

Appendix C

Third Party Data Validation Package



LABORATORY DATA CONSULTANTS, INC.

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Tidewater
3761 Attucks Drive
Powell, OH 43065
ATTN: Mr. David Conner
David.Conner@tideh2o.net

June 11, 2024

SUBJECT: NASA JPL, 2024 PFAS- Data Validation

Dear Mr. Conner,

Enclosed are the final validation reports for the fraction listed below. These SDGs were received on May 21, 2024. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #59041:

SDG #

24C0052, 24C0076, 24C0083, 24C0094,
24C0103, 24C0110, 24C0110, 24C0121,
24C0131, 24C0142

Fraction

Perfluoroalkyl & Polyfluoroalkyl Substances

The data validation was performed under Level III guidelines. The analysis was validated using the following documents, as applicable to each method:

- U.S. Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-24 Environmental Data Quality Workgroup (October 2022)
- Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using Environmental Protection Agency (EPA) Method 537 (November 2018)

Please feel free to contact us if you have any questions.

Sincerely,

Pei Geng
pgeng@lab-data.com
Project Manager/Senior Chemist

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NASA JPL, 2024 PFAS

LDC Report Date: June 5, 2024

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Level III

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 24C0052

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
MW-24-3	24C0052-01	Water	03/11/24
MW-24-2	24C0052-02	Water	03/11/24
DUP-1-031124	24C0052-03	Water	03/11/24
MW-24-1	24C0052-04	Water	03/11/24
MW-23-3	24C0052-05	Water	03/11/24
MW-23-2	24C0052-06	Water	03/11/24
MW-23-1	24C0052-07	Water	03/11/24
EB-1-031124	24C0052-08	Water	03/11/24
FB-1-031124	24C0052-09	Water	03/11/24
SB-1-031124	24C0052-10	Water	03/11/24

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-24 Environmental Data Quality Workgroup (October 2022) and the Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using Environmental Protection Agency (EPA) Method 537 (November 2018). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 1633

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) and relative standard errors (%RSE) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

The bile salts interference check was performed as required by the method and the retention time requirements were met.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the method, initial calibration and continuing calibration blanks.

VI. Field Blanks

Sample EB-1-031124 was identified as an equipment blank. No contaminants were found.

Sample SB-1-031124 was identified as a source blank. No contaminants were found.

Sample FB-1-031124 was identified as a field blank. No contaminants were found.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Low-Level Laboratory Control Samples

Laboratory control samples (LCS) and minimal risk level (MRL) reported as low-level laboratory control samples (LLCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples MW-24-2 and DUP-1-031124 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD
	MW-24-2	DUP-1-031124	
PFBA	1.6	1.7	6
PFPeA	2.2	2.5	13
PFHxA	1.5	1.5	0
PFHpA	0.88	0.86	2
PFOA	0.95	0.94	1
PFDA	0.27	0.22	20
PFBS	0.80	0.80	0
PFPeS	0.51	0.55	8
PFHxS	2.4	2.5	4
PFOS	0.61	0.47	26

X. Internal Standards

All extracted internal standard percent recoveries (%R) were within QC limits.

All non-extracted internal standard areas and retention times were within QC limits.

XI. Target Analyte Quantitation

Raw data were not reviewed for Level III validation.

XII. Target Analyte Identification

Raw data were not reviewed for Level III validation.

All target analyte ion ratios met validation criteria with the following exceptions:

Sample	Finding	Flag	A or P
MW-24-3 MW-24-2 MW-24-1 MW-23-3 MW-23-2 MW-23-1 SB-1-031124	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Data qualified due to ion ratio are summarized and presented in the Data Qualification Summary.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG
24C0052**

Sample	Analyte	Flag	A or P	Reason
MW-24-3 MW-24-2 MW-24-1 MW-23-3 MW-23-2 MW-23-1 SB-1-031124	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio)

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification
Summary - SDG 24C0052**

No Sample Data Qualified in this SDG

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification
Summary - SDG 24C0052**

No Sample Data Qualified in this SDG

LDC #: 59041A96
 SDG #: 24C0052
 Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET
 Level III

Date: 3/11/24
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 1633)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD/RSE ≤ 20% RE ≤ 30%
IV.	Continuing calibration/ISC <u>Bile salt</u>	A	D ≤ 30/30%
V.	Laboratory Blanks	A	
V.I	Field blanks	ND	EB = 8. R . FB = 9. SB = 10
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples <u>LCs</u>	A	LCs / MRL
IX.	Field duplicates	W	D = 2 + 3
X.	Internal Standards	A	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	SW	
XIII.	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
 N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
 SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	MW-24-3	24C0052-01	Water	03/11/24
2	MW-24-2	24C0052-02	Water	03/11/24
3	DUP-1-031124	24C0052-03	Water	03/11/24
4	MW-24-1	24C0052-04	Water	03/11/24
5	MW-23-3	24C0052-05	Water	03/11/24
6	MW-23-2	24C0052-06	Water	03/11/24
7	MW-23-1	24C0052-07	Water	03/11/24
8	EB-1-031124	24C0052-08	Water	03/11/24
9	FB-1-031124	24C0052-09	Water	03/11/24
10	SB-1-031124	24C0052-10	Water	03/11/24
11				
12				

Notes:

<u>BDE0186</u>				

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: LC/MS PFAS (EPA Method 1633)

Compound	Concentration (ng/L)		RPD
	2	3	
PFBA	1.6	1.7	6
PFPeA	2.2	2.5	13
PFHxA	1.5	1.5	0
PFHpA	0.88	0.86	2
PFOA	0.95	0.94	1
PFDA	0.27	0.22	20
PFBS	0.80	0.80	0
PFPeS	0.51	0.55	8
PFHxS	2.4	2.5	4
PFOS	0.61	0.47	26

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NASA JPL, 2024 PFAS

LDC Report Date: June 5, 2024

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Level III

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 24C0076

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
MW-4-4	24C0076-01	Water	03/12/24
MW-4-3	24C0076-02	Water	03/12/24
MW-4-2	24C0076-03	Water	03/12/24
DUP-2-031224	24C0076-04	Water	03/12/24
MW-4-1	24C0076-05	Water	03/12/24
MW-14-4	24C0076-06	Water	03/12/24
MW-14-3	24C0076-07	Water	03/12/24
MW-14-2	24C0076-08	Water	03/12/24
MW-14-1	24C0076-09	Water	03/12/24
EB-2-031224	24C0076-10	Water	03/12/24
FB-2-031224	24C0076-11	Water	03/12/24

Introduction

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The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 1633

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

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- UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) and relative standard errors (%RSE) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

The bile salts interference check was performed as required by the method and the retention time requirements were met.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the method, initial calibration and continuing calibration blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration (ng/L)	Associated Samples
BDC0208-BLK1	03/14/24	PFPeA PFOA PFOS	0.125 0.197 0.0970	All samples in SDG 24C0076

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-4-1	PFPeA PFOA	0.29 0.44	0.73U 0.44J
MW-14-4	PFPeA PFOA PFOS	0.18 0.39 0.34	0.75U 0.39J 0.37U
MW-14-2	PFOA PFOS	0.66 0.25	0.66J 0.37U
MW-14-1	PFOA PFOS	0.72 0.20	0.72J 0.37U
EB-2-031224	PFPeA PFOA PFOS	0.15 0.31 0.076	0.78U 0.39U 0.39U
FB-2-031224	PFPeA PFOA PFOS	0.11 0.29 0.065	0.76U 0.38U 0.38U

