

**TOXICOLOGY ASSESSMENT AND COMPLIANCE ASSURANCE GROUP
3M COMPANY**

**10-195: ORAL STUDY OF MTDID 208
AND MTDID 1004 IN MALE RATS**

FINAL REPORT

ToxDocs Study Number	10-195
Test Material	MTDID 208 MTDID 1004
Lot Number(s)	217 (MTDID 208) 332 (MTDID 1004)
Strategic Tox Lab Study Number	ST-310
Other Identification Number(s)	K ⁺ PFOS (MTDID 208) NH ₄ ⁺ PFOA (MTDID 1004)
19F/1H-NMR Analytical Report GID Number	See Appendices 1 & 2 for Certificate of Analysis
Study Director	Jill Hart, AAS, LATg Laboratory Administrator
Principle Investigator: (Study Monitor)	John Butenhoff, Ph.D., DABT, CIH Corporate Scientist
Testing Facility	3M Strategic Toxicology Laboratory 3M Center, Bldg 270, room SB314 Saint Paul, MN 55144
In-Life Start Date	August 4, 2010
In-Life Termination Date	October 4, 2010

TOXICOLOGY ASSESSMENT AND COMPLIANCE ASSURANCE GROUP
3M COMPANY

**10-195: ORAL STUDY OF MTDID 208
AND MTDID 1004 IN MALE RATS**

Compliance Statement and Signature Page

This study was conducted for research and development purposes and does not conform to regulatory guidelines.

This final report has been reviewed and approved by:



Jill Hart, AAS, LATg
Laboratory Administrator
Study Director

21 JAN 2011

Date



John Butenhoff, Ph.D., DABT, CIH.
Corporate Scientist
Principle Investigator

19 JAN 2011

Date

1 Summary

The purpose of this study was to evaluate the absorption characteristics of perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) from low-dose oral exposure using both water and corn oil as vehicle in male Sprague Dawley rats. Absorption of PFOS and PFOA was evaluated by measuring their concentrations in rat serum at 4 hours and 24 hours after single oral administration of either K⁺PFOS (MTDID 208, 20 µg/kg and 1 mg/kg), NH₄⁺PFOA (MTDID 1004, 20 µg/kg and 1 mg/kg), or K⁺PFOS and NH₄⁺PFOA (20 µg/kg and 1 mg/kg) concurrently.

All rats appeared normal during the study and there was no mortality occurred prior to scheduled study termination. At necropsy, serum and liver were harvested and stored frozen pending PFOS and PFOA concentration determination by LC-MS/MS.

Regardless of preparation (either as single PFOS dosing solution, single PFOA dosing solution, or PFOS/PFOA mixture), the use of corn oil as vehicle generally appeared to reduce uptake of both PFOS and PFOA in serum and liver in male rats when compared to using water as vehicle.

2 Study Objective

The purpose of this study was to evaluate the absorption characteristics of perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) from low-dose oral exposure using both water and corn oil as vehicle in male Sprague Dawley rats. Absorption of PFOS and PFOA was evaluated by measuring their concentrations in serum after oral K⁺PFOS (MTDID 208) and NH₄⁺PFOA (MTDID 1004) administration; either separately or in combination.

3 Test Material Information

3.1 Test Substance

Identity	MTDID 208
Lot Number	217
Chemical Name	Potassium Perfluorooctanesulfonate
Other Identifiers	K ⁺ PFOS
Appearance	White solid
Purity	86.9 %
Density	N/A
Stability	Stable under normal conditions
Expiration Date	June 2019

