DATA EVALUATION RECORD

STUDY 7

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FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 44505208
Miller, M. M. and W. G. Wilson. 1997. [Phenyl-U-^{14}C]ZA1296: Rate of degradation in three soils under aerobic laboratory conditions. Laboratory Study ID: PMS 414. Unpublished study performed by Zeneca Inc., Richmond, CA; and submitted by ZENECA, Inc., Wilmington, DE.

DIRECT-REVIEW TIME = 92 Hours

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CONCLUSIONS

Metabolism - Aerobic Soil

1. This study is ***acceptable*** and ***partially satisfies data requirements*** for aerobic soil metabolism. Although this study was submitted as "supplemental", it provides useful information on aerobic metabolism in 3 soils (one domestic and two foreign) in 3 textural classes: sandy loam (U.S. soil), loam (French soil), and clay loam (English soil). However, the presence of high concentrations of unextracted residues by day 7 indicates that the analytical method, specifically extraction, may not have been adequate (see comment 1 in the Comments section); therefore, without other supporting data available from other studies, the apparent half-lives would be open to interpretation, and there is a degree of uncertainty about the nature and identity of some transformation products.

   In spite of this and other discrepancies noted in the Comments section of this report, this study, in conjunction with several other aerobic metabolism studies (and other fate studies) submitted for mesotrione, is part of a consistent picture of metabolic behavior in aerobic soil. ***In combination with results from this and other studies, data requirements for aerobic soil metabolism are satisfied.***

2. Although submitted as "supplemental" and not intended to fulfill Subdivision N Guideline data requirements, the registrant should carefully consider the critical elements in the Comments section. There were *numerous* unnecessary departures from standard Guideline practices which, in many instances, would vitiate future study results. For example, the reviewer could not confirm soil moisture contents (comment 4), only single samples were incubated and removed for analysis at each sampling interval for each soil (comment 2), there were temperature irregularities (comment 8), and detection limits were not reported (comment 9). However, the Agency applauds the use of multiple test soils.

3. Uniformly phenyl ring-labeled [^{14}C]mesotrione, at a nominal application rate of 0.17 ppm, degraded with calculated half-lives (reported as DT_{50}s, but confirmed by the reviewer to be calculated first-order half-lives) of **12 days** (reviewer-calculated $r^2 = 0.91$), **5.9** days (reviewer-calculated $r^2 = 0.84$), and **4.6** days (reviewer-calculated $r^2 = 0.97$) in U.S. sandy loam, French loam, and English clay loam soils, respectively, **adjusted to 50% of the maximum water-holding capacity** (see comment 4) and incubated in darkness at **20 ± 2°C** for up to 56 days.

   All data designated below as percentages of the applied represent percentages of the nominal application. Reported residue concentration data (in ppm) were reviewer-calculated based on the reported actual application rates and the percentages of the recovered radioactivity; degradate concentrations were reported in parent equivalents.

In the ***U.S. sandy loam soil***, the parent compound was initially present at 99.9% (0.17 ppm) of the applied radioactivity, decreased to 42.1% (0.073 ppm) by 7 days posttreatment, increased to 50.1% (0.087 ppm) by 10 days, was 28.4-39.8% (0.049-0.069 ppm) from 14 to 28 days, and was to 2.5% (0.0044 ppm) at 56 days. The **major degradate MNBA** was first detected at 12.7% (0.022 ppm) of the applied radioactivity at 3 days posttreatment, was a maximum of 27.9% (0.049 ppm) at 7 days posttreatment, and was last detected at 19.2% (0.033 ppm) at 14 days. The **minor degradate AMBA** was detected once, at 4.2% (0.0073 ppm) of the applied radioactivity at 7 days posttreatment. **Unextracted [^{14}C]residues** (reviewer-calculated total of "NaOH solubilized" plus "unextracted") were initially (day 3) 7.6% of the applied radioactivity, were a maximum of 44.7% at 28 days, and were 42.3% at 56 days posttreatment; **Unextracted materials** solubilized with NaOH accounted for 5.0% of the applied at 5 days, increased to 16.1% by 28 days, and were 15.7% at 56 days posttreatment. [^{14}C]Residues associated with the fulvic acid, humic acid, and humin fractions of organic matter were not determined. **Evolved $^{14}CO_2$** accounted for 1.6% of the applied radioactivity at 3 days posttreatment, increased to 12.6% by 14 days, and was 27.0% at 56 days.

