TOXICITY TO TERRESTRIAL PLANTS

## TEST SUBSTANCE

**Identity:** Perfluorooctanesulfonate; may also be referred to as PFOS or FC-95. (1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, potassium salt, CAS # 2795-39-3)

**Remarks:** The test substance is a white powder. Sample was taken from 3M lot number 217. Sample was stored under ambient conditions prior to testing. Purity determined to be 86.9% by LC/MS, $^{1}$H-HMR, $^{19}$F-NMR and elemental analyses techniques.

## METHOD

**Method:** The study was conducted using a protocol based on procedures outlined in U.S. EPA OPPTS Guidelines 850.4100 and 850.4225 and the Organization for Economic Cooperation and Development (OECD) proposed revision of Guideline No. 208.
**Test type:** Artificial soil
**GLP:** Yes
**Year Completed:** 2003
**Species** Monocots:
*Allium cepa* (onion – 'Texas Grano')
*Lolium perenne* (ryegrass – 'Manhattan 3')

Dicots:
*Medicago sativa* (alfalfa)
*Linum usitatissimum* (flax)
*Lactuca sativa* (lettuce – 'Summertime')
*Glycine max* (soybean – 'Green Envy')
*Lycopersicon esculentum* (tomato – 'Rutgers')

**Analytical monitoring**: Test substance concentrations were measured by LCMS in soil at Days 0 and test termination and in plant and (when possible) fruit tissues at test termination.
**Statistical methods:** EC values calculated, when possible, by non-linear regression analysis of Bruce and Versteeg, or with non-linear interpolation using the ICp approach of Norberg-King. Treatment group means were compared to control means with Dunnett's test (a = 0.05) using SAS Version 8 to determine if significant differences in emergence, survival, weight or height from the control occurred.

**Test organism source:**

| | |
|---|---|
| Onion: | Territorial Seed Co., Cottage Grove, OR |
| Ryegrass: | Meyer Seed Co., Baltimore, MD |
| Alfalfa: | Frontier Natural Products, Norway, IA |
| Flax: | Arrowhead Mills, Hereford, TX |

Lettuce: Territorial Seed Co., Cottage Grove, OR
Soybean: Johnny's Selected Seeds, Albion, ME
Tomato: Meyer Seed Co., Baltimore, MD

**Test organism age at study initiation:** seed

**Test conditions**

**Test media:** Artificial loam soil of the following composition: Kaolin clay, industrial quartz sand and peat in a ratio of 2:25:1 by weight. Crushed limestone (to buffer the pH) and a slow-release fertilizer were also added. Final mix consisted of 49% sand, 30% silt, 21% clay, and 2.1% organic matter. Soil pH was 7.79.

**Environmental conditions:** Study conducted in a temperature-controlled greenhouse. Artificial lighting supplemented natural sunlight to provide a uniform 14-hour photoperiod.

**Stock and test solutions preparation:** Approximately 70 kg of each test concentration and the negative control was prepared separately. The test substance was first mixed with a 1000 g aliquot of the 70 kg of test soil (soil moisture of 15%). The test substance-containing aliquot was then added back to the 70 kg of bulk soil and mixed for 10 minutes. The negative control soil was prepared in the same manner, but no test substance was added.

**Exposure vessels:** Plastic pots, approximately 16 cm wide and 12 cm deep.

**Number of replicates:** four

**Number of seeds per replicate:** ten

**Number of concentrations:** five plus a negative control

**Watering procedure:** subirrigation

**Test conditions parameters:**

**Temperature range:** 14.1 – 32.0°C
**Relative humidity range:** 8 – 91%
**Light intensity range:** 12.8 – 26.6 moles PAR

**Exposure period (germination and growth test):** 21-Days

**Exposure period (extended test):** up to 205-days (variable by species)

After observations on day 21, all but one plant was clipped from each pot. The remaining plant was maintained in the extended test, until (if possible) fruit formation. At test termination, the one plant was harvested and the fruit and vegetative tissues were analyzed separately for PFOS.