VI. Field Blanks

Sample EB-2-031224 was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
EB-2-031224	03/12/24	PFPeA PFOA PFOS	0.15 0.31 0.076	MW-4-4 MW-4-3 MW-4-2 DUP-2-031224 MW-4-1 MW-14-4 MW-14-3 MW-14-2 MW-14-1

Sample FB-2-031224 was identified as a field blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
FB-2-031224	03/12/24	PFPeA PFOA PFOS	0.11 0.29 0.065	MW-4-4 MW-4-3 MW-4-2 DUP-2-031224 MW-4-1 MW-14-4 MW-14-3 MW-14-2 MW-14-1

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-4-1	PFPeA PFOA	0.29 0.44	0.73U 0.44J
MW-14-4	PFPeA PFOA PFOS	0.18 0.39 0.34	0.75U 0.39J 0.37U
MW-14-2	PFOA PFOS	0.66 0.25	0.66J 0.37U
MW-14-1	PFOA PFOS	0.72 0.20	0.72J 0.37U

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Low-Level Laboratory Control Samples

Laboratory control samples (LCS) and minimal risk level (MRL) reported as low-level laboratory control samples (LLLCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples MW-4-2 and DUP-2-031224 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD
	MW-4-2	DUP-2-031224	
PFBA	5.1	4.9	4
PFPeA	9.0	8.7	3
PFHxA	8.9	8.6	3
PFHpA	7.9	7.8	1
PFOA	5.7	5.7	0
PFNA	0.076U	0.088	15
PFDA	0.094U	0.097	3
PFBS	12	13	8
PFPeS	0.35	0.33	6
PFHxS	4.5	4.2	7
PFHpS	0.059	0.053	11
PFOS	1.4	1.2	15

X. Internal Standards

All extracted internal standard percent recoveries (%R) were within QC limits.

All non-extracted internal standard areas and retention times were within QC limits.

XI. Target Analyte Quantitation

Raw data were not reviewed for Level III validation.

XII. Target Analyte Identification

Raw data were not reviewed for Level III validation.

All target analyte ion ratios met validation criteria with the following exceptions:

Sample	Finding	Flag	A or P
MW-4-4 MW-4-3 MW-4-2 DUP-2-031224 MW-4-1 MW-14-4 MW-14-3 MW-14-1	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Data qualified due to laboratory blank contamination, equipment blank contamination, field blank contamination, and ion ratio are summarized and presented in the Data Qualification Summary.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG
24C0076**

Sample	Analyte	Flag	A or P	Reason
MW-4-4 MW-4-3 MW-4-2 DUP-2-031224 MW-4-1 MW-14-4 MW-14-3 MW-14-1	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio)

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification
Summary - SDG 24C0076**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-4-1	PFPeA PFOA	0.73U 0.44J
MW-14-4	PFPeA PFOA PFOS	0.75U 0.39J 0.37U
MW-14-2	PFOA PFOS	0.66J 0.37U
MW-14-1	PFOA PFOS	0.72J 0.37U
EB-2-031224	PFPeA PFOA PFOS	0.78U 0.39U 0.39U
FB-2-031224	PFPeA PFOA PFOS	0.76U 0.38U 0.38U

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification
Summary - SDG 24C0076**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-4-1	PFPeA PFOA	0.73U 0.44J

Sample	Analyte	Modified Final Concentration (ng/L)
MW-14-4	PFPeA PFOA PFOS	0.75U 0.39J 0.37U
MW-14-2	PFOA PFOS	0.66J 0.37U
MW-14-1	PFOA PFOS	0.72J 0.37U

LDC #: 59041B96

VALIDATION COMPLETENESS WORKSHEET

Date: 6/5/24

SDG #: 24C0076

Level III

Page: 1 of 1

Laboratory: APPL, Inc., Clovis, CA

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 1633)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A-A	150 / RSE ≤ 20% 10/15/20/30
IV.	Continuing calibration/ISC / Bile salt	A	D ≤ 30/30/70
V.	Laboratory Blanks	SW	
V.I	Field blanks	SW	EB=10. FB=11
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples / LCS	A	LCS/MRL
IX.	Field duplicates	SW	D=3+4
X.	Internal Standards	A	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	SW	
XIII.	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	MW-4-4	24C0076-01	Water	03/12/24
2	MW-4-3	24C0076-02	Water	03/12/24
3	MW-4-2	24C0076-03	Water	03/12/24
4	DUP-2-031224	24C0076-04	Water	03/12/24
5	MW-4-1	24C0076-05	Water	03/12/24
6	MW-14-4	24C0076-06	Water	03/12/24
7	MW-14-3	24C0076-07	Water	03/12/24
8	MW-14-2	24C0076-08	Water	03/12/24
9	MW-14-1	24C0076-09	Water	03/12/24
10	EB-2-031224	24C0076-10	Water	03/12/24
11	FB-2-031224	24C0076-11	Water	03/12/24
12				

Notes:

BDC0208					

LDC #: 39041396

VALIDATION FINDINGS WORKSHEET

Blanks

Page: 1 of 1
 Reviewer: [Signature]

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Draft Method 1633

Blank extraction date: 3/4/21

Conc. units: ng/L **Associated Samples:** All

Analyte	Blank ID	Sample Identification									
	EDC2208BK1	5x	5	6	8	9	10	11			
PFPEA	0.125	0.625	0.29/0.3U	0.18/0.15U			0.15/0.18U	0.11/0.16U			
PFDA	0.197	0.985	0.44/5	0.39/5	0.46/5	0.17/5	0.31/0.39U	0.29/0.38U			
PFOS	0.0070	0.485		0.34/0.31U	0.25/0.31U	0.20/0.31U	0.076/0.39U	0.065/0.38U			

Blank extraction date: _____

Conc. units: _____ **Associated Samples:** _____

Analyte	Blank ID	Sample Identification									

VALIDATION FINDINGS WORKSHEET
Field Blanks

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Method 1633

Y N N/A Were field blanks identified in this SDG?
 Y N N/A Were target compounds detected in the field blanks?

