

18B1561



WELLINGTON
LABORATORIES

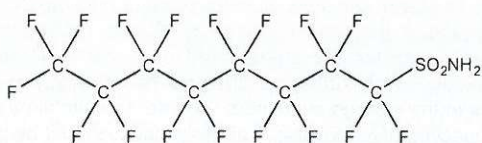
CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE: FOSA-I
COMPOUND: Perfluoro-1-octanesulfonamide

LOT NUMBER: FOSA08171

STRUCTURE:

CAS #: 754-91-6



MOLECULAR FORMULA: C₈H₂F₁₇NO₂S
CONCENTRATION: 50 ± 2.5 µg/ml
CHEMICAL PURITY: >98%
LAST TESTED: (mm/dd/yyyy) 09/01/2017
EXPIRY DATE: (mm/dd/yyyy) 09/01/2022
RECOMMENDED STORAGE: Refrigerate ampoule

MOLECULAR WEIGHT: 499.14
SOLVENT(S): Isopropanol

DOCUMENTATION/ DATA ATTACHED:

- Figure 1: LC/MS Data (TIC and Mass Spectrum)
- Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: 
B.G. Chittim, General Manager

Date: 09/14/2017
(mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B15761

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HAZARDS:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Where possible, all of our products are synthesized using single-product unambiguous routes. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2, \dots, x_n on which it depends is:

$$u_c(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of $\pm 5\%$ (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly tested by an external ISO/IEC 17025 accredited calibration company. In addition, their calibration is verified prior to each weighing using calibrated NIST and/or NRC traceable external weights. All volumetric glassware used is calibrated, of Class A tolerance, and has been tested according to the appropriate ASTM procedures, which are ultimately traceable to NIST. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

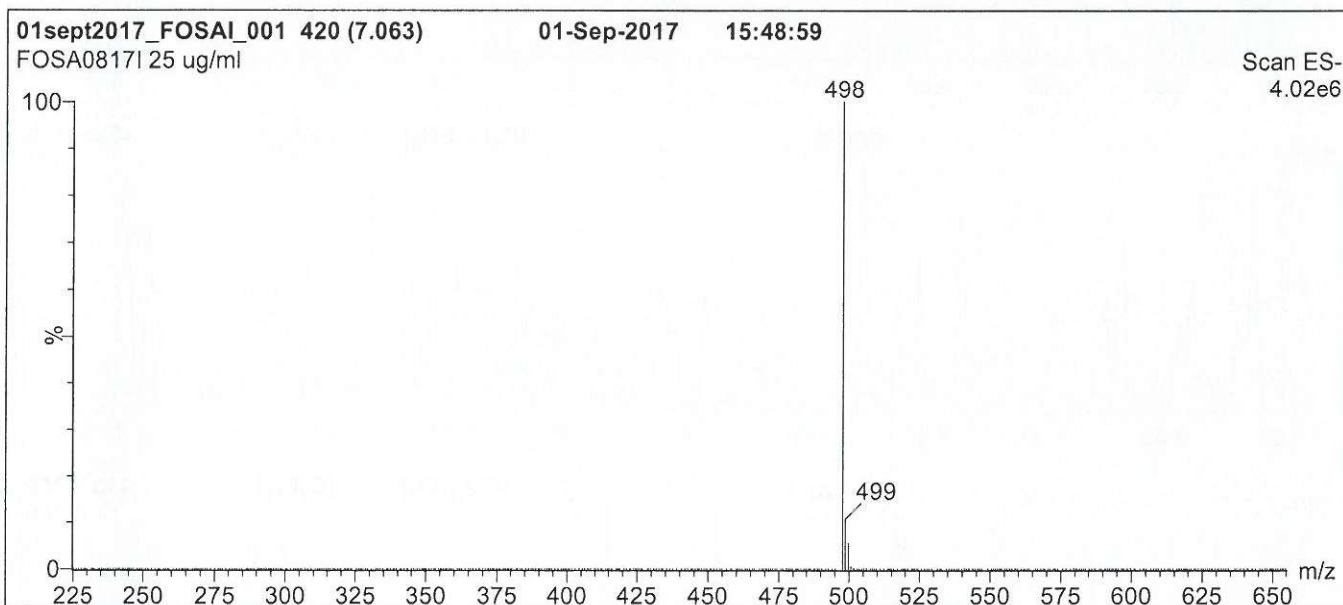
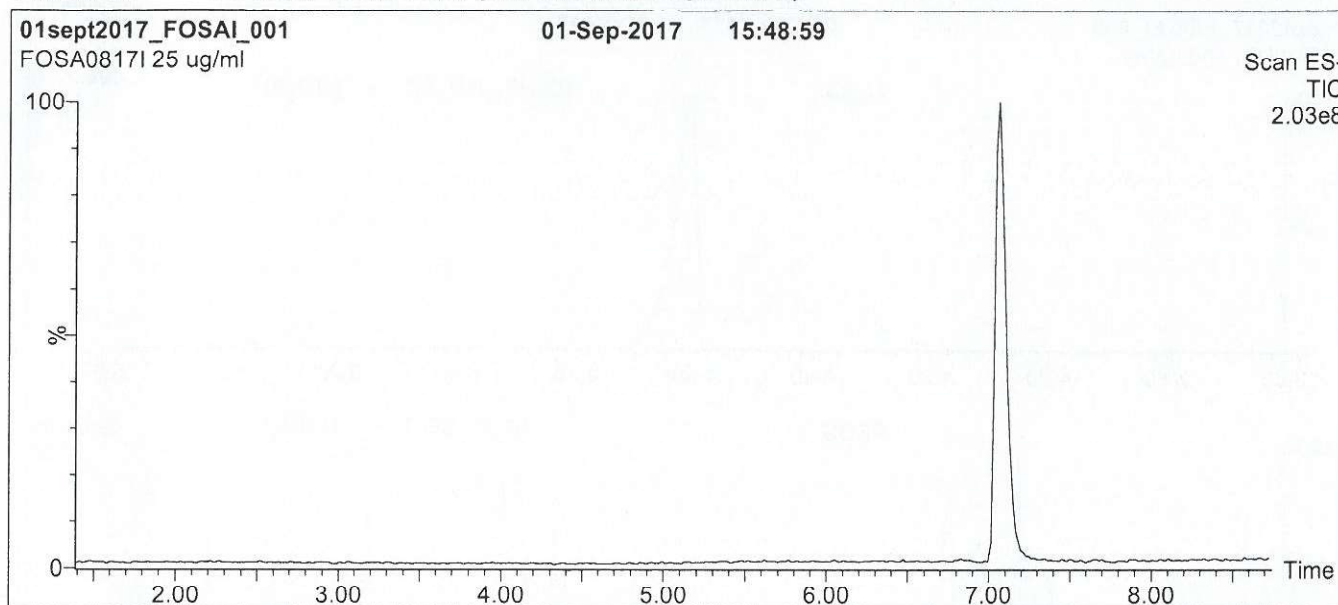
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



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Figure 1: FOSA-I; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 50% (80:20 MeOH:ACN) / 50% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 8 min and hold for 1 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

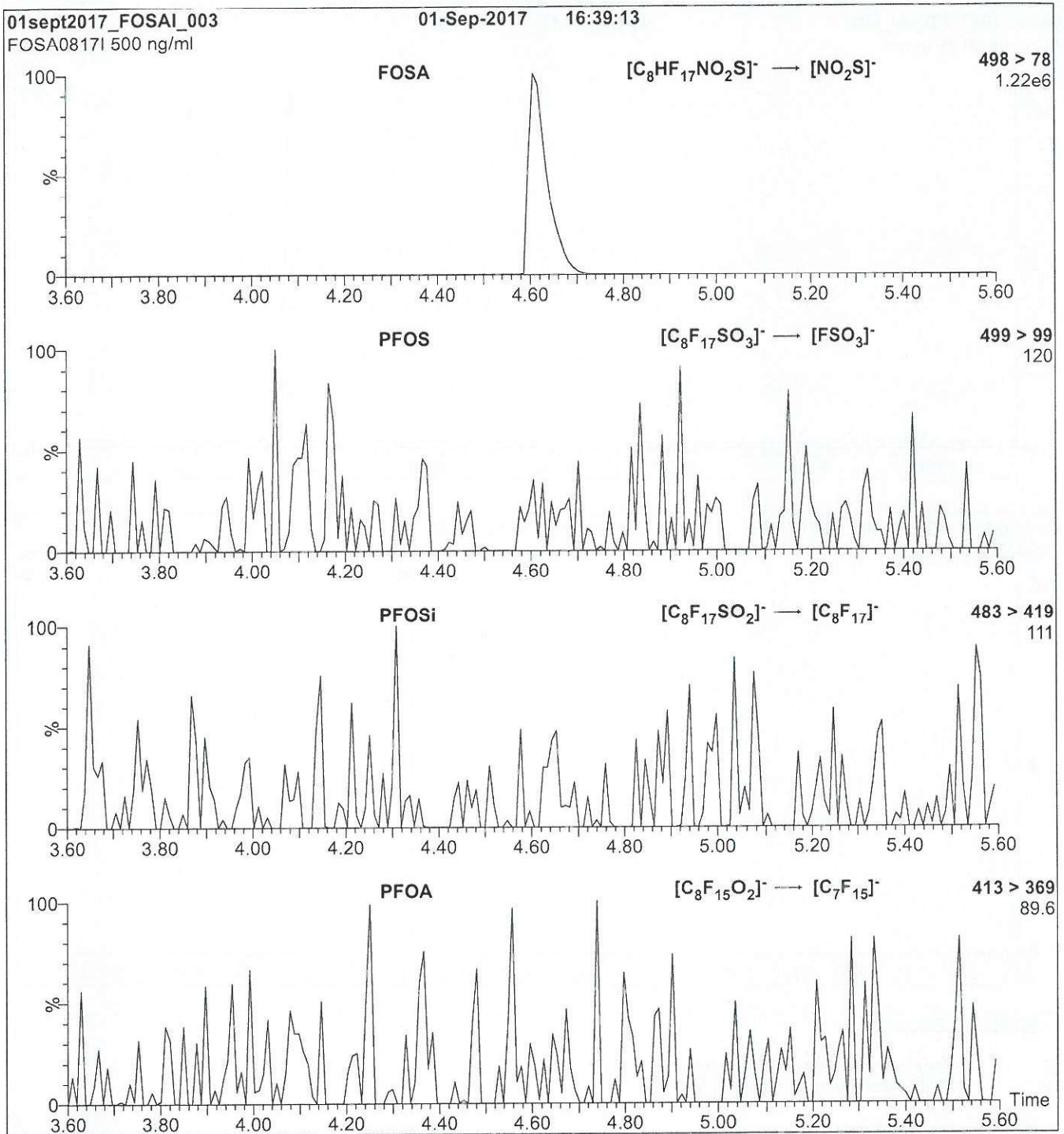
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.50
Cone Voltage (V) = 40.00
Cone Gas Flow (l/hr) = 50
Desolvation Gas Flow (l/hr) = 750

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Figure 2: FOSA-I; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
10 μ l (500 ng/ml FOSA-I)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H₂O
(both with 10 mM NH₄OAc buffer)

Flow: 300 μ l/min

MS Parameters

Collision Gas (mbar) = 3.20e-3
Collision Energy (eV) = 30

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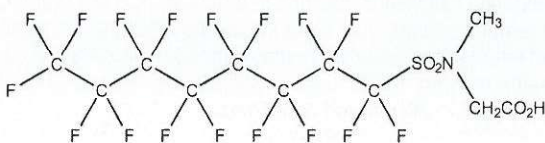


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CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE: N-MeFOSAA **LOT NUMBER:** NMeFOSAA0117
COMPOUND: N-methylperfluoro-1-octanesulfonamidoacetic acid

STRUCTURE: **CAS #:** 2355-31-9



MOLECULAR FORMULA: C₁₁H₆F₁₇NO₄S **MOLECULAR WEIGHT:** 571.21
CONCENTRATION: 50 ± 2.5 µg/ml **SOLVENT(S):** Methanol
Water (<1%)
CHEMICAL PURITY: >98%
LAST TESTED: (mm/dd/yyyy) 01/11/2017
EXPIRY DATE: (mm/dd/yyyy) 01/11/2022
RECOMMENDED STORAGE: Refrigerate ampoule


DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent the conversion of the acetic acid moiety to the methyl ester.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: 
B.G. Chittim **Date:** 01/12/2017
(mm/dd/yyyy)

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where x is expressed as a relative standard uncertainty of the individual parameter.

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LIMITED WARRANTY:

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QUALITY MANAGEMENT:

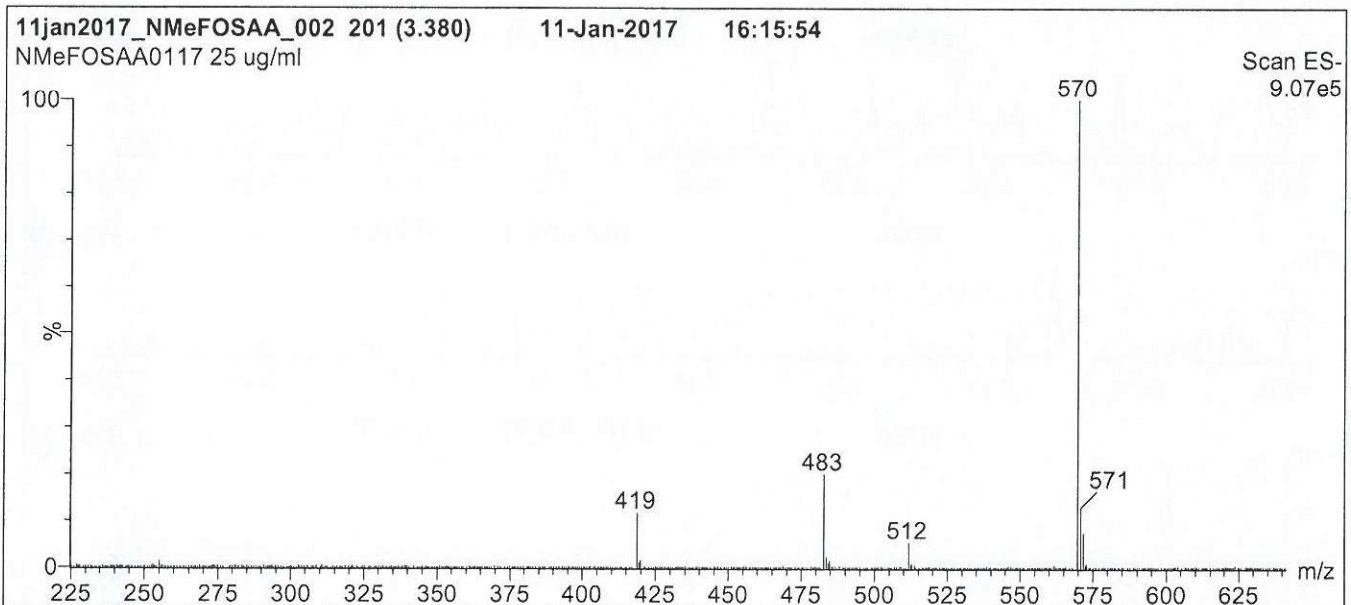
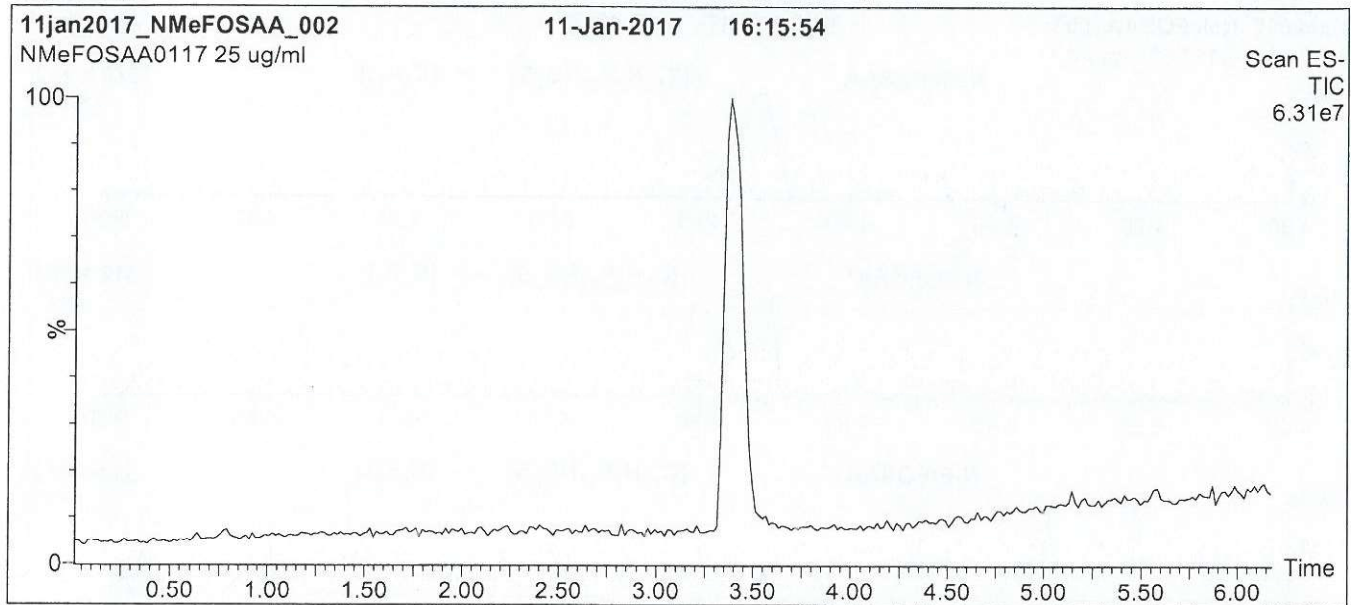
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Figure 1: N-MeFOSAA; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 65% (80:20 MeOH:ACN) / 35% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7.5 min and hold for
1.5 min before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

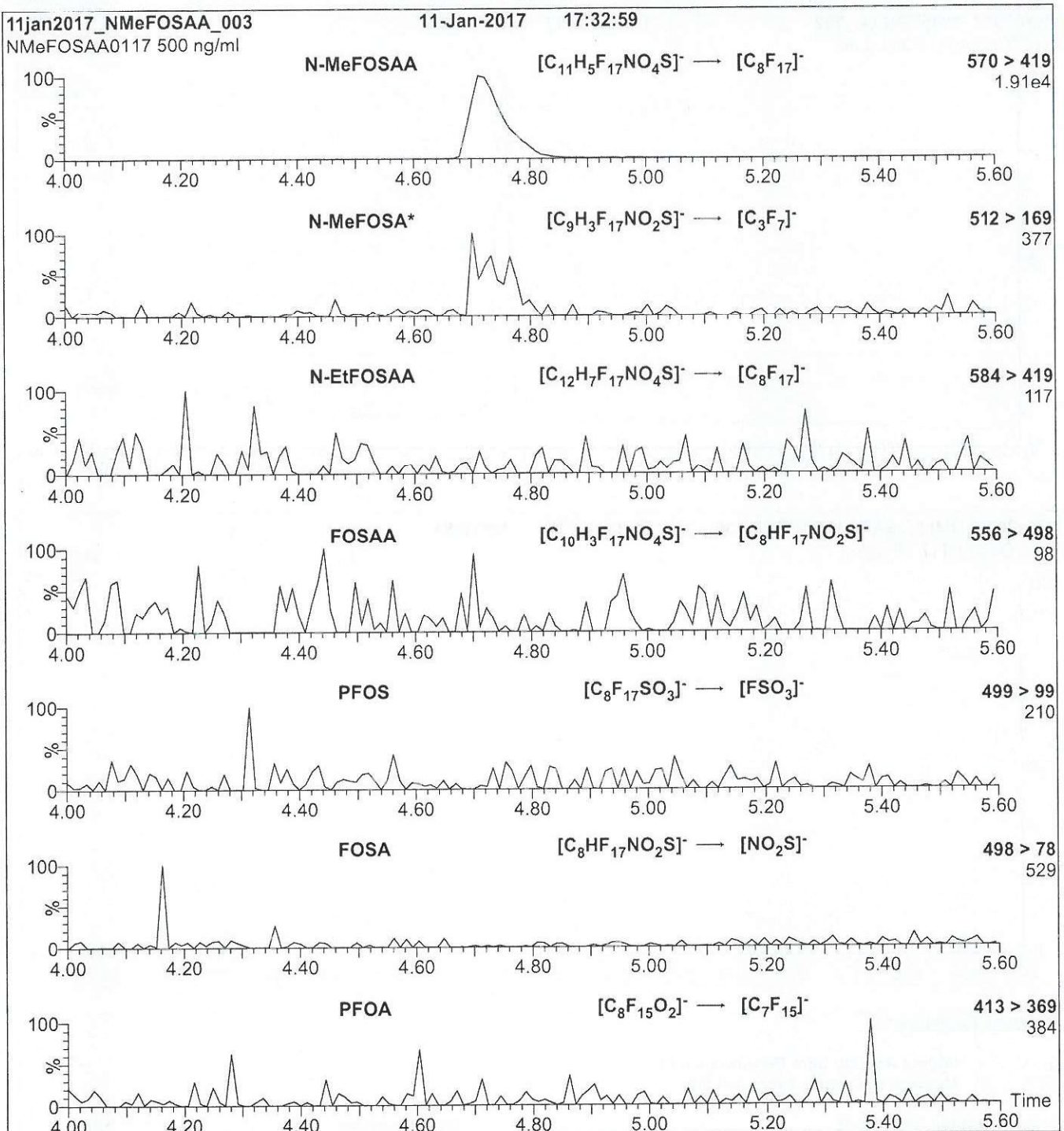
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 35.00
Cone Gas Flow (l/hr) = 50
Desolvation Gas Flow (l/hr) = 750

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Figure 2: N-MeFOSAA; LC/MS/MS Data (Selected MRM Transitions)



*Note: N-MeFOSA is formed by in-source fragmentation.

Conditions for Figure 2:

Injection: Direct loop injection
10 μ l (500 ng/ml N-MeFOSAA)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H₂O
(both with 10 mM NH₄OAc buffer)

Flow: 300 μ l/min

MS Parameters

Collision Gas (mbar) = 3.43e-3
Collision Energy (eV) = 20

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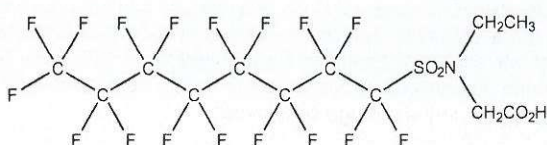


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CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE: N-EtFOSAA **LOT NUMBER:** NEtFOSAA0117
COMPOUND: N-ethylperfluoro-1-octanesulfonamidoacetic acid

STRUCTURE: **CAS #:** 2991-50-6



MOLECULAR FORMULA: $C_{12}H_6F_{17}NO_4S$ **MOLECULAR WEIGHT:** 585.23
CONCENTRATION: $50 \pm 2.5 \mu\text{g/ml}$ **SOLVENT(S):** Methanol
Water (<1%)
CHEMICAL PURITY: >98%
LAST TESTED: (mm/dd/yyyy) 01/11/2017
EXPIRY DATE: (mm/dd/yyyy) 01/11/2022
RECOMMENDED STORAGE: Refrigerate ampoule

DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent the conversion of the acetic acid moiety to the methyl ester.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By:


B.G. Chittim

Date: 01/12/2017
(mm/dd/yyyy)

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LIMITED WARRANTY:

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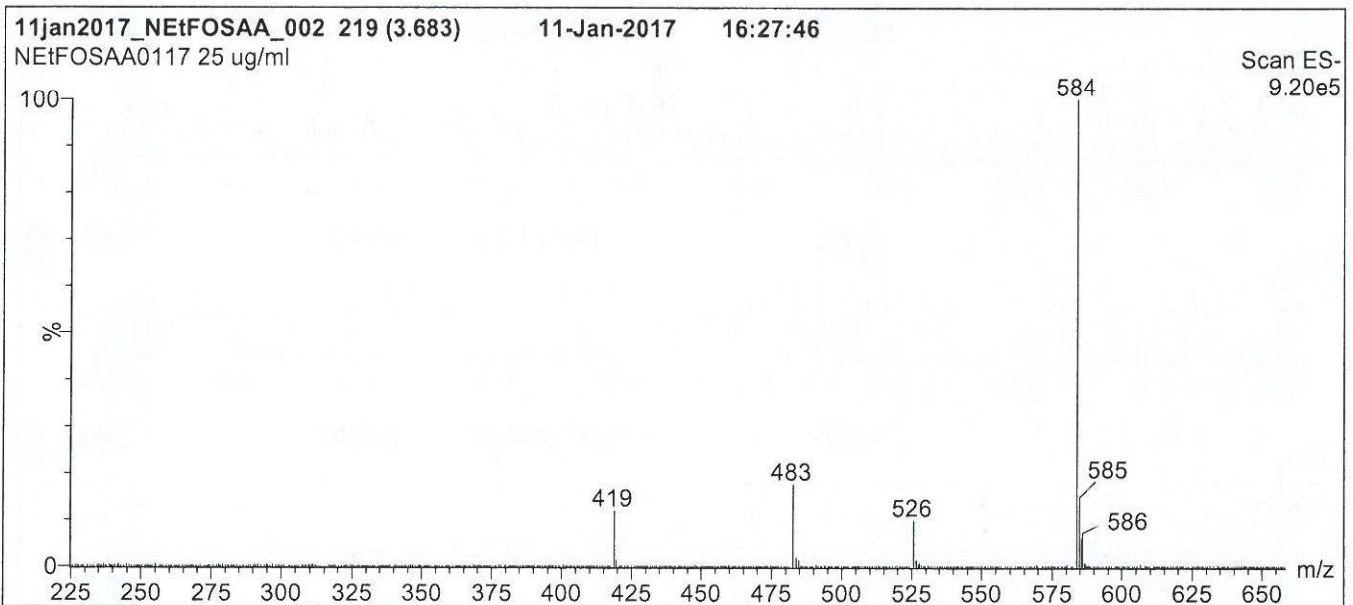
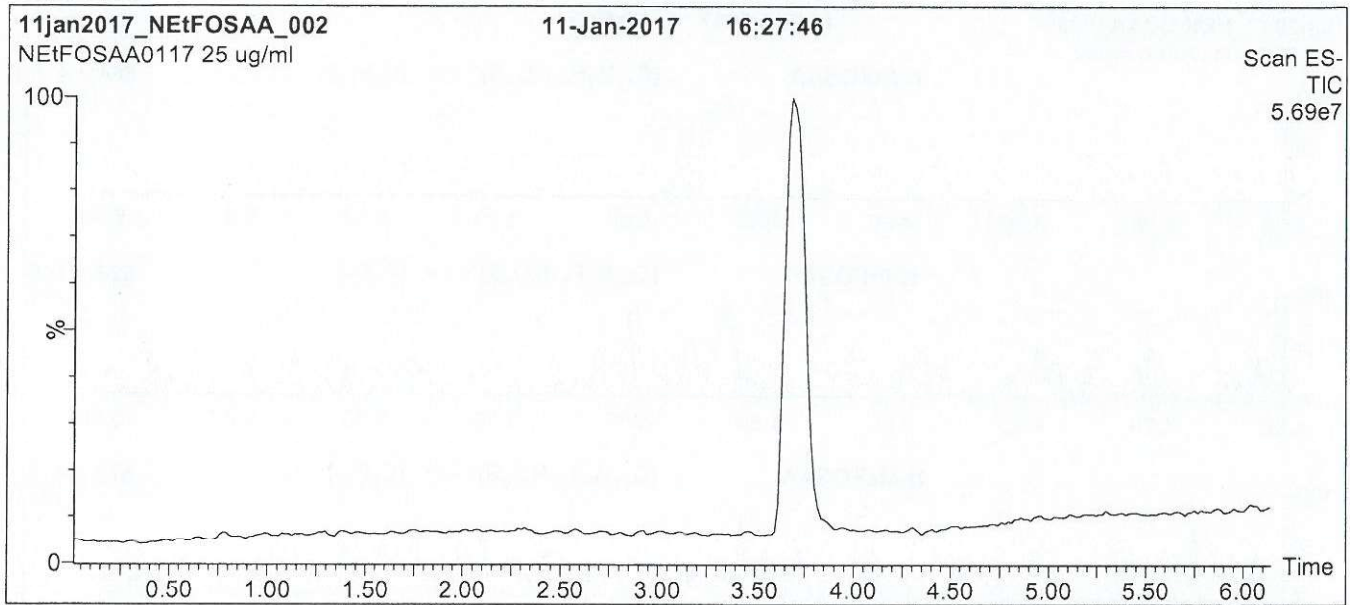
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Figure 1: N-EtFOSAA; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 65% (80:20 MeOH:ACN) / 35% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7.5 min and hold for 1.5 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