**Element Basis:** $EC_{25}$, $EC_{50}$, NOEC – emergence, survival, shoot height, shoot weight

**Other observations:** seedling condition

**Method of reporting test concentrations:** nominal

RESULTS

**Nominal concentrations:** Bk control, 3.91, 15.6, 62.5, 250, 1000 mg/kg
**Initial measured concentrations:** <LOQ, 3.61, 11.1, 50.8, 276, 998 mg/kg

**Element values:**

**21-Day Emergence, mg/kg**

| Species | LOEC | NOEC | $EC_{25}$ | $EC_{50}$ |
|---|---|---|---|---|
| Onion | 250 | 62.5 | 51 | 210 |
| Ryegrass | 250 | 62.5 | 200 | 340 |
| Alfalfa | 1000 | 250 | 370 | 745 |
| Flax | 1000 | 250 | 400 | 600 |
| Lettuce | 1000 | 250 | 390 | 560 |
| Soybean | >1000 | 1000 | >1000 | >1000 |
| Tomato | 1000 | 250 | 310 | 470 |

**21-Day Survival, mg/kg**

| Species | LOEC | NOEC | $EC_{25}$ | $EC_{50}$ |
|---|---|---|---|---|
| Onion | 62.5 | 15.6 | 47 | 57 |
| Ryegrass | 250 | 62.5 | 170 | 310 |
| Alfalfa | 250 | 62.5 | 250 | 450 |
| Flax | 250 | 62.5 | 140 | 230 |
| Lettuce | 250 | 62.5 | 260 | 390 |
| Soybean | >1000 | 1000 | >1000 | >1000 |
| Tomato | 62.5 | 15.6 | 69 | 105 |

**21-Day Shoot Height, mg/kg**

| Species | LOEC | NOEC | $EC_{25}$ | $EC_{50}$ |
|---|---|---|---|---|
| Onion | 62.5 | 15.6 | 29 | 47 |
| Ryegrass | 15.6 | 3.91 | 46 | 130 |
| Alfalfa | 250 | 62.5 | 100 | 250 |
| Flax | 250 | 62.5 | 98 | 140 |
| Lettuce | 3.91 | <3.91 | 6.8 | 40 |
| Soybean | 250 | 62.5 | 280 | 460 |
| Tomato | 62.5 | 15.6 | 22 | 94 |

**21-Day Shoot Weight, mg/kg**

| Species | LOEC | NOEC | $EC_{25}$ | $EC_{50}$ |
|---|---|---|---|---|
| Onion | 15.6 | 3.91 | 13 | 28 |
| Ryegrass | 15.6 | 3.91 | 7.5 | 54 |
| Alfalfa | 250 | 62.5 | 53 | 150 |
| Flax | 250 | 62.5 | 82 | 120 |
| Lettuce | 3.91 | <3.91 | 8.9 | 20 |
| Soybean | 250 | 62.5 | 160 | 330 |
| Tomato | 62.5 | 15.6 | 12 | 29 |

All element values were calculated using nominal concentrations.

**Statistical Evaluation Variables:**
Emergence: Number of emerged seedlings per 10 planted seeds per pot.
Survival: Number of living emerged seedlings per 10 seeds per pot.
Weight: Mean shoot wet weight of living emerged seedlings in each pot
Height: Mean height of living emerged seedlings in each pot.

**Biological observations:**

**Onion – Day 21**

| Nominal Soil Concentration, mg/kg | Mean Emergence % | Mean Survival % | Mean Seedling Fresh Weight, g | Mean Seedling Height cm | Mean Seedling Condition Score[1] | Sublethal Effects Noted [# plants with effect] |
|---|---|---|---|---|---|---|
| Neg. Control | 88 | 85 | 0.10 | 8.1 | 2.9 | None |
| 3.91 | 93 | 90 | 0.09 | 7.3 | 3.8 | Chlorosis [1] |
| 15.6 | 83 | 80 | 0.07* | 7.3 | 4.8 | Necrosis [1] |
| 62.5 | 63 | 33* | 0.02* | 2.6* | 48 | None |
| 250 | 40* | 0* | - | - | 100 | - |
| 1000 | 0* | 0* | - | - | - | - |