In the ***loam soil from France***, the parent compound was initially present at 96.8% (0.17 ppm) of the applied radioactivity, decreased to 63.3% (0.11 ppm) by 3 days and 22.3% (0.039 ppm) by 7 days, and was 1.8% (0.0031 ppm) at 28 days posttreatment. The **major degradate MNBA** was first detected at 25.4% (0.044 ppm) of the applied radioactivity at 3 days posttreatment, was a maximum of 46.8% (0.081 ppm) at 7 days, and was last detected at 19.8% (0.034 ppm) at 14 days. **Unextracted [^{14}C]residues** (reviewer-calculated total of "NaOH solubilized" plus "unextracted") were initially (day 0) 0.6% of the applied radioactivity, increased to 26.4% by 10 days posttreatment, and were a maximum of 46.0% at 28 days; **unextracted materials** solubilized with NaOH accounted for 3.3% of the applied at 3 days and were 5.1-6.6% from 7 to 28 days posttreatment. [^{14}C]Residues associated with the fulvic acid, humic acid, and humin fractions of organic matter were not determined. **Evolved $^{14}CO_2$** accounted for 1.6% of the applied radioactivity at 3 days posttreatment, increased to 20.9% by 14 days, and was 35.3% at 28 days.

In the ***clay loam soil from England***, the parent compound was initially present at 102% (0.19 ppm) of the applied radioactivity, decreased to 73.7% (0.14 ppm) by 3 days and 35.5% (0.065 ppm) by 7 days, and was 3.7% (0.0068 ppm) at 21 days posttreatment; day-28 samples were not analyzed. No major degradates were detected. The **minor degradate MNBA** was detected once, at 4.7% (0.0086 ppm) of the applied radioactivity at 3 days posttreatment. The **minor degradate AMBA** was detected once, at 4.2% (0.0077 ppm) of the applied radioactivity at 7 days posttreatment. **Unextracted [^{14}C]residues** (reviewer-calculated total of "NaOH solubilized" plus "unextracted") were initially (day 0) 1.3% of the applied radioactivity, increased to 10.8% by 3 days and 35.6% by 10 days, and were a maximum of 49.5% at 21 days posttreatment; **unextracted materials** solubilized with NaOH accounted for 1.3% of the applied at day 0, were 11.8-

12.8% at 10-14 days, and were 7.1% at 21 days posttreatment. [^{14}C]Residues associated with the fulvic acid, humic acid, and humin fractions of organic matter were not determined. **Evolved $^{14}CO_2$** accounted for 4.8% of the applied radioactivity at 3 days posttreatment, increased to 17.2% by 10 days, and was 29.4% at 28 days.

METHODOLOGY

Samples (60 g) of sieved (2 mm) sandy loam soil (from North Carolina; 73.2% sand, 19.2% silt, 7.6% clay, 0.98% organic matter, pH 6.4, CEC 2.4 meq/100 g; Tables II, III, pp. 36, 37), loam soil (from Grisolles, France; 43.5% sand, 34.9% silt, 21.6% clay, 1.5% organic matter, pH 7.7, CEC 8.6 meq/100 g), and clay loam soil (from Oxfordshire, England; 41.3% sand, 25.5% silt, 33.2% clay, 5.7% organic matter, pH 7.1, CEC 22.9 meq/100 g) ***adjusted to 50% of the maximum water-holding capacity*** were weighed into centrifuge bottles and pre-incubated at ***20 ± 2°C*** in darkness for up to 14 days prior to treatment (pp. 19, 20). Following the pre-incubation period, soil samples were treated by pipette with uniformly phenyl ring-labeled [^{14}C]mesotrione {2-[4-(methylsulfonyl)-2-nitrobenzoyl]-1,3-cyclohexanedione; radiochemical purity 98.9%, specific activity 38.4 mCi/mmol; Table I, p. 35; pp. 14, 26}, dissolved in 0.05 M sodium hydrogen carbonate, at a nominal application rate of 0.17 ppm (pp. 14, 20; Table IV, p. 38); parent compound was enriched with ^{13}C at the carbonyl position. The treated soil samples were incubated in darkness at ***20 ± 2°C*** for up to 56 days using a flow-through incubation system (Figure 2, p. 43). Humidified air was pumped through the sample bottles and into a CO_2 (1 M NaOH) trap (p. 21). Sample bottles were weighed during the incubation period to verify that the soil moisture content was maintained at 50% of the maximum water-holding capacity; water was added as necessary (p. 20). Single soil samples were removed for analysis at 0, 3, 7, 10, 14, 21, 28, and 56 (sandy loam soil only) days posttreatment (p. 21); clay loam soil samples collected at 28 days posttreatment were not analyzed. Volatile trap solutions were collected for analysis and replaced with 1 M NaOH at each sampling interval.