Blank units: 118/L Associated sample units: 115/L

Sampling date: 3/24

Field blank type: (circle one) Trip Blank/Field Blank / Rinsate / Other: _____ Associated Samples: 1-9

Compound	Blank ID		Sample Identification						
	<u>10 (FB)</u>	<u>11 (FB)</u>	<u>5X</u>	<u>5</u>	<u>6</u>	<u>8</u>	<u>9</u>	<u>12</u>	
PFPA	0.15	0.11	0.75	0.9/0.73	0.18/0.75				
PFOA	0.31	0.29	1.55	0.44/1.5	0.39/1.5	0.66/1.5	0.12/1.5		
PFO5	0.076	0.065	0.38		0.34/0.37	0.25/0.37	0.20/0.37		

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID		Sample Identification						

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: LC/MS PFAS (EPA Method 1633)

Compound	Concentration (ng/L)		RPD
	3	4	
PFBA	5.1	4.9	4
PFPeA	9.0	8.7	3
PFHxA	8.9	8.6	3
PFHpA	7.9	7.8	1
PFOA	5.7	5.7	0
PFNA	0.076U	0.088	15
PFDA	0.094U	0.097	3
PFBS	12	13	8
PFPeS	0.35	0.33	6
PFHxS	4.5	4.2	7
PFHpS	0.059	0.053	11
PFOS	1.4	1.2	15

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NASA JPL, 2024 PFAS
LDC Report Date: June 5, 2024
Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances
Validation Level: Level III
Laboratory: APPL, Inc., Clovis, CA
Sample Delivery Group (SDG): 24C0083

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
MW-21-3	24C0083-01	Water	03/13/24
MW-21-2	24C0083-02	Water	03/13/24
MW-21-1	24C0083-03	Water	03/13/24
FB-3-031324	24C0083-04	Water	03/13/24
EB-3-031324	24C0083-05	Water	03/13/24
MW-19-3	24C0083-06	Water	03/13/24
MW-19-2	24C0083-07	Water	03/13/24
MW-19-1	24C0083-08	Water	03/13/24
MW-19-2MS	24C0083-07MS	Water	03/13/24
MW-19-2MSD	24C0083-07MSD	Water	03/13/24

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-24 Environmental Data Quality Workgroup (October 2022) and the Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using Environmental Protection Agency (EPA) Method 537 (November 2018). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 1633

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) and relative standard errors (%RSE) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

The bile salts interference check was performed as required by the method and the retention time requirements were met.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the method, initial calibration and continuing calibration blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration (ng/L)	Associated Samples
BDC0208-BLK1	03/14/24	PFPeA PFOA PFOS	0.125 0.197 0.0970	All samples in SDG 24C0083

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-21-1	PFOS	0.38	0.38J
FB-3-031324	PFOA	0.23	0.38U
EB-3-031324	PFPeA PFOA PFOS	0.13 0.29 0.079	0.76U 0.38U 0.38U
MW-19-1	PFPeA PFOA	0.32 0.54	0.74U 0.54J

VI. Field Blanks

Sample EB-3-031324 was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
EB-3-031324	03/13/24	PFPeA PFOA PFOS	0.13 0.29 0.079	MW-21-3 MW-21-2 MW-21-1 MW-19-3 MW-19-2 MW-19-1

Sample FB-3-031324 was identified as a field blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
FB-3-031324	03/13/24	PFPeA	0.23	MW-21-3 MW-21-2 MW-21-1 MW-19-3 MW-19-2 MW-19-1

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-21-1	PFOS	0.38	0.38J
MW-19-1	PFPeA PFOA	0.32 0.54	0.74U 0.54J

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Low-Level Laboratory Control Samples

Laboratory control samples (LCS) and minimal risk level (MRL) reported as low-level laboratory control samples (LLLCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Internal Standards

All extracted internal standard percent recoveries (%R) were within QC limits.

All non-extracted internal standard areas and retention times were within QC limits.

XI. Target Analyte Quantitation

Raw data were not reviewed for Level III validation.

XII. Target Analyte Identification

Raw data were not reviewed for Level III validation.

All target analyte ion ratios met validation criteria with the following exceptions:

Sample	Finding	Flag	A or P
MW-21-3 MW-21-1 EB-3-031324 MW-19-3 MW-19-2	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Data qualified due to laboratory blank contamination, equipment blank contamination, field blank contamination, and ion ratio are summarized and presented in the Data Qualification Summary.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG
24C0083**

Sample	Analyte	Flag	A or P	Reason
MW-21-3 MW-21-1 EB-3-031324 MW-19-3 MW-19-2	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio)

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification
Summary - SDG 24C0083**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-21-1	PFOS	0.38J
FB-3-031324	PFOA	0.38U
EB-3-031324	PFPeA PFOA PFOS	0.76U 0.38U 0.38U
MW-19-1	PFPeA PFOA	0.74U 0.54J

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification
Summary - SDG 24C0083**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-21-1	PFOS	0.38J
MW-19-1	PFPeA PFOA	0.74U 0.54J

LDC #: 59041C96

VALIDATION COMPLETENESS WORKSHEET

SDG #: 24C0083

Level III

Laboratory: APPL, Inc., Clovis, CA

Date: 6/3/24

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 1633)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	D A	ISO / RSE ≤ 20%, CV ≤ 20%
IV.	Continuing calibration/ISC <i>file salt</i>	A	DC ≤ 30/30%
V.	Laboratory Blanks	W	
V.I	Field blanks	W	FB=4 EB=5
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples / <i>LCS</i>	A	LCS. NPL
IX.	Field duplicates	N	
X.	Internal Standards	W	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	N	
XIII.	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	MW-21-3	24C0083-01	Water	03/13/24
2	MW-21-2	24C0083-02	Water	03/13/24
3	MW-21-1	24C0083-03	Water	03/13/24
4	FB-3-031324	24C0083-04	Water	03/13/24
5	EB-3-031324	24C0083-05	Water	03/13/24
6	MW-19-3	24C0083-06	Water	03/13/24
7	MW-19-2	24C0083-07	Water	03/13/24
8	MW-19-1	24C0083-08	Water	03/13/24
9	MW-19-2MS	24C0083-07MS	Water	03/13/24
10	MW-19-2MSD	24C0083-07MSD	Water	03/13/24
11				
12				

Notes:

<i>ISO=20%</i>				

LDC #: 39041096

VALIDATION FINDINGS WORKSHEET

Blanks

Page: 1 of 1
Reviewer: [Signature]

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Draft Method 1633

Blank extraction date: 3/14/24

Conc. units: ng/L Associated Samples: All

Analyte	Blank ID	Sample Identification								
	R100208-B4	5X	=	4	5	8				
PFBA PFPA	0.125	0.625			0.13/0.66U	0.32/0.74U				
PFDA	0.197	0.985			0.23/0.38U	0.29/0.38U	0.54/5			
PFOA	0.0970	0.485	0.38/5		0.079/0.38U					

Blank extraction date: _____

Conc. units: _____ Associated Samples: _____

Analyte	Blank ID	Sample Identification								

VALIDATION FINDINGS WORKSHEET
Field Blanks

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Method 1633

Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Blank units: NS/K Associated sample units: NS/K

Sampling date: 3/3/04

Field blank type: (circle one) Trip Blank/Field Blank / Rinsate / Other: _____ Associated Samples: 1-3, 6-8

Compound	Blank ID	Blank ID	Sample Identification							
	4 (FB)	5 (EB)	(5x)	3	8					
PTOA	0.23	0.29	1.45		0.54/5					
PTP2A		0.13	0.65		0.32/0.144					
PTF2S		0.079	0.395	0.38/5						

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NASA JPL, 2024 PFAS
LDC Report Date: June 5, 2024
Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances
Validation Level: Level III
Laboratory: APPL, Inc., Clovis, CA
Sample Delivery Group (SDG): 24C0094