Characterization	The test material is assigned as MTDID 208 and its characterization is attached as Appendix 1
Storage	The test article will be stored tightly sealed in its original container at ambient room temperature.
Handling Precautions	Standard protective equipment will be used. Lab coats, gloves and eye protection will be worn while handling the test article.
Disposition	Any remaining unused test article will be kept in the Study Facility until expiration date.
Identity	MTDID 1004
Lot Number	332
Chemical Name	Ammonium Perfluorooctanoate
Other Identifiers	NH ₄ ⁺ PFOA
Appearance	White solid
Purity	97.99 %
Density	N/A
Stability	Stable under normal conditions
Expiration Date	June 2019
Characterization	The test material is assigned as MTDID 1004 and its characterization is attached as Appendix 2.
Storage	The test article will be stored tightly sealed in its original container at ambient room temperature.
Handling Precautions	Standard protective equipment will be used. Lab coats, gloves and eye protection will be worn while handling the test article.
Disposition	Any remaining unused test article will be kept in the Study Facility until expiration date.

3.2 Dose Preparation

Dose Preparation	The test materials were dissolved in either water or corn oil as 20 µg/mL or 1 mg/mL solution.
Physical State of administered material	Liquid
Route of Administration	Oral

4 Test System

4.1 Test System Information

Species	Rat
Strain	SD
Source	Harlan Laboratories
Age at Initiation of Treatment	8 – 20 weeks
Weight at Initiation of Treatment	Approximately 200 - 479 g
Number and sex	8 males
Identification	Unique tail mark in indelible ink
IACUC Animal Usage Application Number	2008-0459

4.2 Animal Husbandry

Housing	All animals were group-housed in solid-bottom cages throughout the study except during urine and feces collection in which rats were single housed in wired bottom metabolism caging for urine and feces collection for 24 hours prior to designated study termination time.
Diet/Water	HarlanTeklad Rat/Mouse 2018 Diet (HarlanTeklad, Madison, WI) and tap water were available <i>ad libitum</i> throughout the study.
Housing Environment	Temperature Range 72 ± 3°F Humidity Range 30 – 70% Minimum of 10 exchanges of room air per hour 12 hour light/dark cycle

5 Study Design

Dose Group	Compound(s)	Vehicle	Dose	Dosing solution concentration	Dose Volume	N	Sex	Euthanasia
1	PFOS	water	20 ug/kg	20 ug/mL	1 mL/kg	3	M	4 hrs PD
2	PFOA					3		
3	PFOS/PFOA					3		
4	PFOS	corn oil	20 ug/kg	20 ug/mL	1 mL/kg	3	M	4 hrs PD
5	PFOA					3		
6	PFOS/PFOA					3		
7	PFOS	water	20 ug/kg	20 ug/mL	1 mL/kg	3	M	24 hrs PD
8	PFOA					3		
9	PFOS/PFOA					3		

10	PFOS	corn oil	20 ug/kg	20 ug/mL	1 mL/kg	3	M	24 hrs PD
11	PFOA					3		
12	PFOS/PFOA					3		
13	PFOS	water	1 mg/kg	1 mg/mL	1 mL/kg	3	M	4 hrs PD
14	PFOA					3		
15	PFOS/PFOA					3		
16	PFOS	corn oil	1 mg/kg	1 mg/mL	1 mL/kg	3	M	4 hrs PD
17	PFOA					3		
18	PFOS/PFOA					3		
19	PFOS	water	1 mg/kg	1 mg/mL	1 mL/kg	3	M	24 hrs PD
20	PFOA					3		
21	PFOS/PFOA					3		
22	PFOS	corn oil	1 mg/kg	1 mg/mL	1 mL/kg	3	M	24 hrs PD
23	PFOA					3		
24	PFOS/PFOA					3		

All rats were euthanized via CO₂ asphyxiation at designated times followed by gross necropsy with blood (for serum) and livers collected.

6 Parameters Evaluated

6.1 Clinical Observations

Each animal was observed immediately following dosing and throughout the study for mortality and morbidity. Any notable findings were recorded.

6.2 Body Weights

All animals were weighed prior to treatment for the purpose of calculating dose volumes and prior to necropsy.