At each sampling interval, samples were extracted three times by shaking with 0.05 M NH_4OH followed by a single extraction with acetonitrile, and then centrifuged (p. 22). The supernatant was decanted, acidified to pH 1 (HCl), centrifuged, and decanted again. The soil pellet was extracted by shaking and ultrasonic treatment with acetonitrile, and then centrifuged. Aliquots of each extract were analyzed for total radioactivity by LSC; the limit of detection was two times background (Appendix B, p. 57). ***The samples were analyzed for the parent and the degradates AMBA and MNBA*** (Table I, p. 35). The extracts were combined and analyzed by HPLC (column not specified) using a mobile phase gradient of water:acetonitrile (90:10 to 50:50 to 100:0 to 90:10, v:v) with UV (254 nm) and radioactive flow detection; the limit of quantitation was 130 cpm (p. 17; Appendix C, pp. 58, 59). Samples were co-chromatographed with nonradiolabeled

reference standards. To confirm compound identities, aliquots of the sample extracts were further analyzed by TLC using silica gel plates developed in one of two systems: (1) toluene:methanol:triethyamine (12:6:2, v:v:v) or (2) toluene:1,4 dioxane:formic acid (25:15:1, v:v:v; p. 16). Samples were co-chromatographed with nonradiolabeled reference standards which were visualized with UV light (254 nm). Radioactive residues on TLC plates were quantified by radioimage scanning.

In an attempt to remove bound residues, post-extracted soil samples were solubilized by shaking with 0.5 M NaOH and then centrifuged (p. 22). The caustic fractions were acidified (pH 1) and partitioned with ethyl acetate. The extracts were analyzed for total radioactivity by LSC; residue characterization was not performed. Following extraction, soil samples were analyzed for total radioactivity by LSC following combustion; data were corrected for combustion efficiency (p. 15).

At each sampling interval, an aliquot of the 1 M NaOH trapping solution was analyzed for total radioactivity (p. 21); the method used to confirm the presence of $^{14}CO_2$ was not reported.

To determine the viability of the soils, soil samples were analyzed for biomass carbon at the beginning and end of the incubation period (p. 19). Results indicated that the soils were viable (Table III, p. 37).

DATA SUMMARY

Uniformly phenyl ring-labeled [^{14}C]mesotrione (radiochemical purity 98.9%), at a nominal application rate of 0.17 ppm, degraded with registrant-calculated half-lives (reported as DT_{50}s, but confirmed by the reviewer to be calculated half-lives) of *12 days* (reviewer-calculated $r^2 = 0.91$), *5.9 days* (reviewer-calculated $r^2 = 0.84$), and *4.6 days* (reviewer-calculated $r^2 = 0.97$) in sandy loam, loam, and clay loam soils, respectively, adjusted to ***50% of the maximum water-holding capacity*** and incubated in darkness at ***20 ± 2°C*** for up to 56 days (Tables V-VII, pp. 39-41; Figure 10, p. 51).

All data designated below as percentages of the applied represent percentages of the nominal application. Reported residue concentration data (in ppm) were reviewer-calculated based on the reported actual application rates (Table IV, p. 38) and the percentages of the recovered radioactivity; degradate concentrations were reported in parent equivalents.

Sandy loam soil

The parent compound was initially present at 99.9% (0.17 ppm) of the applied radioactivity, decreased to 42.1% (0.073 ppm) of the applied by 7 days posttreatment,

increased to 50.1% (0.087 ppm) of the applied by 10 days posttreatment, was 28.4-39.8% (0.049-0.069 ppm) of the applied from 14 to 28 days posttreatment, and decreased to 2.5% (0.0044 ppm) of the applied by 56 days posttreatment (Table V, p. 39). The *major degradate*