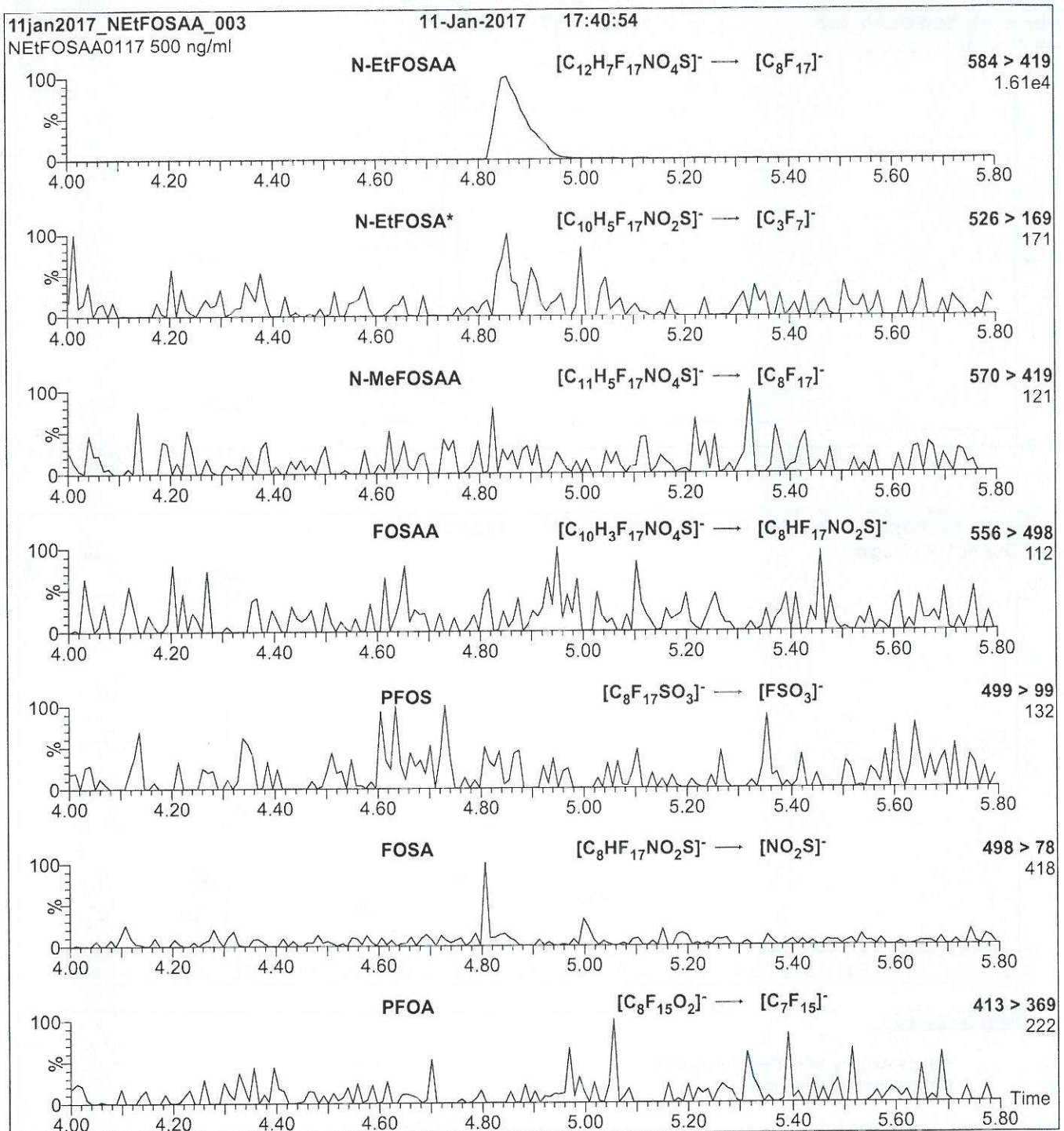
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 35.00
Cone Gas Flow (l/hr) = 50
Desolvation Gas Flow (l/hr) = 750

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Figure 2: N-EtFOSAA; LC/MS/MS Data (Selected MRM Transitions)



Note: N-EtFOSA is formed by fragmentation of N-EtFOSAA.

Conditions for Figure 2:

Injection: Direct loop injection
10 μ l (500 ng/ml N-EtFOSAA)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H₂O
(both with 10 mM NH₄OAc buffer)

Flow: 300 μ l/min

MS Parameters

Collision Gas (mbar) = 3.28e-3
Collision Energy (eV) = 20

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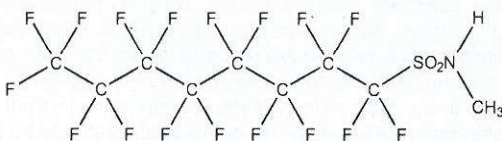


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LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE: N-MeFOSA-M **LOT NUMBER:** NMeFOSA0717M
COMPOUND: N-methylperfluoro-1-octanesulfonamide

STRUCTURE: **CAS #:** 31506-32-8



MOLECULAR FORMULA: C₉H₄F₁₇NO₂S **MOLECULAR WEIGHT:** 513.17
CONCENTRATION: 50 ± 2.5 µg/ml **SOLVENT(S):** Methanol
CHEMICAL PURITY: >98%
LAST TESTED: (mm/dd/yyyy) 07/05/2017
EXPIRY DATE: (mm/dd/yyyy) 07/05/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

DOCUMENTATION/ DATA ATTACHED:

- Figure 1: LC/MS Data (TIC and Mass Spectrum)
- Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By:  **Date:** 07/10/2017
B.G. Chittim, General Manager (mm/dd/yyyy)

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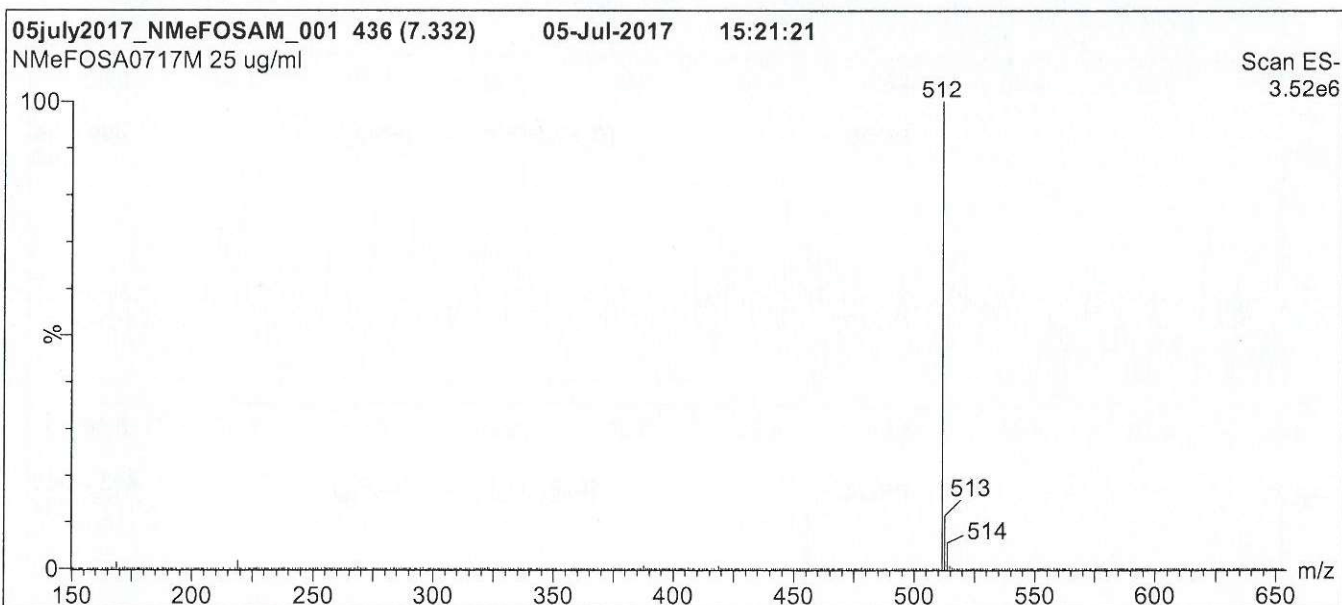
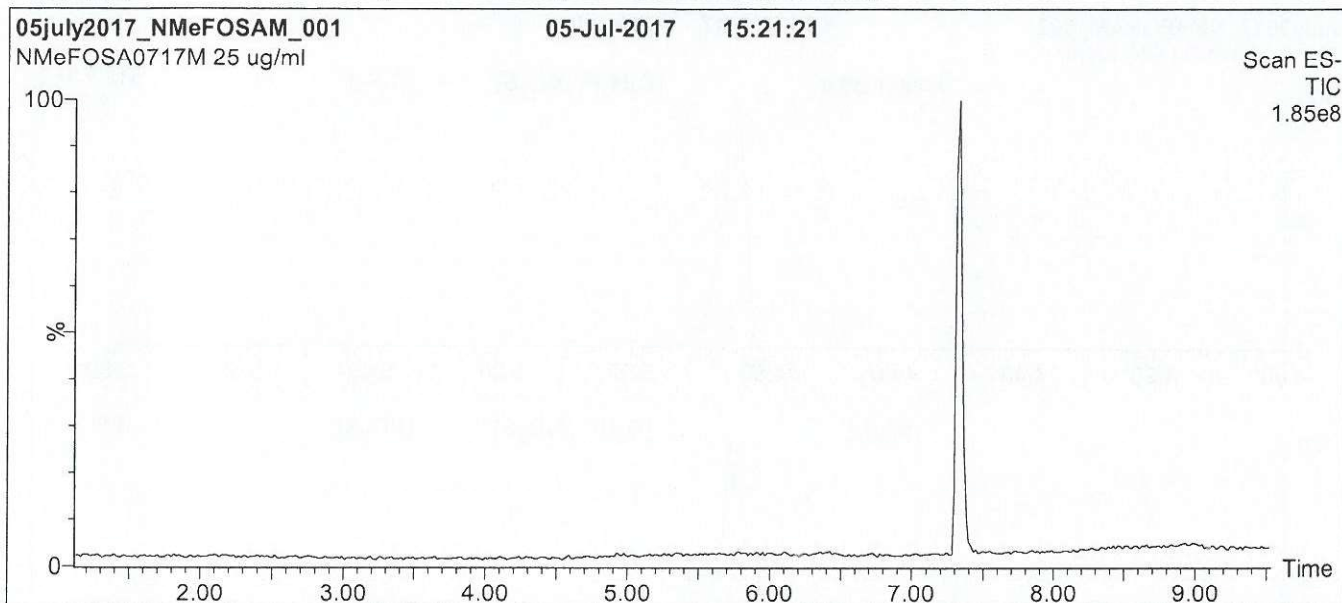
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For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

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Figure 1: N-MeFOSA-M; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient

Start: 45% H₂O / 55% (80:20 MeOH:ACN)
(both with 10 mM NH₄OAc buffer)

Ramp to 90% organic over 7.5 min and hold for
1.5 min before returning to initial conditions in 0.5 min.

Time: 10 min

Flow: 300 μ l/min

MS Parameters

Experiment: Full Scan (150 - 850 amu)

Source: Electrospray (negative)

Capillary Voltage (kV) = 2.50

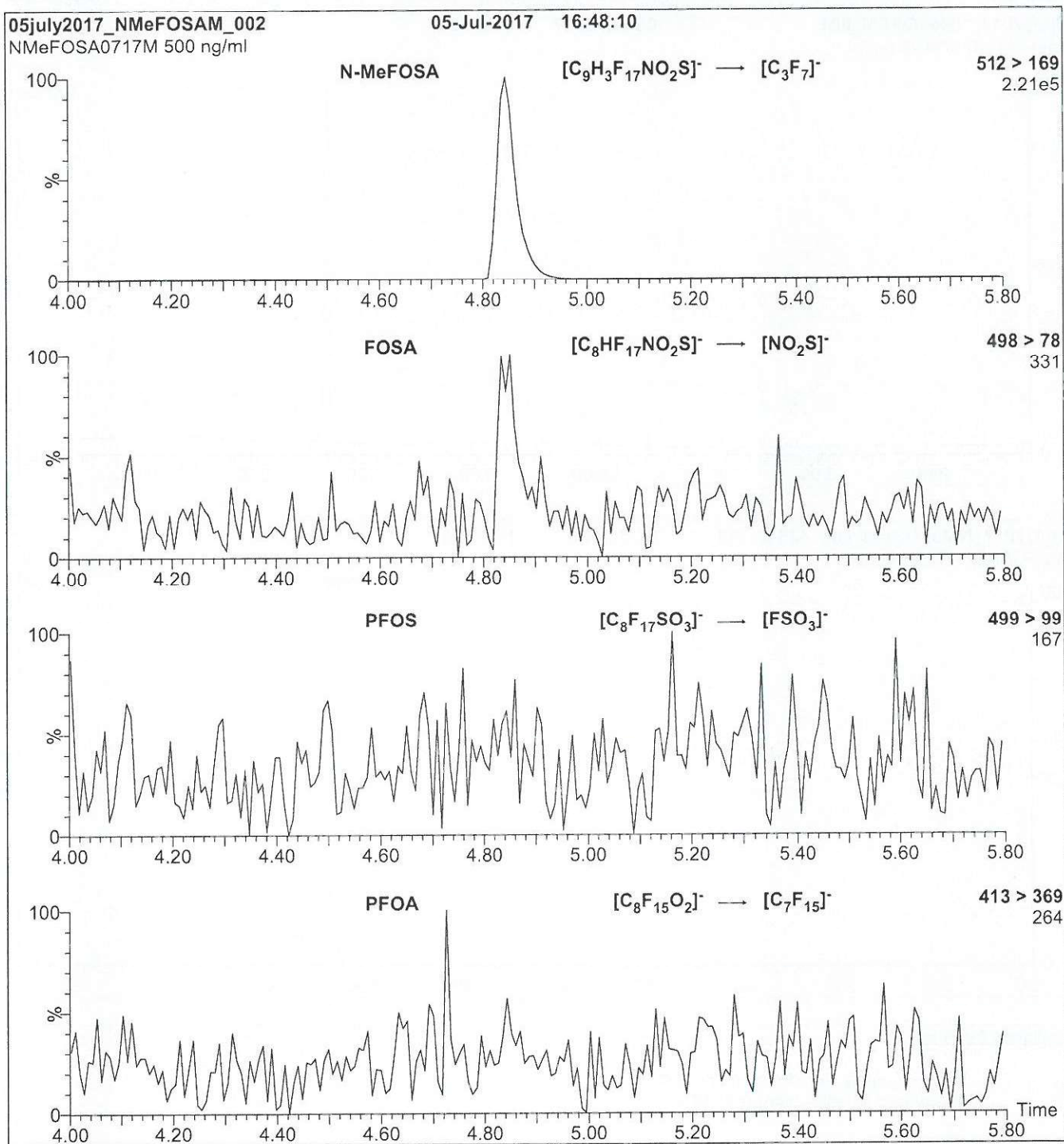
Cone Voltage (V) = 40.00

Cone Gas Flow (l/hr) = 50

Desolvation Gas Flow (l/hr) = 750

18B15e4

Figure 2: N-MeFOSA-M; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
10 μ l (500 ng/ml N-MeFOSA-M)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H₂O
(both with 10 mM NH₄OAc buffer)

Flow: 300 μ l/min

MS Parameters

Collision Gas (mbar) = 3.31e-3
Collision Energy (eV) = 30

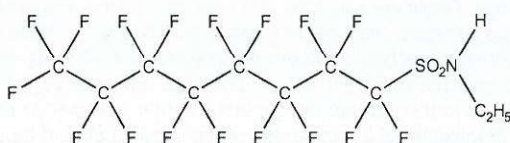
18B1565



WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS DOCUMENTATION

PRODUCT CODE: N-EtFOSA-M **LOT NUMBER:** NEtFOSA0717M
COMPOUND: N-ethylperfluoro-1-octanesulfonamide
STRUCTURE: **CAS #:** 4151-50-2



MOLECULAR FORMULA: C₁₀H₆F₁₇NO₂S **MOLECULAR WEIGHT:** 527.20
CONCENTRATION: 50 ± 2.5 µg/ml **SOLVENT(S):** Methanol
CHEMICAL PURITY: >98%
LAST TESTED: (mm/dd/yyyy) 07/05/2017
EXPIRY DATE: (mm/dd/yyyy) 07/05/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
 Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: 
 B.G. Chittim, General Manager

Date: 07/18/2017
 (mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
 519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

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INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HAZARDS:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Where possible, all of our products are synthesized using single-product unambiguous routes. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2, \dots, x_n on which it depends is:

$$u_c(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of $\pm 5\%$ (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly tested by an external ISO/IEC 17025 accredited calibration company. In addition, their calibration is verified prior to each weighing using calibrated NIST and/or NRC traceable external weights. All volumetric glassware used is calibrated, of Class A tolerance, and has been tested according to the appropriate ASTM procedures, which are ultimately traceable to NIST. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

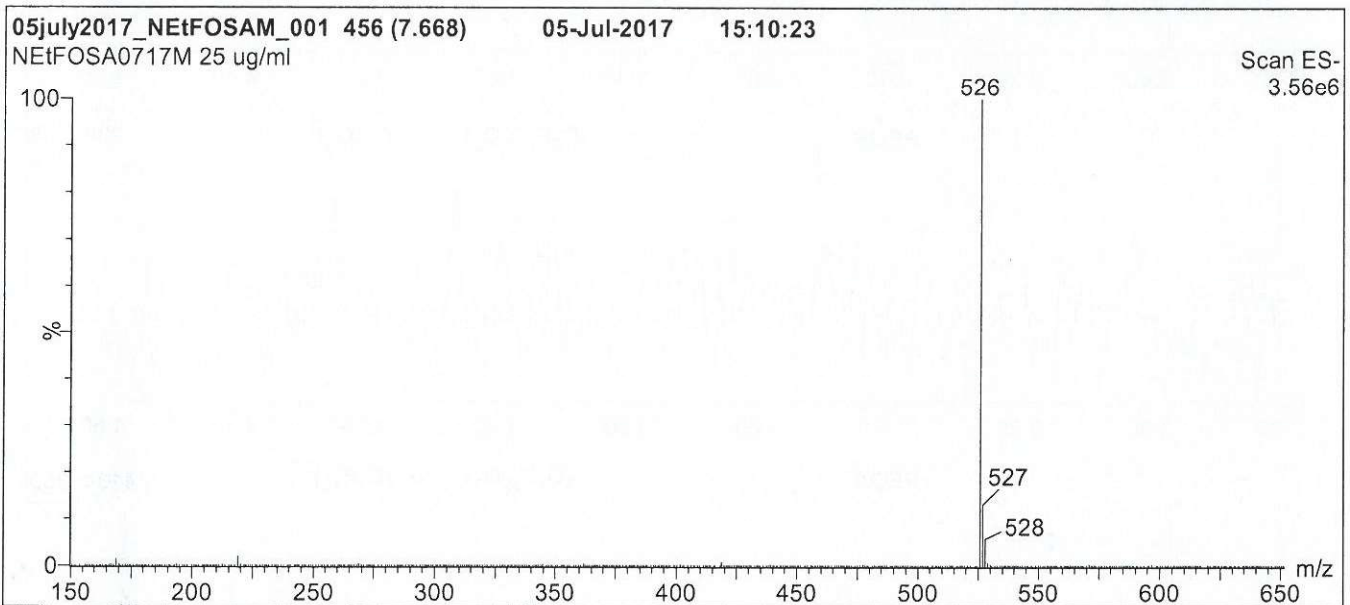
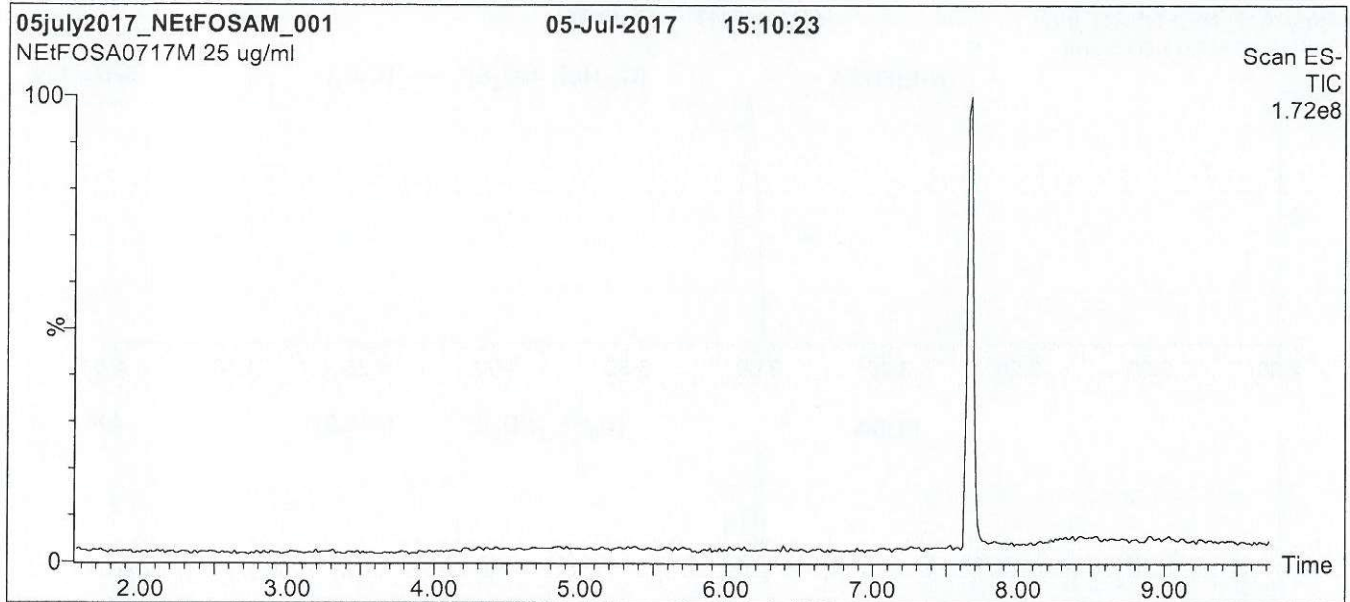
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18B1565

Figure 1: N-EtFOSA-M; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 45% H₂O / 55% (80:20 MeOH:ACN)
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7.5 min and hold for 1.5 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

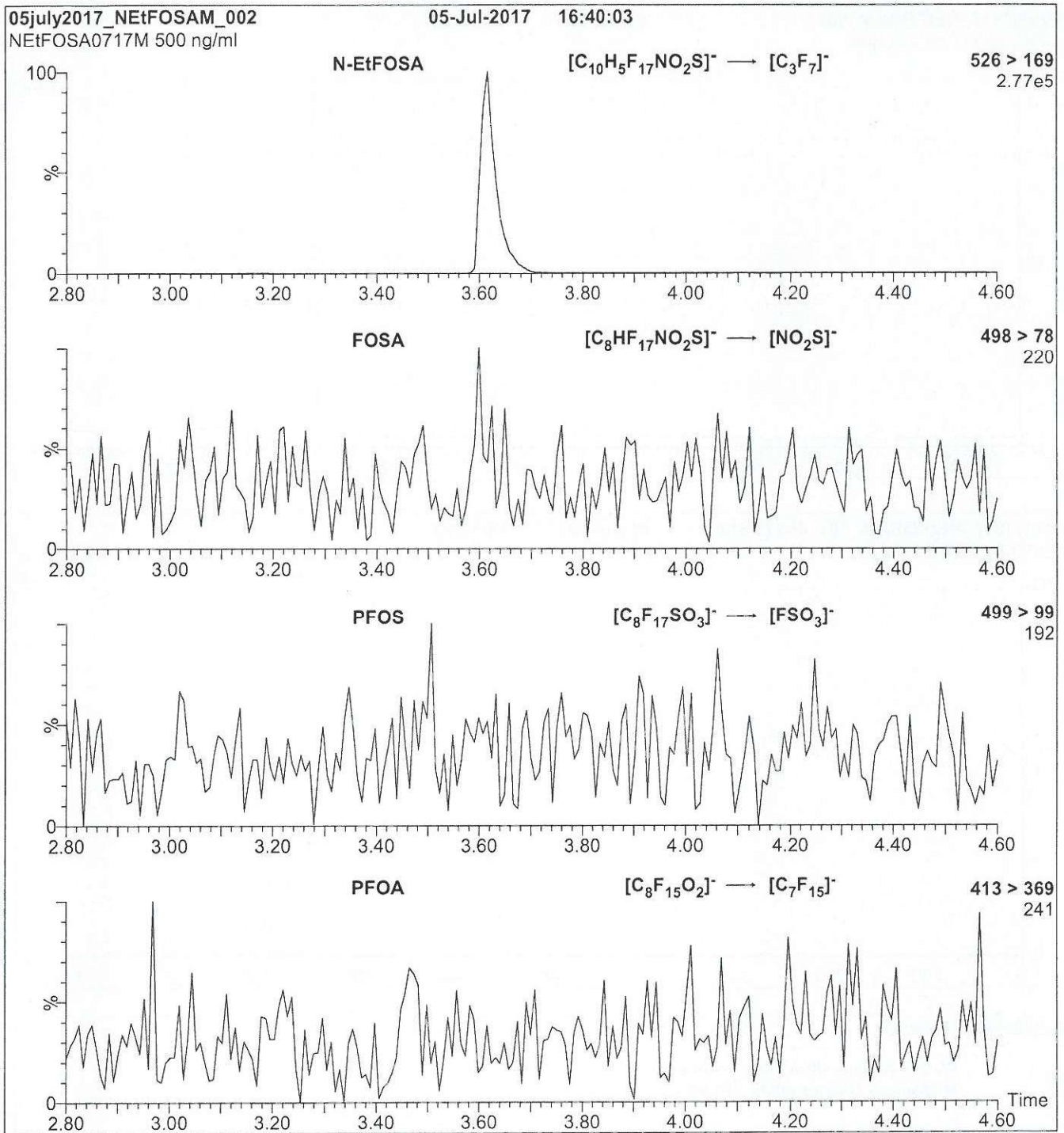
MS Parameters

Experiment: Full Scan (150 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.50
Cone Voltage (V) = 40.00
Cone Gas Flow (l/hr) = 50
Desolvation Gas Flow (l/hr) = 750

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Figure 2: N-EtFOSA-M; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
10 μ l (500 ng/ml N-EtFOSA-M)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H₂O
(both with 10 mM NH₄OAc buffer)

Flow: 300 μ l/min

MS Parameters

Collision Gas (mbar) = 3.43e-3
Collision Energy (eV) = 30

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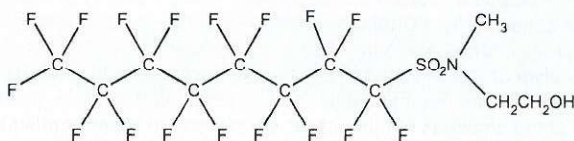


WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE: N-MeFOSE-M **LOT NUMBER:** NMeFOSE0417M
COMPOUND: 2-(N-methylperfluoro-1-octanesulfonamido)-ethanol

STRUCTURE: **CAS #:** 24448-09-7



MOLECULAR FORMULA: C₁₁H₈F₁₇NO₃S **MOLECULAR WEIGHT:** 557.22
CONCENTRATION: 50 ± 2.5 µg/ml **SOLVENT(S):** Methanol
CHEMICAL PURITY: >98%
LAST TESTED: (mm/dd/yyyy) 04/24/2017 (HRGC/LRMS)
04/21/2017 (LC/MS)
EXPIRY DATE: (mm/dd/yyyy) 04/24/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

DOCUMENTATION/ DATA ATTACHED:

- Figure 1: HRGC/LRMS Data (TIC and Mass Spectrum)
- Figure 2: LC/MS Data (TIC and Mass Spectrum)
- Figure 3: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- In order to see the molecular ion (adduct free), the LC mobile phase should be free of ammonium acetate buffer.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By:  **Date:** 05/05/2017
B.G. Chittim, General Manager (mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