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
MW-22-3	24C0094-01	Water	03/14/24
MW-22-2	24C0094-02	Water	03/14/24
MW-22-1	24C0094-03	Water	03/14/24
MW-3-4	24C0094-04	Water	03/14/24
MW-3-3	24C0094-05	Water	03/14/24
MW-3-2	24C0094-06	Water	03/14/24
MW-3-1	24C0094-07	Water	03/14/24
EB-4-031424	24C0094-08	Water	03/14/24
FB-4-031424	24C0094-09	Water	03/14/24
MW-3-2MS	24C0094-06MS	Water	03/14/24
MW-3-2MSD	24C0094-06MSD	Water	03/14/24

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-24 Environmental Data Quality Workgroup (October 2022) and the Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using Environmental Protection Agency (EPA) Method 537 (November 2018). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 1633

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) and relative standard errors (%RSE) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

The bile salts interference check was performed as required by the method and the retention time requirements were met.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the method, initial calibration and continuing calibration blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration (ng/L)	Associated Samples
BDC0200-BLK1	03/18/24	PFOS	0.0642	All samples in SDG 24C0094

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-22-3	PFOS	0.13	0.39U
MW-22-2	PFOS	0.16	0.37U
MW-22-1	PFOS	0.16	0.37U
EB-4-031424	PFOS	0.065	0.37U

VI. Field Blanks

Sample EB-4-031424 was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
EB-4-031424	03/14/24	PFOS	0.065	MW-22-3 MW-22-2 MW-22-1 MW-3-4 MW-3-3 MW-3-2 MW-3-1

Sample FB-4-031424 was identified as a field blank. No contaminants were found.

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-22-3	PFOS	0.13	0.39U
MW-22-2	PFOS	0.16	0.37U
MW-22-1	PFOS	0.16	0.37U

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Low-Level Laboratory Control Samples

Laboratory control samples (LCS) and minimal risk level (MRL) reported as low-level laboratory control samples (LLLCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Internal Standards

All extracted internal standard percent recoveries (%R) were within QC limits.

All non-extracted internal standard areas and retention times were within QC limits.

XI. Target Analyte Quantitation

Raw data were not reviewed for Level III validation.

XII. Target Analyte Identification

Raw data were not reviewed for Level III validation.

All target analyte ion ratios met validation criteria with the following exceptions:

Sample	Finding	Flag	A or P
MW-22-3 MW-22-2 MW-22-1 MW-3-2 MW-3-1	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Data qualified due to laboratory blank contamination, equipment blank contamination, and ion ratio are summarized and presented in the Data Qualification Summary.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG 24C0094**

Sample	Analyte	Flag	A or P	Reason
MW-22-3 MW-22-2 MW-22-1 MW-3-2 MW-3-1	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio)

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification Summary - SDG 24C0094**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-22-3	PFOS	0.39U
MW-22-2	PFOS	0.37U
MW-22-1	PFOS	0.37U
EB-4-031424	PFOS	0.37U

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification Summary - SDG 24C0094**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-22-3	PFOS	0.39U
MW-22-2	PFOS	0.37U
MW-22-1	PFOS	0.37U

LDC #: 59041D96
 SDG #: 24C0094
 Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET

Level III

Date: 4/5/24
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 1633)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD/RSE ≤ 20%, CV ≤ 20%
IV.	Continuing calibration/ISC <i>file salt</i>	A	0 ≤ 30/30%
V.	Laboratory Blanks	W	
V.I	Field blanks	W	EB = 8 FB = 9*
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples <i>1 LCS</i>	D	LCS, MRL
IX.	Field duplicates	N	
X.	Internal Standards	W	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	T/N	
XIII.	Overall assessment of data	A	

Note: A = Acceptable
 N = Not provided/applicable
 SW = See worksheet

*ND = No compounds detected
 R = Rinsate
 FB = Field blank

D = Duplicate
 TB = Trip blank
 EB = Equipment blank

SB=Source blank
 OTHER:

	Client ID	Lab ID	Matrix	Date
1	MW-22-3	24C0094-01	Water	03/14/24
2	MW-22-2	24C0094-02	Water	03/14/24
3	MW-22-1	24C0094-03	Water	03/14/24
4	MW-3-4	24C0094-04	Water	03/14/24
5	MW-3-3	24C0094-05	Water	03/14/24
6	MW-3-2	24C0094-06	Water	03/14/24
7	MW-3-1	24C0094-07	Water	03/14/24
8	EB-4-031424	24C0094-08	Water	03/14/24
9	FB-4-031424	24C0094-09	Water	03/14/24
10	MW-3-2MS	24C0094-06MS	Water	03/14/24
11	MW-3-2MSD	24C0094-06MSD	Water	03/14/24
12				

Notes:

<i>EXCD 200</i>					

LDC #: 59041296

VALIDATION FINDINGS WORKSHEET

Blanks

Page: 1 of 1
Reviewer: Q

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Draft Method 1633

Blank extraction date: 2/18/24
Conc. units: ng/L

Associated Samples: All

Analyte	Blank ID	Sample Identification								
	BDC0200-BA1	5x	1	2	3	8				
PFOS	006A7	0.321	0.13/0.3TU	0.16/0.3TU	0.16/0.3TU	0.065/0.3TU				

Blank extraction date: _____
Conc. units: _____

Associated Samples: _____

Analyte	Blank ID	Sample Identification								

VALIDATION FINDINGS WORKSHEET
Field Blanks

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Method 1633

Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Blank units: NS/K Associated sample units: NS/K

Sampling date: 3/4/21

Field blank type: (circle one) Trip Blank/Field Blank / Rinsate / Other: _____ Associated Samples: 1-7

Compound	Blank ID	Sample Identification								
		5X	1	2	3					
<u>PFOS</u>	<u>8(2B)</u>	<u>0.065</u>	<u>0.325</u>	<u>0.13/0.39U</u>	<u>0.16/0.3TU</u>	<u>0.16/0.3TU</u>				

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NASA JPL, 2024 PFAS

LDC Report Date: June 6, 2024

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Level III

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 24C0103

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
MW-17-4	24C0103-01	Water	03/15/24
MW-17-3	24C0103-02	Water	03/15/24
DUP-3-031524	24C0103-03	Water	03/15/24
MW-17-2	24C0103-04	Water	03/15/24
MW-17-1	24C0103-05	Water	03/15/24
MW-11-3	24C0103-06	Water	03/15/24
MW-11-2	24C0103-07	Water	03/15/24
MW-11-1	24C0103-08	Water	03/15/24
EB-5-031524	24C0103-09	Water	03/15/24
FB-5-031524	24C0103-10	Water	03/15/24
MW-11-2MS	24C0103-07MS	Water	03/15/24
MW-11-2MSD	24C0103-07MSD	Water	03/15/24

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-24 Environmental Data Quality Workgroup (October 2022) and the Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using Environmental Protection Agency (EPA) Method 537 (November 2018). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 1633

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) and relative standard errors (%RSE) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

The bile salts interference check was performed as required by the method and the retention time requirements were met.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the method, initial calibration and continuing calibration blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration (ng/L)	Associated Samples
BDC0200-BLK1	03/18/24	PFOS	0.0642	All samples in SDG 24C0103

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
EB-5-031524	PFOS	0.062	0.36U
FB-5-031524	PFOS	0.060	0.37U

VI. Field Blanks

Sample EB-5-031524 was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
EB-5-031524	03/15/24	PFOS	0.062	MW-17-4 MW-17-3 DUP-3-031524 MW-17-2 MW-17-1 MW-11-3 MW-11-2 MW-11-1