6.3 Serum Collection

At euthanasia, blood was collected via the abdominal aorta and transferred to labeled collection tubes without anticoagulant. The blood samples were allowed to clot for 15 to 30 minutes at room temperature and then centrifuged at 2000 x g for 15 minutes. The serum was transferred to 1.7-mL polypropylene microcentrifuge tubes labeled with a tube code and stored frozen at -70°C pending analysis.

6.4 Gross Necropsy, Organ Weights and Tissue Collection

Following euthanasia, a gross necropsy was performed on all animals. Liver samples were harvested and the corresponding weights were recorded. All samples were stored in a freezer set to maintain -70° C for future analysis. No other tissues were collected.

6.5 Analysis

PFOS and PFOA concentrations were determined in all serum and liver samples by LC-MS/MS.

7 Statistical Analysis

There were no statistical analyses performed on data collected in this study.

8 Raw Data

The raw data for body weights, organ weights and dosing volumes are recorded in 3M Notebook # 154823, pages 78 - 80.

9 Results

9.1 Clinical Observations

No mortalities occurred during this study, all rats survived until scheduled necropsies. Clinical observations were normal throughout the study.

9.2 Body Weights and Organ Weights

Body and liver weight data are presented in Table 1. All animals gained weight during the study.

9.3 Gross Necropsy

There were no gross lesions or other abnormalities noted in any rats during necropsy.

9.4 Analytical Results

PFOS and PFOA concentrations in serum and liver are presented in Table 2.

10 Discussion & Conclusion

Regardless of preparation (either as single PFOS dosing solution, single PFOA dosing solution, or PFOS/PFOA mixture), the use of corn oil as vehicle generally appeared to reduce uptake of both PFOS and PFOA in serum and liver in male rats when compared to using water as vehicle.