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HAZARDS:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Where possible, all of our products are synthesized using single-product unambiguous routes. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2, \dots, x_n on which it depends is:

$$u_c(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of $\pm 5\%$ (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

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Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

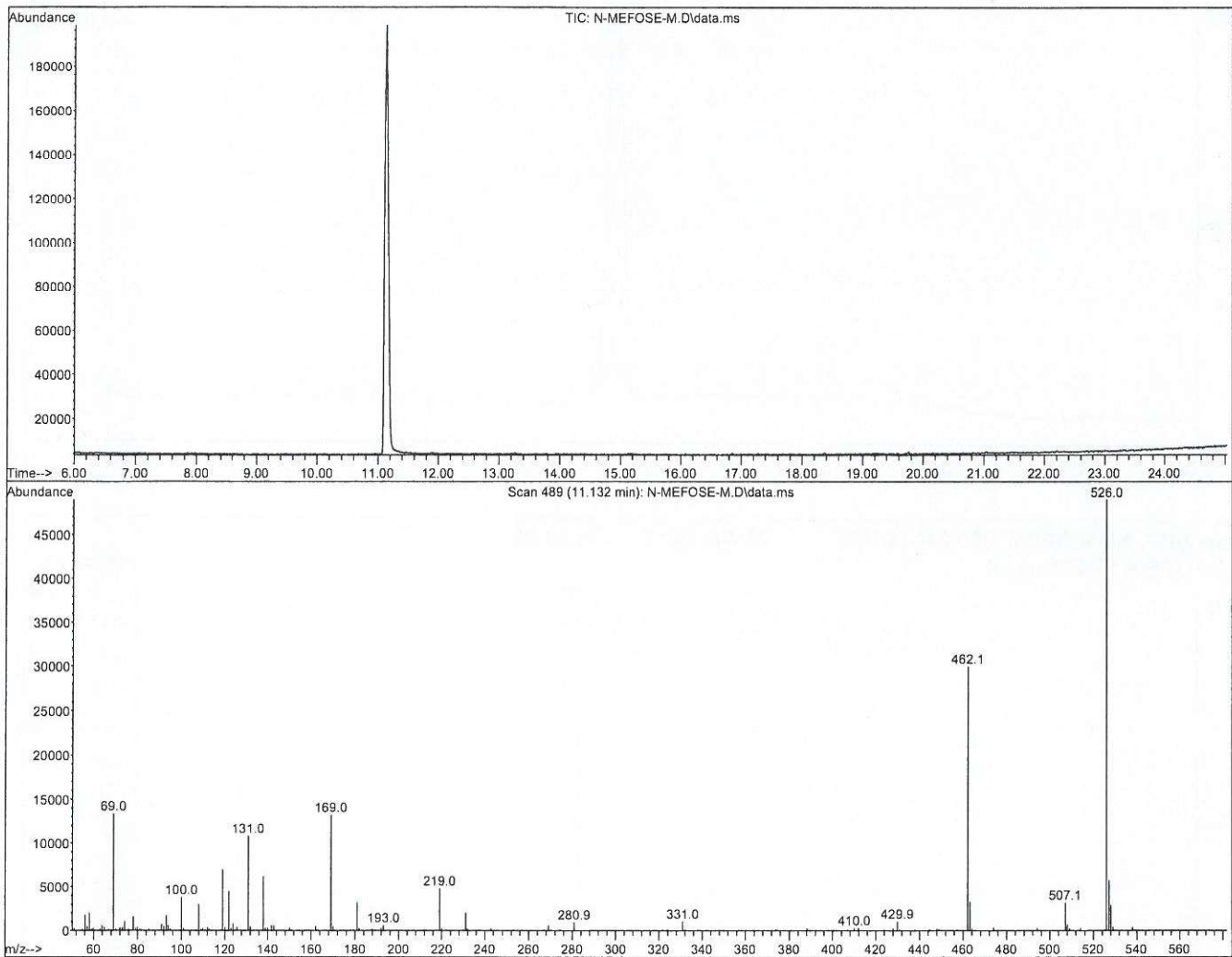
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



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18B1566

Figure 1: N-MeFOSE-M; HRGC/LRMS Data (TIC and Mass Spectrum)



HRGC/LRMS:

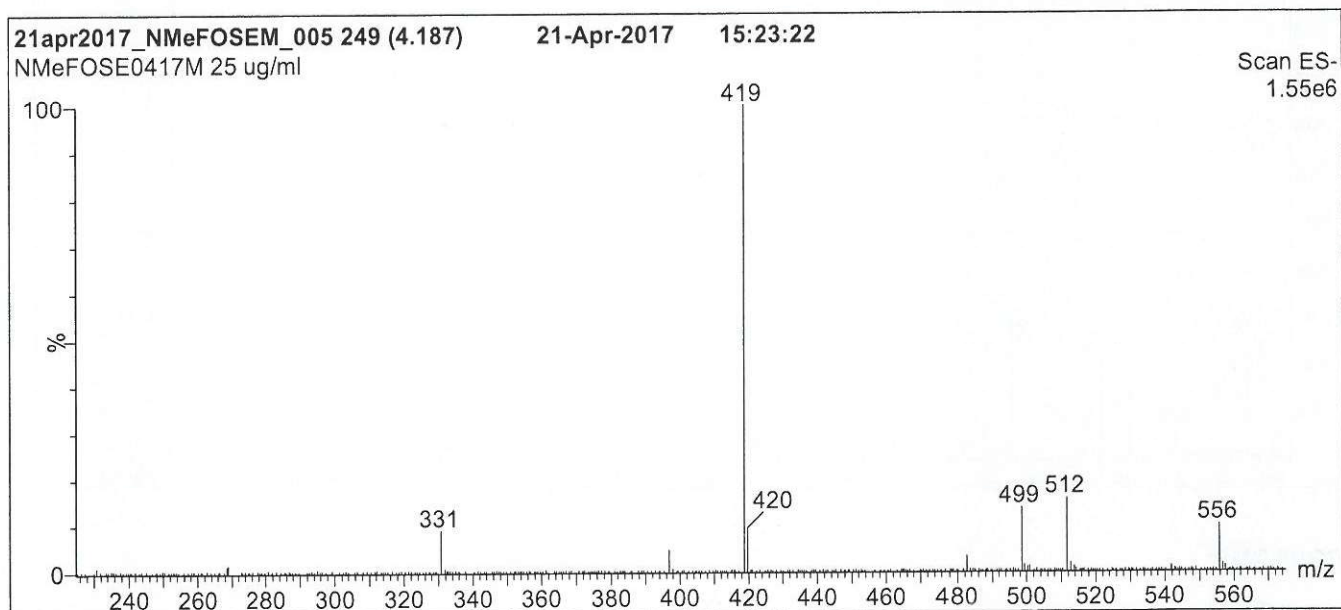
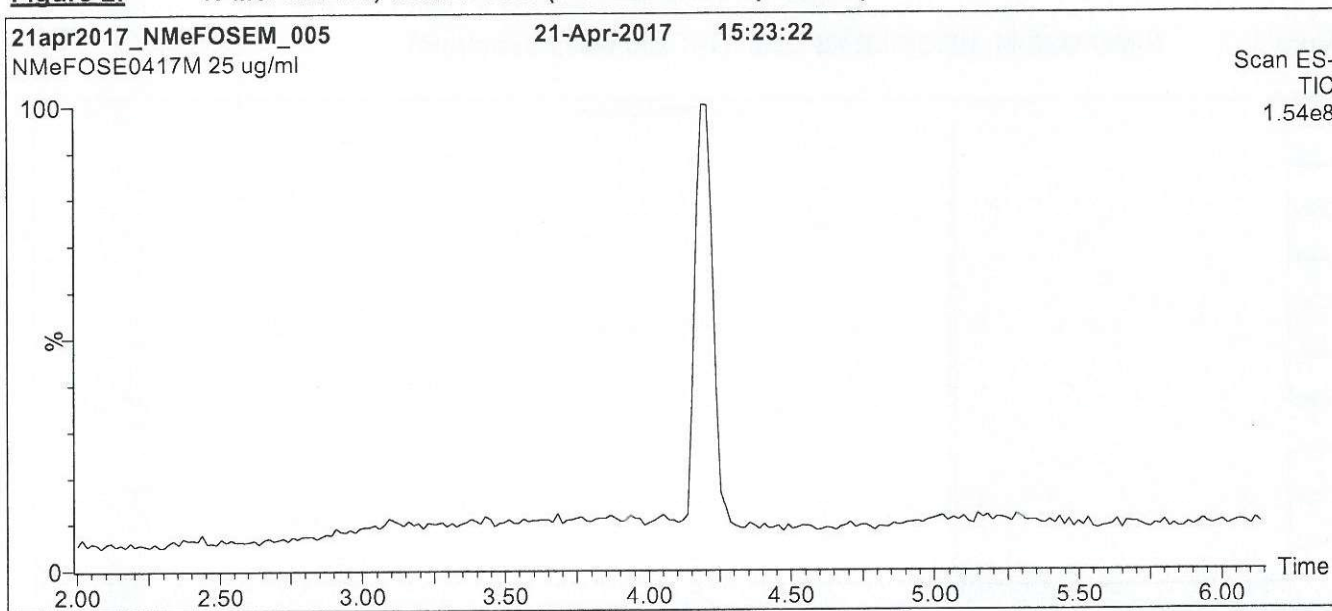
Agilent 7890A (HRGC)
Agilent 5975C (LRMS)

Chromatographic Conditions:

Column: 30 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W
Injector: 250 °C (Splitless Injection)
Oven: 100 °C (5 min)
10 °C/min to 325 °C
325 °C (20 min)
Ionization: EI+
Detector: 250 °C
Full Scan (50-1000 amu)

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Figure 2: N-MeFOSE-M; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 2:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 60% MeOH / 40% H₂O
Ramp to 90% organic over 7 min and hold for 1.5 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

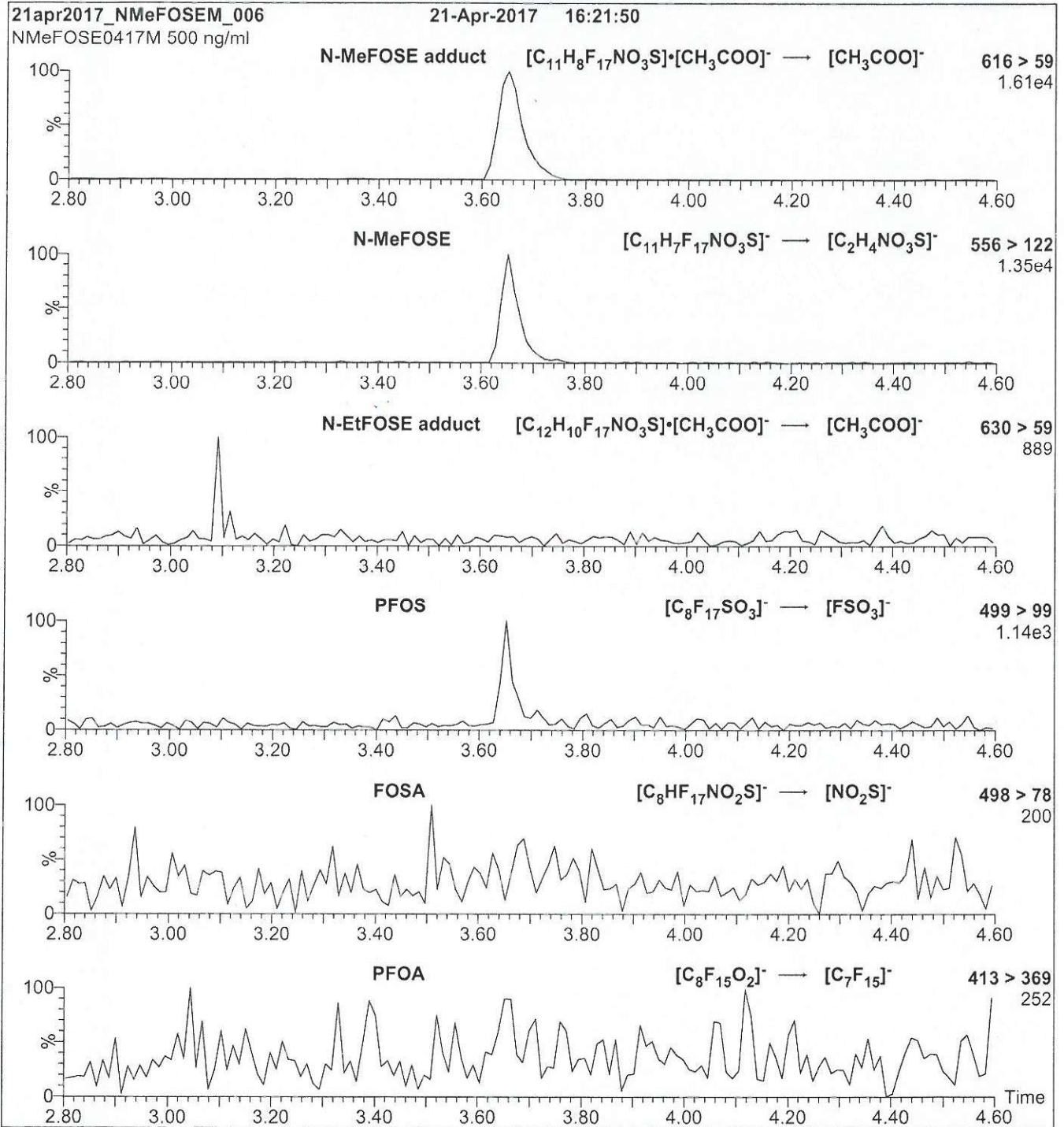
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.50
Cone Voltage (V) = 40.00
Cone Gas Flow (l/hr) = 60
Desolvation Gas Flow (l/hr) = 750

18B1566

Figure 3: N-MeFOSE-M; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 3:

Injection: Direct loop injection
10 μ l (500 ng/ml N-MeFOSE-M)

Mobile phase: Isocratic 80% MeOH / 20% H₂O

Flow: 300 μ l/min

MS Parameters

Collision Gas (mbar) = 3.28e-3
Collision Energy (eV) = 35

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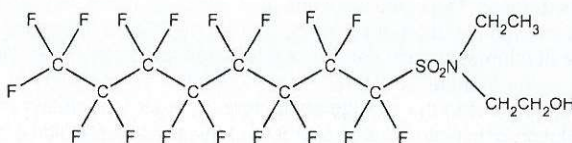


WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS DOCUMENTATION

PRODUCT CODE: N-EtFOSE-M **LOT NUMBER:** NEtFOSE0417M
COMPOUND: 2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol

STRUCTURE: **CAS #:** 1691-99-2



MOLECULAR FORMULA: C₁₂H₁₀F₁₇NO₃S **MOLECULAR WEIGHT:** 571.25
CONCENTRATION: 50 ± 2.5 µg/ml **SOLVENT(S):** Methanol
CHEMICAL PURITY: >98%
LAST TESTED: (mm/dd/yyyy) 04/24/2017 (HRGC/LRMS)
 04/21/2017 (LC/MS)
EXPIRY DATE: (mm/dd/yyyy) 04/24/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

DOCUMENTATION/ DATA ATTACHED:

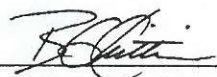
Figure 1: HRGC/LRMS Data (TIC and Mass Spectrum)
 Figure 2: LC/MS Data (TIC and Mass Spectrum)
 Figure 3: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- In order to see the molecular ion (adduct free), the LC mobile phase should be free of ammonium acetate buffer.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By:


 B.G. Chittim, General Manager

Date: 04/26/2017

(mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
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$$u_c(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

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QUALITY MANAGEMENT:

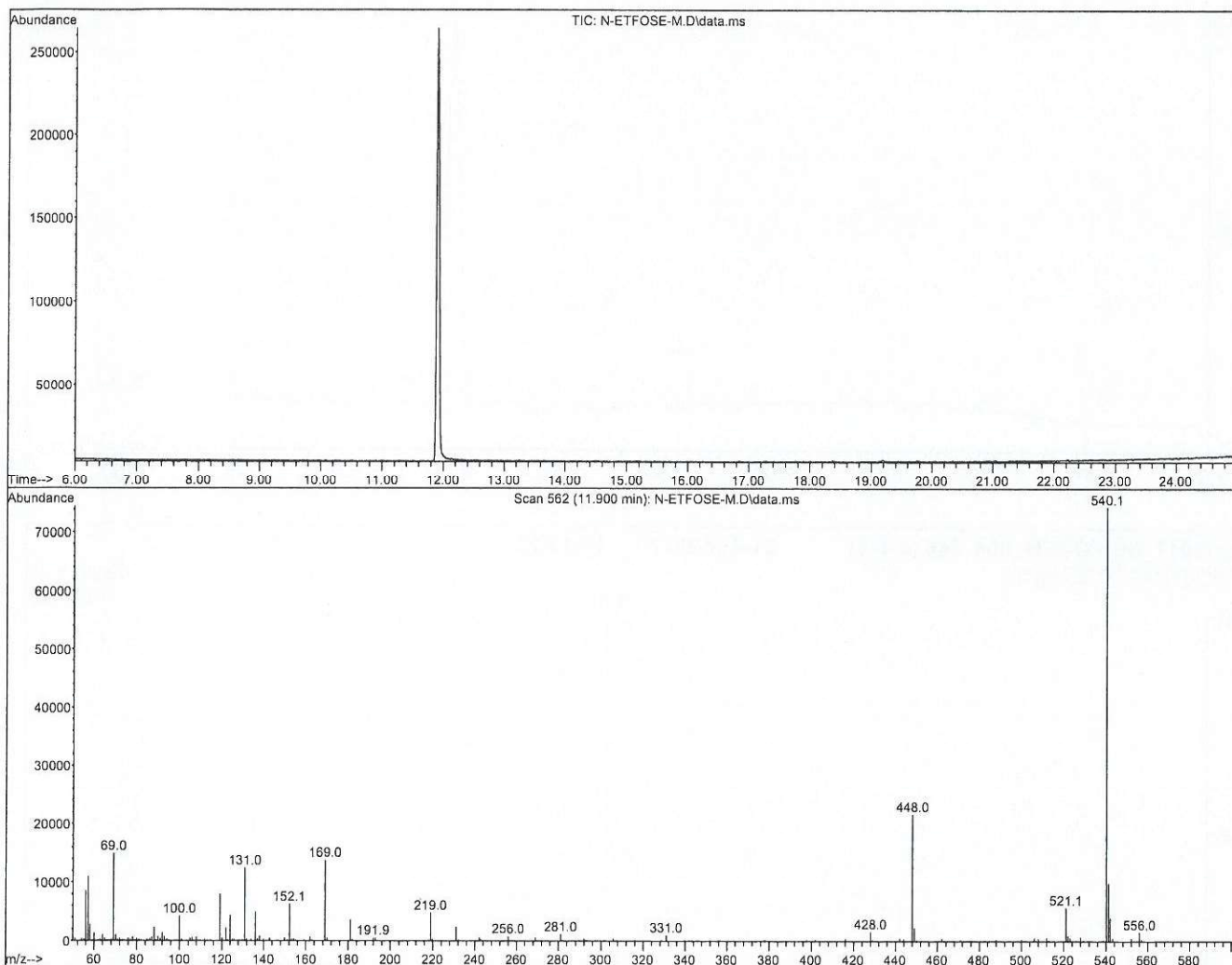
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18B1567

Figure 1: N-EtFOSE-M; HRGC/LRMS Data (TIC and Mass Spectrum)



HRGC/LRMS:

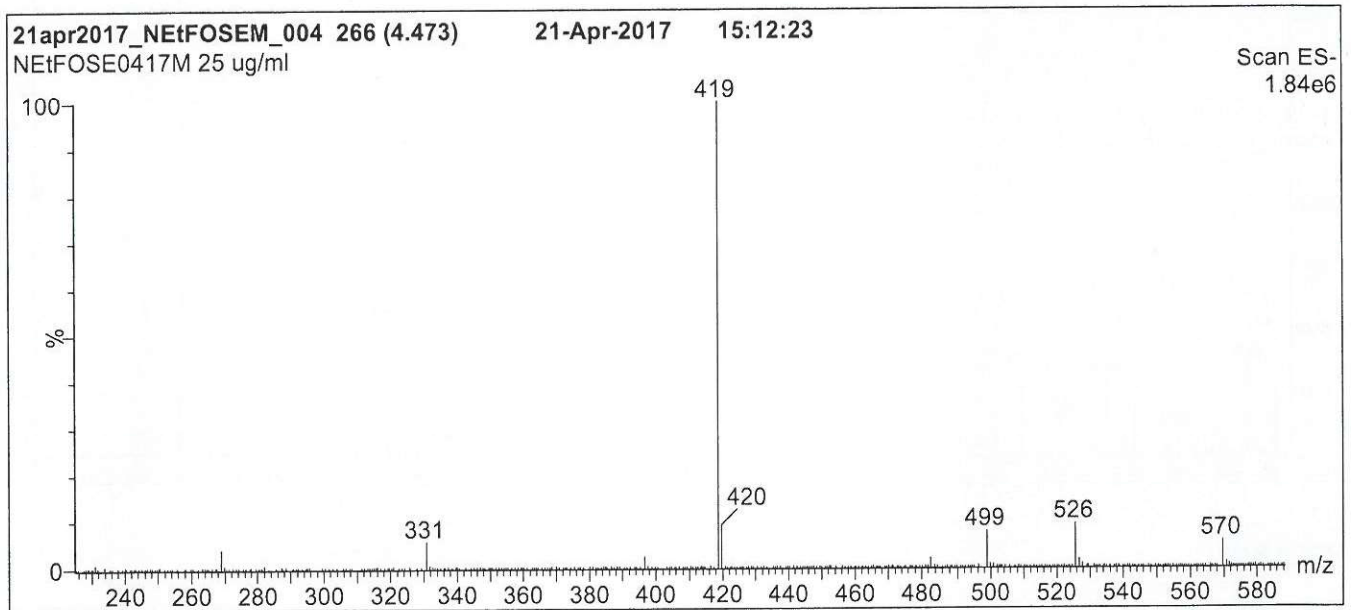
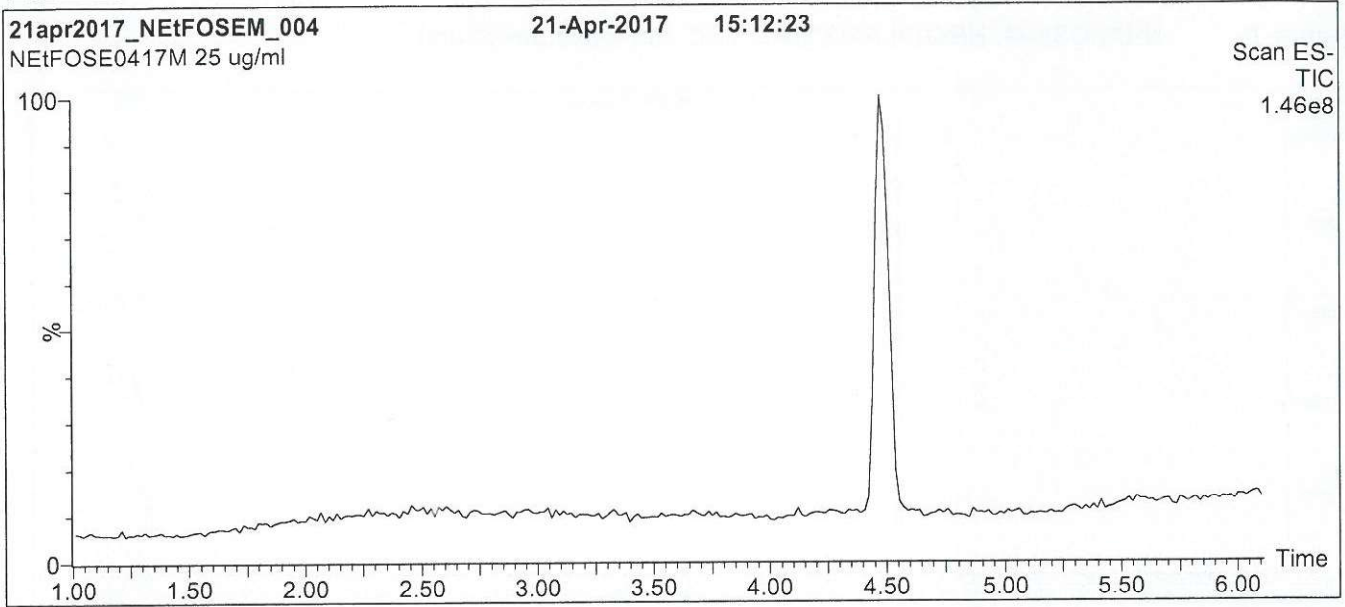
Agilent 7890A (HRGC)
Agilent 5975C (LRMS)

Chromatographic Conditions:

Column: 30 m DB-5 (0.25 mm id, 0.25 μ m film thickness) Agilent J&W
Injector: 250 $^{\circ}$ C (Splitless Injection)
Oven: 100 $^{\circ}$ C (5 min)
10 $^{\circ}$ C/min to 325 $^{\circ}$ C
325 $^{\circ}$ C (20 min)
Ionization: EI+
Detector: 250 $^{\circ}$ C
Full Scan (50-1000 amu)

18B1567

Figure 2: N-EtFOSE-M; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 2:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 60% MeOH / 40% H₂O
Ramp to 90% organic over 7 min and hold for 1.5 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

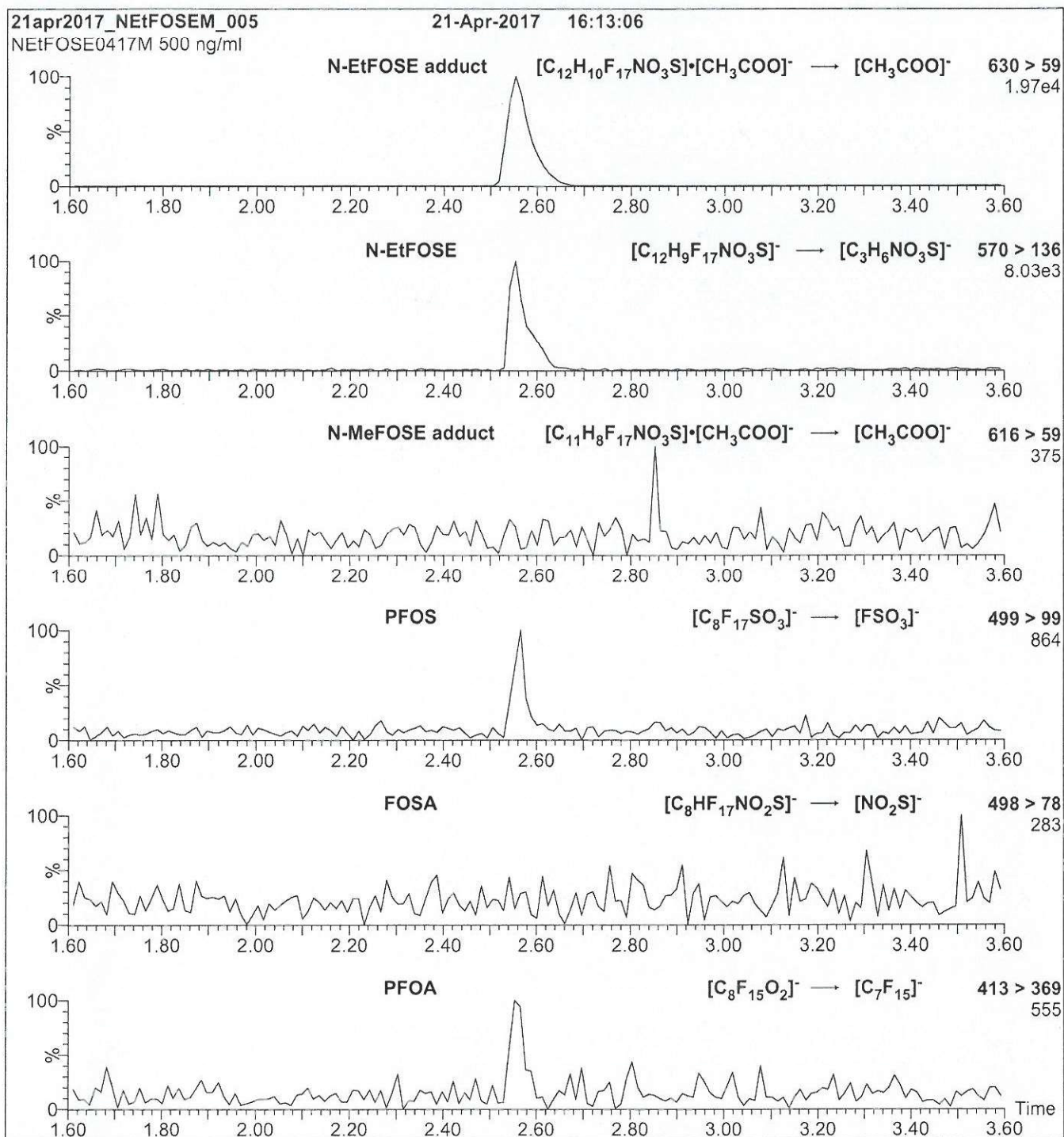
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 40.00
Cone Gas Flow (l/hr) = 100
Desolvation Gas Flow (l/hr) = 750

