Appendix B

Supplemental Fate Information

Environmental Fate and Transport Studies

Degradation

Hydrolysis (161-1)

Guideline study data suggest oxyfluorfen is resistant to hydrolysis. In a hydrolysis study, a concentration of 0.05 ppm oxyfluorfen was stable in aqueous buffered pH 4, 7, and 10 solutions, since >97% of the radioactivity present after 30 days was parent oxyfluorfen. Other than parent, the only compound detected was RH-34670 [(2-chloro-1-(3-hydroxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene] at 1.2-1.7% of the applied radioactivity. MRID 134454.

Photodegradation in water (161-2)

A guideline study showed that oxyfluorfen in water degrades fairly rapidly in the presence of light. In an aqueous photolysis study, ^{14}C-labeled oxyfluorfen added to sterile aqueous solution (0.01M sodium phosphate buffer) at approximately 1 ppm and irradiated with natural sunlight, photodegraded with half-lives of 6.2 and 7.5 days for the nitrophenyl ring-labeled and the chlorophenyl ring-labeled, respectively. Volatile compounds accounted for <2% of the applied radioactivity. Although there were numerous compounds observed in the TLC plates, oxyfluorfen and the MW-332 degradate [2-chloro-1-(3-ethoxy-4-hydroxyphenol)-4-(trifluoromethyl) benzene] were the only single components present in concentrations $\geq$10% of the applied radioactivity. MRID 421291-01.

In another aqueous photolysis study, ^{14}C-labeled oxyfluorfen dosed at a concentration of approximately 1 ppm in sterile pH 7 aqueous buffer solution (1% acetonitrile) and irradiated with 12 hours light/dark with a xenon arc lamp at 25 $\pm$ 1 ^{o}C for 30 days, photodegraded with half-lives of 3.7 to 5.4 days, for the chlorophenyl ring-labeled and the nitrophenyl ring-labeled, respectively. In contrast, 94% of the radioactivity was identified as [^{14}C]oxyfluorfen, in the dark controls, after 30 days. MRID 421423-07.

Photodegradation on soil (161-3)

A guideline study showed oxyfluorfen (nitrophenyl and chlorophenyl ring- labeled) on a soil surface photodegraded with a half-life of 28 days; with little degradation occurring in the dark controls. After 30 days, approximately 41-46% of the applied oxyfluorfen remained. Carbon dioxide accounted for 4.0-8.1% of the applied radioactivity after 30 days; while individual degradates in extracts and unextractable radioactivity (soil bound residues) were $\leq$10.0% of the applied radioactivity. MRID 419999-01.

Aerobic soil (162-1)

Guideline study results suggest that oxyfluorfen is resistant to aerobic degradation on soil. Nitrophenyl ring-labeled and chlorophenyl ring-labeled [^{14}C]oxyfluorfen added to

soil at 8.83-9.64 ppm concentration degraded with half-lives of 556 and 596 days in a sandy loam soil and 291 and 294 days in a clay loam soil. The minor degradate, RH-34800, was identified in the extracts from the clay loam soil treated with the chlorophenyl ring-labeled compound. Parent oxyfluorfen was 44-64% of applied by the end of the study. Soil bound residues accounted for up to 43% of applied radioactivity and CO_2 was up to 5% of applied. MRID 421423-09.

In another study, the biotransformation of [chlorophenyl ring-U-14C]-labeled oxyfluorfen (RH-2915) was studied in three European soils for 120 days under aerobic conditions in the dark at 20±1°C and 40% of the maximum water holding capacity. [^{14}C]oxyfluorfen decreased from 96.2-97.4% of the applied at time 0 to 49.3-51.0% at 61 days posttreatment, and 29.4-34.1% at 120 days. The parent dissipated with half-lives of 77.0 days in the Weide sandy loam soil, 68.0 days in the Karolinenhof loamy sand/sandy loam soil, and 69.3 days in the Senozan clay loam soil. The total nonextractable [14C]residues ranged from 37.3% to 45.4% at 120 days, an additional 0.7-8.1% of the applied was released via harsh extraction. Fractionation of the nonextracted residues in the 120-day harsh-extracted soil (32.1-37.7% of the applied) determined that an average 4.7-16.4%, 2.8-8.3%, and 17.5-24.8% of the applied was associated with fulvic acids, humic acids, and humin, respectively. No major transformation products were isolated from any of the test soils at any time during the study. Eight minor transformation products (M1, M3, M4, M5, M6, M7, M8, M9) were isolated in each soil, these compounds were not identified. Each compound was ≤2.1% of the applied at all sampling intervals, with the exception of M1 at 5.8% of the applied at 9 days posttreatment in the Weide sandy loam soil. At 120 days posttreatment, CO_2 and volatile organics from the three soils totaled averages of 18.0-21.0% and 2.3-2.4% of the applied, respectively. MRID 463731-03.