[1]A score of 0 = normal seedling; 100 = dead seedling
*Statistically significantly different from the control ($p<0.05$)

**Ryegrass – Day 21**

| Nominal Soil Concentration, mg/kg | Mean Emergence % | Mean Survival % | Mean Seedling Fresh Weight, g | Mean Seedling Height cm | Mean Seedling Condition Score[1] | Sublethal Effects Noted [# plants with effect] |
|---|---|---|---|---|---|---|
| Neg. Control | 80 | 80 | 0.12 | 16.9 | 0 | None |
| 3.91 | 93 | 93 | 0.11 | 15.4 | 0 | None |
| 15.6 | 90 | 90 | 0.07* | 13.7* | 0 | None |
| 62.5 | 85 | 83 | 0.08* | 13.6* | 2.9 | None |
| 250 | 58* | 53* | 0.01* | 3.7* | 22 | Necrosis [11] |
| 1000 | 7.5* | 7.5* | 0.03* | 2.0* | 13 | Necrosis [2] |

[1]A score of 0 = normal seedling; 100 = dead seedling
*Statistically significantly different from the control ($p<0.05$)

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## Alfalfa – Day 21

| Nominal Soil Concentration, mg/kg | Mean Emergence % | Mean Survival % | Mean Seedling Fresh Weight, g | Mean Seedling Height cm | Mean Seedling Condition Score[1] | Sublethal Effects Noted [# plants with effect] |
|---|---|---|---|---|---|---|
| Neg. Control | 90 | 88 | 0.12 | 6.5 | 4.2 | Necrosis [1] |
| 3.91 | 85 | 83 | 0.11 | 6.4 | 2.9 | None |
| 15.6 | 80 | 80 | 0.10 | 5.4 | 5.9 | Necrosis [3] |
| 62.5 | 80 | 80 | 0.10 | 6.1 | 0.9 | Necrosis [1] |
| 250 | 73 | 63* | 0.03* | 2.8* | 17 | Necrosis [1] |
| 1000 | 33* | 15* | 0.02* | 1.0* | 75 | Necrosis [4] |

[1]A score of 0 = normal seedling; 100 = dead seedling
*Statistically significantly different from the control ($p<0.05$)

## Flax – Day 21

| Nominal Soil Concentration, mg/kg | Mean Emergence % | Mean Survival % | Mean Seedling Fresh Weight, g | Mean Seedling Height cm | Mean Seedling Condition Score[1] | Sublethal Effects Noted [# plants with effect] |
|---|---|---|---|---|---|---|
| Neg. Control | 73 | 73 | 0.19 | 8.9 | 1.4 | Unshed seed coat [1] |
| 3.91 | 73 | 68 | 0.18 | 8.7 | 9.7 | Leaf curl [1] |
| 15.6 | 80 | 80 | 0.18 | 8.8 | 2.5 | Unshed seed coat [1] |
| 62.5 | 85 | 85 | 0.16 | 8.2 | 1.2 | Necrosis [1] |
| 250 | 73 | 33* | 0.02* | 1.3* | 91 | Unshed seed coat [13] |
| 1000 | 0* | 0* | - | - | - | - |

[1]A score of 0 = normal seedling; 100 = dead seedling
*Statistically significantly different from the control ($p<0.05$)

## Lettuce – Day 21

| Nominal Soil Concentration, mg/kg | Mean Emergence % | Mean Survival % | Mean Seedling Fresh Weight, g | Mean Seedling Height cm | Mean Seedling Condition Score[1] | Sublethal Effects Noted [# plants with effect] |
|---|---|---|---|---|---|---|
| Neg. Control | 88 | 88 | 0.38 | 6.4 | 0 | None |
| 3.91 | 90 | 90 | 0.25* | 5.0* | 0 | None |
| 15.6 | 90 | 90 | 0.24* | 5.0* | 1.1 | Necrosis [1] |
| 62.5 | 85 | 85 | 0.05* | 2.6* | 33 | Necrosis [29] |
| 250 | 83 | 68* | 0.01* | 1.0* | 42 | Necrosis [17]<br>Leaf curl [1] |
| 1000 | 13* | 5.0* | Insufficient sample* | 1.0* | 94 | Necrosis [1]<br>Unshed seed coat [1] |