Table 1: Body weight (BW) and liver weight (LW) data

Dose Group	Compound/ Vehicle	Dose	Animal #	Tail Mark	Tube Code	Pre-Dose BW (g)	Necropsy BW (g)	LW (g)
1	PFOS/Water	20 ug/kg	OR127	Blue I	1M	478	478	16.97
			OR129	Blue II	2M	424	424	13.69
			OR131	Blue III	3M	486	486	15.57
2	PFOA/Water		OR191	Blue IV	4M	403	403	14.32
			OR192	Blue V	5M	446	446	14.52
			OR194	Blue VI	6M	472	472	16.97
3	PFOS/PFOA/ Water		OR195	Blue VII	7M	434	434	14.22
			OR196	Blue VII	8M	429	429	13.89
			OR381	Blue IX	9M	388	388	13.78
4	PFOS/Corn Oil		OR382	Blue X	10M	373	373	14.11
			OR383	Blue XI	11M	364	364	12.85
			OR384	Blue XII	12M	368	368	14.05
5	PFOA/Corn Oil		OR385	Blue XIII	13M	378	378	12.97
			OR386	Blue XIV	14M	364	364	13.91
			OR387	Blue XV	15M	391	391	14.5
6	PFOS/PFOA/ Corn Oil		OR388	Blue XVI	16M	383	383	15.36
			OR389	Blue XVII	17M	387	387	14.72
			OR390	Blue XVIII	18M	399	399	15.84
7	PFOS/Water		OR391	Blue XIX	19M	351	346	13.2
			OR392	Blue XX	20M	355	353	13.4
			OR405	Blue XXI	21M	325	323	12.7
8	PFOA/Water		OR406	Blue XXII	22M	303	305	12.4
			OR446	Blue XXIII	23M	278	280	10.8
			OR447	Blue XXIV	24M	315	321	13.6
9	PFOS/PFOA/ Water		OR448	Blue XXV	25M	294	295	12.8
			OR449	Blue XXVI	26M	301	303	12.6
			OR450	Blue XXVI	27M	288	291	12.5
10	PFOS/Corn Oil		OR493	Blue XXVII	28M	209	220	10.2
			OR494	Blue XXIX	29M	218	230	10.8
			OR495	Blue XXX	30M	209	215	10.3
11	PFOA/Corn Oil		OR496	Blue XXXI	31M	204	213	10.3
			OR497	Blue XXXII	32M	211	224	10.7
			OR498	Blue XXXII	33M	212	221	10.1
12	PFOS/PFOA/ Corn Oil		OR499	Blue XXXIV	34M	230	241	11.3
			OR500	Blue XXXV	35M	212	221	10.5
			OR501	Blue XXXV	36M	216	227	10.9
13	PFOS/Water	OR502	Blue XXXVI	37M	206	206	9.5	
		OR503	Blue XXXVI	38M	214	214	10.0	
		OR504	Blue XXXIX	39M	201	201	9.3	
14	PFOA/Water	OR505	Blue XL	40M	216	216	10.8	
		OR506	Blue XLI	41M	211	211	9.3	
		OR507	Blue XLII	42M	203	203	9.7	
15	PFOS/PFOA/ Water	OR508	Blue XLIII	43M	205	205	8.8	
		OR509	Blue XLIV	44M	210	210	9.6	
		OR510	Blue XLV	45M	207	207	8.4	
16	PFOS/Corn Oil	OR511	Blue XLVI	46M	218	218	10.3	
		OR512	Blue XLVII	47M	218	218	9.7	
		OR513	Blue XLVII	48M	227	227	11.1	
17	PFOA/Corn Oil	OR514	Blue XLIX	49M	219	219	10.7	
		OR515	Blue L	50M	225	225	10.5	
		OR516	Blue LI	51M	218	218	10.5	
18	PFOS/PFOA/ Corn Oil	OR517	Blue LII	52M	231	231	10.5	
		OR518	Blue LIII	53M	218	218	9.4	
		OR519	Blue LIV	54M	216	216	9.5	
19	PFOS/Water	OR520	Blue LV	55M	230	236	11.0	
		OR521	Blue LVI	56M	226	234	11.4	
		OR522	Blue LVII	57M	229	236	11.3	
20	PFOA/Water	OR523	Blue LVIII	58M	226	227	10.1	
		OR524	Blue LIX	59M	251	254	12.2	
		OR525	Blue LX	60M	239	246	11.9	
21	PFOS/PFOA/ Water	OR526	Blue LXI	61M	242	251	12.0	
		OR527	Blue LXII	62M	239	241	11.0	
		OR528	Blue LXIII	63M	240	240	10.9	
22	PFOS/Corn Oil	OR529	Blue LXIV	64M	218	225	10.9	
		OR530	Blue LXV	65M	222	227	9.5	
		OR531	Blue LXVI	66M	224	231	11.5	
23	PFOA/Corn Oil	OR532	Blue LXVII	67M	218	222	10.8	
		OR533	Blue XLVIII	68M	212	217	9.7	
		OR534	Blue XLIX	69M	226	230	11.9	
24	PFOS/PFOA/ Corn Oil	OR535	Blue LXX	70M	222	226	10.6	
		OR536	Blue LXXI	71M	208	213	9.8	
		OR537	Blue LXXII	72M	222	223	9.9	