Anaerobic soil metabolism (162-2)

In the guideline study oxyfluorfen was highly persistent in anaerobic soil. Nitrophenyl ring-labeled [^{14}C]oxyfluorfen (uniformly labeled; radiochemical purity >93%), at 8.83 ppm, and chlorophenyl ring-labeled [^{14}C]oxyfluorfen (uniformly labeled; radiochemical purity 96%), at 9.46 ppm, degraded with half-lives of 603 and 554 days, respectively, in sandy loam soil that was incubated in the dark under aerobic conditions for 30 days and under anaerobic conditions (flooding plus nitrogen atmosphere) for 60 days at 25 ± 1°C. After 60 days under anaerobic conditions, 82% of the applied was extractable parent. Soil bound residues (unextractable residues) were 6.8-12.4% of applied during the anaerobic phase; while organic volatiles and CO_2 were <1%. MRID 421423-10.

Aerobic aquatic metabolism (162-4)

The aerobic biotransformation of [chlorophenyl-U-^{14}C]-labeled oxyfluorfen was studied in a river water/sandy loam sediment system (water pH 8.24; sediment pH 7.47, organic carbon 1.1%) and in a pond water/silt loam sediment system (water pH 8.08; sediment pH 7.17, organic carbon 2.5%) each from Switzerland for 100 days in dark at 20±2°C. The pH of the river water averaged 8.27±0.21 and of the pond water averaged 8.15±0.11.

During the study, redox potentials in the river water ranged from 172 to 220mV and in the sediment ranged from -98 to -161 mV. During the study, redox potentials in the pond water ranged from 157 to 322 mV and in the sediment ranged from -73 to -151 mV.

Oxyfluorfen dissipated with a half-life of 39.6 days in the total river system and 30 days in the total pond system. In the river system, oxyfluorfen dissipated with a half-life of 4.7 days in the water and 50.6 days in the sediment. In the pond system, oxyfluorfen dissipated with a half-life of 3.9 days in the water and 31.5 days in the sediment. Nonextractable [^{14}C]residues increased to a maximum average of 45.6% of the applied at 100 days posttreatment in the river sediment and 59.3% in the pond sediment. Harsh extraction of the 100-day extracted sediment released an additional 6.8-7.1% of the applied from the river sediment and 15.5-17.2% of the applied from the pond sediment. At study termination (100 days), $^{14}CO_2$ and volatile organic [^{14}C]residues totaled an average 9.0-9.4% and 0.5-0.8% of the applied, respectively. The study indicates that oxyfluorfen applied to water dissipates rapidly from water column by mineralization to CO_2 and minor transformation products and by sorption into the organic matter of the sediment. MRID 463731-04.

Mobility

Leaching/adsorption/desorption (163-1)

Oxyfluorfen is relatively immobile in soils with significant organic content. In an unaged column leaching study, oxyfluorfen did not leach below four inches in any soil, except sand, where traces were found at nine inches. The majority of the radioactivity was detected in the 0-2 inch soil depth. In an aged column leaching study, between 1.35 and 1.85% of the radioactivity was detected in the leachate. Greater than 82% of the radioactivity was detected in the top two inches of soil, indicating slight mobility. TLC analysis of the methanol extractable residues was shown to be all parent compound. Approximately 15% of the radioactivity was unaccounted for and was attributed, by the study author, to volatilization, which is a doubtful conclusion given the low vapor pressure (2×10^{-7} Torr) of the compound. MRID 110728.

The leaching data from a batch equilibrium study indicate that according to FAO mobility classification oxyfluorfen is slightly mobile in sandy soils, sandy loam soils, and clay loam soils, and hardly mobile in silty clay loam soils (K_d's = 8.5, 62, 99, 228). It shows that the compound has a strong affinity for soils with small particle size (*i.e.*, large surface area) and high organic matter content. The study was not acceptable because the effect of chemical binding to the Teflon tube on the K_d values was not discussed, the tested concentration range was too narrow, and the equilibration temperature was not reported. A preliminary study showed that an average of 95%of the oxyfluorfen adhered to empty polyethylene tubes, 61% adhered to polycarbonate tubes, and the least amount, 48%, adhered to Teflon. In addition, at the completion of the study, the material balance for the sand soil averaged only 73% (101% for the sandy loam soil, 96% for the clay loam soil, and 84% for the silty clay loam soil). MRID 421423-11.

EFED does not believe that any further leaching/adsorption/desorption studies are needed at the present time, since previous acceptable leaching/adsorption/desorption studies (MRID 110728, 134454, 134457) generally confirm the results presented in this study. Therefore, the leaching/adsorption/desorption study (Subdivision N Guideline 163-1) is satisfied.