4-(methylsufonyl)-2-nitrobenzoic acid (MNBA)

was first detected at 12.7% (0.022 ppm) of the applied radioactivity at 3 days posttreatment, increased to a maximum of 27.9% (0.049 ppm) of the applied by 7 days posttreatment, and was last detected at 19.2% (0.033 ppm) of the applied at 14 days posttreatment. The *minor degradate 2-amino-4-(methylsulfonyl)benzoic acid (AMBA)* was detected once, at 4.2% (0.0073 ppm) of the applied radioactivity at 7 days posttreatment. *Unextracted [^{14}C]residues* (reviewer-calculated total of "NaOH solubilized" plus "unextracted") were initially (day 3) 7.6% of the applied radioactivity, increased to a maximum of 44.7% of the applied by 28 days, and were 42.3% of the applied at 56 days posttreatment; unextracted materials solubilized with NaOH accounted for 5.0% of the applied at 5 days posttreatment, increased to 16.1% of the applied by 28 days posttreatment, and were 15.7% of the applied at 56 days posttreatment. [^{14}C]Residues associated with the fulvic acid, humic acid, and humin fractions of organic matter were not determined. *Evolved $^{14}CO_2$* accounted for 1.6% of the applied radioactivity at 3 days posttreatment, increased to 12.6% of the applied by 14 days, and were 27.0% of the applied at 56 days posttreatment.

The material balances (based on LSC analysis) were 96.8-102% of the applied radioactivity throughout the incubation period (Table V, p. 39).

Loam soil

The parent compound was initially present at 96.8% (0.17 ppm) of the applied radioactivity, decreased to 63.3% (0.11 ppm) by 3 days and 22.3% (0.039 ppm) by 7 days, and was 1.8% (0.0031 ppm) of the applied at 28 days posttreatment (Table VI, p. 40). The *major degradate*

MNBA

was first detected at 25.4% (0.044 ppm) of the applied radioactivity at 3 days posttreatment, increased to a maximum of 46.8% (0.081 ppm) of the applied by 7 days, and was last detected at 19.8% (0.034 ppm) of the applied at 14 days posttreatment. *Unextracted [^{14}C]residues* (reviewer-calculated total of "NaOH solubilized" plus "unextracted") were initially (day 0) 0.6% of the applied radioactivity, increased to 26.4% of the applied by 10 days posttreatment, and were a maximum of 46.0% of the applied at 28 days posttreatment; unextracted materials solubilized with NaOH accounted for 3.3% of the applied at 3 days posttreatment and were 5.1-6.6% of the applied from 7 to 28 days

posttreatment. [^{14}C]Residues associated with the fulvic acid, humic acid, and humin fractions of organic matter were not determined. *Evolved $^{14}CO_2$* accounted for 1.6% of the applied radioactivity at 3 days posttreatment, increased to 20.9% of the applied by 14 days, and was 35.3% of the applied at 28 days posttreatment.

The material balances (based on LSC analysis) were 96.0-98.4% of the applied radioactivity from 0 to 14 days posttreatment and were 90.2-92.3% of the applied at 21-28 days posttreatment (Table VI, p. 40).

Clay loam soil

The parent compound was initially present at 102% (0.19 ppm) of the applied radioactivity, decreased to 73.7% (0.14 ppm) by 3 days and 35.5% (0.065 ppm) by 7 days, and was 3.7% (0.0068 ppm) of the applied at 21 days posttreatment (Table VII, p. 41); day-28 samples were not analyzed. *No major degradates* were detected. The *minor degradate MNBA* was detected once, at 4.7% (0.0086 ppm) of the applied radioactivity at 3 days posttreatment. The *minor degradate AMBA* was detected once, at 4.2% (0.0077 ppm) of the applied radioactivity at 7 days posttreatment. An *unidentified minor degradate* was detected once, at 7.1% (0.013 ppm) of the applied radioactivity at 7 days post-treatment. *Unextracted [^{14}C]residues* (reviewer-calculated total of "NaOH solubilized" plus "unextracted") were initially (day 0) 1.3% of the applied radioactivity, increased to 10.8% by 3 days and 35.6% by 10 days, and were a maximum of 49.5% of the applied at 21 days posttreatment; unextracted materials solubilized with NaOH accounted for 1.3% of the applied at day 0, were 11.8-12.8% of the applied at 10-14 days posttreatment, and were 7.1% of the applied at 21 days posttreatment. [^{14}C]Residues associated with the fulvic acid, humic acid, and humin fractions of organic matter were not determined. *Evolved $^{14}CO_2$* accounted for 4.8% of the applied radioactivity at 3 days posttreatment, increased to 17.2% of the applied by 10 days, and was 29.4% of the applied at 28 days posttreatment.

The material balances (based on LSC analysis) were initially 103% of the applied radioactivity, were 83.4-88.6% of the applied (with no observed pattern of decline) from 7 to 14 days posttreatment, and were 93.3% of the applied at 21 days posttreatment (Table VII, p. 41); day-28 samples were not analyzed.