[1]A score of 0 = normal seedling; 100 = dead seedling
*Statistically significantly different from the control ($p<0.05$)

002185

**Soybean – Day 21**

| Nominal Soil Concentration, mg/kg | Mean Emergence % | Mean Survival % | Mean Seedling Fresh Weight, g | Mean Seedling Height cm | Seedling Condition Score[1] | Sublethal Effects Noted [# plants with effect] |
|---|---|---|---|---|---|---|
| Neg. Control | 100 | 100 | 3.63 | 28.3 | 0 | None |
| 3.91 | 98 | 98 | 3.64 | 26.8 | 0.8 | Leaf curl [1] |
| 15.6 | 95 | 95 | 3.63 | 26.9 | 0 | None |
| 62.5 | 100 | 100 | 4.00 | 30.7 | 1.8 | Leaf curl [2] |
| 250 | 100 | 98 | 2.07* | 22.5* | 7.0 | Chlorosis [2]<br>Leaf curl [3]<br>Necrosis [1] |
| 1000 | 100 | 100 | 0.57* | 4.1* | 51 | Unshed seed coat [2]<br>Stem curl [7]<br>Leaf curl [11]<br>Necrosis [25] |

[1]A score of 0 = normal seedling; 100 = dead seedling
*Statistically significantly different from the control ($p<0.05$)

**Tomato – Day 21**

| Nominal Soil Concentration, mg/kg | Mean Emergence % | Mean Survival % | Mean Seedling Fresh Weight, g | Mean Seedling Height cm | Mean Seedling Condition Score[1] | Sublethal Effects Noted [# plants with effect] |
|---|---|---|---|---|---|---|
| Neg. Control | 93 | 93 | 0.35 | 5.2 | 0 | None |
| 3.91 | 83 | 83 | 0.40 | 5.6 | 0 | None |
| 15.6 | 83 | 80 | 0.28 | 4.8 | 6.7 | Leaf curl [1]<br>Necrosis [3] |
| 62.5 | 85 | 68 | 0.08* | 2.6* | 40 | Necrosis [19] |
| 250 | 73 | 7.5 | 0.03* | 2.0* | 97 | Necrosis [3] |
| 1000 | 10* | 0* | - | - | 100 | - |

[1]A score of 0 = normal seedling; 100 = dead seedling
*Statistically significantly different from the control ($p<0.05$)

**Control response:** Satisfactory for all species

**Extended test observations:** There were no additional findings of phytotoxicity at the termination of the extended growth portion of the test.

**Analytical Methodology:** Analyses of test soils and plants were performed at Wildlife International Ltd. using high performance liquid chromatography with triple quadrupole mass spectrometric detection (HPLC/MS/MS). When determining the concentration of the test substance in the samples, the same and most prominent peak response for perfluorooctanesulfonate was used. No attempt was made to quantify on the basis of individual isomeric components. The LOQ (limit of quantitation) in soil was 1.18 mg/kg. For vegetative tissue, the LOQ

ranged from 2.4 – 7.6 mg/kg. For fruit, the LOQ ranged from 0.12 – 6.4 mg/kg.

The recovery of matrix fortifications analyzed concurrently during sample analysis ranged from 83.9% – 89.0% in the soil, 86.3% – 117% in the fruit and 88.0% – 110% in the vegetative tissue. Soil samples collected at test initiation had measured values from 71.2% to 110% of nominal. Measured values for samples taken at test termination ranged from 22.8% to 62.8% of nominal.

Values reported as <LOQ were excluded from all calculations of mean concentration.