Sample FB-5-031524 was identified as a field blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
FB-5-031524	03/15/24	PFPeA PFHxA PFOS	0.098 0.052 0.060	MW-17-4 MW-17-3 DUP-3-031524 MW-17-2 MW-17-1 MW-11-3 MW-11-2 MW-11-1

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-17-2	PFPeA PFHxA	0.20 0.15	0.74U 0.37U
MW-17-1	PFPeA PFHxA	0.20 0.10	0.74U 0.37U
MW-11-3	PFPeA	0.45	0.74U

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Low-Level Laboratory Control Samples

Laboratory control samples (LCS) and minimal risk level (MRL) reported as low-level laboratory control samples (LLCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples MW-17-3 and DUP-3-031524 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD
	MW-17-3	DUP-3-031524	
PFBA	0.89	1.8	68
PFPeA	1.1	1.4	24
PFHxA	0.76	0.81	6
PFHpA	0.39	0.49	23
PFOA	0.98	1.0	2
PFNA	0.34	0.28	19
PFDA	1.1	0.79	33
PFBS	1.9	2.0	5
PFPeS	0.32	0.28	13
PFHxS	1.6	1.3	21
PFOS	6.0	4.0	40
NMeFOSAA	0.10	0.14	33

X. Internal Standards

All extracted internal standard percent recoveries (%R) were within QC limits.

All non-extracted internal standard areas and retention times were within QC limits.

XI. Target Analyte Quantitation

Raw data were not reviewed for Level III validation.

XII. Target Analyte Identification

Raw data were not reviewed for Level III validation.

All target analyte ion ratios met validation criteria with the following exceptions:

Sample	Finding	Flag	A or P
DUP-3-031524 MW-17-2 MW-11-3 MW-11-2 MW-11-1	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Data qualified due to laboratory blank contamination, equipment blank contamination, field blank contamination, and ion ratio are summarized and presented in the Data Qualification Summary.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG
24C0103**

Sample	Analyte	Flag	A or P	Reason
DUP-3-031524 MW-17-2 MW-11-3 MW-11-2 MW-11-1	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio)

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification
Summary - SDG 24C0103**

Sample	Analyte	Modified Final Concentration (ng/L)
EB-5-031524	PFOS	0.36U
FB-5-031524	PFOS	0.37U

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification
Summary - SDG 24C0103**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-17-2	PFPeA PFHxA	0.74U 0.37U
MW-17-1	PFPeA PFHxA	0.74U 0.37U
MW-11-3	PFPeA	0.74U

LDC #: 59041E96

VALIDATION COMPLETENESS WORKSHEET

SDG #: 24C0103

Level III

Laboratory: APPL, Inc., Clovis, CA

Date: 6/1/24

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 1633)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A, A	RSD / ASE ≤ 20%, Y ² CV ≤ 70%
IV.	Continuing calibration/ISC <i>File self</i>	A	D ≤ 30/30%
V.	Laboratory Blanks	W	
V.I	Field blanks	W	EB = 9 FB = 10
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples <i>LCS</i>	A	LCS, MRL
IX.	Field duplicates	W	D = 2 + 3
X.	Internal Standards	W	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	SN	
XIII.	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	MW-17-4	24C0103-01	Water	03/15/24
2	MW-17-3	24C0103-02	Water	03/15/24
3	DUP-3-031524	24C0103-03	Water	03/15/24
4	MW-17-2	24C0103-04	Water	03/15/24
5	MW-17-1	24C0103-05	Water	03/15/24
6	MW-11-3	24C0103-06	Water	03/15/24
7	MW-11-2	24C0103-07	Water	03/15/24
8	MW-11-1	24C0103-08	Water	03/15/24
9	EB-5-031524	24C0103-09	Water	03/15/24
10	FB-5-031524	24C0103-10	Water	03/15/24
11	MW-11-2MS	24C0103-07MS	Water	03/15/24
12	MW-11-2MSD	24C0103-07MSD	Water	03/15/24
13				

Notes:

<i>BDC0200</i>				

VALIDATION FINDINGS WORKSHEET Blanks

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Draft Method 1633

Blank extraction date: 3/18/14

Conc. units: ng/L **Associated Samples:** All

Analyte	Blank ID	Sample Identification																	
	BDC02021	5x	9	10															
PFOS	0.0642	0.32	0.062	0.060															
			0.36U	0.37U															

Blank extraction date: _____

Conc. units: _____ **Associated Samples:** _____

Analyte	Blank ID	Sample Identification																	

VALIDATION FINDINGS WORKSHEET
Field Blanks

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Method 1633

Y **N** **N/A** Were field blanks identified in this SDG?
 Y **N** **N/A** Were target compounds detected in the field blanks?

Blank units: NS/L **Associated sample units:** NS/L

Sampling date: 3/15/24

Field blank type: (circle one) Trip Blank/Field Blank / Rinsate / Other: _____ **Associated Samples:** 1-8

Compound	Blank ID		Sample Identification						
	9 (EB)	10 (FB)	(5x)	4	5	6			
PFOS	0.062	0.060	0.31						
PFPA		0.098	0.49	0.20/0.74U	0.20/0.74U	0.45/0.74U			
PFXA		0.052	0.26	0.15/0.37U	0.10/0.37U				

Blank units: _____ **Associated sample units:** _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ **Associated Samples:** _____

Compound	Blank ID		Sample Identification						

VALIDATION FINDINGS WORKSHEET
Field Duplicates**METHOD:** LC/MS PFAS (EPA Method 1633)

Compound	Concentration (ng/L)		RPD
	2	3	
PFBA	0.89	1.8	68
PFPeA	1.1	1.4	24
PFHxA	0.76	0.81	6
PFHpA	0.39	0.49	23
PFOA	0.98	1.0	2
PFNA	0.34	0.28	19
PFDA	1.1	0.79	33
PFBS	1.9	2.0	5
PFPeS	0.32	0.28	13
PFHxS	1.6	1.3	21
PFOS	6.0	4.0	40
NMeFOSAA	0.10	0.14	33

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NASA JPL, 2024 PFAS

LDC Report Date: June 6, 2024

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Level III & IV

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 24C0110

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
MW-12-4**	24C0110-01**	Water	03/18/24
MW-12-3**	24C0110-02**	Water	03/18/24
MW-12-2**	24C0110-03**	Water	03/18/24
MW-12-1**	24C0110-04**	Water	03/18/24
DUP-4-031824**	24C0110-05**	Water	03/18/24
MW-18-4**	24C0110-06**	Water	03/18/24
MW-18-3**	24C0110-07**	Water	03/18/24
MW-18-2**	24C0110-08**	Water	03/18/24
MW-18-1**	24C0110-09**	Water	03/18/24
SB-2-031824	24C0110-10	Water	03/18/24
EB-6-031824	24C0110-11	Water	03/18/24
FB-6-031824	24C0110-12	Water	03/18/24
MW-18-1MS	24C0110-09MS	Water	03/18/24
MW-18-1MSD	24C0110-09MSD	Water	03/18/24

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-24 Environmental Data Quality Workgroup (October 2022) and the Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using Environmental Protection Agency (EPA) Method 537 (November 2018). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 1633