COMMENTS

1. Unextracted [^{14}C]residue concentrations were high for all three soils by 7 days post-treatment. Total unextracted [^{14}C]residues (reviewer-calculated from "NaOH solubilized" and "unextracted" data in tables V-VII, pp. 39-41) were 19.9%, 21.5%, and 24.1% of the applied radioactivity for the sandy loam, loam, and clay loam soils, respectively, by day 7 and were respective maximums of 44.7%, 46.0%, and 56.6% of the

applied. The presence of high concentrations of unextracted residues by day 7 (for each soil) indicates that the analytical method, specifically extraction, may have been inadequate for the determination of the parent. Without the appropriate extraction procedures to ensure quantitative recovery of the compounds of interest, the validity of the reported half-lives is questionable. Additionally, the patterns of formation and decline of the degradate MNBA are questionable. Following preliminary extractions, soil samples were solubilized with NaOH and centrifuged, and the supernatant was acidified and partitioned with ethyl acetate (p. 22). The reviewer notes that in another submitted aerobic soil metabolism study of mesotrione (MRID 44505129), the parent, the degradate MNBA, and two unidentified degradates were detected in the organic extracts of the acid hydrosylate. The reviewer also notes that in another submitted aerobic soil metabolism study of the mesotrione degradate AMBA (MRID 44901714), AMBA was detected in both the organic and aqueous fractions of the NaOH extract. Therefore, the initial extraction method in the two aforementioned studies (which utilized extraction with NH_4OH and acetonitrile rather than NH_4OH and acetone, as did the current study) was inadequate for quantitative extraction of the applied radioactivity. In the current study, the radioactivity in the NaOH extract was not further characterized other than as radioactivity removed by extraction with ethyl acetate (which was not analyzed by chromatography). Additionally, organic matter fractionation was not performed. Generally, soil samples are extracted sufficiently to remove any extractable residues, and the initial extracts are analyzed for the primary characterization of the parent and its degradates. Then, soil samples are often further extracted, perhaps using harsh methods such as reflux or Soxhlet extraction, in an attempt to remove bound residues; the harsh extracts are not usually characterized due to the compound-altering effects of the extractants on the residues. The reviewer notes, however, that the study was submitted as a supplemental study.

2. Duplicate samples were not utilized in the study. The use of single test samples is generally not considered to be good laboratory practice; at a minimum, duplicate samples should be utilized for each sampling interval and each treatment. The reviewer notes that variability seen in the data over time may have been lessened by the use of duplicate samples. However, the use of three soils with single samples at each interval is superior to one soil with duplicate samples at each interval.

3. The study author stated that the application rate for the present study, 165 g a.i./ha (0.17 ppm), was 10% greater than the proposed maximum label rate for pre-emergence application (150 g a.i./ha; p. 24). The reviewer notes than in another aerobic soil metabolism study of mesotrione (MRID 44373531), the proposed maximum label rate for pre-emergence application was reported as 280 g a.i./ha. Clarification by the registrant is necessary. The use of exaggerated dose rates may affect the degradation rate of the chemical relative to the degradation rate that would occur under normal use rates. While exaggerated dose rates may be used to facilitate residue identification, EPA requires that kinetics studies be performed using the proposed maximum application rate (US EPA.

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1993. *Pesticide Reregistration Rejection Rate Analysis: Environmental Fate*. EPA 738-R-93-010, p. 67). However, this is a moot point because the maximum application rate given in the currently proposed label is 482 g a.i./ha (0.43 lb/acre), which for a 6-inch soil incorporation is approximately equivalent to a concentration of 0.2 ppm, and does not differ significantly from the test concentrations.

4. The reviewer could not confirm that the soil moisture was maintained at 75% of the soil moisture at 0.33 bar during the incubation period as required by Subdivision N Guidelines. The study authors stated that the soil moisture content was maintained at approximately 50% of the maximum water-holding capacity (p. 19). The study authors did not report the relationship between the two moisture contents. Clarification by the registrant is necessary. The reviewer notes that the moisture content (50% of the maximum WHC) was likely to provide a desirable moisture level for microbial activity

5. The material balances for the clay loam soil were outside the acceptable range of 90-110% of the applied radioactivity from 7 to 14 days posttreatment; recoveries were 83.4-88.3% of the applied (Table VII, p. 41). Subdivision N Guidelines require that material balances be 90-110% of the applied radioactivity. The reviewer notes, however, that a pattern of decline was not observed during those intervals and that the material balance was 93.3% of the applied at 21 days posttreatment.