18B1567

Figure 3: N-EtFOSE-M; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 3:

Injection: Direct loop injection
10 μ l (500 ng/ml N-EtFOSE-M)

Mobile phase: Isocratic 80% MeOH / 20% H₂O

Flow: 300 μ l/min

MS Parameters

Collision Gas (mbar) = 3.28e-3
Collision Energy (eV) = 33

10/13/2011

Analytical Standard Record

Vista Analytical Laboratory

18D2005

Parent Standards used in this standard:

Standard	Description	Prepared	Prepared By	Expires	(mls)
18B1530	13C2-FOUEA	15-Feb-18	** Vendor **	14-Nov-19	1
18B1531	13C3-PFHxS	15-Feb-18	** Vendor **	05-Jul-22	1.06
18B1532	13C4-PFOS	15-Feb-18	** Vendor **	17-Oct-22	1.05
18B1533	13C7-PFUDa	15-Feb-18	** Vendor **	13-Jul-22	1
18B1534	13C5-PFHxA	15-Feb-18	** Vendor **	17-Oct-22	1
18B1535	13C6-PFDA	15-Feb-18	** Vendor **	17-Oct-22	1
18B1536	13C8-PFOA	15-Feb-18	** Vendor **	05-Jul-22	1.02
18B1537	13C4-PFBA	15-Feb-18	** Vendor **	12-Apr-22	1
18B1538	13C9-PFNA	15-Feb-18	** Vendor **	23-May-22	1

Description:	PFC-RS	Expires:	20-Apr-20
Standard Type:	Reagent	Prepared:	20-Apr-18
Solvent:	MeOH	Prepared By:	Giana R. Bilotta
Final Volume (mls):	40	Department:	LCMS
Vials:	1	Last Edit:	20-Apr-18 10:41 by GRB

Analyte	CAS Number	Concentration	Units
13C9-PFNA		1.25	ug/mL
13C8-PFOA		1.25	ug/mL
13C7-PFUnA		1.25	ug/mL
13C6-PFDA		1.25	ug/mL
13C5-PFHxA		1.25	ug/mL
13C4-PFOS		1.25	ug/mL
13C4-PFBA		1.25	ug/mL
13C3-PFHxS		1.25	ug/mL
13C2-FOUEA		1.25	ug/mL

18B1530



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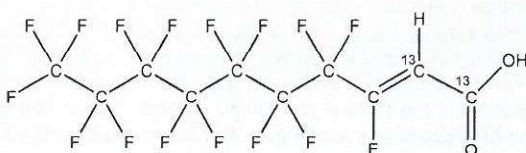
CERTIFICATE OF ANALYSIS DOCUMENTATION

PRODUCT CODE: MFOUEA
COMPOUND: 2H-Perfluoro-[1,2-¹³C₂]-2-decenoic acid

LOT NUMBER: MFOUEA1117

STRUCTURE:

CAS #: Not available



MOLECULAR FORMULA: ¹³C₂¹²C₈H₂F₁₆O₂
CONCENTRATION: 50 ± 2.5 µg/ml

MOLECULAR WEIGHT: 460.08
SOLVENT(S): Anhydrous
Isopropanol

CHEMICAL PURITY: >98%
LAST TESTED: (mm/dd/yyyy) 11/14/2017

ISOTOPIC PURITY: ≥99% ¹³C
(1,2-¹³C₂)

EXPIRY DATE: (mm/dd/yyyy) 11/14/2019

RECOMMENDED STORAGE: Refrigerate ampoule

DOCUMENTATION/ DATA ATTACHED:

- Figure 1: LC/MS Data (TIC and Mass Spectrum)
- Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Dilution of this standard in methanol may lead to the formation of 2H-3-methoxy-perfluoro-[1,2-¹³C₂]-2-decenoic acid. This reaction can be catalyzed by the presence of acid or base. All dilutions should be routinely checked for degradation.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: 
B.G. Chittim, General Manager

Date: 11/15/2017
(mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B1530

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HAZARDS:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Where possible, all of our products are synthesized using single-product unambiguous routes. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2, \dots, x_n on which it depends is:

$$u_c(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of $\pm 5\%$ (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly tested by an external ISO/IEC 17025 accredited calibration company. In addition, their calibration is verified prior to each weighing using calibrated NIST and/or NRC traceable external weights. All volumetric glassware used is calibrated, of Class A tolerance, and has been tested according to the appropriate ASTM procedures, which are ultimately traceable to NIST. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

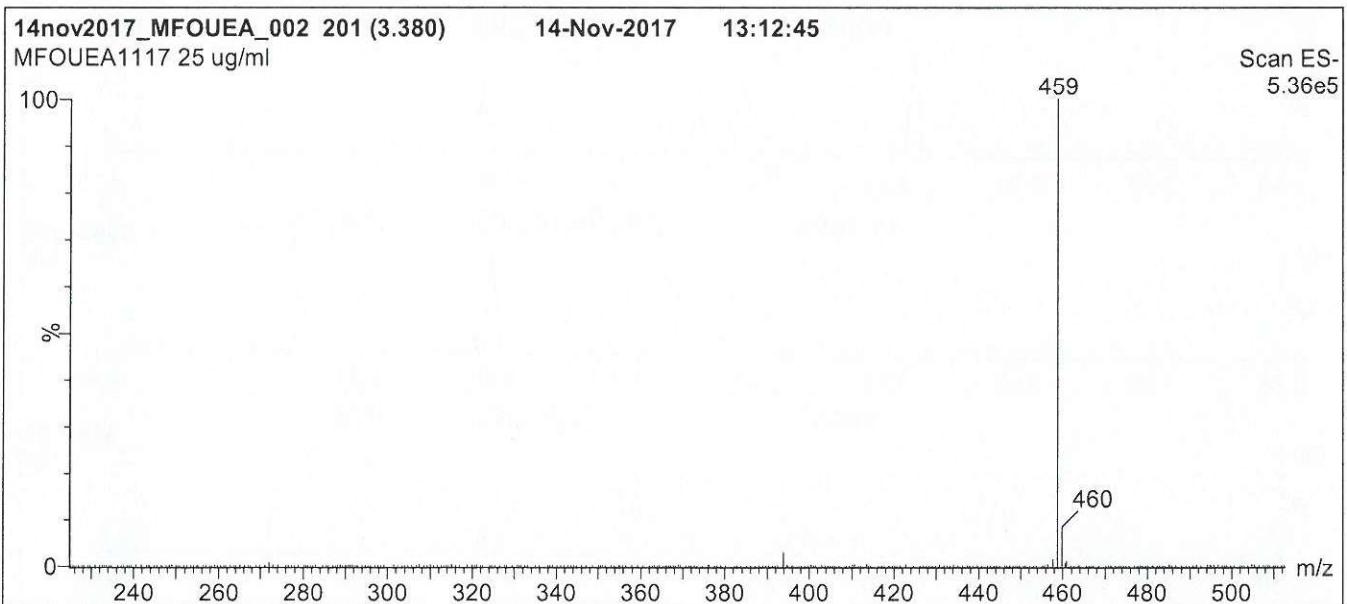
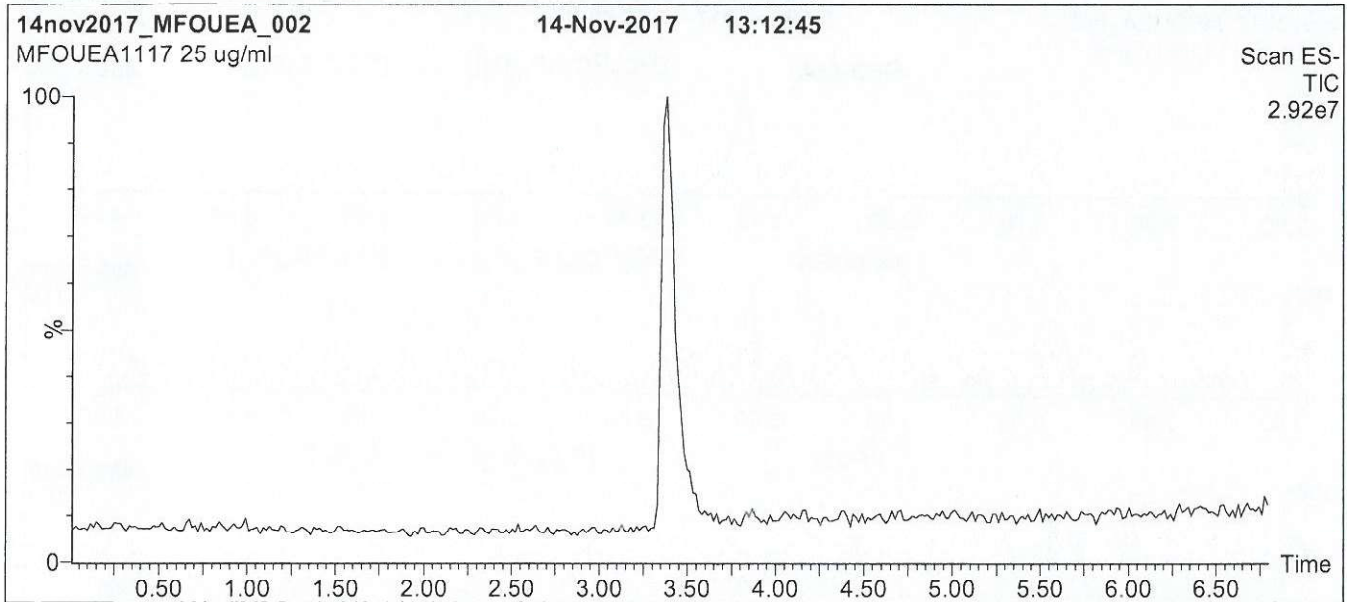
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

18B1530

Figure 1: MFOUEA; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 55% (80:20 MeOH:ACN) / 45% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7.5 min and hold
for 1.5 min before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

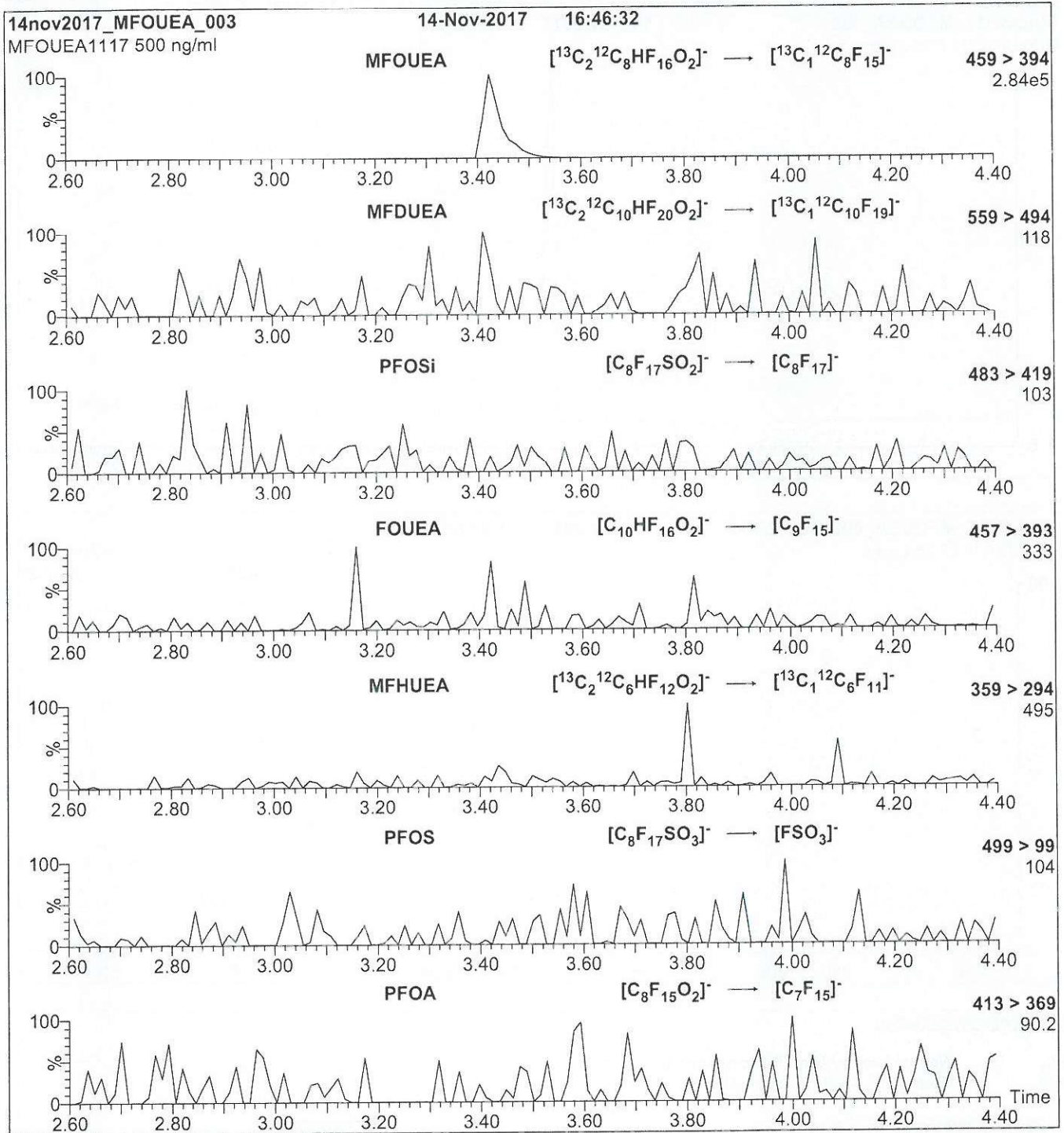
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 14.00
Cone Gas Flow (l/hr) = 60
Desolvation Gas Flow (l/hr) = 750

18B1530

Figure 2: MFOUEA; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
10 μl (500 ng/ml MFOUEA)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H_2O
(both with 10 mM NH_4OAc buffer)

Flow: 300 $\mu\text{l}/\text{min}$

MS Parameters

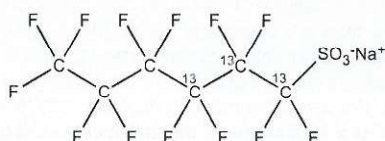
Collision Gas (mbar) = 3.39e-3
Collision Energy (eV) = 21

18B1531


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 CERTIFICATE OF ANALYSIS
 DOCUMENTATION

PRODUCT CODE: M3PFHxS **LOT NUMBER:** M3PFHxS0717
COMPOUND: Sodium perfluoro-1-[1,2,3-¹³C₃]hexanesulfonate
STRUCTURE: **CAS #:** Not available



MOLECULAR FORMULA: ¹³C₃¹²C₃F₁₃SO₃Na **MOLECULAR WEIGHT:** 425.07
CONCENTRATION: 50.0 ± 2.5 µg/ml (Na salt) **SOLVENT(S):** Methanol
 47.3 ± 2.4 µg/ml (M3PFHxS anion)
CHEMICAL PURITY: >98% **ISOTOPIC PURITY:** ≥99% ¹³C
LAST TESTED: (mm/dd/yyyy) 07/05/2017 (1,2,3-¹³C₃)
EXPIRY DATE: (mm/dd/yyyy) 07/05/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
 Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: 
 B.G. Chittim, General Manager

Date: 07/14/2017
 (mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
 519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B1531

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HAZARDS:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Where possible, all of our products are synthesized using single-product unambiguous routes. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2, \dots, x_n on which it depends is:

$$u_c(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of $\pm 5\%$ (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly tested by an external ISO/IEC 17025 accredited calibration company. In addition, their calibration is verified prior to each weighing using calibrated NIST and/or NRC traceable external weights. All volumetric glassware used is calibrated, of Class A tolerance, and has been tested according to the appropriate ASTM procedures, which are ultimately traceable to NIST. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

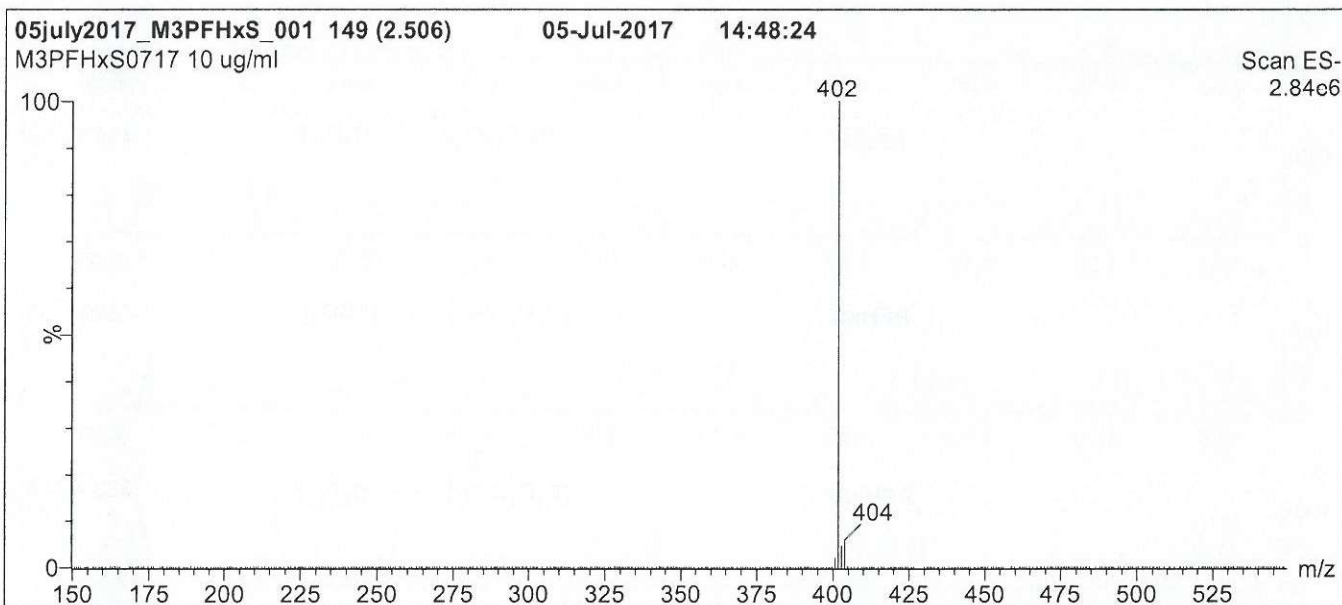
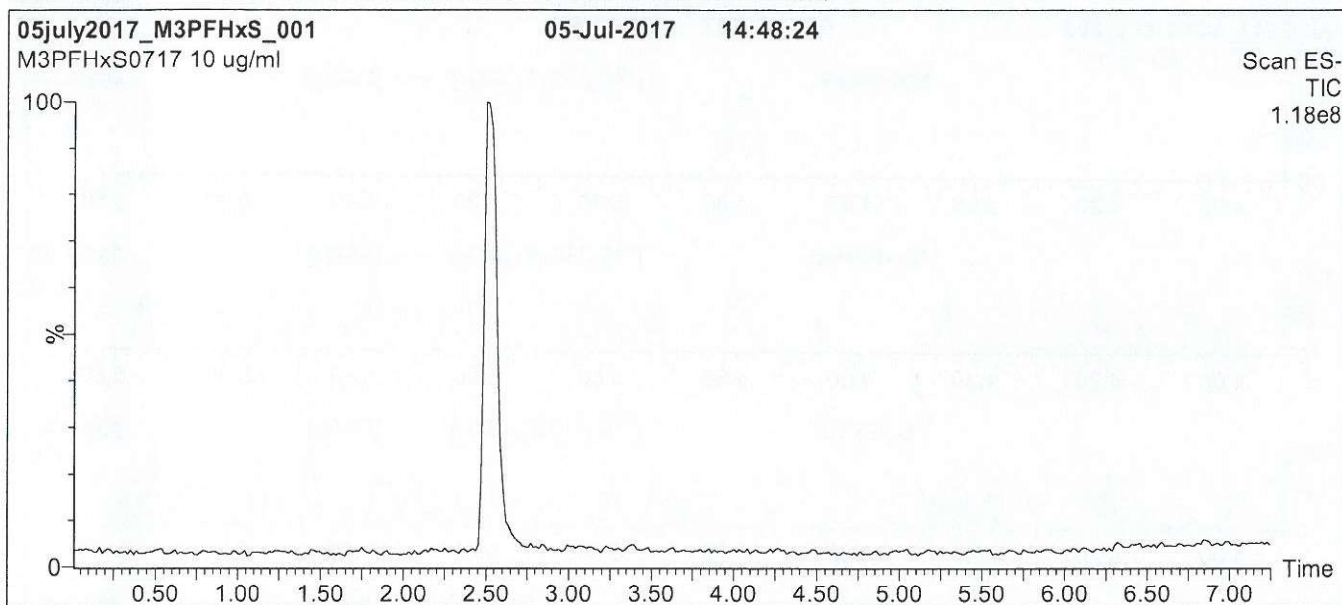
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

18B1531

Figure 1: M3PFHxS; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 55% (80:20 MeOH:ACN) / 45% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7.5 min and hold for
1.5 min before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

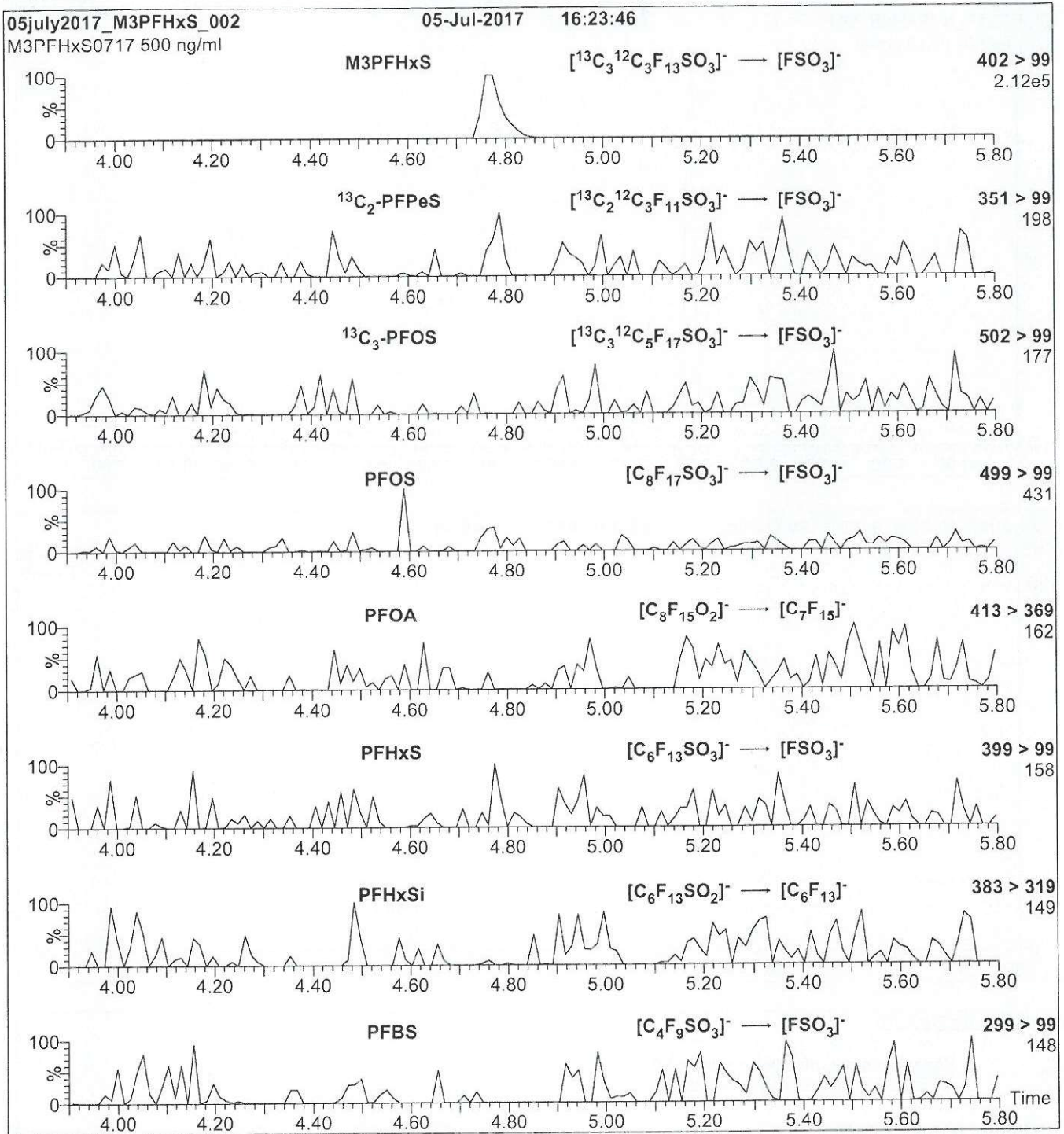
MS Parameters

Experiment: Full Scan (150 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 50.00
Cone Gas Flow (l/hr) = 60
Desolvation Gas Flow (l/hr) = 750

18B1531

Figure 2: M3PFHxS; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
 10 µl (500 ng/ml M3PFHxS)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H₂O
 (both with 10 mM NH₄OAc buffer)

Flow: 300 µl/min

MS Parameters

Collision Gas (mbar) = 3.43e-3
 Collision Energy (eV) = 30

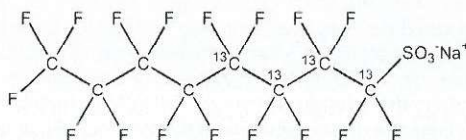
18B1532



WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS DOCUMENTATION

PRODUCT CODE: MPFOS **LOT NUMBER:** MPFOS1017
COMPOUND: Sodium perfluoro-1-[1,2,3,4-¹³C₄]octanesulfonate
STRUCTURE: **CAS #:** Not available



MOLECULAR FORMULA: ¹³C₄¹²C₄F₁₇SO₃Na **MOLECULAR WEIGHT:** 526.08
CONCENTRATION: 50.0 ± 2.5 µg/ml (Na salt) **SOLVENT(S):** Methanol
 47.8 ± 2.4 µg/ml (MPFOS anion)
CHEMICAL PURITY: >98% **ISOTOPIC PURITY:** ≥99% ¹³C
LAST TESTED: (mm/dd/yyyy) 10/17/2017 (1,2,3,4-¹³C₄)
EXPIRY DATE: (mm/dd/yyyy) 10/17/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

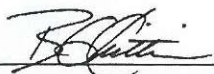
DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
 Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains ~ 0.4% Sodium perfluoro-1-[1,2,3-¹³C₃]heptanesulfonate.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By:  **Date:** 10/18/2017
 B.G. Chittim, General Manager (mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
 519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B153Z

INTENDED USE:

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HAZARDS:

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where x is expressed as a relative standard uncertainty of the individual parameter.

