

US EPA ARCHIVE DOCUMENT

CONCLUSIONS

Mobility - Leaching & Adsorption/Desorption

1. This study is scientifically valid and provides acceptable information on the soil mobility (batch equilibrium) of parent 2,4-D, and two degradates: 2,4-DCP (2,4-dichlorophenol) and 2,4-DCA (2,4-dichloroanisole) in four U.S. soils. EFED concludes that 2,4-D has the potential to very mobile ($K_{oc}s = 70$ to 117 mL/g) in the soil and to reach surface water via runoff and/or erosion during periods of precipitation and/or irrigation. The degradates have the potential to be mobile to moderately mobile in the soils studied ($K_{oc}s = 368$ to 1442 mL/g).
2. This study meets Subdivision N Guidelines for the fulfillment of EPA data requirements on soil mobility (batch equilibrium).
3. **2,4-D:** Nonradiolabeled plus uniformly phenyl ring-labeled [^{14}C]2,4-D, at nominal concentrations of 1.0, 2.5, 5.0 and 10.0 $\mu\text{g/mL}$, was studied in sandy loam, sand, silty clay loam and loam soil:solution slurries that were equilibrated for 24 hours at 25 ± 1 °C. Freundlich K_{ads} values were 0.17 for the sandy loam soil, 0.36 for the sand soil, 0.52 for the silty clay loam soil (1.5% O.M.) and 0.28 for the loam soil (0.4% o.m.); corresponding K_{oc} values were 70, 76, 59 and 117 mL/g. Respective 1/N values were 0.68, 0.82, 0.82 and 0.80 for adsorption. Freundlich K_{des} values determined following a 24-hour equilibration period were 0.87 for the sandy loam soil, 1.2 for the sand soil, 2.0 for the silty clay loam soil and 1.6 for the loam soil; corresponding K_{oc} values were 362, 247, 226 and 658 mL/g. Respective 1/N values were 0.73, 0.94, 0.93 and 1.0 for desorption. The reviewer-calculated coefficient of determination (r^2) values for the relationships K_{ads} vs. organic matter, K_{ads} vs. pH and K_{ads} vs. clay content were 0.34, 0.19 and 0.59, respectively. Similar mobility data have been reported in previously reviewed adsorption/desorption studies (MRID 42045302, Acc. No. 00112937).

Summary of adsorption and desorption constants of [^{14}C]2,4-D in soils.

Soil	Adsorption				Desorption			
	K_d	1/N	% OC	K_{oc}	K_d	1/N	% OC	K_{oc}
Sand	0.36	0.82	0.47	76	1.16	0.94	0.47	247
Sandy loam	0.17	0.68	0.24	70	0.87	0.73	0.24	362
Loam	0.28	0.80	0.24	117	1.58	1.00	0.24	658
Silty clay loam	0.52	0.82	0.88	59	1.99	0.93	0.88	226

K_d = Adsorption and desorption coefficients

1/N = Slope of Freundlich adsorption/desorption isotherms

K_{oc} = Coefficient adsorption per organic carbon ($K_d \times 100/\%$ organic carbon (OC))

2,4-DCP: Nonradiolabeled plus uniformly phenyl ring-labeled [^{14}C]2,4-DCP, at nominal concentrations of 1.0, 2.5, 5.0 and 10.0 $\mu\text{g/mL}$, was studied in sandy loam, sand, silty