**Summaries of Analytical Chemistry Data (All results reported as dry weight):**

**Soil, Day 0:**

| Nominal Test Concentration, mg/kg | Measured Replicate Values, mg/kg | Mean Concentration, mg/kg | Percent of Nominal |
|---|---|---|---|
| Negative Control | All < LOQ[1] | <LOQ | - |
| 3.91 | 3.43, 2.83, 4.56 | 3.61 | 92.3 |
| 15.6 | 11.1, 11.2 | 11.1 | 71.2 |
| 62.5 | 50.0, 44.7, 57.6 | 50.8 | 81.3 |
| 250 | 415, 244, 170 | 276 | 110 |
| 1000 | 1070, 983, 942 | 998 | 99.8 |

[1]LOQ = 1.18 mg/kg

**Soil, termination (Day 205):**

| Nominal Test Concentration, mg/kg | Measured Replicate Values, mg/kg | Mean Concentration, mg/kg | Percent of Nominal |
|---|---|---|---|
| Negative Control | All < LOQ[1] | <LOQ | - |
| 3.91 | 1.21, 1.36 | 1.29 | 33.0 |
| 15.6 | 4.91, 2.21 | 3.56 | 22.8 |
| 62.5 | 16.3, 16.1 | 16.2 | 25.9 |
| 250 | 153, 161 | 157 | 62.8 |
| 1000 | 432, 515 | 474 | 47.4 |

[1]LOQ = 1.18 mg/kg

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## Onion Vegetative Tissue, Termination (67-days):

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All < LOQ[(1)] | <LOQ |
| 3.91 | All < LOQ[(1)] | <LOQ |
| 15.6 | 5.86, 15.4, <LOQ | 10.6 |
| 62.5 | Insufficient sample | - |
| 250 | No plants living | - |
| 1000 | No plants living | - |

[(1)]LOQ = 4.7 mg/kg

## Onion Fruit, Termination (67-days)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | 0.517, 0.487, insufficient sample | 0.502 |
| 3.91 | 5.81, 0.453, insufficient sample | 3.13 |
| 15.6 | <LOQ[(1)], 19.7, 24.6 | 22.2 |
| 62.5 | Insufficient sample | - |
| 250 | Insufficient sample | - |
| 1000 | No plants living | - |

[(1)]LOQ = 0.42 mg/kg

## Ryegrass Vegetative Tissue, Termination (205 days)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[(1)] | <LOQ |
| 3.91 | 7.13, 8.70, 8.70 | 8.18 |
| 15.6 | 13.8, 49.0, <LOQ | 31.4 |
| 62.5 | 42.5, 67.0, 36.7 | 48.7 |
| 250 | 31.9, 37.5, 129 | 66.1 |
| 1000 | Insufficient sample | - |

[(1)]LOQ = 3.3 mg/kg

**Ryegrass fruit – No sample (did not mature by 205 days)**

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## Alfalfa Vegetative Tissue, Termination (141 days)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[1] | <LOQ |
| 3.91 | <LOQ, <LOQ, 6.16 | 6.16 |
| 15.6 | 5.66, 2.74, <LOQ | 4.2 |
| 62.5 | 12.9, 9.66, 11.1 | 11.2 |
| 250 | 14.2, 15.8, 17.3 | 15.8 |
| 1000 | Insufficient sample | - |

[1]LOQ = 2.7 mg/kg

## Alfalfa Fruit, Termination (141 days)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[1] | <LOQ |
| 3.91 | Insufficient sample, insufficient sample, <LOQ | <LOQ |
| 15.6 | <LOQ (composite) | <LOQ |
| 62.5 | <LOQ (composite) | <LOQ |
| 250 | <LOQ (composite) | <LOQ |
| 1000 | Insufficient sample | - |

[1]LOQ = 6.4 mg/kg

## Flax Vegetative Tissue, Termination (94 days)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[1] | <LOQ |
| 3.91 | 4.56, 6.43, 3.85 | 4.95 |
| 15.6 | 13.1, 26.4, 17.0 | 18.8 |
| 62.5 | 54.7, 72.7, 37.5 | 55.0 |
| 250 | Insufficient sample | - |
| 1000 | No plants living | - |

[1]LOQ = 2.4 mg/kg

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## Flax Fruit, Termination (94 days)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[1] | <LOQ |
| 3.91 | 0.217, 0.277, 0.195 | 0.230 |
| 15.6 | 1.07, 0.622, 2.41 | 1.36 |
| 62.5 | 1.26, 2.20, 4.23 | 2.56 |
| 250 | Insufficient sample | - |
| 1000 | No plants living | - |