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LIMITED WARRANTY:

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QUALITY MANAGEMENT:

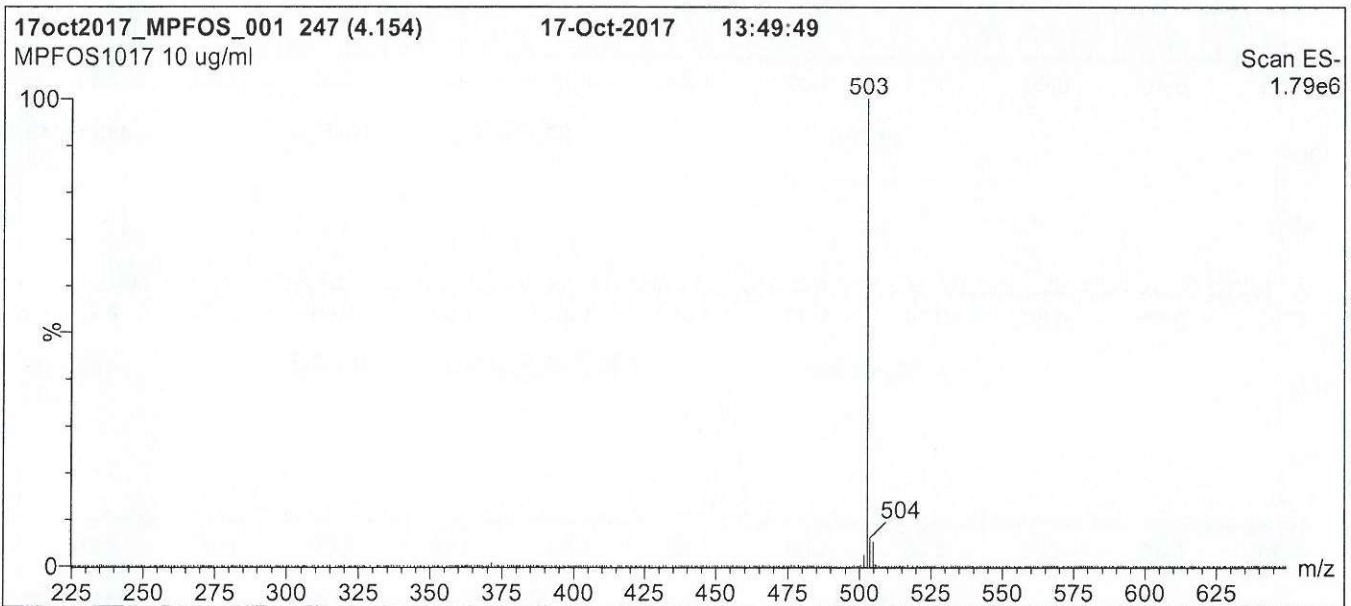
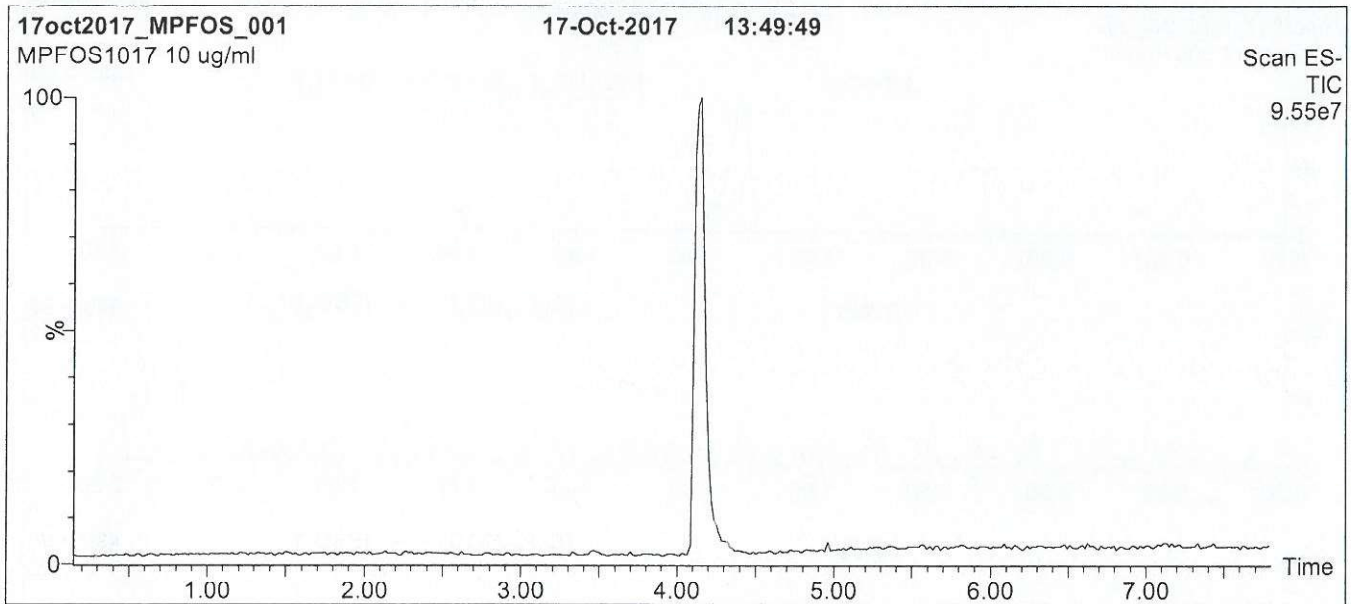
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



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18B1532

Figure 1: MPFOS; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 50% (80:20 MeOH:ACN) / 50% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7 min and hold for 2 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

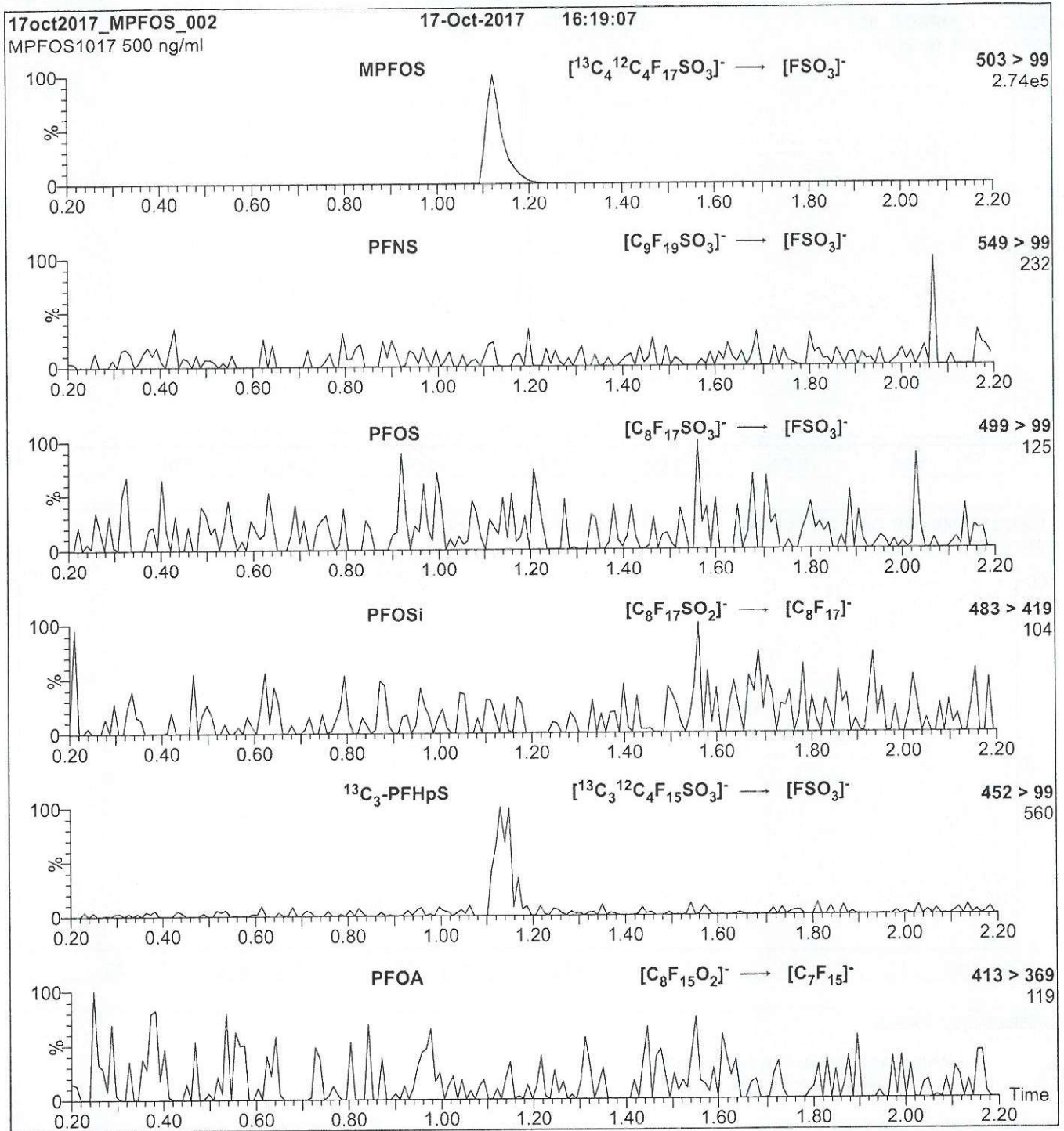
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 60.00
Cone Gas Flow (l/hr) = 50
Desolvation Gas Flow (l/hr) = 750

18B1532

Figure 2: MPFOS; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
10 μl (500 ng/ml MPFOS)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H_2O
(both with 10 mM NH_4OAc buffer)

Flow: 300 $\mu\text{l}/\text{min}$

MS Parameters

Collision Gas (mbar) = 3.31e-3
Collision Energy (eV) = 40

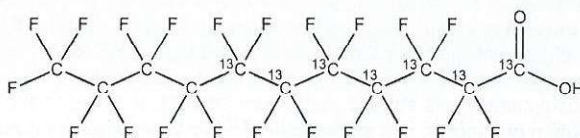
18B1533



WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE: M7PFUdA **LOT NUMBER:** M7PFUdA0717
COMPOUND: Perfluoro-n-[1,2,3,4,5,6,7-¹³C₇]undecanoic acid
STRUCTURE: **CAS #:** Not available



MOLECULAR FORMULA: ¹³C₇¹²C₄HF₂₁O₂ **MOLECULAR WEIGHT:** 571.04
CONCENTRATION: 50 ± 2.5 µg/ml **SOLVENT(S):** Methanol
Water (<1%)
CHEMICAL PURITY: >98% **ISOTOPIC PURITY:** ≥99% ¹³C
LAST TESTED: (mm/dd/yyyy) 07/13/2017 (1,2,3,4,5,6,7-¹³C₇)
EXPIRY DATE: (mm/dd/yyyy) 07/13/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

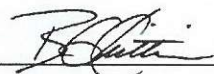
DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: 
B.G. Chittim, General Manager **Date:** 07/14/2017
(mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B1533

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HAZARDS:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Where possible, all of our products are synthesized using single-product unambiguous routes. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2, \dots, x_n on which it depends is:

$$u_c(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of $\pm 5\%$ (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly tested by an external ISO/IEC 17025 accredited calibration company. In addition, their calibration is verified prior to each weighing using calibrated NIST and/or NRC traceable external weights. All volumetric glassware used is calibrated, of Class A tolerance, and has been tested according to the appropriate ASTM procedures, which are ultimately traceable to NIST. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

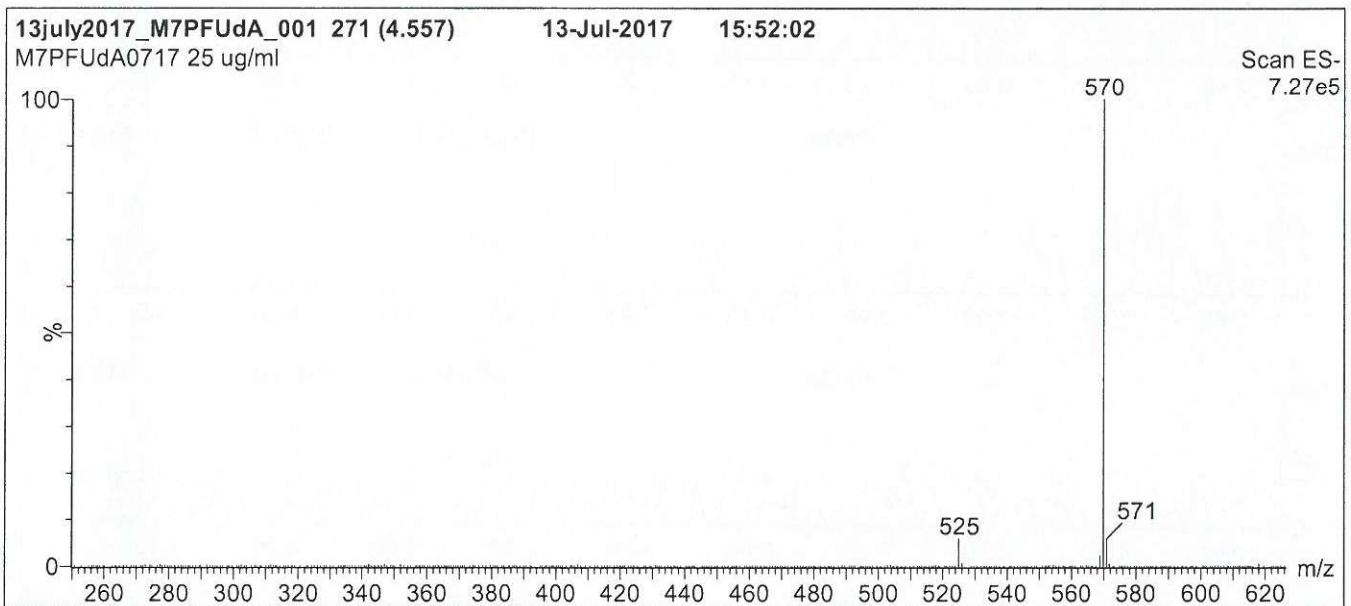
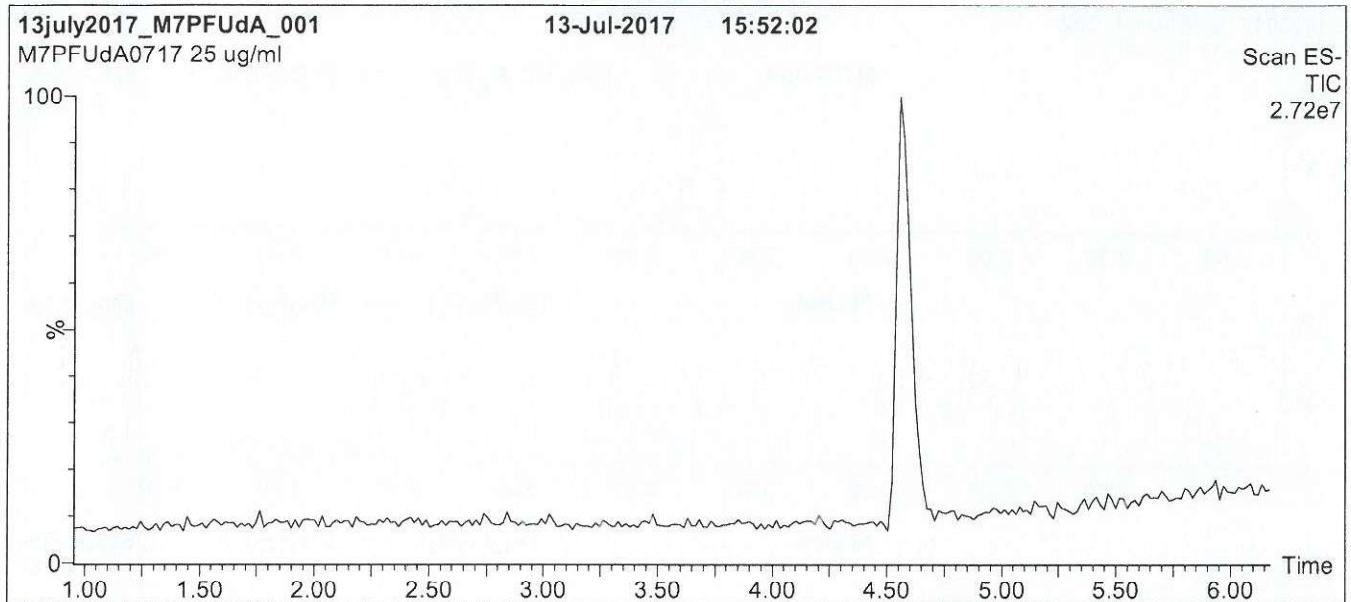
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



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18B1533

Figure 1: M7PFUdA; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 55% (80:20 MeOH:ACN) / 45% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7 min and hold for 2 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

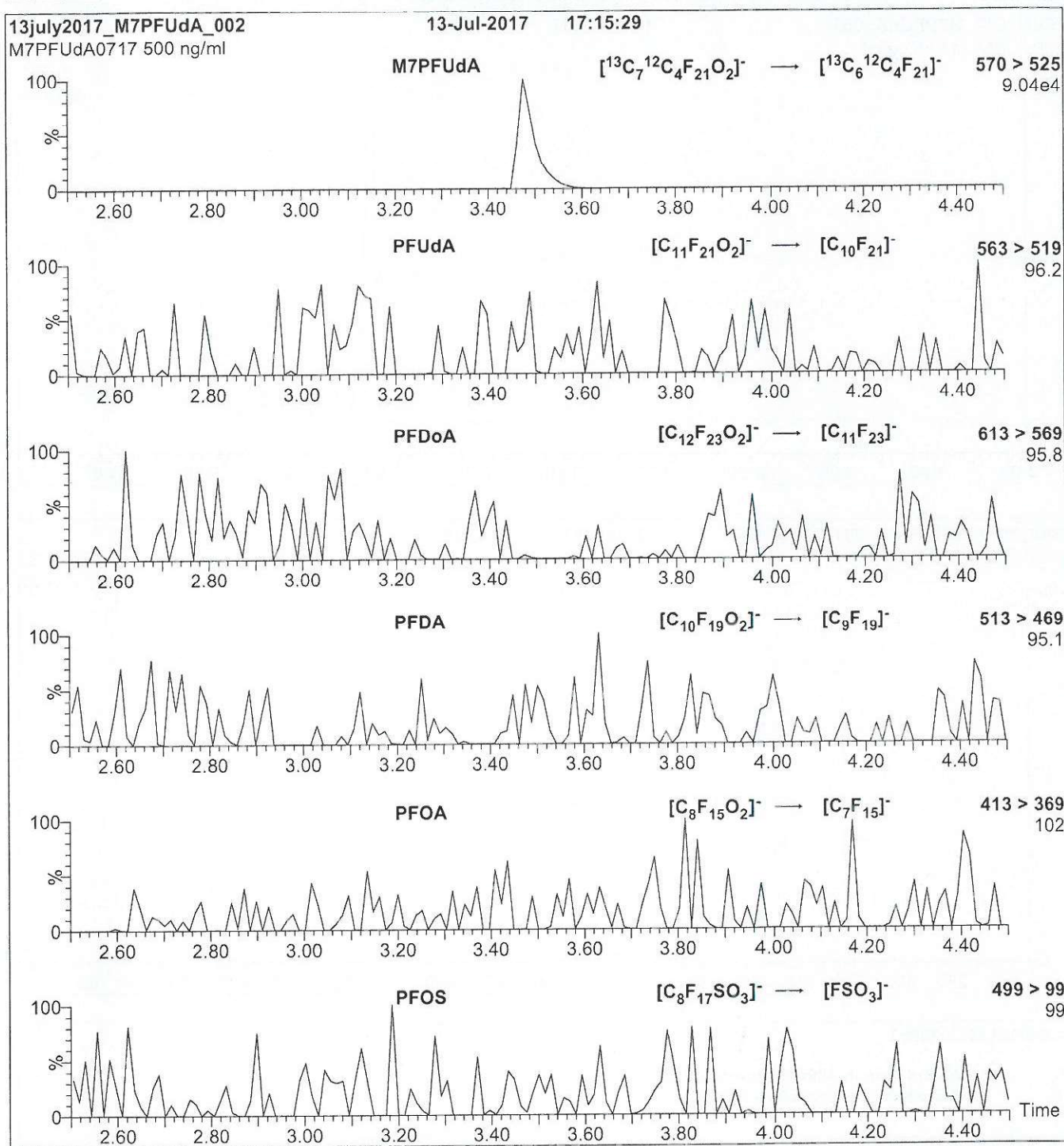
MS Parameters

Experiment: Full Scan (250 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 15.00
Cone Gas Flow (l/hr) = 65
Desolvation Gas Flow (l/hr) = 750

18B1533

Figure 2: M7PFUdA; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
10 μl (500 ng/ml M7PFUdA)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H_2O
(both with 10 mM NH_4OAc buffer)

Flow: 300 $\mu\text{l}/\text{min}$

MS Parameters

Collision Gas (mbar) = 3.28e-3
Collision Energy (eV) = 11

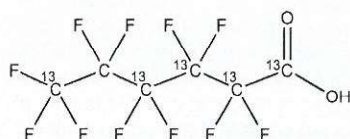
18B1534



WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE: M5PFHxA **LOT NUMBER:** M5PFHxA1017
COMPOUND: Perfluoro-n-[1,2,3,4,6-¹³C₅]hexanoic acid
STRUCTURE: **CAS #:** Not available



MOLECULAR FORMULA: ¹³C₅¹²C₁HF₁₁O₂ **MOLECULAR WEIGHT:** 319.02
CONCENTRATION: 50 ± 2.5 µg/ml **SOLVENT(S):** Methanol
Water (<1%)
CHEMICAL PURITY: >98% **ISOTOPIC PURITY:** ≥99% ¹³C
(1,2,3,4,6-¹³C₅)
LAST TESTED: (mm/dd/yyyy) 10/17/2017
EXPIRY DATE: (mm/dd/yyyy) 10/17/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By:  **Date:** 10/18/2017
B.G. Chittim, General Manager (mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B1534

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HAZARDS:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

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HOMOGENEITY:

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EXPIRY DATE / PERIOD OF VALIDITY:

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LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

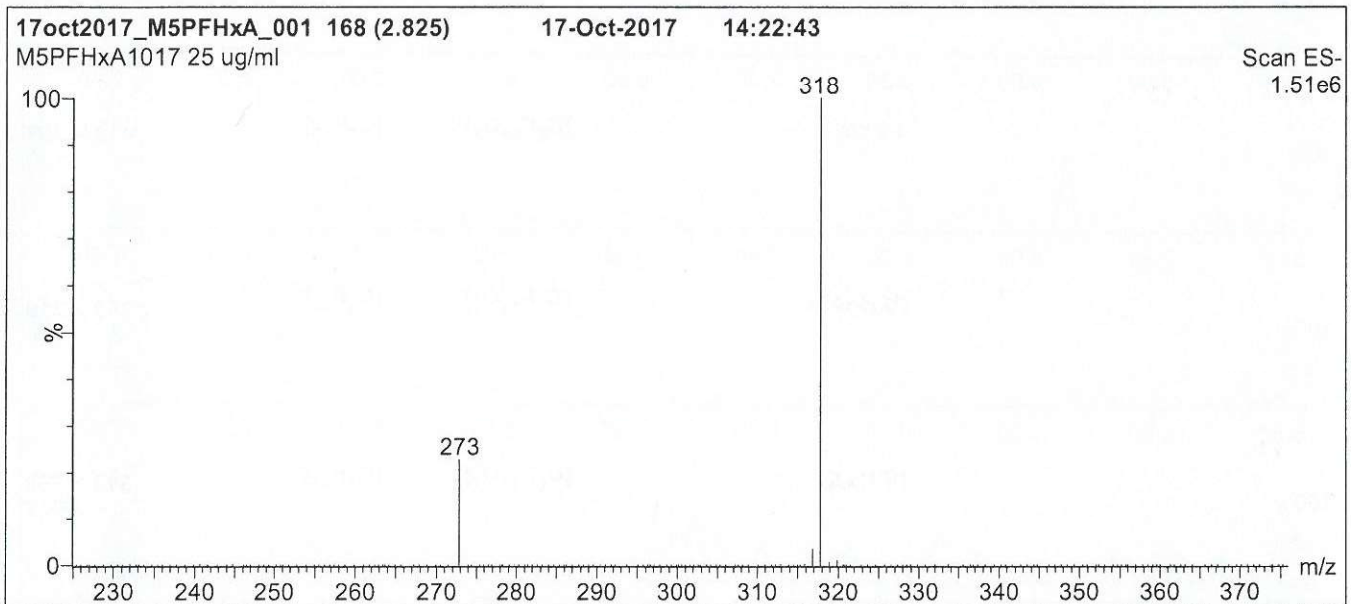
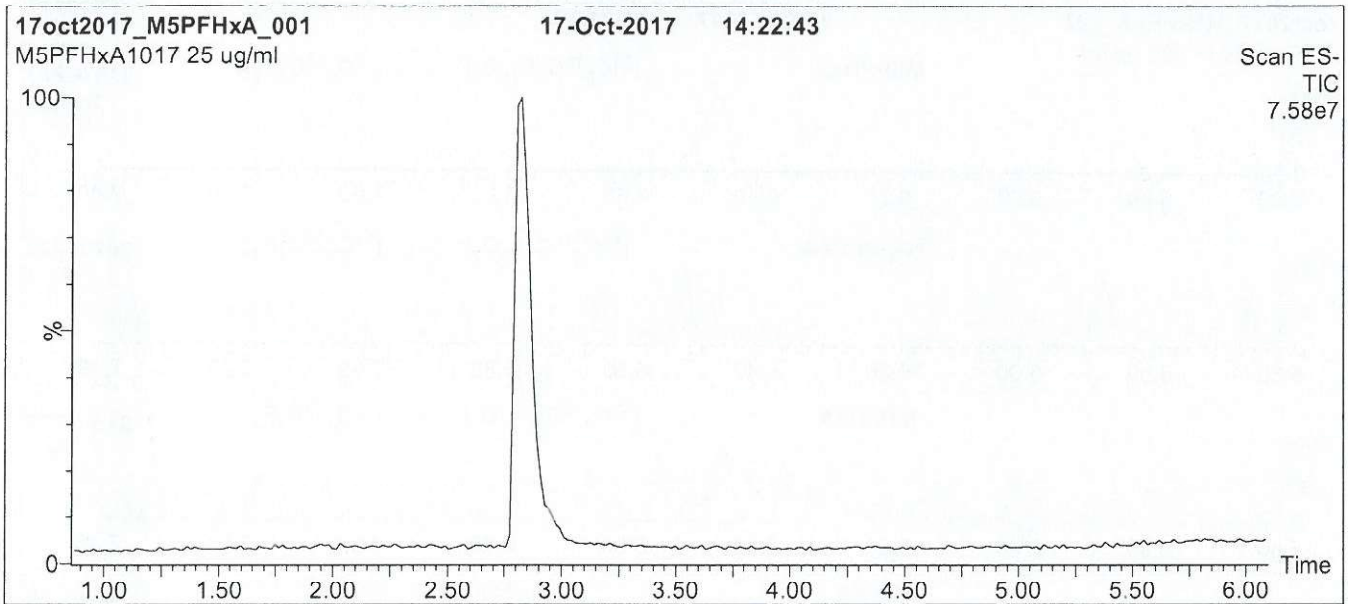
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



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18B1534

Figure 1: M5PFHxA; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 40% (80:20 MeOH:ACN) / 60% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7 min and hold for 2 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