clay loam and loam soil:solution slurries that were equilibrated for 24 hours at 25 ± 1 °C. Freundlich K_{ads} values were 2.0 for the sandy loam soil (0.4% o.m.), 1.7 for the sand soil, 3.3 for the silty clay loam soil (1.5% o.m.) and 2.9 for the loam soil (0.4% o.m.); corresponding K_{oc} values were 821, 368, 374 and 1204 mL/g. Respective 1/N values were 0.84, 0.91, 0.74 and 0.80 for adsorption. Freundlich K_{des} values determined following a 24-hour equilibration period were 6.3 for the sandy loam soil, 3.8 for the sand soil, 7.1 for the silty clay loam soil and 5.6 for the loam soil; corresponding K_{oc} values were 2625, 813, 807 and 2325 mL/g. Respective 1/N values were 0.89, 0.79, 0.81 and 0.73 for desorption. The reviewer-calculated coefficient of determination (r^2) values for the relationships K_{ads} vs. organic matter, K_{ads} vs. pH and K_{ads} vs. clay content were 0.28, 0.98 and 0.64, respectively.

Table 8: Summary of adsorption and desorption constants of [14 C]2,4-DCP in soils

Soil	Adsorption				Desorption			
	K_d	1/N	% OC	K_{oc}	K_d	1/N	% OC	K_{oc}
Sand	1.73	0.91	0.47	368	3.82	0.79	0.47	813
Sandy loam	1.97	0.84	0.24	821	6.30	0.89	0.24	2625
Loam	2.89	0.80	0.24	1204	5.58	0.73	0.24	2325
Silty clay loam	3.29	0.74	0.88	374	7.10	0.81	0.88	807

K_d = Adsorption and desorption coefficients

1/N = Slope of Freundlich adsorption/desorption isotherms

K_{oc} = Coefficient adsorption per organic carbon ($K_d \times 100/\%$ organic carbon (OC))

2,4-DCA: Nonradiolabeled plus uniformly phenyl ring-labeled [14 C]2,4-DCA, at nominal concentrations of 0.5, 1.0, 2.5 and 5.0 μ g/mL, was studied in sandy loam, sand, silty clay loam and loam soil:solution slurries that were equilibrated for 24 hours at 25 ± 1 °C. Freundlich K_{ads} values were 1.6 for the sandy loam soil, 2.1 for the sand soil, 5.4 for the silty clay loam soil (1.5% o.m.) and 3.5 for the loam soil (0.4% o.m.); corresponding K_{oc} values were 667, 436, 616 and 1442 mL/g. Respective 1/N values were 0.98, 0.96, 0.81 and 0.85 for adsorption. Freundlich K_{des} values determined following a 24-hour equilibration period were 2.4 for the sandy loam soil, 3.4 for the sand soil, 8.6 for the silty clay loam soil and 4.4 for the loam soil; corresponding K_{oc} values were 996, 721, 975 and 1850 mL/g. Respective 1/N values were 0.65, 0.98, 0.74 and 0.79 for desorption. The reviewer-calculated coefficient of determination (r^2) values for the relationships K_{ads} vs. organic matter, K_{ads} vs. pH and K_{ads} vs. clay content were 0.24, 0.68 and 0.80, respectively.

Table 8: Summary of adsorption and desorption constants of [¹⁴C]2,4-DCA in soils

Soil	Adsorption				Desorption			
	K _d	1/N	% OC	K _{oc}	K _d	1/N	% OC	K _{oc}
Sand	2.05	0.96	0.47	436	3.39	0.98	0.47	721
Sandy loam	1.60	0.98	0.24	667	2.39	0.65	0.24	996
Loam	3.46	0.85	0.24	1442	4.44	0.79	0.24	1850
Silty clay loam	5.42	0.81	0.88	616	8.58	0.74	0.88	975

K_d = Adsorption and desorption coefficients

1/N = Slope of Freundlich adsorption/desorption isotherms

K_{oc} = Coefficient adsorption per organic carbon (K_d x 100/% organic carbon (OC))

METHODOLOGY

2,4-D

Based on preliminary study data, an equilibration period of 24 hours was chosen for the adsorption of uniformly phenyl ring-labeled [¹⁴C]2,4-D (2,4-dichlorophenoxy acetic acid; radiochemical purity 100%, specific activity 22.3 mCi/mmol; Table 3, p. 33; Figure 1, p. 40). Based on a preliminary study, a 1:1 (w:v) soil:solution ratio was chosen for the definitive study (p. 26). Based on a preliminary study, the test compound was determined to be stable following the adsorption phase; 94.7-108.7% of the applied radioactivity was present as parent (Table 4, p. 34). In a preliminary study, adsorption of the test compound to the glass beakers was not observed (Table 2, p. 32).

