944$) in Gore silty clay loam, and 29.7 weeks ($r^2=0.9476$) in a Wisborough silty clay loam when incubated at 20°C at 40% soil water holding capacity (MRID 00135660). Minor degradation products were identified as 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy)-2-nitrobenzoic acid and CO₂.

162-2 Anaerobic Soil Metabolism

Radiolabeled fomesafen, at 3.56 µg/g, in sand loam soil was incubated under aerobic condition for 30 days followed by incubation under anaerobic conditions for 29 days. Fomesafen and its metabolites had a half-life < 20 days in anaerobic soils (MRID

41181001). During aerobic incubation, fomesafen declined to 75% of the applied radioactivity. Anaerobic degradation accounted for degradation to 20 to 28% of applied radioactivity. Anaerobic degradation products were identified as the fomesafen amine and fomesafen amino acid.

162-4 Aerobic Aquatic Metabolism

Radiolabeled fomesafen, at 1 kg a.i./ha, had a DT₅₀ of < 7 days in 18 Acre sandy loam soil when incubated under aerobic conditions at 25°C at 40% soil water holding capacity for 3 weeks followed by flood conditions for 18 weeks (Accession No. 071059). No total system half-lives could be determined. No degradation products except CO₂ were identified.

Radiolabeled fomesafen, at 0.5 kg a.i./ha, had a first-order half-life of 8.7 weeks in 18 Acre sandy loam soil, 19.9 weeks in Frensham loamy sand soil, 13.2 weeks in Gore Hill calcareous clay loam soil, and 16.5 weeks in Wisborough Green silty clay loam soil when incubated under flooded conditions at 20°C for 52 weeks (Accession No. 72158 and 259413). The major degradation product was identified as 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy)-N-methylsulphonylanthranilamide (fomesafen amine). Minor degradation products were identified as 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy)-2-nitrobenzoic acid (fomesafen acid), 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy) anthranilic acid (fomesafen amino acid) and CO₂ were identified.

Radiolabeled fomesafen, at 0.5 kg a.i./ha, had a first-order half-life of 8.7 weeks in 18 Acre sandy loam soil, 19.9 weeks in Frensham loamy sand soil, 13.2 weeks in Gore Hill calcareous clay loam soil, and 16.5 weeks in Wisborough Green silty clay loam soil when incubated under flooded conditions at 20°C for 52 weeks (MRID 40327301). Major degradation products were identified as 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy)-N-ethylsulphonylanthranilamide (fomesafen amine). Minor degradation products were identified as 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy)-2-nitrobenzoic acid (fomesafen acid), 5-(2-chloro- α,α,α -trifluoro-p-tolyloxy) anthranilic acid (fomesafen amino acid) and CO₂ were identified.

A study was conducted to assess whether fomesafen Schiff's base was a metabolite of fomesafen or an artifact of the analytical method. Radiolabeled fomesafen, at 1.8 μ g/g (5 kg a.i./ha) had a DT₅₀ of < 7 days ($t_{1/2}$ = 4.4 days) in 18 Acres sandy loam soil when incubated under flooded conditions at 20°C for 31 days. Additionally, other treatments included : 1.) soil treated with extraction solvent [acetonitrile and HCl] and unlabeled fomesafen amine; 2.) soil treated with unlabeled fomesafen prior to conventional extraction acetonitrile and HCl; and soil treated with acetonitrile:HCl with radiolabeled (C¹³) formaldehyde for MS analysis. The study found that fomesafen degrades to the fomesafen amine in flooded soils. However, the formation of Schiff's base (interaction of amines with formaldehyde) was solely due to an artifact in the extraction procedure. The registrant recommends an amine addition to limit the formation of Schiff's base during soil extraction.

Radiolabeled fomesafen, at 1 kg a.i./ha, had first-order a half-life in soil of 4.2 weeks in 18 Acre sandy loam soil and 6.1 weeks in Frensham loamy sand soil when incubated under flooded conditions for 18 weeks (Accession No. 071059). No degradation products except CO₂ were identified.