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) and relative standard errors (%RSE) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The signal to noise (S/N) ratio was within validation criteria for all analytes associated to samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

Retention time windows were established as required by the method for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The signal to noise (S/N) ratio was within validation criteria for all analytes associated to samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

Retention times of all analytes in the calibration standards were within the established retention time windows for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The bile salts interference check was performed as required by the method and the retention time requirements were met.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the method, initial calibration and continuing calibration blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration (ng/L)	Associated Samples
BDC0268-BLK1	03/19/24	PFHxA PFOA PFOS	0.063 0.182 0.0727	All samples in SDG 24C0110

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-12-4**	PFHxA PFOA PFOS	0.11 0.34 0.21	0.37U 0.37U 0.37U
MW-12-3**	PFOA	0.86	0.86J
MW-18-4**	PFOA PFOS	0.56 0.34	0.56J 0.37U
MW-18-2**	PFHxA PFOA	0.085 0.39	0.37U 0.39J
MW-18-1**	PFHxA PFOA	0.16 0.44	0.37U 0.44J
SB-2-031824	PFOA PFOS	0.20 0.071	0.37U 0.37U
EB-6-031824	PFOA PFOS	0.18 0.069	0.35U 0.35U
FB-6-031824	PFOA PFOS	0.17 0.067	0.39U 0.39U

VI. Field Blanks

Sample EB-6-031824 was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
EB-6-031824	03/18/24	PFOA PFOS	0.18 0.069	MW-12-4** MW-12-3** MW-12-2** MW-12-1** DUP-4-031824** MW-18-4** MW-18-3** MW-18-2** MW-18-1**

Sample SB-2-031824 was identified as a source blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
SB-2-031824	03/18/24	PFPeA PFOA PFOS	0.11 0.20 0.071	MW-12-4** MW-12-3** MW-12-2** MW-12-1** DUP-4-031824** MW-18-4** MW-18-3** MW-18-2** MW-18-1**

Sample FB-6-031824 was identified as a field blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
FB-6-031824	03/18/24	PFPeA PFOA PFOS	0.14 0.17 0.067	MW-12-4** MW-12-3** MW-12-2** MW-12-1** DUP-4-031824** MW-18-4** MW-18-3** MW-18-2** MW-18-1**

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-12-4**	PFPeA PFOA PFOS	0.24 0.34 0.21	0.73U 0.37U 0.37U
MW-12-3**	PFOA	0.86	0.86J
MW-12-1**	PFPeA	0.41	0.75U
DUP-4-031824**	PFPeA	0.44	0.74U
MW-18-4**	PFOA PFOS	0.56 0.34	0.56J 0.37U
MW-18-2**	PFPeA PFOA	0.15 0.39	0.74U 0.39J
MW-18-1**	PFPeA PFOA	0.26 0.44	0.74U 0.44J

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Low-Level Laboratory Control Samples

Laboratory control samples (LCS) and minimal risk level (MRL) reported as low-level laboratory control samples (LLLCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples MW-12-1** and DUP-4-031824** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD
	MW-12-1**	DUP-4-031824**	
PFPeA	0.41	0.44	7
PFHxA	0.44	0.47	7
PFHpA	0.21	0.27	25
PFOA	1.4	1.5	7
PFNA	0.37	0.34	8
PFDA	1.1	0.83	28
PFBS	0.50	0.47	6

Analyte	Concentration (ng/L)		RPD
	MW-12-1**	DUP-4-031824**	
PFHxS	0.27	0.25	8
PFOS	2.4	2.0	18

X. Internal Standards

All extracted internal standard percent recoveries (%R) were within QC limits.

All non-extracted internal standard areas and retention times were within QC limits.

XI. Target Analyte Quantitation

All target analyte quantitations met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XII. Target Analyte Identification

All target analyte identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

All target analyte ion ratios met validation criteria with the following exceptions:

Sample	Finding	Flag	A or P
MW-12-3** MW-18-2**	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

Manual integrations were reviewed and were considered acceptable. The laboratory provided before and after integration printouts.

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Data qualified due to laboratory blank contamination, equipment blank contamination, source blank contamination, field blank contamination, and ion ratio are summarized and presented in the Data Qualification Summary.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG
24C0110**

Sample	Analyte	Flag	A or P	Reason
MW-12-3** MW-18-2**	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio)

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification
Summary - SDG 24C0110**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-12-4**	PFHxA PFOA PFOS	0.37U 0.37U 0.37U
MW-12-3**	PFOA	0.86J
MW-18-4**	PFOA PFOS	0.56J 0.37U
MW-18-2**	PFHxA PFOA	0.37U 0.39J
MW-18-1**	PFHxA PFOA	0.37U 0.44J
SB-2-031824	PFOA PFOS	0.37U 0.37U
EB-6-031824	PFOA PFOS	0.35U 0.35U
FB-6-031824	PFOA PFOS	0.39U 0.39U

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification
Summary - SDG 24C0110**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-12-4**	PFPeA PFOA PFOS	0.73U 0.37U 0.37U
MW-12-3**	PFOA	0.86J
MW-12-1**	PFPeA	0.75U
DUP-4-031824**	PFPeA	0.74U
MW-18-4**	PFOA PFOS	0.56J 0.37U
MW-18-2**	PFPeA PFOA	0.74U 0.39J
MW-18-1**	PFPeA PFOA	0.74U 0.44J

LDC #: 59041F96

VALIDATION COMPLETENESS WORKSHEET

SDG #: 24C0110

Level III/IV

Laboratory: APPL, Inc., Clovis, CA

Date: 4/4/24

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 1633)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD / RSE ≤ 20%. Y ² , 10V ≤ 30
IV.	Continuing calibration/ISC <i>Asile salt</i>	A	Δ ≤ 30/30%
V.	Laboratory Blanks	W	
V.I	Field blanks	W	SB=10. EB=11. FB=12
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples <i>/LLCS(MPL)</i>	A	LCS. LLCS (MPL)
IX.	Field duplicates	W	D=4+5
X.	Internal Standards	A	
XI.	Target analyte quantitation	A	Not reviewed for Level III validation.
XII.	Target analyte identification	W	Not reviewed for Level III validation. MI
XIII.	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

SB=Source blank
OTHER:

** Indicates sample underwent Level IV validation

	Client ID	Lab ID	Matrix	Date
1	MW-12-4**	24C0110-01**	Water	03/18/24
2	MW-12-3**	24C0110-02**	Water	03/18/24
3	MW-12-2**	24C0110-03**	Water	03/18/24
4	MW-12-1**	24C0110-04**	Water	03/18/24
5	DUP-4-031824**	24C0110-05**	Water	03/18/24
6	MW-18-4**	24C0110-06**	Water	03/18/24
7	MW-18-3**	24C0110-07**	Water	03/18/24
8	MW-18-2**	24C0110-08**	Water	03/18/24
9	MW-18-1**	24C0110-09**	Water	03/18/24
10	SB-2-031824	24C0110-10	Water	03/18/24
11	EB-6-031824	24C0110-11	Water	03/18/24
12	FB-6-031824	24C0110-12	Water	03/18/24
13	MW-18-1MS	24C0110-09MS	Water	03/18/24
14	MW-18-1MSD	24C0110-09MSD	Water	03/18/24
15				
16	<i>RDCD26 8</i>			