For the adsorption phase of the definitive study, aliquots (5 mL) of 0.01 M CaCl₂ solution containing nonradiolabeled plus uniformly phenyl ring-labeled [¹⁴C]2,4-D (dissolved in methanol), at nominal concentrations of 1.0, 2.5, 5.0 and 10.0 µg/mL (actual concentrations: 1.1, 2.6, 5.0, 9.9-10.6 µg/mL), were added to glass screw-top test tubes containing samples (5 g) of air-dried, sieved (2 mm) California sandy loam, Plainfield sand, Arizona silty clay loam and Mississippi loam soils (Table 1, p. 31); duplicate tubes were prepared for each soil type/treatment rate combination (p. 19). The tubes containing the soil:solution slurries (1:1, w:v) were equilibrated as described previously for [¹⁴C]2,4-DCP. Triplicate aliquots of supernatant from each sample were analyzed for total radioactivity by LSC; the limit of detection was 34 dpm (p. 25).

For the desorption phase of the definitive study, 5 mL of pesticide-free 0.01 M CaCl₂ solution was added to the soil pellets from the adsorption phase of the study (p. 20). The soil:solution slurries were equilibrated and analyzed as described previously for [¹⁴C]2,4-DCP.

Following desorption, samples from the highest treatment rate (10.0 µg/mL) were extracted by sonicating sequentially with acetic acid:methanol (5:95, v:v), acetic

acid:methanol (50:50, v:v) and 5% acetic acid in water (pp. 17, 20). Aliquots of the extract were analyzed by HPLC (Spherisorb ODS-1 column) using a mobile phase gradient of 0.05% trifluoroacetic acid in water:acetonitrile (75:25 to 60:40 to 50:50 to 10:90 to 0:100, v:v) with both UV (254 nm) and radioactive flow detection (pp. 17, 18). Subsamples of the extracted and unextracted (1.0, 2.5 and 5.0 $\mu\text{g}/\text{mL}$ treatments) soils were air-dried and analyzed for total radioactivity by LSC following combustion (p. 20); data were corrected for oxidation efficiency (p. 15).

To determine the stability of the test compound in the test system, aliquots of the desorption supernatants from the soils treated at the highest rate (10.0 $\mu\text{g}/\text{mL}$) were analyzed by HPLC as described previously (p. 20). The stability of the test compound in samples treated at the lower three application rates was not determined.

To determine the viability of the soils prior to the adsorption phase, soil samples were diluted, plated (plate count agar) and analyzed visually for microbial growth (p. 14). Separate counts of aerobic and anaerobic microorganisms were performed; results indicated soils were viable.

2,4-DCP

Based on preliminary study data, an equilibration period of 24 hours was chosen for the adsorption of uniformly phenyl ring-labeled [^{14}C]2,4-DCP (2,4-dichlorophenol; radiochemical purity 95.2%, specific activity 12.7 mCi/mmol; p. 12; see Comment #5; Table 3, p. 32; Figure 1, p. 39). Based on a preliminary study, a 1:2 (w:v) soil:solution ratio was chosen for the definitive study. Based on a preliminary study, the test compound was determined to be stable following the adsorption phase; 91.7-92.9% of the applied radioactivity was present as parent (Table 4, p. 33). In a preliminary study, adsorption of the test compound to the glass beakers was not observed (Table 2, p. 31).