Table 2: PFOS and PFOA concentrations in serum and liver

Dose Group	Compound/ Vehicle	Dose (ug/kg)	Animal #	Euthanasia	Serum [PFOA], ng/mL	Liver [PFOA], ng/g	Serum [PFOS], ng/mL	Liver [PFOS], ng/g
1	PFOS/Water	20 ug/kg	OR127	4 hrs PD	< LLOQ*		3.2	160
	OR129		6.3				276	
	OR131		7.8				397	
2	PFOA/Water		OR191	4 hrs PD	52.9	172	< LLOQ*	
	OR192		68.0		186			
	OR194		58.8		187			
3	PFOS/PFOA/Water		OR195	4 hrs PD	68.0	220	9.3	436
	OR196		47.0		157	5.4	296	
	OR381		56.2		218	7.4	401	
4	PFOS/Corn Oil		OR382	4 hrs PD	< LLOQ*		2.6	123
	OR383		4.3				227	
	OR384		5.1				240	
5	PFOA/Corn Oil		OR385	4 hrs PD	< 1.0	< 5	< LLOQ*	
	OR386		< 1.0		< 5			
	OR387		< 1.0		< 5			
6	PFOS/PFOA/Corn Oil		OR388	4 hrs PD	< 1.0	< 5	< 1.0	< 5
	OR389		< 1.0		< 5	< 1.0	< 5	
	OR390		< 1.0		< 5	< 1.0	< 5	
7	PFOS/Water		OR391	24 hrs PD	< LLOQ*		7.4	454
	OR392		10.5				441	
	OR405		5.6				423	
8	PFOA/Water		OR406	24 hrs PD	54.5	190	< LLOQ*	
	OR446		51.0		226			
	OR447		56.0		179			
9	PFOS/PFOA/Water		OR448	24 hrs PD	49.6	191	4.8	363
	OR449		54.2		184	6.6	363	
	OR450		58.1		172	6.8	354	
10	PFOS/Corn Oil		OR493	24 hrs PD	< LLOQ*		9.0	292
	OR494		10.9				298	
	OR495		9.1				295	
11	PFOA/Corn Oil		OR496	24 hrs PD	1.5	< 5	< LLOQ*	
	OR497		2.0		< 5			
	OR498		1.9		< 5			
12	PFOS/PFOA/Corn Oil		OR499	24 hrs PD	6.4	11.5	< 1.0	16.8
	OR500		7.0		11.9	< 1.0	18.5	
	OR501		6.7		12.5	< 1.0	19.0	
13	PFOS/Water	1 mg/kg	OR502	4 hrs PD	< LLOQ**		1960	8230
	OR503		2160				7310	
	OR504		1220				5590	
14	PFOA/Water		OR505	4 hrs PD	5370	3820	< LLOQ**	
	OR506		5000		3730			
	OR507		5060		3840			
15	PFOS/PFOA/Water		OR508	4 hrs PD	3640	1620	1150	4480
	OR509		5870		2800	2100	7590	
	OR510		6280		2910	2425	7590	
16	PFOS/Corn Oil		OR511	4 hrs PD	< LLOQ**		17.9	944
	OR512		16.6				566	
	OR513		13.9				600	
17	PFOA/Corn Oil		OR514	4 hrs PD	5470	3270	< LLOQ**	
	OR515		4510		3020			
	OR516		4940		4190			
18	PFOS/PFOA/Corn Oil		OR517	4 hrs PD	5880	2830	681	2810
	OR518		5550		2860	895	3670	
	OR519		5585		3130	947	4520	
19	PFOS/Water		OR520	24 hrs PD	< LLOQ**		2560	8350
	OR521		2180				8960	
	OR522		2150				8660	
20	PFOA/Water		OR523	24 hrs PD	3960	3490	< LLOQ**	
	OR524		4720		4010			
	OR525		4820		3650			
21	PFOS/PFOA/Water		OR526	24 hrs PD	5850	2370	2410	7760
	OR527		6310		2320	2870	7630	
	OR528		5975		2240	2635	6310	
22	PFOS/Corn Oil		OR529	24 hrs PD	< LLOQ**		3760	11100
	OR530		105				2530	
	OR531		40				1300	
23	PFOA/Corn Oil		OR532	24 hrs PD	4500	3720	< LLOQ**	
	OR533		4170		4410			
	OR534		4060		3390			
24	PFOS/PFOA/Corn Oil		OR535	24 hrs PD	5790	2620	1060	3910
	OR536		5640		3240	1020	5130	
	OR537		5505		3540	856	5060	

* LLOQ = 1 ng/mL for serum samples and 5 ng/g for liver samples

** LLOQ = 10 ng/mL for serum samples and 50 ng/g for liver samples

Although not dosed with PFOA, PFOA concentration in serum sample from animal OR529 was at 58.4 ng/mL; this was likely due to sample contamination.