Method: LC/MS PFAS (EPA Method 1633)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. LC/MS Instrument performance check				
Were the instrument performance reviewed and found to be within the validation criteria?	/			
III. Initial calibration and Initial Calibration Verification				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) ^{RSE} ≤ 20%?	/			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the coefficient of determination (r ²) criteria of > 0.990?	/			
Were all analytes within 70-130% or percent differences (%D) ≤ 30% of their true value for each calibration standard?			/	
Was the signal to noise (S/N) ratio for all compounds within the validation criteria?	/			
Were the retention time windows properly established?	/			
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) of the initial calibration verification ≤ 30%?	/			
IV. Continuing calibration and Instrument Sensitivity Check				
Was a continuing calibration analyzed prior to sample analysis, after every 10 samples and at the end of the analytical sequence?	/			
Were all percent differences (%D) of the continuing calibration ≤ 30%?	/			
Were all the retention times within the acceptance windows?	/			
Was the signal to noise (S/N) ratio for all compounds within the validation criteria?	/			
Were all percent differences (%D) of the Instrument Sensitivity Check < 30%?	/			
Were the RTs for the bile salt peaks outside the RT window of PFOS by at least one minute?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was there contamination in the laboratory blanks?	/			
VI. Field blanks				
Were field blanks identified in this SDG?	/			
Were target analytes detected in the field blanks?	/			
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed per extraction batch for this SDG?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target analytes detected in the field duplicates?	/			
X. Internal Standards				
Were extracted internal standard <EIS) percent recoveries (%R) within ^{QC limits} 20-150%?	/			
Were non-extracted internal standard (NIS) areas >30% of the average area of the calibration standards?	/			
Were NIS retention times within 0.4 minutes of the initial calibration midPoint?	/			
XI. Target analyte quantitation				
Did the laboratory reporting limits (i.e. DL, LOD, LOQ) meet the QAPP?	/			
Did reported results include both branched and linear isomers?	/			
Were the correct ion transition, labeled compound and relative response factor (RRF) used to quantitate the compound?	/			
Were compound retention times within 0.1 minutes of the associated labeled compound for compounds with a labeled analog?	/			
Were analyte quantitation and reporting limits adjusted to reflect all sample dilutions and dry weight factors applicable to Stage 4 validation?	/			
XII. Target analyte identification				
Was the signal to noise (S/N) ratio for all compounds within the validation criteria?	/			
Were two transitions and the ion transition ratio per analyte monitored and documented with the exception of PFBA and PFPeA?	/			
Were ion ratios between 50-150%?		/		
Were manual integrations reviewed and found acceptable?	/			
Did the laboratory provide before and after integration printouts?	/			
XIII. Overall assessment of Data				
Overall assessment of data was found to be acceptable.	/			

TARGET COMPOUND WORKSHEET

METHOD: PFAS

A. Perfluorobutanoic acid (PFBA)	X. NMeFOSA	UU. N-Ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)
B. Perfluoropentanoic acid (PFPeA)	Y. NEtFOSA	VV. Hexafluoropropylene oxide dimer acid (HFPO-DA)
C. Perfluorohexanoic acid (PFHxA)	Z. NMeFOSAA	WW. 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)
D. Perfluoroheptanoic acid (PFHpA)	AA. NEtFOSAA	XX. 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)
E. Perfluorooctanoic acid (PFOA)	BB. NMeFOSE	YY. 1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)
F. Perfluorononanoic acid (PFNA)	CC. NEtFOSE	ZZ. 1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)
G. Perfluorodecanoic acid (PFDA)	DD. HFPO-DA (GenX)	A1. 1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)
H. Perfluoroundecanoic acid (PFUnDA)	EE. 4,8-Dioxo-3H-perfluorononanoic acid (ADONA)	B1. N-ethylperfluorooctane sulfonamide (NEtFOSA)
I. Perfluorododecanoic acid (PFDoA)	FF. Perfluoro-4-methoxybutanoic acid (PFMBA)	C1. N-methylperfluorooctane sulfonamide (NMeFOSA)
J. Perfluorotridecanoic acid (PFTrDA)	GG. Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	D1. N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)
K. Perfluorotetradecanoic acid (PFTeDA)	HH. Perfluoro-3-methoxypropanoic acid (PFMPA)	E1. N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)
L. Perfluorobutanesulfonic acid (PFBS)	II. 9Cl-PF3ONS	F1. 3-Perfluoropropyl propanoic acid (3:3FTCA)
M. Perfluoropentanesulfonic acid (PFPeS)	JJ. 11Cl-PF3OUdS	G1. 2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA)
N. Perfluorohexanesulfonic acid (PFHxS)	KK. Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	H1. 3-Perfluoroheptyl propanoic acid (7:3FTCA)
O. Perfluoroheptanesulfonic acid (PFHpS)	LL. 3:3 FTCA	
P. Perfluorooctanesulfonic acid (PFOS)	MM. 5:3 FTCA	
Q. Perfluorononanesulfonic acid (PFNS)	NN. 7:3 FTCA	
R. Perfluorodecanesulfonic acid (PFDS)	OO. 3:3 Fluorotelomer carboxylate (3:3 FTCA)	
S. Perfluorododecanesulfonic acid (PFDoS)	PP. 5:3 Fluorotelomer carboxylate (5:3 FTCA)	
T. 4:2 FTS	QQ. 7:3 Fluorotelomer carboxylate (7:3 FTCA)	
U. 6:2 FTS	RR. Perfluorooctadecanoic acid (PFODA)	
V. 8:2 FTS	SS. Perfluorohexadecanoic acid (PFHxDA)	
W. Perfluorooctanesulfonamide (PFOSA)	TT. N-Methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	

VALIDATION FINDINGS WORKSHEET
Blanks

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Draft Method 1633

Blank extraction date: 2/19/24

Conc. units: ng/L **Associated Samples:** All

Analyte	Blank ID	Sample Identification									
	BDC0288BK	(5x)	12	1	2	6	8	9	10	11	
PFHxA	0.0603	0.3015	0.24/0.39U	0.11/0.3TU			0.085/0.3TU	0.16/0.3TU			
PFOA	0.182	0.91	0.17/0.39U	0.34/0.3TU	0.86/5	0.56/5	0.39/5	0.44/5	0.20/0.3TU	0.18/0.35U	
PFOS	0.0727	0.3635	0.067/0.39U	0.21/0.3TU		0.34/0.3TU			0.071/0.3TU	0.069/0.35U	

Blank extraction date: _____

Conc. units: _____ **Associated Samples:** _____

Analyte	Blank ID	Sample Identification									

VALIDATION FINDINGS WORKSHEET
Field Blanks

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Method 1633

Y **N** **N/A** Were field blanks identified in this SDG?
 Y **N** **N/A** Were target compounds detected in the field blanks?