For the adsorption phase of the definitive study, aliquots (10 mL) of 0.01 M CaCl_2 solution containing nonradiolabeled plus uniformly phenyl ring-labeled [^{14}C]2,4-DCP (dissolved in acetonitrile), at nominal concentrations of 1.0, 2.5, 5.0 and 10.0 $\mu\text{g}/\text{mL}$ (actual concentrations: 0.87, 2.5, 5.3, 10.4 $\mu\text{g}/\text{mL}$), were added to glass screw-top test tubes containing samples (5 g) of air-dried, sieved (2 mm) California sandy loam, Plainfield sand, Arizona silty clay loam and Mississippi loam soils (Table 1, p. 30); duplicate tubes were prepared for each soil type/treatment rate combination (p. 19). The tubes containing the soil:solution slurries (1:2, w:v) were capped, vortexed and equilibrated in a shaking water bath for 24 hours at 25 ± 1 °C. Following the adsorption equilibration period, soil:solution slurries were vortexed and centrifuged, and the supernatants were decanted. Triplicate aliquots of supernatant from each sample were analyzed for total radioactivity by LSC; the limit of detection was 34 dpm (p. 25).

For the desorption phase of the definitive study, 10 mL of pesticide-free 0.01 M CaCl_2 solution was added to the soil pellets from the adsorption phase of the study (p. 19). Tubes containing soil:solution slurries were capped, vortexed and placed on the shaking

water bath for 24 hours at 25 ± 1 °C. Following equilibration, soil:solution slurries were centrifuged and the supernatants were decanted. Triplicate aliquots of supernatant from each sample were analyzed for total radioactivity by LSC.

Following desorption, subsamples of air-dried soil were analyzed for total radioactivity by LSC following combustion (pp. 19, 20); data were corrected for oxidation efficiency (p. 15).

To determine the stability of the test compound in the test system, aliquots of the desorption supernatants from the soils treated at the highest rate (10.0 $\mu\text{g}/\text{mL}$) were analyzed by HPLC (Spherisorb ODS-1 column) using a mobile phase gradient of 0.05% trifluoroacetic acid in water:acetonitrile (75:25 to 60:40 to 50:50 to 10:90 to 0:100, v:v) with both UV (254 nm) and radioactive flow detection (pp. 17, 18). The stability of the test compound in samples treated at the lower three application rates was not determined.

To determine the viability of the soils prior to the adsorption phase, soil samples were diluted, plated (plate count agar) and analyzed visually for microbial growth (p. 14). Separate counts of aerobic and anaerobic microorganisms were performed; results indicated soils were viable.

2,4-DCA

Based on preliminary study data, an equilibration period of 24 hours was chosen for the adsorption of uniformly phenyl ring-labeled [^{14}C]2,4-DCA (2,4-dichloroanisole; radiochemical purity 100%, specific activity 24.46 mCi/mmol; Table 3, p. 32; Figure 1, p. 39). Based on a preliminary study, a 1:5 (w:v) soil:solution ratio was chosen for the definitive study. Based on a preliminary study, the test compound was determined to be stable following the adsorption phase; 93.6-105.0% of the applied radioactivity was present as parent (Table 4, p. 33). In a preliminary study, adsorption of the test compound to the glass beakers was not observed (Table 2, p. 31).

For the adsorption phase of the definitive study, aliquots (10 mL) of 0.01 M CaCl_2 solution containing nonradiolabeled plus uniformly phenyl ring-labeled [^{14}C]2,4-DCA (dissolved in acetonitrile), at nominal concentrations of 0.5, 1.0, 2.5 and 5.0 $\mu\text{g}/\text{mL}$ (actual concentrations: 0.43, 0.94, 2.5, 4.9 $\mu\text{g}/\text{mL}$), were added to glass screw-top test tubes containing samples (2 g) of air-dried, sieved (2 mm) California sandy loam, Plainfield sand, Arizona silty clay loam and Mississippi loam soils (Table 1, p. 30); duplicate tubes were prepared for each soil type/treatment rate combination (p. 19). The tubes containing the soil:solution slurries (1:5, w:v) were equilibrated as described previously for [^{14}C]2,4-DCP. Triplicate aliquots of supernatant from each sample were analyzed for total radioactivity by LSC; the limit of detection was 34 dpm (p. 25).