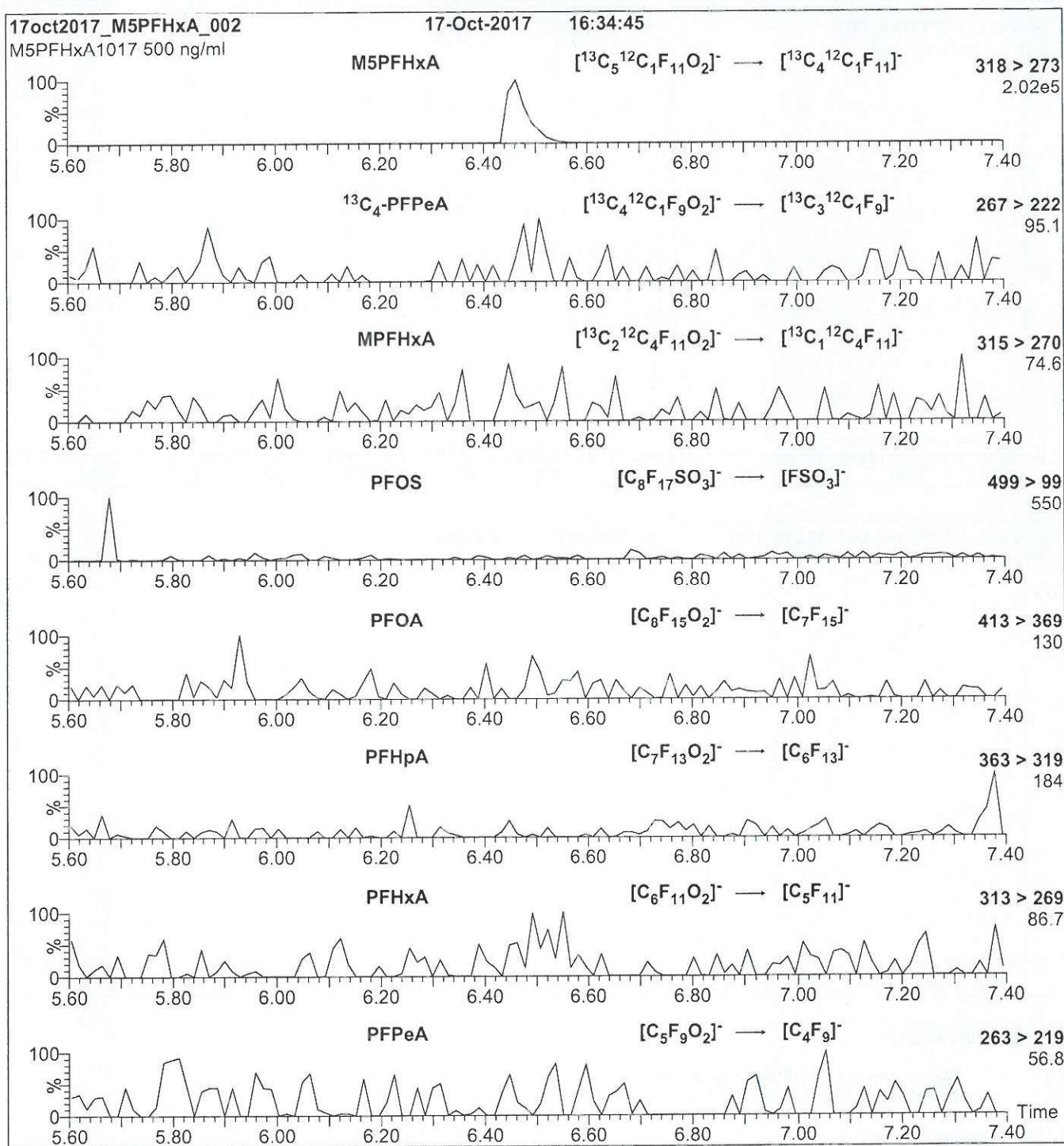
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.00
Cone Voltage (V) = 15.00
Cone Gas Flow (l/hr) = 100
Desolvation Gas Flow (l/hr) = 750

18B1534

Figure 2: M5PFHxA; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
10 μl (500 ng/ml M5PFHxA)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H_2O
(both with 10 mM NH_4OAc buffer)

Flow: 300 $\mu\text{l}/\text{min}$

MS Parameters

Collision Gas (mbar) = 3.31e-3
Collision Energy (eV) = 9

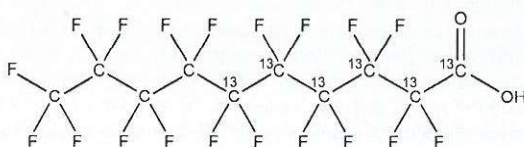
18B1535



WELLINGTON
LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

PRODUCT CODE: M6PFDA **LOT NUMBER:** M6PFDA1017
COMPOUND: Perfluoro-n-[1,2,3,4,5,6-¹³C₆]decanoic acid
STRUCTURE: **CAS #:** Not available



MOLECULAR FORMULA: ¹³C₆¹²C₄H₁₉O₂ **MOLECULAR WEIGHT:** 520.04
CONCENTRATION: 50 ± 2.5 µg/ml **SOLVENT(S):** Methanol
 Water (<1%)
CHEMICAL PURITY: >98% **ISOTOPIC PURITY:** ≥99% ¹³C
 (1,2,3,4,5,6-¹³C₆)
LAST TESTED: (mm/dd/yyyy) 10/17/2017
EXPIRY DATE: (mm/dd/yyyy) 10/17/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place


DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
 Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By:  **Date:** 10/20/2017
 B.G. Chittim, General Manager (mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
 519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B1535

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HAZARDS:

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SYNTHESIS / CHARACTERIZATION:

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HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

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where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of $\pm 5\%$ (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

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EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

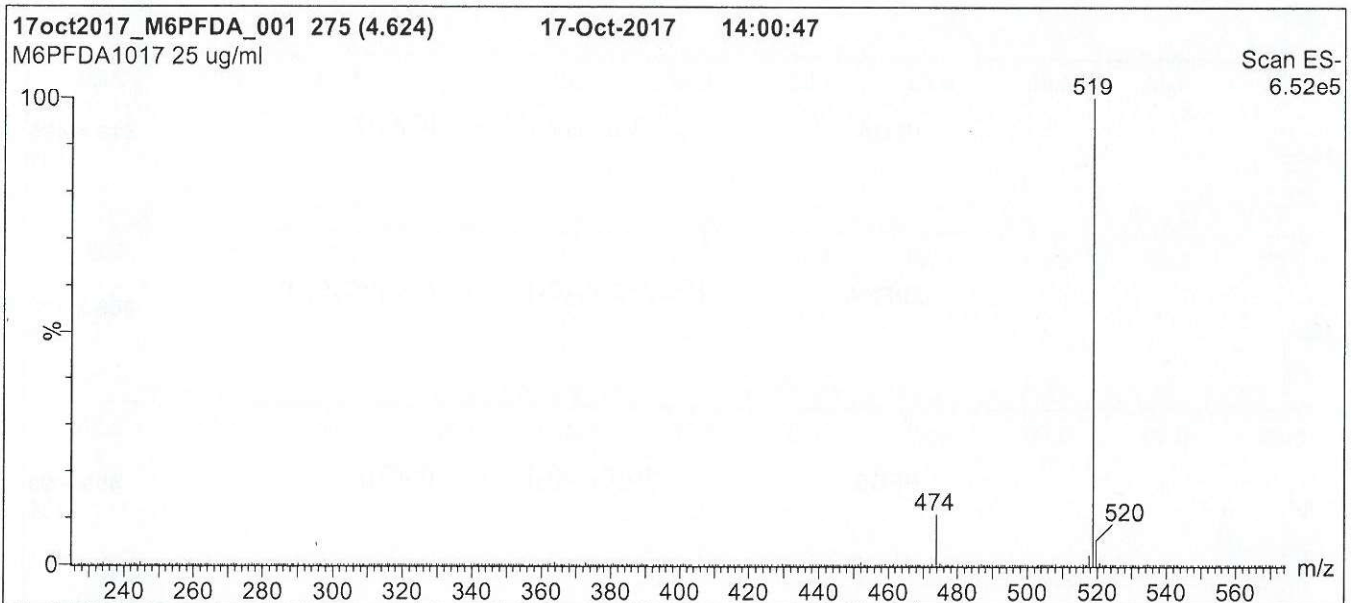
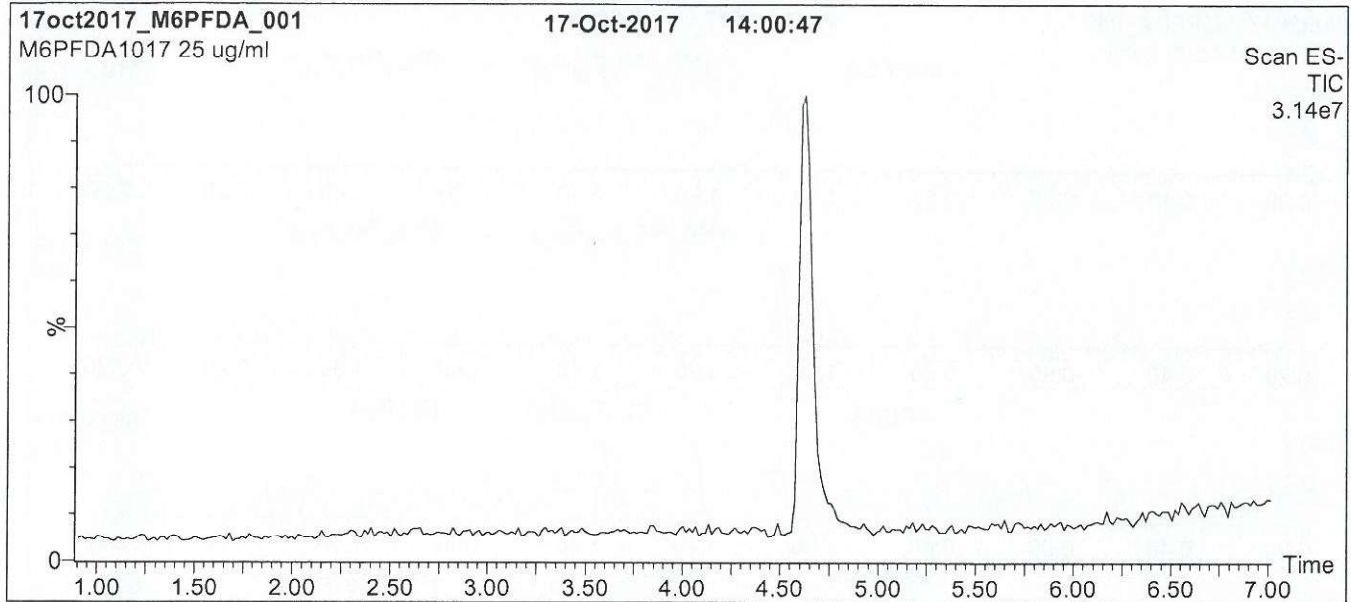
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



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18B1535

Figure 1: M6PFDA; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 50% (80:20 MeOH:ACN) / 50% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7 min and hold for 2 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

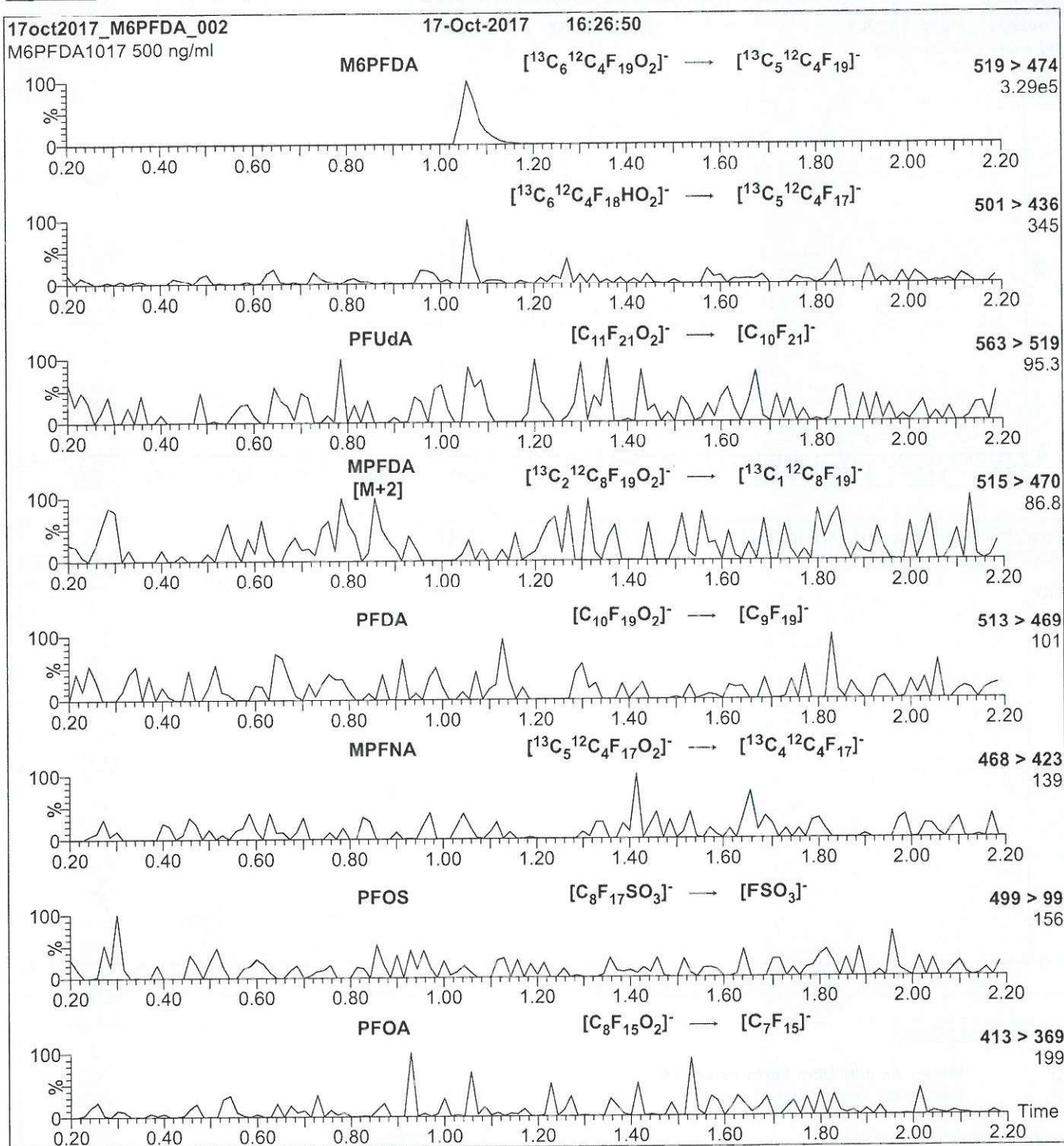
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 15.00
Cone Gas Flow (l/hr) = 50
Desolvation Gas Flow (l/hr) = 750

18B1535

Figure 2: M6PFDA; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
10 μl (500 ng/ml M6PFDA)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H_2O
(both with 10 mM NH_4OAc buffer)

Flow: 300 $\mu\text{l}/\text{min}$

MS Parameters

Collision Gas (mbar) = 3.24e-3
Collision Energy (eV) = 13

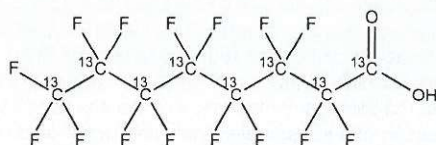
18B1536



WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS DOCUMENTATION

PRODUCT CODE: M8PFOA **LOT NUMBER:** M8PFOA0717
COMPOUND: Perfluoro-n-[¹³C₈]octanoic acid
STRUCTURE: **CAS #:** Not available



MOLECULAR FORMULA: ¹³C₈H₁₅O₂ **MOLECULAR WEIGHT:** 422.01
CONCENTRATION: 49 ± 2.45 µg/ml **SOLVENT(S):** Methanol
 Water (<1%)
CHEMICAL PURITY: 97.9% (M8PFOA) **ISOTOPIC PURITY:** ≥99% ¹³C
 2.1% (MPFOA [M+4]) (¹³C₈)
LAST TESTED: (mm/dd/yyyy) 07/05/2017
EXPIRY DATE: (mm/dd/yyyy) 07/05/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
 Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.
- Contains < 0.1% of native perfluoro-n-octanoic acid (PFOA) and ~ 2.1% of [M+4] perfluoro-n-octanoic acid.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: 
 B.G. Chittim, General Manager

Date: 07/14/2017
 (mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
 519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B1536

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HAZARDS:

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where x is expressed as a relative standard uncertainty of the individual parameter.

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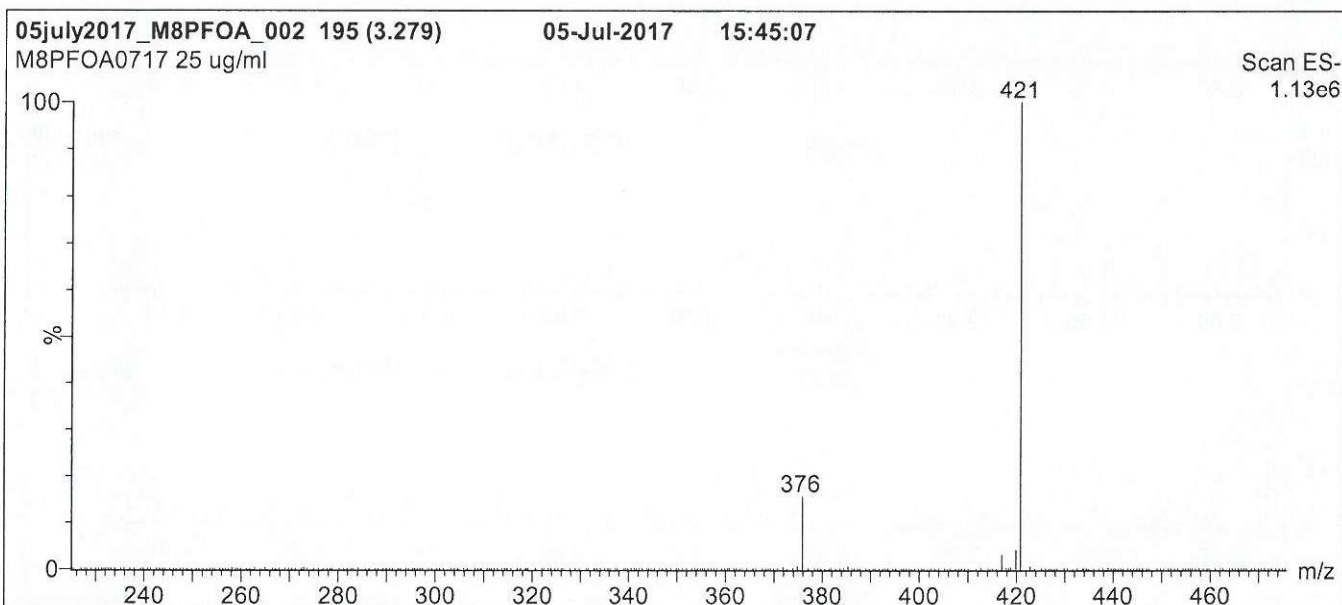
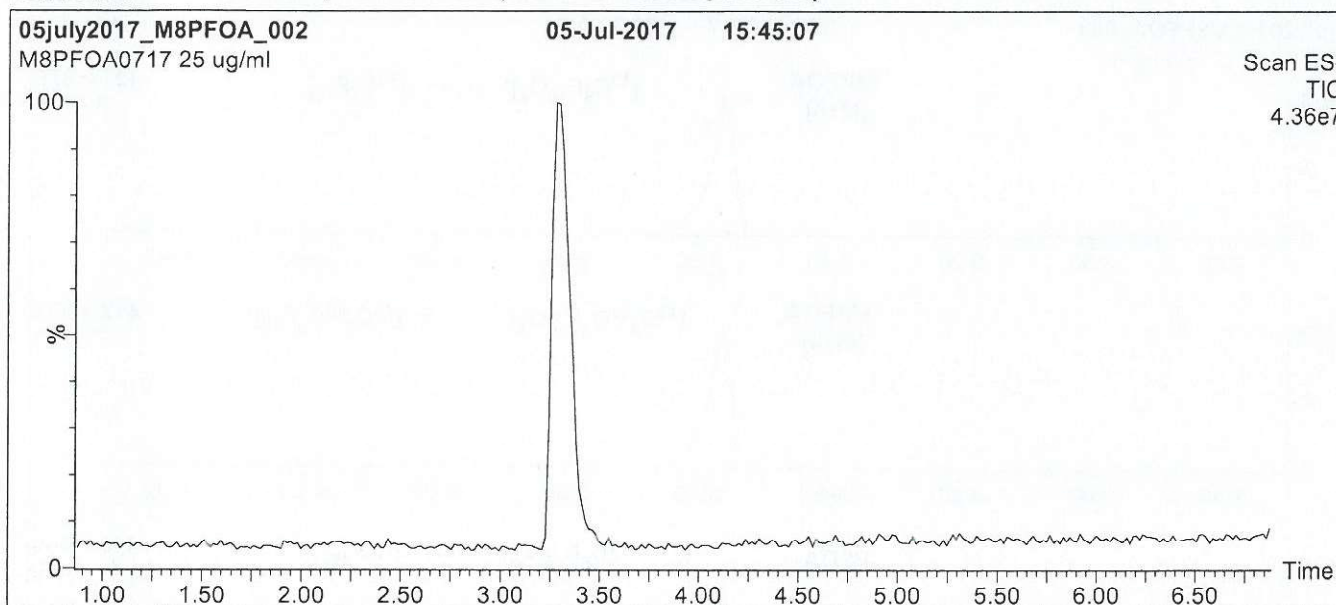
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18B1536

Figure 1: M8PFOA; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 55% (80:20 MeOH:ACN) / 45% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7.5 min and hold for 1.5 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

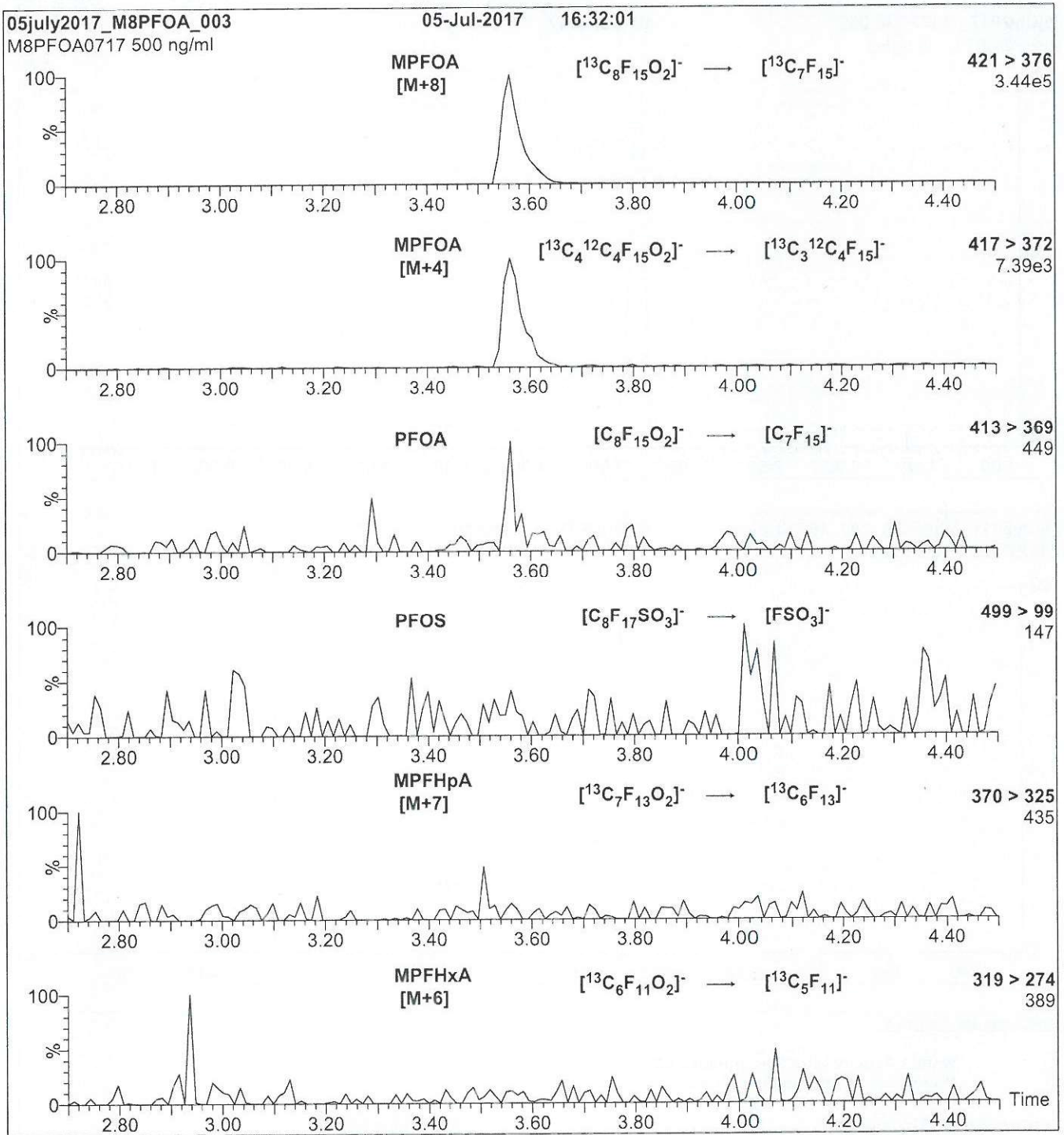
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 15.00
Cone Gas Flow (l/hr) = 100
Desolvation Gas Flow (l/hr) = 750

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Figure 2: M8PFOA; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
 10 µl (500 ng/ml M8PFOA)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H₂O
 (both with 10 mM NH₄OAc buffer)

Flow: 300 µl/min

MS Parameters

Collision Gas (mbar) = 3.28e-3
 Collision Energy (eV) = 10

18B1537



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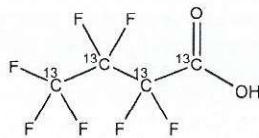
CERTIFICATE OF ANALYSIS DOCUMENTATION

PRODUCT CODE: MPFBA
COMPOUND: Perfluoro-n-[1,2,3,4-¹³C₄]butanoic acid

LOT NUMBER: MPFBA0417

STRUCTURE:

CAS #: Not available



MOLECULAR FORMULA: ¹³C₄HF₇O₂
CONCENTRATION: 50 ± 2.5 µg/ml

MOLECULAR WEIGHT: 218.01
SOLVENT(S): Methanol
Water (<1%)

CHEMICAL PURITY: >98%
LAST TESTED: (mm/dd/yyyy) 04/12/2017
EXPIRY DATE: (mm/dd/yyyy) 04/12/2022

ISOTOPIC PURITY: ≥99%¹³C
(1,2,3,4-¹³C₄)

RECOMMENDED STORAGE: Store ampoule in a cool, dark place

DOCUMENTATION/ DATA ATTACHED:

- Figure 1: LC/MS Data (TIC and Mass Spectrum)
- Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: 
B.G. Chittim, General Manager

Date: 04/20/2017
(mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B1537

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compound it contains.