6. The reviewer-calculated the total unextracted [^{14}C]residues for each soil as the sums of the "NaOH solubilized" plus "unextracted" data points reported in Tables V-VII (pp. 39-41). The values reported by the study authors on page 28 as "bound radioactivity" or the radioactivity remaining in the soil following extraction do not include the uncharacterized radioactivity solubilized with NaOH and, therefore, do not match the reviewer-calculated values reported in this DER. It is noted, however, that the data reported as "bound residues" are misleading in that they don't fully describe the fractions of applied radioactivity that were not characterized.

7. The registrant reported the calculated half-lives as DT_{50}s (Tables V-VII, pp. 39-41; Figure 10, p. 51). The study authors used linear regression to determine the decline of the parent (p. 23); therefore, the reported DT_{50}s are actually registrant-calculated half-lives. These values were confirmed by the reviewer using a first-order linear regression model; the r^2 values determined by the reviewer using the regression analysis were reported in the DER.

8. The incubation temperature was not held constant at ± 1°C as required by Subdivision N Guidelines. The study authors reported that the soils were incubated at 20 ± 2°C (p. 21). In addition, the temperature was >22°C during the incubation of the clay loam soil samples on four separate occasions (p. 25). Temperatures were 22-24°C (day 14) for 12 hours, 22-24.5°C (day 15) for 2.5 hours, 22-24.5°C (day 26) for 12 hours, and 22-26°C (day 27). The study authors stated that the clay loam soil incubated for 28 days was not

analyzed due to temperature fluctuations (p. 25).

9. Method detection limits were not reported for HPLC or TLC analyses and limits of quantitation were not reported for LSC or TLC. Both limits of detection and quantitation should be reported to allow the reviewer to evaluate the adequacy of the method for the determination of the parent compound and its degradates.

10. The study was conducted using uniformly phenyl ring-labeled [^{14}C]mesotrione; the compound contained an additional ring structure (cyclohexane) that was not radiolabeled. The reviewer noted that additional aerobic soil metabolism studies were also submitted (MRIDS 44373531, 44505130, 44505129 and 44901714).

11. The soil series name for the sandy loam soil collected from NC was not reported. The loam and clay loam soils were foreign soils.

12. It was unclear whether the loam or clay loam soils were representative of the intended use area of mesotrione. It is preferred that the soil used in aerobic soil metabolism studies be either a sandy loam or silt loam or representative of the intended use area. Clarification by the registrant may be necessary.

13. The reviewer noted that the sandy loam and loam soils were treated with the same treatment solution (actual application rate of 0.174 ppm; Table IV, p. 38) and incubated simultaneously, and that the clay loam soil was treated with a different treatment solution (actual application rate of 0.184 ppm) and incubated at a later date (p. 20). Reported residue concentrations (in ppm) were reviewer-calculated based on the application rates for the respective soils.

14. Residue data were reported only as percentages of the nominal application rate; concentration data were not reported. All concentration data (in ppm based on parent equivalents) were reviewer-calculated from the nominal application rates and the reported percentages of the applied radioactivity. In future studies submitted to the EPA, it is necessary that data be reported as both percentages of the applied radioactivity and in units of concentration, such as ppm.

15. Sterilized test systems were not prepared and incubated along with the treated test systems as controls. Sterile controls would have helped to quantify the extent of abiotic degradation occurring in the test systems.

16. At 21 days posttreatment, the CO_2 trap solution was accidentally mixed with the NH_4OH soil extract prior to analysis (p. 25). The study authors stated that the analysis of the soil extract was performed at a basic pH followed by analysis at an acidic pH in an attempt to account for $^{14}CO_2$; the amount of radioactivity lost between the analysis of the basic to acidic pH was considered to be $^{14}CO_2$. The study authors did not state whether or not this

method was successful; however, the reviewer noted that the amount of radioactivity associated with the 21-day NH_4OH soil extract did not deviate from the pattern reported over time for each soil (Tables V-VII, pp. 39-41).

17. The reviewer noted that the pesticide neburon was applied (4 kg/ha) to the loam soil eight months prior to soil collection (Table II, p. 36); the reviewer confirmed that neburon is not chemically related to the parent compound used in the current study (*Farm Chemicals Handbook*, 1997). Chemicals were not applied to either the sandy loam and clay loam soils within five years of soil collection.

MP# 44505208

Page ___ is not included in this copy.

Pages 12 through 30 are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product inert impurities.

_____ Description of the product manufacturing process.

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_____ A draft product label.

_____ The product confidential statement of formula.

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