Field Dissipation

Guideline terrestrial field dissipation data indicate that the compound and its metabolites are moderately persistent. However, the route of dissipation was not identified. Oxyfluorfen dissipated from bare ground loamy sand and clay loam soil plots in CA with half-lives of 53 and 58 days, respectively. The half-lives for the degradates RH-4672, RH-0671, and RH-2382 varied from 37 to 61 days. EFED notes that it is difficult to obtain accurate half-lives for degradates since they are being produced from the parent while being degraded to other compounds. MRID 438401-01.

Two published studies reporting oxyfluorfen persistence in different soils showed a larger range of dissipation rates than the guideline studies. The field half life of oxyfluorfen applied to muck soils in Canada used for growing onions ranged from 30 to 103 days (Frank *et al.* 1991). Increased persistence over winter months was noted in the study (no measurable dissipation) suggesting persistence may be increased in colder climates. Consistent with available information on leaching, the study also stated no residues were found in tile drain water; however, the detection limit and method of analysis for water samples were not described. Ying and Williams (2000) reported a longer field dissipation half life (119 days) than studies above. The study was conducted in Australian vineyards during a cool and damp season. Oxyfluorfen levels were measured over an approximate 14-week period, with little change in concentration apparent after approximately six weeks. The authors attributed oxyfluorfen's most likely route of dissipation to volatilization.

Accumulation in Fish (165-4)

The data indicates that the compound can accumulate in bluegill sunfish since bioconcentration factors were 450 and 605X in muscle, 3265 and 4360X in viscera, and 1075 and 2200X in whole fish. However, rapid loss of the compound occurred out of tissues; after fourteen days of depuration, 86 and 94% elimination of ^{14}C-residues in the muscle tissue, 83 and 94% elimination in the viscera, and 82 and 91% elimination in whole fish occurred. Cumulative mortalities for bluegill in the control and treated aquaria were 2 and 1%, respectively. MRID 140477.

Fish collected in the Columbia River in the Northwestern US showed significant levels of oxyfluorfen in their tissues. The range of quantifiable concentrations was 10 to 370 ppb.

Columbia River Basin: Fifteen Mile Creek near the Dalles Dam in Oregon was the site of an oxyfluorfen spill (August 24, 2000). A truck carrying formulated oxyfluorfen (Goal 2XL) crashed on a bridge dumping thousands of gallons of herbicide into the creek yards

from where the creek enters the Columbia River. Oxyfluorfen measurements were made in water, soil, and sediment in response to the spill. In order to determine background levels of oxyfluorfen in the environment, the spill response team collected several samples in areas that were unaffected by the spill, including upstream in Fifteen Mile Creek, upstream in the Columbia River, and in other creeks feeding into the Columbia River. The samples collected are relevant to drinking water because the Columbia River is used as a drinking water source and significant oxyfluorfen use is understood to occur in the watershed. Most samples collected up and downstream outside the spill site contained undetectable levels (< 0.01 ppb) of oxyfluorfen. Excluding the two weeks immediately following the spill, only seven of approximately 300 water samples collected in the Columbia contained any detectable levels of oxyfluorfen. The detections were at relatively high levels and were most likely a result of leakage from the spill site. The few water samples collected from nearby rivers contained undetectable levels. Of 35 background sediment measurements made in nearby rivers and streams, which were unaffected by the spill, two detections of oxyfluorfen in sediment were noted. The highest detection, 541 ppb in Mosier Creek, was downstream of orchards.

Spray Drift

Droplet size spectrum (201-1)

A droplet size spectrum (201-1) study is required since the product may be applied by aerial and ground spray equipment and due to the concern for potential risk to nontarget plants. However, to satisfy these requirements, the registrant, in conjunction with other registrants of other pesticide active ingredients, formed the Spray Drift Task Force (SDTF). The SDTF has completed and submitted to the Agency its series of studies, which are intended to characterize spray droplet drift potential due to various factors, including application methods, application equipment, meteorological conditions, crop geometry, and droplet characteristics. In the interim and for this assessment, the Agency is relying on previously submitted spray drift data and the open literature for off-target drift rates. The standard assumption used by EFED for ground and aerial application is that 1 and 5%, respectively, of the application rate is deposited 100 feet downwind. After peer review of the SDTF data is completed, the Agency will determine whether a reassessment is warranted of the potential risks from the application of this chemical.

Drift-field evaluation (202-1)

In field drift evaluation studies using lettuce as a bioassay, lettuce plants showed visible symptoms as far as 800 meters downwind from the point of application, but symptoms were quantifiable only up to 100 meters. MRID 144894.