For the desorption phase of the definitive study, 10.0 mL of pesticide-free 0.01 M CaCl_2 solution was added to the soil pellets from the adsorption phase of the study (p. 19). The soil:solution slurries were equilibrated and analyzed as described previously for [^{14}C]2,4-

DCP.

Following desorption, subsamples of air-dried soil were analyzed for total radioactivity by LSC following combustion (p. 19); data were corrected for oxidation efficiency (p. 15).

To determine the stability of the test compound in the test system, aliquots of the desorption supernatants from the soils treated at the highest rate (5.0 $\mu\text{g/mL}$) were analyzed by HPLC as described previously (p. 20); an OMNIPAC PAX-500 column was used in place of the Spherisorb ODS-1 column (p. 17). The stability of the test compound in samples treated at the lower three application rates was not determined.

To determine the viability of the soils prior to the adsorption phase, soil samples were diluted, plated (plate count agar) and analyzed visually for microbial growth (p. 14). Separate counts of aerobic and anaerobic microorganisms were performed; results indicated soils were viable.

DATA SUMMARY

2,4-D

Nonradiolabeled plus uniformly phenyl ring-labeled [^{14}C]2,4-D (radiochemical purity 100%), at nominal concentrations of 1.0, 2.5, 5.0 and 10.0 $\mu\text{g/mL}$, was studied in sandy loam, sand, silty clay loam and loam soil:solution slurries that were equilibrated for 24 hours at 25 ± 1 °C. Freundlich K_{ads} values were 0.17 for the sandy loam soil, 0.36 for the sand soil, 0.52 for the silty clay loam soil (1.5% o.m.) and 0.28 for the loam soil (0.4% o.m.; Table 6, p. 36); corresponding K_{oc} values were 70, 76, 59 and 117 mL/g. Respective $1/N$ values were 0.68, 0.82, 0.82 and 0.80 for adsorption. The reviewer-calculated coefficient of determination (r^2) values for the relationships K_{ads} vs. organic matter, K_{ads} vs. pH and K_{ads} vs. clay content were 0.34, 0.19 and 0.59, respectively. Freundlich K_{des} values determined following a 24-hour equilibration period were 0.87 for the sandy loam soil, 1.2 for the sand soil, 2.0 for the silty clay loam soil and 1.6 for the loam soil (Table 6, p. 36); corresponding K_{oc} values were 362, 247, 226 and 658 mL/g. Respective $1/N$ values were 0.73, 0.94, 0.93 and 1.0 for desorption.

During the 24-hour equilibration period, 4.2-18.9% of the applied radioactivity was adsorbed to the sandy loam soil (across all application levels), 18.9-28.8% of the applied was adsorbed to the sand soil, 26.2-37.9% of the applied was adsorbed to the silty clay loam soil, 14.7-23.7% of the applied was adsorbed to the loam soil (Table 5, p. 35). Following the 24-hour desorption, 27.2-61.8% of the adsorbed radioactivity was desorbed from the sandy loam soil (across all application levels), 46.8-55.0% was desorbed from the sand soil, 35.6-45.9% was desorbed from the silty clay loam soil, 30.1-51.3% was desorbed from the loam soil (Table 7, p. 37).

The test compound was determined to be stable in the desorption supernatants from the

samples treated at the highest rate; 100% of the radioactivity detected in the samples was present as the parent compound (10.0 $\mu\text{g/mL}$; p. 29).