HAZARDS:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Where possible, all of our products are synthesized using single-product unambiguous routes. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products are compared to older lots in the same manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2, \dots, x_n on which it depends is:

$$u_c(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of $\pm 5\%$ (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly tested by an external ISO/IEC 17025 accredited calibration company. In addition, their calibration is verified prior to each weighing using calibrated NIST and/or NRC traceable external weights. All volumetric glassware used is calibrated, of Class A tolerance, and has been tested according to the appropriate ASTM procedures, which are ultimately traceable to NIST. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

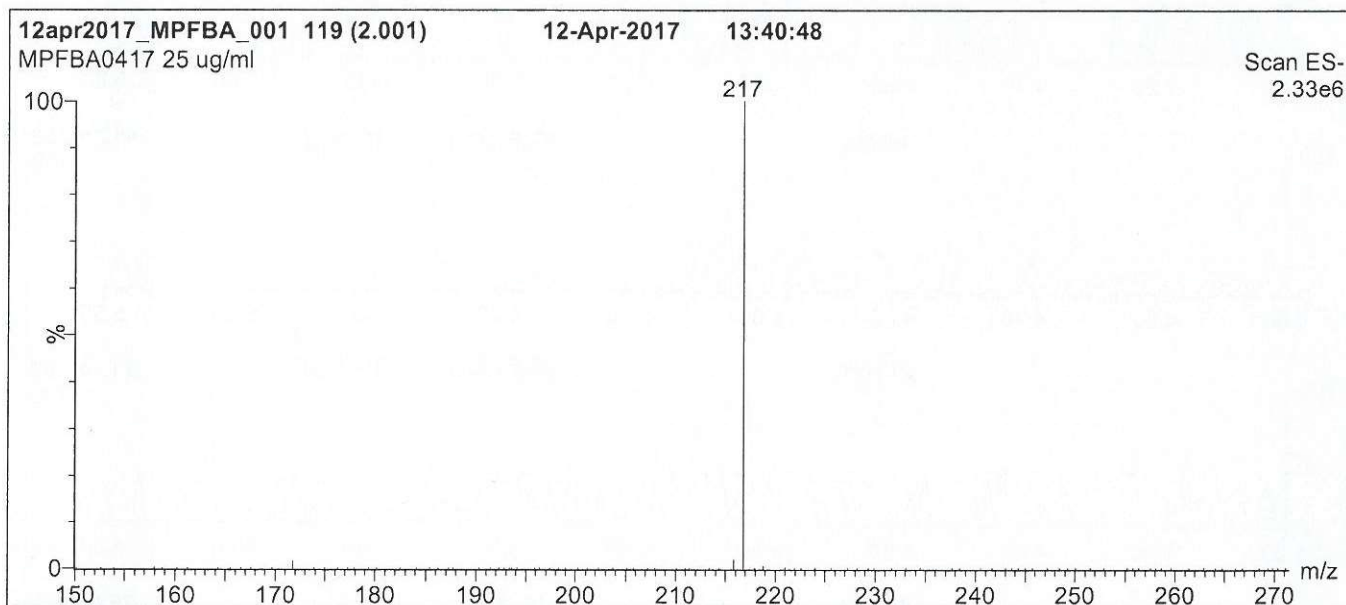
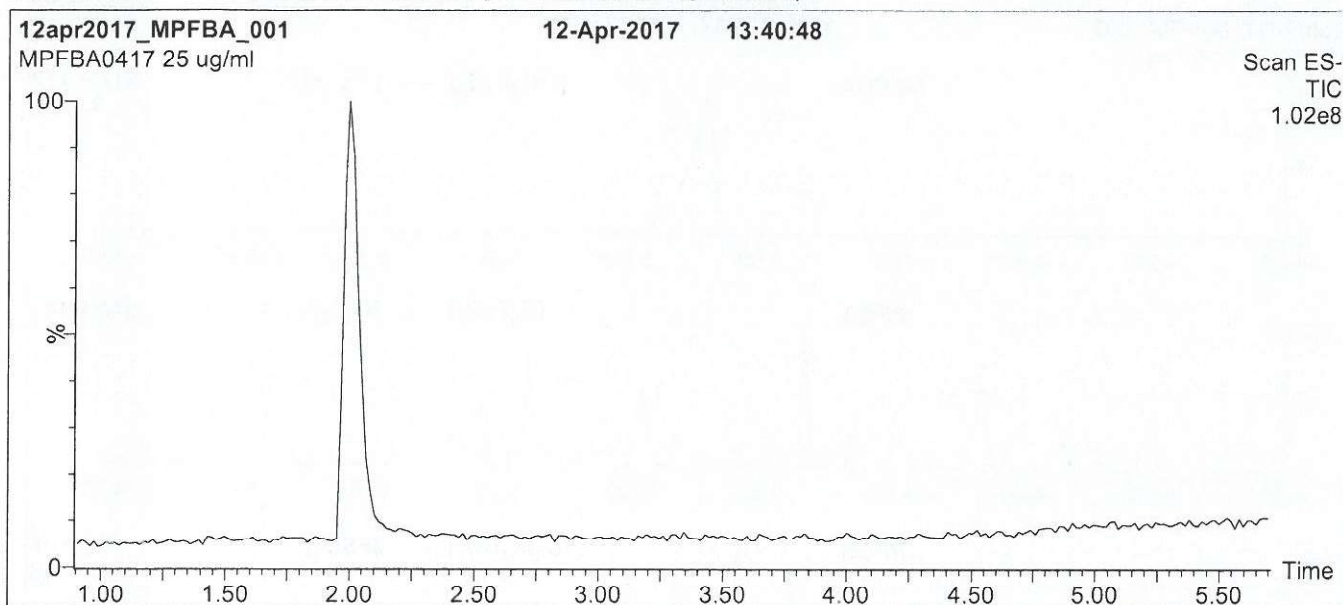
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

18B1537

Figure 1: MPFBA; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 30% (80:20 MeOH:ACN) / 70% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7 min and hold for 1.5 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

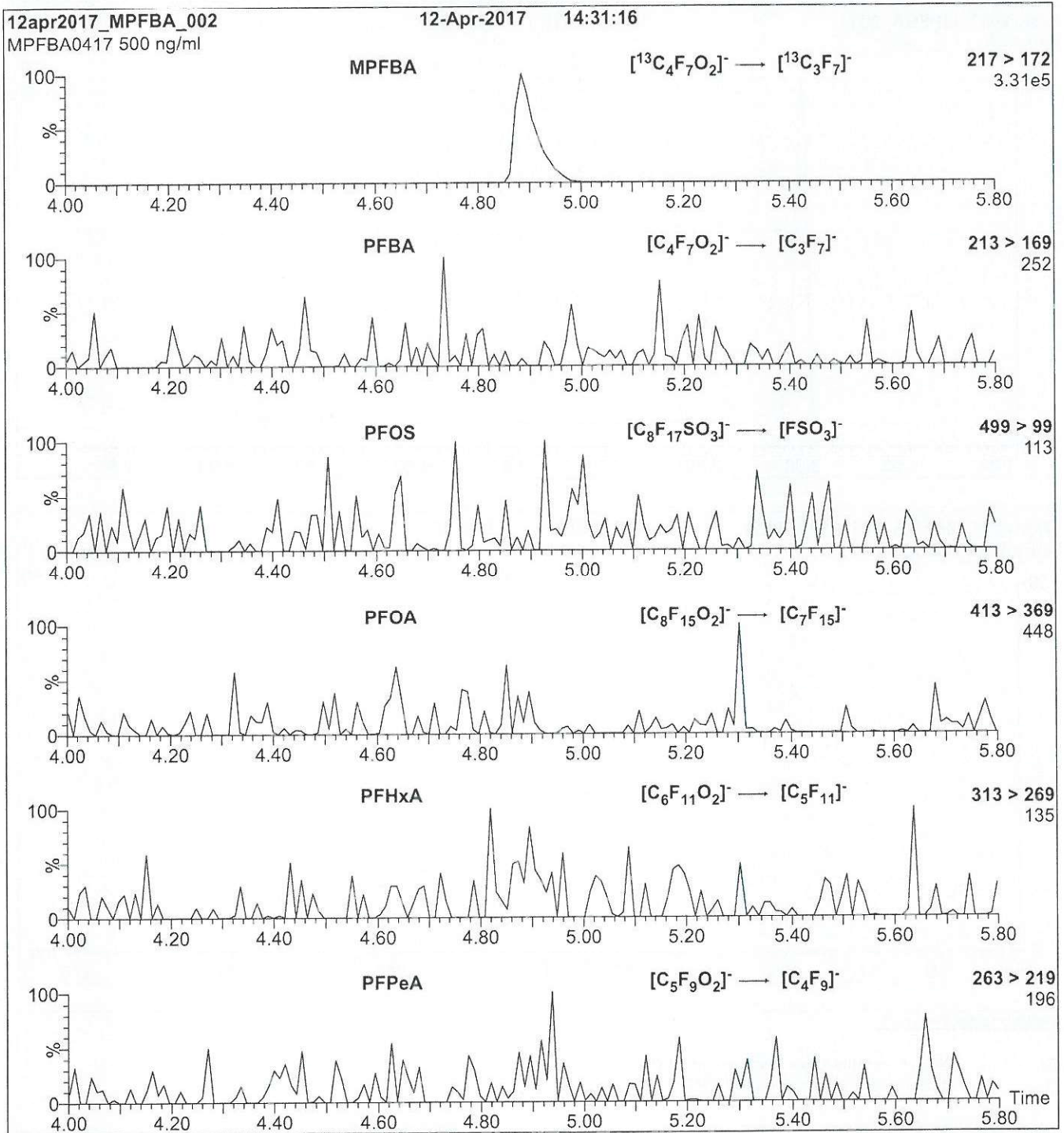
MS Parameters

Experiment: Full Scan (150 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 3.00
Cone Voltage (V) = 10.00
Cone Gas Flow (l/hr) = 100
Desolvation Gas Flow (l/hr) = 750

18B1537

Figure 2: MPFBA; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
10 μl (500 ng/ml MPFBA)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H_2O
(both with 10 mM NH_4OAc buffer)

Flow: 300 $\mu\text{l}/\text{min}$

MS Parameters

Collision Gas (mbar) = 3.35e-3
Collision Energy (eV) = 10

18B1538

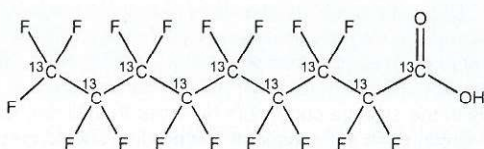


WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS DOCUMENTATION

PRODUCT CODE: M9PFNA **LOT NUMBER:** M9PFNA0517
COMPOUND: Perfluoro-n-[¹³C₉]nonanoic acid

STRUCTURE: **CAS #:** Not available



MOLECULAR FORMULA: ¹³C₉HF₁₇O₂ **MOLECULAR WEIGHT:** 473.01
CONCENTRATION: 50 ± 2.5 µg/ml **SOLVENT(S):** Methanol
 Water (<1%)
CHEMICAL PURITY: >98% **ISOTOPIC PURITY:** ≥99% ¹³C
 (¹³C₉)
LAST TESTED: (mm/dd/yyyy) 05/23/2017
EXPIRY DATE: (mm/dd/yyyy) 05/23/2022
RECOMMENDED STORAGE: Store ampoule in a cool, dark place

DOCUMENTATION/ DATA ATTACHED:

Figure 1: LC/MS Data (TIC and Mass Spectrum)
 Figure 2: LC/MS/MS Data (Selected MRM Transitions)

ADDITIONAL INFORMATION:

- See page 2 for further details.
- Contains 4 mole eq. of NaOH to prevent conversion of the carboxylic acid to the methyl ester.
- Contains ~ 0.9% of ¹³C₅¹²C₄HF₁₇O₂ (MPFNA).

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: 
 B.G. Chittim, General Manager

Date: 05/25/2017
 (mm/dd/yyyy)

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
 519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

18B1538

INTENDED USE:

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HAZARDS:

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The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2, \dots, x_n on which it depends is:

$$u_c(y(x_1, x_2, \dots, x_n)) = \sqrt{\sum_{i=1}^n u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of $\pm 5\%$ (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

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EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

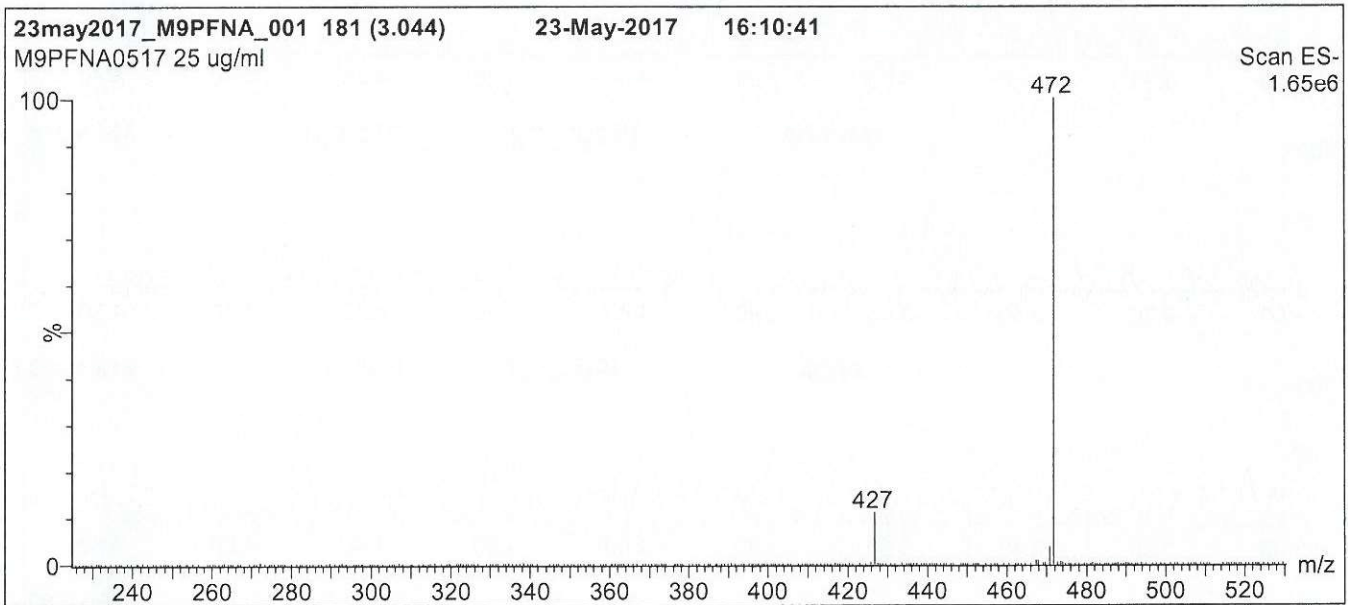
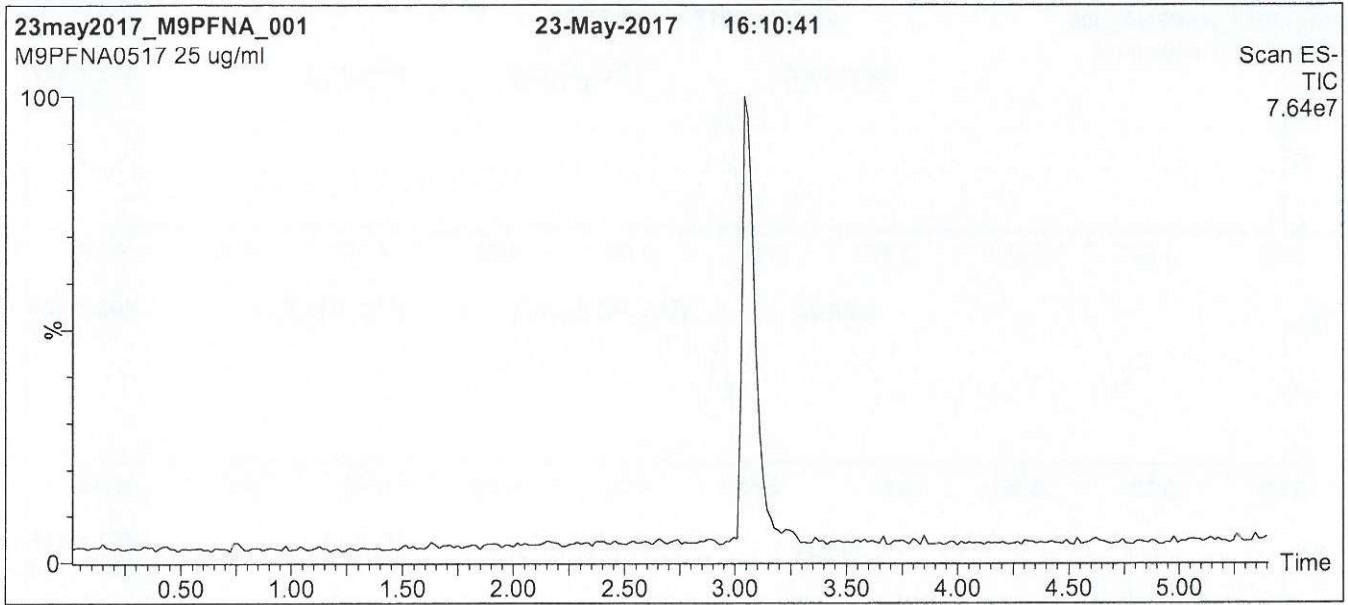
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).



For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

18B1538

Figure 1: M9PFNA; LC/MS Data (TIC and Mass Spectrum)



Conditions for Figure 1:

LC: Waters Acquity Ultra Performance LC
MS: Micromass Quattro *micro* API MS

Chromatographic Conditions

Column: Acquity UPLC BEH Shield RP₁₈
1.7 μ m, 2.1 x 100 mm

Mobile phase: Gradient
Start: 60% (80:20 MeOH:ACN) / 40% H₂O
(both with 10 mM NH₄OAc buffer)
Ramp to 90% organic over 7 min and hold for 1.5 min
before returning to initial conditions in 0.5 min.
Time: 10 min

Flow: 300 μ l/min

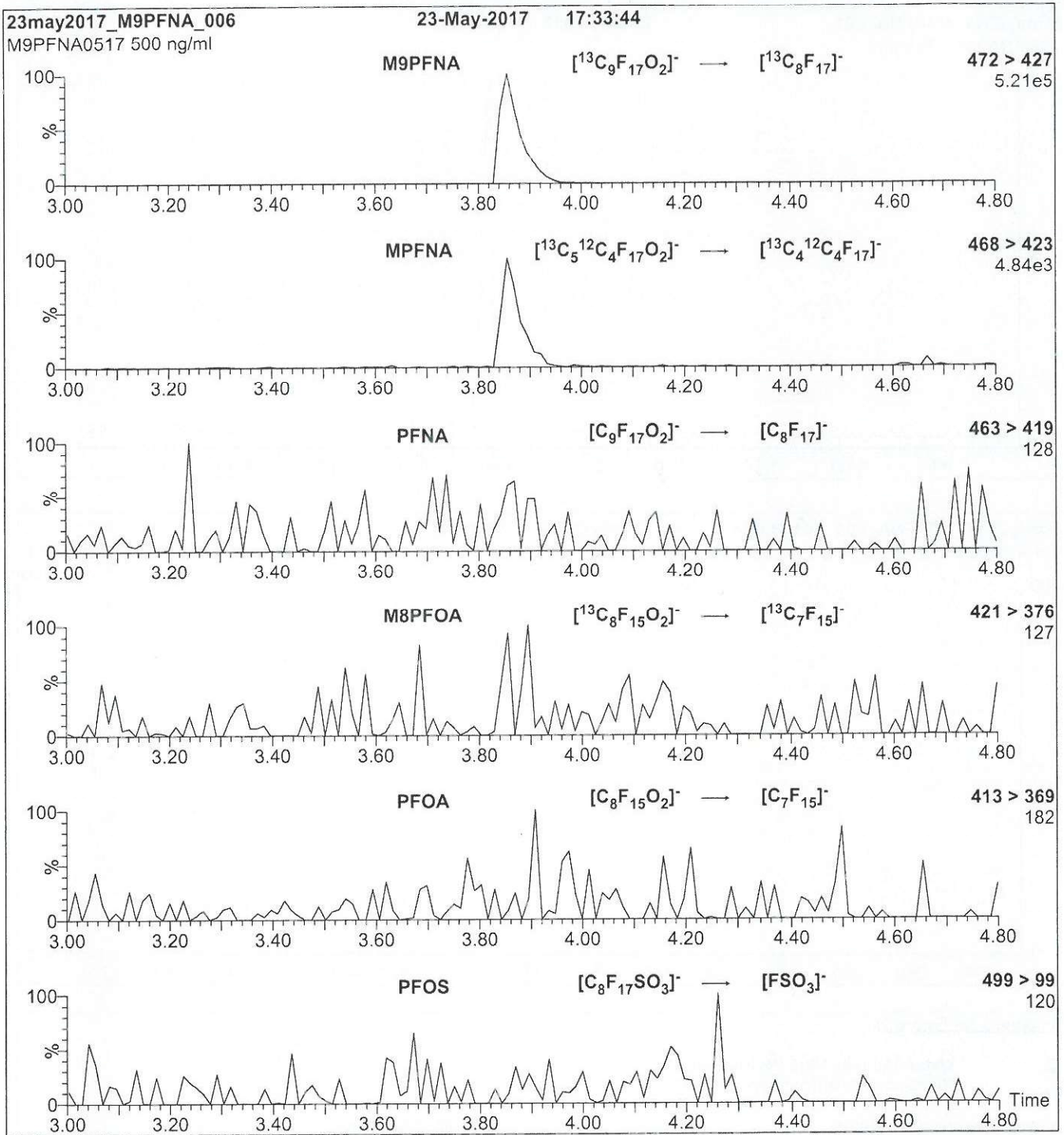
MS Parameters

Experiment: Full Scan (225 - 850 amu)

Source: Electrospray (negative)
Capillary Voltage (kV) = 2.00
Cone Voltage (V) = 15.00
Cone Gas Flow (l/hr) = 50
Desolvation Gas Flow (l/hr) = 750

18B1538

Figure 2: M9PFNA; LC/MS/MS Data (Selected MRM Transitions)



Conditions for Figure 2:

Injection: Direct loop injection
 10 µl (500 ng/ml M9PFNA)

Mobile phase: Isocratic 80% (80:20 MeOH:ACN) / 20% H₂O
 (both with 10 mM NH₄OAc buffer)

Flow: 300 µl/min

MS Parameters

Collision Gas (mbar) = 3.20e-3
 Collision Energy (eV) = 11

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"BP-MH-SW4001-South-FRB-20180501","Modified EPA 537","Initial","1800860-01","Vista","13C2-PFUnA","13C2-PFUnA","56.0","%R","",-99,"NA","","IS","56.0","",-99,"NA","YES","100","","0.115","0.001","-99",""

"BP-MH-SW4001-South-FRB-20180501","Modified EPA 537","Initial","1800860-01","Vista","d5-EtFOSAA","d5-EtFOSAA","68.4","%R","",-99,"NA","","IS","68.4","",-99,"NA","YES","100","","0.115","0.001","-99",""

"BP-MH-SW4001-South-FRB-20180501","Modified EPA 537","Initial","1800860-01","Vista","13C2-PFDoA","13C2-PFDoA","77.4","%R","",-99,"NA","","IS","77.4","",-99,"NA","YES","100","","0.115","0.001","-99",""

"BP-MH-SW4001-South-FRB-20180501","Modified EPA 537","Initial","1800860-01","Vista","13C2-PFTeDA","13C2-PFTeDA","62.0","%R","",-99,"NA","","IS","62.0","",-99,"NA","YES","100","","0.115","0.001","-99",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","375-22-4","PFBA","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","2706-90-3","PFPeA","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","375-73-5","PFBS","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","307-24-4","PFHxA","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","375-85-9","PFHpA","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","355-46-4","PFHxS","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","27619-97-2","6:2 FTS","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","335-67-1","PFOA","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","375-92-8","PFHpS","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","1763-23-1","PFOS","5.00","ng/L","UU","2.74","LOD","","TRG","","","8.00","LOQ","YES","-99","","0.125","0.001","5.00",""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","375-95-

1", "PFNA", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.00", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "335-76-
2", "PFDA", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.00", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "39108-34-4", "8:2
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"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "754-91-
6", "PFOSA", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.00", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "2355-31-
9", "MeFOSAA", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.0
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"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "335-77-
3", "PFDS", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.00", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "2058-94-
8", "PFUnA", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.00", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "2991-50-
6", "EtFOSAA", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.00
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"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "307-55-
1", "PFDoA", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.00", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "72629-94-
8", "PFTTrDA", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.00", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "376-06-
7", "PFTeDA", "5.00", "ng/L", "UU", "2.74", "LOD", "", "TRG", "", "", "8.00", "LOQ", "YES", "-99", "", "0.125", "0.001", "5.00", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C3-PFBA", "13C3-
PFBA", "98.5", "%R", "", "-99", "NA", "", "IS", "98.5", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C3-PFPeA", "13C3-
PFPeA", "89.6", "%R", "", "-99", "NA", "", "IS", "89.6", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C3-PFBS", "13C3-
PFBS", "114", "%R", "", "-99", "NA", "", "IS", "114", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C2-PFHxA", "13C2-
PFHxA", "95.0", "%R", "", "-99", "NA", "", "IS", "95.0", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C4-PFHpA", "13C4-
PFHpA", "92.8", "%R", "", "-99", "NA", "", "IS", "92.8", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "18O2-PFHxS", "18O2-
PFHxS", "92.8", "%R", "", "-99", "NA", "", "IS", "92.8", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C2-PFOA", "13C2-
PFOA", "88.7", "%R", "", "-99", "NA", "", "IS", "88.7", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C8-PFOS", "13C8-
PFOS", "82.1", "%R", "", "-99", "NA", "", "IS", "82.1", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C5-PFNA", "13C5-
PFNA", "71.2", "%R", "", "-99", "NA", "", "IS", "71.2", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C2-PFDA", "13C2-
PFDA", "80.9", "%R", "", "-99", "NA", "", "IS", "80.9", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C8-PFOA", "13C8-
PFOA", "55.1", "%R", "", "-99", "NA", "", "IS", "55.1", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "d3-MeFOSAA", "d3-
MeFOSAA", "78.7", "%R", "", "-99", "NA", "", "IS", "78.7", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""
"B8E0076-BLK1", "Modified EPA 537", "Initial", "B8E0076-BLK1", "Vista", "13C2-PFUnA", "13C2-
PFUnA", "72.5", "%R", "", "-99", "NA", "", "IS", "72.5", "", "-99", "NA", "YES", "100", "", "0.125", "0.001", "-99", ""

"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","d5-EtFOSAA","d5-EtFOSAA","81.9","%R","",-99","NA","","IS","81.9","",-99","NA","YES","100","","0.125","0.001","-99",""
"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","13C2-PFD_oA","13C2-PFD_oA","74.3","%R","",-99","NA","","IS","74.3","",-99","NA","YES","100","","0.125","0.001","-99",""
"B8E0076-BLK1","Modified EPA 537","Initial","B8E0076-BLK1","Vista","13C2-PFTeDA","13C2-PFTeDA","77.7","%R","",-99","NA","","IS","77.7","",-99","NA","YES","100","","0.125","0.001","-99",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","375-22-4","PFBA","88.7","ng/L","","2.74","LOD","","TRG","111","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","2706-90-3","PFPeA","88.0","ng/L","","2.74","LOD","","TRG","110","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","375-73-5","PFBS","85.1","ng/L","","2.74","LOD","","TRG","106","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","307-24-4","PFHxA","85.8","ng/L","","2.74","LOD","","TRG","107","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","375-85-9","PFHpA","91.7","ng/L","","2.74","LOD","","TRG","115","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","355-46-4","PFHxS","80.7","ng/L","","2.74","LOD","","TRG","101","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","27619-97-2","6:2 FTS","92.8","ng/L","","2.74","LOD","","TRG","116","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","335-67-1","PFOA","95.3","ng/L","","2.74","LOD","","TRG","119","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","375-92-8","PFHpS","102","ng/L","","2.74","LOD","","TRG","127","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","1763-23-1","PFOS","101","ng/L","","2.74","LOD","","TRG","126","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","375-95-1","PFNA","78.8","ng/L","","2.74","LOD","","TRG","98.5","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","335-76-2","PFDA","83.8","ng/L","","2.74","LOD","","TRG","105","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","39108-34-4","8:2 FTS","80.6","ng/L","","2.74","LOD","","TRG","101","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","754-91-6","PFOSA","83.7","ng/L","","2.74","LOD","","TRG","105","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","2355-31-9","MeFOSAA","95.8","ng/L","","2.74","LOD","","TRG","120","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","335-77-3","PFDS","86.3","ng/L","","2.74","LOD","","TRG","108","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","2058-94-8","PFUnA","81.2","ng/L","","2.74","LOD","","TRG","101","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","2991-50-6","EtFOSAA","96.4","ng/L","","2.74","LOD","","TRG","121","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",""

"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","307-55-1","PFDoA","94.1","ng/L","","2.74","LOD","","TRG","118","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",
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"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","72629-94-8","PFTeDA","91.3","ng/L","","2.74","LOD","","TRG","114","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",
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"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","376-06-7","PFTeDA","80.1","ng/L","","2.74","LOD","","TRG","100","","8.00","LOQ","YES","80.0","","0.125","0.001","5.00",
""
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C3-PFBA","13C3-PFBA","95.3","%R","","-99","NA","","IS","95.3","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C3-PFPeA","13C3-PFPeA","89.0","%R","","-99","NA","","IS","89.0","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C3-PFBS","13C3-PFBS","106","%R","","-99","NA","","IS","106","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C2-PFHxA","13C2-PFHxA","93.3","%R","","-99","NA","","IS","93.3","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C4-PFHpA","13C4-PFHpA","88.7","%R","","-99","NA","","IS","88.7","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","18O2-PFHxS","18O2-PFHxS","94.5","%R","","-99","NA","","IS","94.5","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C2-PFOA","13C2-PFOA","84.9","%R","","-99","NA","","IS","84.9","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C8-PFOS","13C8-PFOS","84.5","%R","","-99","NA","","IS","84.5","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C5-PFNA","13C5-PFNA","91.4","%R","","-99","NA","","IS","91.4","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C2-PFDA","13C2-PFDA","78.9","%R","","-99","NA","","IS","78.9","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C8-PFOA","13C8-PFOA","60.3","%R","","-99","NA","","IS","60.3","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","d3-MeFOSAA","d3-MeFOSAA","78.4","%R","","-99","NA","","IS","78.4","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C2-PFUnA","13C2-PFUnA","82.3","%R","","-99","NA","","IS","82.3","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","d5-EtFOSAA","d5-EtFOSAA","80.5","%R","","-99","NA","","IS","80.5","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C2-PFDoA","13C2-PFDoA","71.2","%R","","-99","NA","","IS","71.2","","-99","NA","YES","100","","0.125","0.001","-99",
"B8E0076-BS1","Modified EPA 537","Initial","B8E0076-BS1","Vista","13C2-PFTeDA","13C2-PFTeDA","80.1","%R","","-99","NA","","IS","80.1","","-99","NA","YES","100","","0.125","0.001","-99",
"112G08005-WE09","112G08005-WE09","BP-MH-SW4001-South-FRB-20180501","05/01/2018 07:50","AQ","1800860-01","NM","","1.70","Modified EPA 537","METHOD","Initial","05/15/2018 08:15","05/24/2018 23:53","Vista","COA","WET","NA","1","NA","NA","01/01/1900 00:00","100","B8E0076","B8E0076","NA","S8E0059","1800860","05/02/2018 10:02","01/01/1900 00:00",
"112G08005-WE09","112G08005-WE09","B8E0076-BLK1","01/01/1900 00:00","AQ","B8E0076-BLK1","MB","","-99","Modified EPA 537","METHOD","Initial","05/15/2018 08:15","05/24/2018 20:45","Vista","COA","WET","NA","1","NA","NA","01/01/1900 00:00","100","B8E0076","B8E0076","NA","S8E0059","1800860","01/01/1900 00:00","01/01/1900 00:00",
"112G08005-WE09","112G08005-WE09","B8E0076-BS1","01/01/1900 00:00","AQ","B8E0076-BS1","LCS","","-99","Modified EPA 537","METHOD","Initial","05/15/2018 08:15","05/24/2018 20:55","Vista","COA","WET","NA","1","NA","NA","01/01/1900 00:00","100","B8E0076","B8E0076","NA","S8E0059","1800860","01/01/1900 00:00","01/01/1900 00:00",