[1]LOQ = 0.12 mg/kg

## Lettuce Vegetative Tissue, Termination (67 days)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[1] | <LOQ |
| 3.91 | 12.2, 6.16, 7.52 | 8.63 |
| 15.6 | 15.5, 7.06, 9.26 | 10.6 |
| 62.5 | 39.8, 58.9, 27.0 | 41.9 |
| 250 | Insufficient sample | - |
| 1000 | Insufficient sample | - |

[1]LOQ = 5.5 mg/kg

## Soybean Vegetative Tissue, Termination (67 days)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[1] | <LOQ |
| 3.91 | 17.7, 10.0, 19.1 | 15.6 |
| 15.6 | 29.3, 48.9, 29.3 | 35.8 |
| 62.5 | 63.9, 70.7, 55.4 | 63.3 |
| 250 | 64.2, 175, 103 | 114 |
| 1000 | Insufficient sample | - |

[1]LOQ = 6.0 mg/kg

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## Soybean Fruit, Termination (67 days)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[1] | <LOQ |
| 3.91 | 0.947, 0.339, 2.91 | 1.40 |
| 15.6 | 0.464, 1.63, 0.528 | 0.874 |
| 62.5 | 1.14, 1.14, 1.33 | 1.20 |
| 250 | 1.57, 5.56, 2.49 | 3.21 |
| 1000 | Insufficient sample | - |

[1]LOQ = 0.18 mg/kg

## Tomato Vegetation, Termination (day 94)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[1] | <LOQ |
| 3.91 | All <LOQ | - |
| 15.6 | 12.5, 27.9, 61.1 | 33.8 |
| 62.5 | 70.9, 44.5, 34.9 | 50.1 |
| 250 | Insufficient sample | - |
| 1000 | No plants living | - |

[1]LOQ = 7.6 mg/kg

## Tomato Fruit, Termination (day 94)

| Nominal Test Concentration, mg/kg | Measured Replicate Tissue Values, mg/kg | Mean tissue Concentration, mg/kg |
|---|---|---|
| Negative Control | All <LOQ[1] | <LOQ |
| 3.91 | <LOQ, <LOQ, insufficient sample | < LOQ |
| 15.6 | <LOQ, 1.51, 0.58 | 1.05 |
| 62.5 | 0.946, <LOQ, <LOQ | 0.946 |
| 250 | Insufficient sample | - |
| 1000 | No plants living | - |

[1]LOQ = 0.47 mg/kg



Samples of soil and plant tissues from all species were also obtained at Day 21 and analyzed for PFOS. However, plant tissues and soil obtained on Day 21 had considerably higher than expected PFOS concentrations. Day 21 soil samples were collected by scraping the surface of the soil,

whereas a soil core sampler was used for samples collected at test termination. The laboratory concluded that PFOS concentrated in the top layer of the soil as a result of watering by subirrigation. Plant tissues collected at Day 21 were very small in size, and likely contaminated with surface soil due to improper collection techniques. Therefore, Day 21 values were considered to be not representative, and were not reported.

## CONCLUSIONS

The potassium perfluorooctanesulfonate 21-day $EC_{50}$ range for seven species of terrestrial plants for the four study endpoints were found to be:

Emergence: 210 - > 1000 mg/kg
Survival: 57 - >1000 mg/kg
Height: 40 – 460 mg/kg
Shoot Weight: 20 – 330 mg/kg

The 21-day no observed effect concentration ranges were found to be:

Emergence: 62.5 – 1000 mg/kg
Survival: 15.6 – 1000 mg/kg
Height: <3.91 – 62.5 mg/kg
Shoot Weight: <3.91 – 62.5 mg/kg

**Submitter:** 3M Corporation, Environmental Laboratory, P.O. Box 33331, St. Paul, Minnesota, 55133

## DATA QUALITY

**Reliability:** Klimisch ranking 1.

## REFERENCES

This study was conducted at Wildlife International, Ltd. Easton, MD at the request of the 3M Company.

## OTHER

**Last changed:** 6/3/03