Appendix 1: MTDID 208 Certificate of Analysis

INTERIM CERTIFICATE OF ANALYSIS**REVISION 1(9/7/00)**

Centre Analytical Laboratories COA Reference #: 023-018A

3M Product: PFOS, Lot 217**Reference #: SD-018**

Purity: 86.9%

Test Name	Specifications	Result
Purity ¹		86.9%
Appearance	White Crystalline Powder	Conforms
Identification		Positive
NMR		
Metals (ICP/MS)		
1. Calcium		1. 0.005 wt./wt.%
2. Magnesium		2. 0.001 wt./wt.%
3. Sodium		3. 1.439 wt./wt.%
4. Potassium ²		4. 6.849 wt./wt.%
5. Nickel		5. <0.001
6. Iron		wt./wt.%
7. Manganese		6. 0.005 wt./wt.%
		7. <0.001
		wt./wt.%
Total % Impurity (NMR)		1.93 wt./wt.%
Total % Impurity (LC/MS)		8.41 wt./wt.%
Total % Impurity (GC/MS)		None Detected
Related Compounds – POAA		0.33 wt./wt.%
Residual Solvents (TGA)		None Detected
Purity by DSC		Not Applicable ³
Inorganic Anions (IC)		
1. Chloride		1. <0.015
2. Fluoride		wt./wt.%
3. Bromide		2. 0.59 wt./wt.%
4. Nitrate		3. <0.040
5. Nitrite		wt./wt.%
6. Phosphate		4. <0.009
7. Sulfate ⁴		wt./wt.%

		5. <0.006 wt./wt.% 6. <0.007 wt./wt.% 7. 8.76 wt./wt.%
Organic Acids ⁵ (IC) 1. TFA 2. PFPA 3. HFBA 4. NFPA		1. <0.1 wt./wt.% 2. <0.1 wt./wt.% 3. 0.10 wt./wt.% 4. 0.28 wt./wt.%
Elemental Analysis ⁶ : 1. Carbon 2. Hydrogen 3. Nitrogen 4. Sulfur 5. Fluorine	1. Theoretical Value = 17.8% 2. Theoretical Value = 0% 3. Theoretical Value = 0% 4. Theoretical Value = 5.95% 5. Theoretical Value = 60%	1. 12.48 wt./wt.% 2. 0.244 wt./wt.% 3. 1.74 wt./wt.% 4. 8.84 wt./wt.% 5. 54.1 wt./wt.%

INTERIM CERTIFICATE OF ANALYSIS

Centre Analytical Laboratories COA Reference #: 023-018A

Date of Last Analysis: 08/31/00

Expiration Date: 08/31/01

Storage Conditions: Frozen $\leq -10^{\circ}\text{C}$

Re-assessment Date: 08/31/01

¹Purity = 100% - (sum of metal impurities, 1.45% + LC/MS impurities, 8.41% + Inorganic Fluoride, 0.59% + NMR impurities, 1.93% + organic acid impurities, 0.38% + POAA, 0.33%)

Total impurity from all tests = 13.09%

Purity = 100% - 13.09% = 86.9%

²Potassium is expected in this salt form and is therefore not considered an impurity.

³Purity by DSC is generally not applicable to materials of low purity. No endotherm was observed for this sample.

⁴Sulfur in the sample appears to be converted to SO_4 and hence detected using the inorganic anion method conditions. The anion result agrees well with the sulfur determination in the elemental analysis, lending confidence to this interpretation. Based on the results, the SO_4 is not considered an impurity.

⁵ TFA	Trifluoroacetic acid
HFBA	Heptafluorobutyric acid
NFPA	Nonofluoropentanoic acid
PFPA	Pentafluoropropanoic acid

⁶Theoretical value calculations based on the empirical formula, $\text{C}_8\text{F}_{17}\text{SO}_3\text{K}^+$ (MW=538)

This work was conducted under EPA Good Laboratory Practice Standards (40 CFR 160).