Material balances across all application rates were 99.0-108.7% for the sandy loam soil samples, 97.7-102.1% for the sand soil samples, 97.2-110.7% for the silty clay loam soil samples and 96.0-101.8% for the loam soil samples (Tables 8, 9, pp. 38, 39)

2,4-DCP

Nonradiolabeled plus uniformly phenyl ring-labeled [^{14}C]2,4-DCP (radiochemical purity 95.2%), at nominal concentrations of 1.0, 2.5, 5.0 and 10.0 $\mu\text{g/mL}$, was studied in sandy loam, sand, silty clay loam and loam soil:solution slurries that were equilibrated for 24 hours at 25 ± 1 °C. Freundlich K_{ads} values were 2.0 for the sandy loam soil (0.4% o.m.), 1.7 for the sand soil, 3.3 for the silty clay loam soil (1.5% o.m.) and 2.9 for the loam soil (0.4% o.m.; Table 6, p. 35); corresponding K_{oc} values were 821, 368, 374 and 1204 mL/g. Respective 1/N values were 0.84, 0.91, 0.74 and 0.80 for adsorption. The reviewer-calculated coefficient of determination (r^2) values for the relationships K_{ads} vs. organic matter, K_{ads} vs. pH and K_{ads} vs. clay content were 0.28, 0.98 and 0.64, respectively. Freundlich K_{des} values determined following a 24-hour equilibration period were 6.3 for the sandy loam soil, 3.8 for the sand soil, 7.1 for the silty clay loam soil and 5.6 for the loam soil (Table 6, p. 35); corresponding K_{oc} values were 2625, 813, 807 and 2325 mL/g. Respective 1/N values were 0.89, 0.79, 0.81 and 0.73 for desorption.

During the 24-hour equilibration period, 41.9-53.6% of the applied radioactivity was adsorbed to the sandy loam soil (across all application levels), 42.6-49.7% of the applied was adsorbed to the sand soil, 53.9-72.1% of the applied was adsorbed to the silty clay loam soil, 49.8-64.8% of the applied was adsorbed to the loam soil (Table 5, p. 34). Following the 24-hour desorption, 20.4-27.2% of the adsorbed radioactivity was desorbed from the sandy loam soil (across all application levels), 24.3-37.8% was desorbed from the sand soil, 16.1-26.0% was desorbed from the silty clay loam soil, 17.7-31.9% was desorbed from the loam soil (Table 7, p. 36).

The test compound was determined to be stable in the desorption supernatants from the samples treated at the highest rate; 100% of the radioactivity detected in the samples was present as the parent compound (10.0 $\mu\text{g/mL}$; p. 28).

Material balances across all application rates were 92.4-95.8% for the sandy loam soil samples, 88.6-92.9% for the sand soil samples, 89.6-95.6% for the silty clay loam soil samples and 89.6-93.6% for the loam soil samples (Tables 8, 9, pp. 37, 38).

2,4-DCA

Nonradiolabeled plus uniformly phenyl ring-labeled [^{14}C]2,4-DCA (radiochemical purity 100%), at nominal concentrations of 0.5, 1.0, 2.5 and 5.0 $\mu\text{g/mL}$, was studied in sandy loam, sand, silty clay loam and loam soil:solution slurries that were equilibrated for 24

hours at 25 ± 1 °C. Freundlich K_{ads} values were 1.6 for the sandy loam soil, 2.1 for the sand soil, 5.4 for the silty clay loam soil (1.5% o.m.) and 3.5 for the loam soil (0.4% o.m.; Table 6, p. 35); corresponding K_{oc} values were 667, 436, 616 and 1442 mL/g. Respective 1/N values were 0.98, 0.96, 0.81 and 0.85 for adsorption. The reviewer-calculated coefficient of determination (r^2) values for the relationships K_{ads} vs. organic matter, K_{ads} vs. pH and K_{ads} vs. clay content were 0.24, 0.68 and 0.80, respectively. Freundlich K_{des} values determined following a 24-hour equilibration period were 2.4 for the sandy loam soil, 3.4 for the sand soil, 8.6 for the silty clay loam soil and 4.4 for the loam soil (Table 6, p. 35); corresponding K_{oc} values were 996, 721, 975 and 1850 mL/g. Respective 1/N values were 0.65, 0.98, 0.74 and 0.79 for desorption.