163-1 Batch Equilibrium and Soil Column Leaching

Radiolabeled fomesafen, at a nominal concentrations of 10 to 50 mg a.i./kg soil, had simple K_d soil-water partitioning coefficients of 0.68 in a Blount silt loam, 1.91 in a Bryce silty clay loam, 0.51 in a Dickenson loamy coarse sand, 1.51 in a Drummer silty clay loam, 1.00 in a Flanagan silt loam, 0.93 in a Norfolk coarse sandy loam, 0.38 in a Onarga coarse sand, 0.88 in a Peotone silty clay loam, 1.04 in a Plano silt loam, 1.30 in a Terrarosa sandy clay, 1.51 in a Brazilian 1B sandy clay loam, and 2.45 in a Peartree sandy clay loam (Accession No. 259413).

Radiolabeled fomesafen, at 3 mg a.i./kg, in sandy clay soil and sandy loam soil was incubated under anaerobic conditions in the dark at 20°C for 47 days (MRID 40361703). Subsamples of the incubated soil were further incubated under anaerobic conditions for 35 days to facilitate formation of the fomesafen amine. Following incubation, soil samples were placed on top of replicated soil columns and then leached with 0.01 M CaCl₂ solution. Major degradation products in the aged soil samples of fomesafen were fomesafen amine and fomesafen amino acid. Minor degradation products were fomesafen nitro acid and fomesafen Schiff's base. The majority of radiolabeled residues (92 to 96.4%) were detected in the 0-5 cm section of soil. Radioactivity in leachate samples accounted for 0.05% to 0.06% of applied radioactivity.

Radiolabeled fomesafen, at 0.5 kg a.i./ha, in a German and three UK soils were incubated under aerobic conditions for 3 weeks at 20°C (Accession No. 150555). After incubation, each incubated soil was placed on top of seven packed soil columns per soil type. Soil columns were leached with 30 ml aliquots of 0.01 M CaCl₂ solution for a total of 9 weeks (equivalent of 661 mm of rain). Radiolabeled fomesafen residues were detected throughout the soil columns. Leachate samples generally contained less than < 0.3% of applied radioactivity with the exception of one sample with 15 to 17% of applied radioactivity in a coarse sand soil.

Time dependent partitioning of radiolabeled fomesafen, at 0.2 µg/g, was determined in sand loam and silty clay soil slurries during a 16 week equilibration under two different conduction: 1.) soil slurries were incubated at 20°C in darkness and 2.) soils slurries subjected to successive wetting/drying cycles (MRID 45048207). Time dependent soil-water partition (K_d) coefficients at 20°C were: 0.77 at time 0 and 1.09 to 2.31 during the 16 week equilibration period in a sandy loam soil ; and 2.84 at time 0 and 4.72 to 7.75 during the 16 week equilibration period in a silty clay loam. Time dependent soil water partition (K_d) coefficients in successive wetting/drying cycles were: 1.15 at time 0 and 1.46 to 2.05 during a 16 week equilibration period in sandy loam soil; and, 4.85 at time 0 and 5.79 to 7.59 during a 16 week equilibration period in silty clay soil.

The mobility of radiolabeled fomesafen, at 2 kg/ha, was evaluated using thin layer chromatography (TLC) for 13 soils from the United States, Brazil, and United Kingdom (Accession No. 071059; MRID 00110509). Atrazine was used as a reference standard for assessing mobility in 0.01 M CaCl₂ eluent. Fomesafen was as mobile to twice as mobile as atrazine in US and UK soils. However, fomesafen was less mobile than atrazine in soils from Brazil. The researchers believe the low mobility of fomesafen in Brazilian soils is due the presence of Fe oxides.

164-1 Field Dissipation

Fomesafen, applied at 0.56 kg a.i./ha (0.5 lbs a.i./A), had field dissipation half-lives of 80.6 days in the NC, 133 days in IL and 55.5 days in MS (MRID 40644401). Fomesafen amine was detected in surface soil (0-5 cm) at concentrations of 0.01 mg/kg in the NC and IL field sites. Fomesafen was detected to a soil depth of 40 cm in NC, 30 cm in IL, and 60-70 cm in MS.