DATA VALIDATION REPORT

Project:	Naval Weapons Industrial Reserve Plant Bethpage
Laboratory:	Vista Analytical Laboratory
Sample Delivery Groups:	1800802, 1800803, 1800822, 1800824, 1800859, and 1800860
Analyses/Method:	Per- and Polyfluoroalkyl Substances (PFAS) via Modified U.S. EPA Method 537 compliant with Department of Defense Quality System's Manual Version 5.1 Table B-15
Validation Level:	Stage 4 Validation Electronic and Manual
Project Number:	0888812477.SA.DV

SUMMARY

This report summarizes data review findings for the PFAS groundwater sampling event (samples listed below) collected by Tetra Tech at Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage Site between on 24 April and 1 May 2018 in accordance with the following Uniform Federal Policy (UFP) Sampling and Analysis Plan (SAP):

- *Sampling and Analysis Plan for Per- and Polyfluoroalkyl Substances Investigation, Facility Wide, Naval Weapons Industrial Reserve Plant, Bethpage, New York. (Tetra Tech February 2018).*

Sample Summary Per- and Polyfluoroalkyl Substances via Modified U.S. EPA Method 537				
Sample Delivery Group	Lab Identification	Sample Identification	Sample Date	Matrix/Sample Type
1800802	1800802-01	BP-TT-AOC22-MW10-20180424	4/24/2018	Groundwater
1800802	1800802-02	BP-HN-MW24S-20180424	4/24/2018	Groundwater
1800802	1800802-03	BPS1-TT-MW309S-20180425	4/25/2018	Groundwater
1800802	1800802-04	BPS1-TT-MW313S-20180425	4/25/2018	Groundwater
1800802	1800802-05	BPS1-TT-MW301S-20180425	4/25/2018	Groundwater
1800802	1800802-06	BP-DUP02-20180425	4/25/2018	Duplicate of BPS1-TT-MW309S-20180425
1800802	1800802-07	BP-EB01-20180425	4/25/2018	Equipment Blank
1800802	1800802-08	BPS1-TT-MW307I-20180426	4/26/2018	Groundwater
1800802	1800802-09	BPS1-TT-MW306S-20180426	4/26/2018	Groundwater
1800802	1800802-10	BPS1-TT-MW307D-20180426	4/26/2018	Groundwater
1800802	1800802-11	BPS1-TT-MW306I-20180426	4/26/2018	Groundwater
1800802	1800802-12	BPS1-TT-MW307S-20180426	4/26/2018	Groundwater
1800802	1800802-13	BPS1-TT-MW306D-20180426	4/26/2018	Groundwater
1800802	1800802-14	BPS1-TT-MW308I-20180426	4/26/2018	Groundwater
1800802	1800802-15	BPS1-TT-MW309I-20180426	4/26/2018	Groundwater
1800802	1800802-16	BPS1-DUP03-20180426	4/26/2018	Duplicate of BPS1-TT-MW307D-20180426
1800803	1800803-01	BPS1-TT-MW308S-20180426	4/26/2018	Groundwater
1800803	1800803-02	BPS1-TT-MW305D-20180427	4/27/2018	Groundwater
1800803	1800803-03	BPS1-TT-MW305S-20180427	4/27/2018	Groundwater

Sample Summary Per- and Polyfluoroalkyl Substances via Modified U.S. EPA Method 537				
Sample Delivery Group	Lab Identification	Sample Identification	Sample Date	Matrix/Sample Type
1800803	1800803-04	BP-HN-MW24IR-20180427	4/27/2018	Groundwater
1800803	1800803-05	BPS1-TT-MW305I-20180427	4/27/2018	Groundwater
1800803	1800803-06	BP-MH-SW4001-SOUTH-20180427	4/27/2018	Surface water
1800803	1800803-07	BP-TT-SW4002-20180427	4/27/2018	Surface water
1800803	1800803-08	BP-TT-SW4004-20180427	4/27/2018	Surface water
1800822	1800822-01	BPS1-TT-MW306D-FRB-20180426	4/26/2018	Groundwater
1800822	1800822-02	BPS1-TT-MW309S-FRB-20180425	4/25/2018	Groundwater
1800822	1800822-03	BP-TT-AOC22-MW10-FRB-20180424	4/24/2018	Groundwater
1800822	1800822-04	BP-TT-SW4004-FRB-20180427	4/27/2018	Surface water
1800824	1800824-01	BPS1-TT-MW309D-20180429	4/29/2018	Groundwater
1800824	1800824-02	BPS1-TT-MW301D-20180429	4/29/2018	Groundwater
1800824	1800824-03	BP-EB02-20180429	4/29/2018	Equipment Blank
1800824	1800824-04	BPS1-TT-MW311S-20180429	4/29/2018	Groundwater
1800824	1800824-05	BPS1-TT-MW312S-20180429	4/29/2018	Groundwater
1800824	1800824-06	BP-DUP05-20180429	4/29/2018	Duplicate of BPS1-TT-MW311S-20180429
1800824	1800824-07	BPS1-TT-MW310S-20180430	4/30/2018	Groundwater
1800824	1800824-08	BPS1-TT-MW301I-20180430	4/30/2018	Groundwater
1800824	1800824-09	BPS1-TT-MW314S-20180430	4/30/2018	Groundwater
1800824	1800824-10	BPS1-TT-MW314I-20180430	4/30/2018	Groundwater
1800824	1800824-11	BP-EB03-20180430	4/30/2018	Equipment Blank
1800824	1800824-12	BPS1-TT-MW308D-20180430	4/30/2018	Groundwater
1800859	1800859-01	BP-MH-SW4001-SOUTH-20180501	5/1/2018	Surface water
1800859	1800859-02	BP-TT-SW4002-20180501	5/1/2018	Surface water
1800859	1800859-03	BP-DUP06-20180501	5/1/2018	Duplicate of BP-MH-SW4001-SOUTH-20180501
1800859	1800859-04	BP-EB04-20180501	5/1/2018	Equipment Blank
1800860	1800860-01	BP-MH-SW4001-SOUTH-FRB-20180501	5/1/2018	Surface water

Data validation activities were conducted using the measurement performance criteria identified in the project UFP SAP and the following guidance documents: *General Data Validation Guidelines* (DoD 2018), *National Functional Guidelines for Superfund Organic Methods Data Review* (U.S. EPA January 2017), *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (U.S. EPA January 2009), *Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories*, Version 5.1 (DoD February 2017). In the absence of method-specific information, laboratory quality control (QC) limits, project-specific requirements, and/or professional judgment were used as appropriate.

REVIEW ELEMENTS

The data were evaluated based on the following parameters:

✓	Data completeness (chain-of-custody)/sample integrity
✓	Holding times and sample preservation
✓	Gas chromatography/mass spectrometer performance checks
✓	Ion transitions
✓	Initial calibration/initial calibration verification/continuing calibration verification
✓	Instrument sensitivity check
✓	Laboratory blanks/equipment blanks
X	Extracted and injection internal standard analytes recoveries
X	Matrix spike and/or matrix spike duplicate result
✓	Laboratory control sample /laboratory control sample duplicate result
✓	Field duplicate
✓	Sample results/reporting issues

The symbol (✓) indicates that no validation qualifiers were applied based on this parameter. Acceptable data parameters for which all criteria were met, no qualification was performed, and/or non-conformance or other issues that were noted during validation, but did not result in qualification of data are not discussed further. The symbol (X) indicates that a QC non-conformance resulted in the qualification of data. Any QC non-conformance that resulted in the qualification of data is discussed below.

RESULTS

Extracted and Injection Internal Standard Analytes Recoveries

Internal standards are pure chemicals, structurally similar to the method analytes, which are added to each sample prior to extraction (extracted internal standard) or just prior to analysis (injection internal standard). The internal standard percent recoveries (%Rs) are used to measure the relative response of PFAS and extraction effectiveness. Extracted and injection internal standard %R non-conformances are summarized in Attachment A in Tables A-1 and A-2; respectively.

Data qualification on the basis of internal standard was as follows:

Internal Standard Non-Conformance Chart:

Criteria	Action		
	Detected	Non-Detected	Reason Code
$50\% \leq \%R \leq 150\%$	No qualification	No qualification	None
$\%R \geq 150\%$	J-	UJ	I10
$20\% \leq \%R \leq 50\%$	J+	No qualification	I9
$\%R \leq 20\%$	J+	X	I9

Notes:

ICAL = Initial calibration	CCV = Continuing calibration verification
%R = Percent recovery	J+ = Positive value estimated, high bias
UJ = Undetected and estimated	J- = Undetected value estimated, low bias
I9 = Internal standard infraction, high bias	I10 = Internal standard infraction, low bias
X = Serious deficiency project team to decide data use	

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results

MS/MSDs are generated to provide information about the effect of each sample matrix on the sample preparation and the measurement methodology. MS/MSD %Rs assess the effect of the sample matrix on the accuracy of the analytical results and %Rs above the control limit could indicate a potential high result bias while %Rs below QC limits could indicate a potential low result bias. The relative percent differences (RPDs) between the MS and MSD results are evaluated to assess sample precision. The MS/MSD %Rs and RPDs were reviewed for conformance with the QC acceptance criteria. Non-conformances are summarized in Attachment A in Table A-3. Data qualification to the analytes associated with the specific MS/MSD non-conformances were as follows:

MS/MSD Non-conformances Chart:

Criteria	Action		
	Detected	Non-detected	Reason Code
$\%R \geq 130\%$	J+	No qualification	M2
$\geq 70\% \%R \leq 130\%$	No qualification	No qualification	None
$20\% \leq \%R \leq 70$	J-	UJ	M3
$\%R \leq 20\%$	J-	X	M3
$RPD \leq 30\%$	No qualification	No qualification	None
$RPD \geq 30\%$	J	UJ	M4

Notes:

%R = Percent recovery	RPD = Relative percent difference
J+ = Positive value estimated, biased high	UJ = Undetected and estimated
J- = Undetected value estimated, low bias	X = Serious deficiency project team to decide data use
M2 = Percent recovery infraction, high bias	M3 = Percent recovery infraction, low bias
M4 = Duplicate precision infraction	X = Serious deficiency; project team to decide data use

Qualification Actions

The data were reviewed independently from the laboratory to assess data quality. All analytes detected at concentrations less than the limit of quantitation but greater than the method detection limit were qualified by the laboratory as estimated (J). This "J" qualifier was retained during data validation. Any sample that was analyzed at a dilution because of high concentrations of target or non-target analytes was checked to confirm that the results and/or sample-specific limit of quantitation and limit of detections were adjusted accordingly by the laboratory.

No results were rejected; therefore, analytical completeness was calculated to be 100 percent. Data not qualified during data review are considered usable by the project. The remaining results qualified as estimated may be high or low, but the data are usable for their intended purpose, according to U.S. EPA and Department of Defense guidelines. Attachment B provides a summary of all qualified results during this data review.

ATTACHMENTS

Attachment A: Non-Conformance Summary Tables

Attachment B: Qualified Results Summary after Data Review

Attachment A
Non-Conformance Summary Tables

Table A-1 Extracted Internal Standard Recovery Non-Conformance							
SDG	Lab ID	Sample ID	Isotope	Associated Analyte	%R	Limits	Flags
1800824	1800824-10	BPS1-TT-MW314I-20180430	13C3-PFBS	Perfluorobutanesulfonic acid (PFBS)	153	50-150	J-
1800824	1800824-12	BPS1-TT-MW308D-20180430	13C3-PFBS	Perfluorobutanesulfonic acid (PFBS)	161	50-150	J-

Notes:

Results that are undetected with potential high bias were not qualified and are not summarized.

SDG = Sample delivery group

ID = Identification

%R = Percent recovery

J- = Result was qualified estimated and may be biased low.

Table A-2 Injected Internal Standard Recovery Non-Conformance							
SDG	Lab ID	Sample ID	Isotope	Associated Analyte	%R	Limits	Flags
1800802	1800802-05	PS1-TT-MW301S-20180425	13C8-PFOA	Perfluorooctanoic acid (PFOA)	49.9	50-150	J+
1800803	1800803-05	BPS1-TT-MW305I-20180427	13C9-PFNA	Perfluorononanoic acid (PFNA)	38.9	50-150	J+
1800803	1800803-05	BPS1-TT-MW305I-20180427	13C8-PFOA	Perfluorooctanoic acid (PFOA)	47.3	50-150	J+
1800803	1800803-06	BP-MH-SW400I-South-20180427	13C6-PFDA	Perfluorodecanoic acid (PFDA)	39.9	50-150	J+
1800803	1800803-06	BP-MH-SW400I-South-20180427	13C9-PFNA	Perfluorononanoic acid (PFNA)	45.1	50-150	J+
1800803	1800803-06	BP-MH-SW400I-South-20180427	13C8-PFOA	Perfluorooctanoic acid (PFOA)	44.2	50-150	J+
1800803	1800803-07	BP-TT-SW4002-20180427	13C8-PFOA	Perfluorooctanoic acid (PFOA)	47.8	50-150	J+
1800824	1800824-05	BPS1-TT-MW312S-20180429	13C4-PFBA	Perfluorobutanoic Acid (PFBA)	48.2	50-150	J+
1800824	1800824-05	BPS1-TT-MW312S-20180429	13C5-PFHxA	Perfluorohexanoic acid (PFHXA)	49	50-150	J+
1800824	1800824-05	BPS1-TT-MW312S-20180429	13C8-PFOA	Perfluorooctanoic acid (PFOA)	47.8	50-150	J+
1800824	1800824-06	BP-DUP05-20180429	3C8-PFOA	Perfluorooctanoic acid (PFOA)	49.3	50-150	J+
1800824	1800824-07	BPS1-TT-MW310S-20180430	13C4-PFBA	Perfluorobutanoic Acid (PFBA)	49	50-150	J+
1800824	1800824-07	BPS1-TT-MW310S-20180430	13C5-PFHxA	Perfluorohexanoic acid (PFHXA)	47.7	50-150	J+
1800824	1800824-07	BPS1-TT-MW310S-20180430	13C9-PFNA	Perfluorononanoic acid (PFNA)	49.9	50-150	J+
1800824	1800824-07	BPS1-TT-MW310S-20180430	13C8-PFOA	Perfluorooctanoic acid (PFOA)	45	50-150	J+
1800824	1800824-08	BPS1-TT-MW301I-20180430	13C4-PFBA	Perfluorobutanoic Acid (PFBA)	45	50-150	J+
1800824	1800824-08	BPS1-TT-MW301I-20180430	13C6-PFDA	Perfluorodecanoic acid (PFDA)	44.1	50-150	J+
1800824	1800824-08	BPS1-TT-MW301I-20180430	13C5-PFHxA	Perfluorohexanoic acid (PFHXA)	47.7	50-150	J+
1800824	1800824-08	BPS1-TT-MW301I-20180430	13C9-PFNA	Perfluorononanoic acid (PFNA)	42.9	50-150	J+
1800824	1800824-08	BPS1-TT-MW301I-20180430	13C8-PFOA	Perfluorooctanoic acid (PFOA)	46.4	50-150	J+
1800824	1800824-09	BPS1-TT-MW314S-20180430	13C4-PFBA	Perfluorobutanoic Acid (PFBA)	49.8	50-150	J+

**Table A-2
Injected Internal Standard Recovery Non-Conformance**

SDG	Lab ID	Sample ID	Isotope	Associated Analyte	%R	Limits	Flags
1800824	1800824-09	BPS1-TT-MW314S-20180430	13C5-PFHxA	Perfluorohexanoic acid (PFHXA)	48.9	50-150	J+
1800824	1800824-10	BPS1-TT-MW314I-20180430	13C4-PFBA	Perfluorobutanoic Acid (PFBA)	35.4	50-150	J+
1800824	1800824-10	BPS1-TT-MW314I-20180430	13C6-PFDA	Perfluorodecanoic acid (PFDA)	37	50-150	J+
1800824	1800824-10	BPS1-TT-MW314I-20180430	13C5-PFHxA	Perfluorohexanoic acid (PFHXA)	39.8	50-150	J+
1800824	1800824-10	BPS1-TT-MW314I-20180430	13C9-PFNA	Perfluorononanoic acid (PFNA)	44.2	50-150	J+
1800824	1800824-10	BPS1-TT-MW314I-20180430	13C8-PFOA	Perfluorooctanoic acid (PFOA)	38.7	50-150	J+
1800824	1800824-10	BPS1-TT-MW314I-20180430	13C7-PFUdA	Perfluoroundecanoic acid (PFUNA)	35	50-150	J+
1800824	1800824-12	BPS1-TT-MW308D-20180430	13C4-PFBA	Perfluorobutanoic Acid (PFBA)	19.9	50-150	J+
1800824	1800824-12	BPS1-TT-MW308D-20180430	13C6-PFDA	Perfluorodecanoic acid (PFDA)	38.9	50-150	J+
1800824	1800824-12	BPS1-TT-MW308D-20180430	13C9-PFNA	Perfluorononanoic acid (PFNA)	42.7	50-150	J+
1800824	1800824-12	BPS1-TT-MW308D-20180430	13C8-PFOA	Perfluorooctanoic acid (PFOA)	41.6	50-150	J+

Notes:

Results that are undetected with potential high bias were not qualified and are not summarized.

- SDG = Sample delivery group
- ID = Identification
- %R = Percent recovery
- J+ = Result was qualified estimated and may be biased high.

**Table A-3
Matrix Spike/Matrix Spike Duplicate Non-Conformance**

SDG	Lab ID	Spiked Sample	Analyte	MS %R	MSD %R	%R Limits	RPD	RPD Limits	Flags
1800802	1800802-02	BP-HN-MW24S-20180424	Perfluorooctanoic acid (PFOA)	74.8	115	70-130	42.4*	<30	J
1800824	1800824-05	BPS1-TT-MW312S-20180429	Perfluorooctane sulfonic acid (PFOS)	119	131*	70-130	9.6	<30	J+
1800824	1800824-05	BPS1-TT-MW312S-20180429	Perfluorohexanoic acid (PFHXA)	110	139*	70-130	23.3	<30	J+
1800824	1800824-05	BPS1-TT-MW312S-20180429	Perfluorodecanoic acid (PFDA)	87.8	120	70-130	31*	<30	J

Notes:

Results that are undetected with potential high bias were not qualified and are not summarized.

- SDG = Sample delivery group
- ID = Identification
- %R = Percent recovery
- RPD = Relative percent difference
- * = Outside control limits
- J+ = Result was qualified estimated and may be biased high.
- J = Result was qualified as estimated due to potential poor precision.

Attachment B
Qualified Results Summary after Data Review

**Table B-1
Qualified Results Summary after Data Review**

SDG	Lab ID	Sample ID	Sample Date	CAS No	Analyte	Result (ng/L)	Lab Qualifier	Final Qualifier	Reason Code
1800802	1800802-02	BP-HN-MW24S-20180424	4/24/2018	335-67-1	Perfluorooctanoic acid (PFOA)	96.2		J	M4
1800802	1800802-05	BPS1-TT-MW301S-20180425	4/25/2018	335-67-1	Perfluorooctanoic acid (PFOA)	4.73		J+	I9
1800803	1800803-05	BPS1-TT-MW305I-20180427	4/27/2018	375-95-1	Perfluorononanoic acid (PFNA)	1.84	J	J+	I9
1800803	1800803-05	BPS1-TT-MW305I-20180427	4/27/2018	335-67-1	Perfluorooctanoic acid (PFOA)	16.2		J+	I9
1800803	1800803-06	BP-MH-SW4001-SOUTH-20180427	4/27/2018	335-76-2	Perfluorodecanoic acid (PFDA)	1.56	J	J+	I9
1800803	1800803-06	BP-MH-SW4001-SOUTH-20180427	4/27/2018	375-95-1	Perfluorononanoic acid (PFNA)	9.66		J+	I9
1800803	1800803-06	BP-MH-SW4001-SOUTH-20180427	4/27/2018	335-67-1	Perfluorooctanoic acid (PFOA)	20.7		J+	I9
1800803	1800803-07	BP-TT-SW4002-20180427	4/27/2018	335-67-1	Perfluorooctanoic acid (PFOA)	4.21		J+	I9
1800824	1800824-05	BPS1-TT-MW312S-20180429	4/29/2018	375-22-4	Perfluorobutanoic acid (PFBA)	14.5		J+	I9
1800824	1800824-05	BPS1-TT-MW312S-20180429	4/29/2018	335-76-2	Perfluorodecanoic acid (PFDA)	2.45	U	UJ	M4
1800824	1800824-05	BPS1-TT-MW312S-20180429	4/29/2018	307-24-4	Perfluorohexanoic acid (PFHXA)	21		J+	M2,I9
1800824	1800824-05	BPS1-TT-MW312S-20180429	4/29/2018	1763-23-1	Perfluorooctane sulfonic acid (PFOS)	3.72	J	J+	M2
1800824	1800824-05	BPS1-TT-MW312S-20180429	4/29/2018	335-67-1	Perfluorooctanoic acid (PFOA)	26		J+	I9
1800824	1800824-06	BP-DUP05-20180429	4/29/2018	335-67-1	Perfluorooctanoic acid (PFOA)	11.6		J+	I9
1800824	1800824-07	BPS1-TT-MW310S-20180430	4/30/2018	375-22-4	Perfluorobutanoic acid (PFBA)	10.8		J+	I9
1800824	1800824-07	BPS1-TT-MW310S-20180430	4/30/2018	307-24-4	Perfluorohexanoic acid (PFHXA)	10.8		J+	I9
1800824	1800824-07	BPS1-TT-MW310S-20180430	4/30/2018	375-95-1	Perfluorononanoic acid (PFNA)	6.84		J+	I9
1800824	1800824-07	BPS1-TT-MW310S-20180430	4/30/2018	335-67-1	Perfluorooctanoic acid (PFOA)	30.1		J+	I9
1800824	1800824-08	BPS1-TT-MW301I-20180430	4/30/2018	375-22-4	Perfluorobutanoic acid (PFBA)	4.48		J+	I9
1800824	1800824-08	BPS1-TT-MW301I-20180430	4/30/2018	335-76-2	Perfluorodecanoic acid (PFDA)	1.56	J	J+	I9
1800824	1800824-08	BPS1-TT-MW301I-20180430	4/30/2018	307-24-4	Perfluorohexanoic acid (PFHXA)	7.94		J+	I9
1800824	1800824-08	BPS1-TT-MW301I-20180430	4/30/2018	375-95-1	Perfluorononanoic acid (PFNA)	2.5	J	J+	I9
1800824	1800824-08	BPS1-TT-MW301I-20180430	4/30/2018	335-67-1	Perfluorooctanoic acid (PFOA)	6.31		J+	I9
1800824	1800824-09	BPS1-TT-MW314S-20180430	4/30/2018	375-22-4	Perfluorobutanoic acid (PFBA)	7.6		J+	I9
1800824	1800824-09	BPS1-TT-MW314S-20180430	4/30/2018	307-24-4	Perfluorohexanoic acid (PFHXA)	16.3		J+	I9
1800824	1800824-10	BPS1-TT-MW314I-20180430	4/30/2018	375-73-5	Perfluorobutanesulfonic acid (PFBS)	1.63	J	J-	I10
1800824	1800824-10	BPS1-TT-MW314I-20180430	4/30/2018	375-22-4	Perfluorobutanoic acid (PFBA)	16.7		J+	I9
1800824	1800824-10	BPS1-TT-MW314I-20180430	4/30/2018	335-76-2	Perfluorodecanoic acid (PFDA)	2.81	J	J+	I9
1800824	1800824-10	BPS1-TT-MW314I-20180430	4/30/2018	307-24-4	Perfluorohexanoic acid (PFHXA)	35		J+	I9
1800824	1800824-10	BPS1-TT-MW314I-20180430	4/30/2018	375-95-1	Perfluorononanoic acid (PFNA)	10		J+	I9
1800824	1800824-10	BPS1-TT-MW314I-20180430	4/30/2018	335-67-1	Perfluorooctanoic acid (PFOA)	16.8		J+	I9
1800824	1800824-10	BPS1-TT-MW314I-20180430	4/30/2018	2058-94-8	Perfluoroundecanoic acid (PFUNA)	2.14	J	J+	I9
1800824	1800824-12	BPS1-TT-MW308D-20180430	4/30/2018	375-73-5	Perfluorobutanesulfonic acid (PFBS)	2.42	U	UJ	I10
1800824	1800824-12	BPS1-TT-MW308D-20180430	4/30/2018	375-22-4	Perfluorobutanoic acid (PFBA)	21.3		J+	I9
1800824	1800824-12	BPS1-TT-MW308D-20180430	4/30/2018	335-76-2	Perfluorodecanoic acid (PFDA)	3.91		J+	I9

**Table B-1
Qualified Results Summary after Data Review**

SDG	Lab ID	Sample ID	Sample Date	CAS No	Analyte	Result (ng/L)	Lab Qualifier	Final Qualifier	Reason Code
1800824	1800824-12	BPS1-TT-MW308D-20180430	4/30/2018	375-95-1	Perfluorononanoic acid (PFNA)	4.34		J+	I9
1800824	1800824-12	BPS1-TT-MW308D-20180430	4/30/2018	335-67-1	Perfluorooctanoic acid (PFOA)	16.1		J+	I9

Notes:

SDG = Sample delivery group

ID = Identification

CAS No. = Chemical Abstracts Services number

ng/L = Nanograms liter

U = **Undetected** — The analyte was analyzed but undetected at the listed limit of detection.

UJ = Undetected and estimated

J = **Estimated Value** — One or more quality control parameters were outside control limits or the analyte concentration was less than the limit of quantitation.

J+ = Positive value estimated with potential high bias

J- = Undetected value estimated with potential low bias

Qualification Reason Codes:

I9 = Internal standard infraction with potential high bias

I10 = Internal standard infraction with potential low bias

M2 = Percent recovery infraction with potential high bias

M4 = Duplicate precision infraction

DODCMD_ID	INSTALLATION_ID	SDG	SITE_NAME	NORM_SITE_NAME	LOCATION_NAME	LOCATION_TYPE_DESC	COORD_X	COORD_Y	CONTRACT_ID	DO_CTO_NUMBER	CONTR_NAME	SAMPLE_NAME	SAMPLE_MATRIX_DESC	SAMPLE_TYPE_DESC	COLLECT_DATE	ANALYTICAL_METHOD	ANALYTICAL_METHOD_GRP_DESC
MID_ATLANTIC	BETHPAGE_NWIRP	1800860							N6247016D9008	WE09	TETRA TECH NUS, INC.	BP-MH-SW4001-SOUTH-FRB-20180501	Water for QC samples	Field Reagent Blank	1-May-18	537_MOD	Perfluoroalkyl Compounds