INTERIM CERTIFICATE OF ANALYSIS

Centre Analytical Laboratories COA Reference #: 023-018A

LC/MS Purity Profile:

Impurity	wt./wt. %
C4	1.22
C5	1.33
C6	4.72
C7	1.14
Total	8.41

Note: The C4 and C6 values were calculated using the C4 and C6 standard calibration curves, respectively. The C5 value was calculated using the average response factors from the C4 and C6 standard curves. Likewise, the C7 value was calculated using the average response factors from the C6 and C8 standard curves.

Prepared By: _____
David S. Bell
Scientist, Centre Analytical Laboratories

Date

Reviewed By: _____
John Flaherty
Laboratory Manager, Centre Analytical Laboratories

Date

Appendix 2: MTDID 1004 Certificate of Analysis

CERTIFICATE OF ANALYSIS**FC-143, Lot 332**

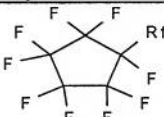
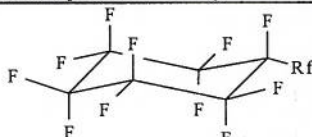
March 2, 2000

Richard M. Payfer

This sample was analyzed using GC/AED, LC/MS, ^1H -NMR, and GC/MS techniques. The results of these tests show the sample to contain the following weight percent composition:

$\text{C}_3\text{F}_7\text{CO}_2\text{NH}_4^+$	0.01 %
$\text{C}_4\text{F}_9\text{CO}_2\text{NH}_4^+$	0.03 %
$\text{C}_5\text{F}_{11}\text{CO}_2\text{NH}_4^+$	0.43 %
$\text{C}_6\text{F}_{13}\text{CO}_2\text{NH}_4^+$	0.57 %
$\text{C}_7\text{F}_{15}\text{CO}_2\text{NH}_4^+$	97.99 %
$\text{C}_8\text{F}_{17}\text{CO}_2\text{NH}_4^+$	0.16 %
$\text{C}_7\text{F}_{14}\text{HCO}_2\text{NH}_4^+$	0.09 %
$\text{C}_7\text{F}_{13}\text{CO}_2\text{NH}_4^+$	0.72 %

Additionally, the isomer distribution of the sample was determined using ^{19}F -NMR techniques and found to contain the following mole percent composition:

$\text{CF}_3(\text{CF}_2)_x\text{-CO}_2(-)\text{NH}_4(+)$ (Normal chain, where x is mainly 6)	77.6%
$\text{CF}_3(\text{CF}_2)_x\text{-CF}(\text{CF}_3)\text{-(CF}_2)_y\text{-CO}_2(-)\text{NH}_4(+)$ (Internal monomethyl branch, where x+y is mainly 4, and x $\neq$ 0, y $\neq$ 0)	12.6%
$(\text{CF}_3)_2\text{CF}(\text{CF}_2)_x\text{-CO}_2(-)\text{NH}_4(+)$ (Isopropyl branch, where x is mainly 4)	9.0%
$(\text{CF}_3)_3\text{C}(\text{CF}_2)_x\text{-CO}_2(-)\text{NH}_4(+)$ (t-butyl branch, where x is mainly 3)	0.2%
 Possible where $-\text{R}_f$ is undefined	0.2%
$\text{CF}_3\text{-(CF}_2)_x\text{-C}(\text{CF}_3)_2\text{-(CF}_2)_y\text{-CO}_2(-)\text{NH}_4(+)$ (Internal gem-dimethyl branch, where x+y is mainly 3, and x $\neq$ 0)	0.1%
 Possible where $-\text{R}_f$ is undefined	0.1%
Possible $\text{C}_x\text{F}_{2x+1}\text{-CF}(\text{CF}_3)\text{-CO}_2(-)\text{NH}_4(+)$ (Alpha branch, where x is mainly 5)	0.1%