Radiolabeled fomesafen, applied at 0.28, dissipated with a half-life of 8 to 16 weeks in a MS silt loam soil (MRID 40327308). Radiolabeled residues were predominately detected in the surface soil (0-7 inches); however, radiolabeled residues were detected as deep as 19 to 22 inches. Parent fomesafen comprised 23.5% of the residues in the surface soil. Degradation products of fomesafen were identified as fomesafen amine (3.2% of applied), fomesafen nitro acid (0.8% of applied), and fomesafen amino acid (1.1% of applied).

Following the application of fomesafen (REFLEX, 2 lb ai/gal, SC/L) at 0.25 or 0.5 lb ai/A to soybeans, fomesafen dissipated from the surface 6 inches of soil with half-lives of approximately 50 days in silty clay loam (AR, LA, MO), silt loam (AR, LA, MO, IL), clay (AR, TX), loam (IN) soils, and approximately 50 to 150 days in silty clay loam (LA, MO), silt loam (AR, AL, LA, IL), clay (AR), clay loam (MS), silty clay (MS), sandy clay loam (IN), and sandy loam (MI) soils (MRID 40327302, 40327303, 40327304). At the NC site (loam soil), the half-life of fomesafen residues ranged from 337 to 385 days in 1985 and < 56 days in 1983. Fomesafen residues were ≤ 0.08 ppm at soil depths of 6 to 12 inches.

Reviewer Comment- Data are deemed unacceptable because the analytical method was not provided for 15 of the 22 sites (MRID 40327305, 40327306, 40327307). Also, there were insufficient sampling protocol to establish a clear pattern of decline and at 4 sites the data were too variable to assess dissipation. The reviewer is reporting these data as ancillary information on relative rates of fomesafen dissipation in the United States.

Following the application of fomesafen (formulation unspecified) at 0.5 lbs ai/A to soybeans, fomesafen residues dissipated from the upper 2 inches of soil with half-lives of < 30 days in GA sand and AR silt loam soils, 50-91 days in IL silt loam soil, 120 –265 days in LA silty clay loam soils, and < 126 days loamy sand (NC, AL, and LA), sandy loams (IA and NC), silt loam (KY, IN, IL, MO, MS), clay loam (IA), clay (NC). Half-lives could not be estimated from sites in Geneseo, IL; Hills, MN; Sioux Falls, SD; and Thomastown, LA because the data were too variable. After 232 to 342 days, fomesafen

residues were predominately detected in the surface soil (0-6 inch) samples. Fomesafen residues were detected to a depth of 20 to 30 inches.

Fomesafen residues dissipated from the 0-to-6 inch depth of fallow field plots located in Goldsboro, NC, Vicksburg, MS, Champaign, IL and White Health, IL treated with fomesafen at 1.0 lb ai/A with half-lives of < 42 days, <33 days, and <22 days, respectively (Accession No. 259413). Residues were ≤ 0.04 ppm at soil depths of 6 to 24 inches at any sampling interval.

165-4 Bioaccumulation in Fish

Radiolabeled fomesafen, at exposure nominal concentrations of 1 mg/L, had a bioconcentration factor of 0.7 for whole fish, 0.2 for edible tissue, and 5.2 for nonedible tissue after a 14 day exposure period (MRID 00150555). After a 14 day depuration period, total radiolabeled residues in fish tissues decreased by 95% of the 7 day accumulation concentrations. Residues in fish tissues were not identified.

166-1 Prospective Ground Water Monitoring Study

Fomesafen, applied at 0.5 lb a.i./A, had a field dissipation half-life of 32.4 days from surface soils (0-4 inches) in an agricultural field of Kenansville loamy sand cropped with soybeans in Wayne County, NC (MRID 42247001). One route of dissipation for fomesafen was leaching. Fomesafen movement through soil was detected from suction lysimeters; fomesafen was detected in soil pore water at 2 months at 17 ug/L and at 1 ug/L in the 6-ft and 9-ft lysimeters at 3 months and 4 months, respectively. Maximum concentrations of fomesafen in suction lysimeters were 33 ug/L (3 months posttreatment), 12 ug/L (7 months), and 5 ug/L (8, 10, 11, and 12 months). The shallow wells were dry during the study. Fomesafen was detected at 1 ug/L in the medium and deep-depth monitoring wells.