During the 24-hour equilibration period, 22.1-28.3% of the applied radioactivity was adsorbed to the sandy loam soil (across all application levels), 27.2-34.0% of the applied was adsorbed to the sand soil, 46.0-62.1% of the applied was adsorbed to the silty clay loam soil, 35.1-47.6% of the applied was adsorbed to the loam soil (Table 5, p. 34). Following the 24-hour desorption, 37.4-69.3% of the adsorbed radioactivity was desorbed from the sandy loam soil (across all application levels), 57.8-63.2% was desorbed from the sand soil, 23.0-36.4% was desorbed from the silty clay loam soil, 38.0-52.8% was desorbed from the loam soil (Table 7, p. 36).

The test compound was determined to be stable in the desorption supernatants from the samples treated at the highest rate; 100% of the radioactivity detected in the samples was present as the parent compound (5.0 $\mu\text{g/mL}$; p. 29).

Material balances across all application rates were 95.4-111.8% for the sandy loam soil samples, 91.8-108.6% for the sand soil samples, 91.4-112.2% for the silty clay loam soil samples and 90.5-102.6% for the loam soil samples (Tables 8, 9, pp. 37, 38).

REVIEWER'S COMMENTS:

1. The reviewer noted that the soil characteristics reported in the three studies were not similar for all parameters, although the same four soils were used in the studies. In the 2,4-D DCP study (MRID 44105201), values reported for the sandy loam soil do not agree with those reported in the other two studies, nor do they agree with a summary statement about the soils which appears on page 13 of the 2,4-D DCP study; typographical errors are suspected. Clarification by the registrant would be appropriate. The reviewer notes that the coefficients of determination (r^2) values reported in the DER for the 2,4-D DCP study were determined using the soil characteristic data (pH 5.7, 0.4% OM) actually reported in the studies. A recalculation of two of those values may be necessary if typographical errors are confirmed. The values reported in the other two studies for the two parameters in question were pH 6.7 and 1.0%OM (Table 1).
2. Method detection limits were reported for LSC analyses (p. 25), but were not reported for HPLC analyses. Both method detection and quantitation limits should be reported to allow the reviewer to evaluate the adequacy of the method for the determination of the

test compound.

3. It could not be determined whether one of the soils was the same type (soil series) of soil used in an aerobic soil metabolism study. The soil series names reported by the study author, with the exception of "Plainfield" for the sand soil, are suspected to be names of the geographic locations at which the soils were collected, rather than true soil series names. Clarification by the registrant may be necessary.
4. In a footnote to Tables 5 and 7 from the 2,4-DCP study, the study author stated that one replicate of the silty clay loam soil samples treated at 10.0 $\mu\text{g}/\text{mL}$ was lost in a lab accident (pp. 34, 36; MRID 44105201). Therefore, only one replicate of the 10.0 $\mu\text{g}/\text{mL}$ treatment was 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 used.
5. In the 2,4-DCP study, the reviewer noted that two specific activity values (12.7 mCi/mmol and 54.1 mCi/mmol) were reported (p. 12, MRID 44105201). It could not be determined which value was correct.
6. The study author stated that two additional samples in the 2,4-D study were treated with a separate 10 $\mu\text{g}/\text{mL}$ treatment solution to replace two samples that were lost in a laboratory accident (p. 19).

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Pages 11 through 55 are not included in this copy.

The material not included contains the following type of information:

- Identity of product inert ingredients.
- Identity of product impurities.
- Description of the product manufacturing process.
- Description of quality control procedures.
- Identity of the source of product ingredients.
- Sales or other commercial/financial information.
- A draft product label.
- The product confidential statement of formula.
- Information about a pending registration action.
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