Blank units: 18/L **Associated sample units:** 18/L

Sampling date: 3/18/24

Field blank type: (circle one) Trip Blank/Field Blank / Rinsate / Other: _____ **Associated Samples:** 1-9 total 14

Compound	Blank ID	Blank ID		Sample Identification								
		BK10	BK11	1	2	A	5	6	8	9		
PFPA	0.55	0.11	0.14	0.24/0.3TU		0.41/0.75U	0.44/0.74U	0.4	0.15/0.74U	0.26/0.74U		
PFDA	1.0	0.20	0.18	0.17	0.74/0.3TU	0.86/5		0.56/5	0.39/5	0.44/5		
PFOS	0.355	0.071	0.069	0.067	0.21/0.3TU			0.34/0.3TU				

Blank units: _____ **Associated sample units:** _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ **Associated Samples:** _____

Compound	Blank ID	Sample Identification								

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: LC/MS PFAS (EPA Method 1633)

Compound	Concentration (ng/L)		(\leq50)
	4	5	RPD
PFPeA	0.41	0.44	7
PFHxA	0.44	0.47	7
PFHpA	0.21	0.27	25
PFOA	1.4	1.5	7
PFNA	0.37	0.34	8
PFDA	1.1	0.83	28
PFBS	0.50	0.47	6
PFHxS	0.27	0.25	8
PFOS	2.4	2.0	18

V:\FIELD DUPLICATES\Field Duplicates\FD_Organics\2024\59041F96_Tidewater_JPL.wpd

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

METHOD: LC/MS PFAS (EPA Method 1633)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is}) / (A_{is})(C_x)$

average RRF = sum of the RRFs/number of standards

$\%RSD = 100 * (S/X)$

A_x = Area of compound,

C_x = Concentration of compound,

S = Standard deviation of the RRFs

X = Mean of the RRFs

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
				RRF (std)	RRF (std)	Average RRF (initial)	Average RRF (initial)	%RSD	%RSD
1	KX	3/19/24	PFOA (13C8-PFOA)						
			PFOS (13C8-PFOS)	0.548191		0.53562	0.53562	5.0	5.0
2									
3									
4									

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

Validation Findings Worksheet
Initial Calibration Calculation Verification

Method: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 537M/QSM 5.3 Table B-15)

Calibration Date	Instrument	Compound	Standard	(Y) Response	(X) Conc.	(X ²) Conc.
3/19/2024	Saphira	PFOA	1	0.059350	0.100	0.01
			2	0.261882	0.500	0.25
			3	0.496390	1.000	1
			4	1.081624	2.000	4
			5	2.246125	5.000	25
			6	4.620099	10.000	100
			7	10.693360	20.000	400
			8	26.562771	50.000	2500

Regression Output	Calculated		Reported	
Constant	c	-0.07970		0.01226
Std Err of Y Est				
R Squared		0.9992396		0.9990500
Degrees of Freedom				
	b	a	b	a
X Coefficient(s)	0.51151184	0.000441955	0.48413	9.99867E-04
Std Err of Coef.				
Correlation Coefficient		0.999620		
Coefficient of Determination (r ²)		0.999240		

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

METHOD: LC/MS/MS PFAs (EPA Method 1633)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
 RRF = continuing calibration RRF
 A_x = Area of compound, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	CONC Average RRF (initial)	Reported	Recalculated	Reported	Recalculated
					CONC RRF	CONC RRF	%D	%D
1	<u>520240321B</u>	<u>3/21/24</u>	PFOA ($^{13}\text{C}_8$ -PFOA)	<u>5.00</u>	<u>4.88</u>	<u>4.88</u>	<u>2.4</u>	<u>2.4</u>
			PFOS ($^{13}\text{C}_8$ -PFOS)	<u>4.65</u>	<u>4.39</u>	<u>4.39</u>	<u>5.7</u>	<u>5.7</u>
2			PFOA ($^{13}\text{C}_8$ -PFOA)					
			PFOS ($^{13}\text{C}_8$ -PFOS)					
3			PFOA ($^{13}\text{C}_8$ -PFOA)					
			PFOS ($^{13}\text{C}_8$ -PFOS)					
4			PFOA ($^{13}\text{C}_8$ -PFOA)					
			PFOS ($^{13}\text{C}_8$ -PFOS)					
5			PFOA ($^{13}\text{C}_8$ -PFOA)					
			PFOS ($^{13}\text{C}_8$ -PFOS)					

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Method: LC/MS PFAS (EPA Method 1633)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

$\% \text{ Recovery} = 100 * (\text{SSC} - \text{SC}) / \text{SA}$

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

$\text{RPD} = | \text{MSC} - \text{MSC} | * 2 / (\text{MSC} + \text{MSDC})$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 13/14

Compound	Spike Added (<u>NS/K</u>)		Sample Concentration (<u>NS/K</u>)	Spiked Sample Concentration (<u>NS/K</u>)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
PFOA	3.75	3.72	0.440	3.68	3.83	86.4	86.4	91.0	91.1	3.82	3.99
PFOS	3.49	3.46	0.861	3.98	3.80	89.5	89.4	85.0	84.9	4.66	4.63

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Method: LC/MS PFAS (EPA Method 1633)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA)

Where: SSC = Spike concentration
 SA = Spike added

RPD = | LCSC - LCSDC | * 2 / (LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: BD0268BS1

Compound	Spike Added (NS/L)		Spike Concentration (NS/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
PFOA	4.00	NA	3.67	NA	91.7	91.7				
PFOS	3.72	✓	3.38	✓	90.8	90.9				

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Method: LC/MS PFAS (EPA Method 1633)

The concentration of the sample was calculated for the compound identified below using the following calculation:

$$\text{Concentration} = \frac{(A_x)(I_s)(V_i)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$$

- A_x = Area of the characteristic ion (EICP) for the compound to be measured
- A_{is} = Area of the characteristic ion (EICP) for the specific internal standard
- I_s = Amount of internal standard added in nanograms (ng)
- V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V_i = Volume of extract injected in microliters (ul)
- V_t = Volume of the concentrated extract in microliters (ul)
- Df = Dilution Factor.
- %S = Percent solids, applicable to soil and solid matrices only.
- 2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 31 PFOS:

$$\text{Conc.} = \frac{(58832)(1)(0.9275)(2)}{(163972)(0.53562)(0.51641)}$$

$$= 0.21 \text{ } \mu\text{g/L}$$

#	Sample ID	Analyte	Reported Concentration (ug/L)	Calculated Concentration (ug/L)	Qualification
	1	PFOS	0.21	0.21	-
	2	PFDA	0.86	0.86	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NASA JPL, 2024 PFAS
LDC Report Date: June 6, 2024
Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances
Validation Level: Level III
Laboratory: APPL, Inc., Clovis, CA
Sample Delivery Group (SDG): 24C0121

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
MW-20-4	24C0121-01	Water	03/19/24
MW-20-3	24C0121-02	Water	03/19/24
MW-20-2	24C0121-03	Water	03/19/24
MW-20-1	24C0121-04	Water	03/19/24
MW-6	24C0121-05	Water	03/19/24
MW-10	24C0121-06	Water	03/19/24
DUP-5-031924	24C0121-07	Water	03/19/24
MW-5	24C0121-08	Water	03/19/24
EB-7-031924	24C0121-09	Water	03/19/24
FB-7-031924	24C0121-10	Water	03/19/24
MW-6MS	24C0121-05MS	Water	03/19/24
MW-6MSD	24C0121-05MSD	Water	03/19/24
MW-5MS	24C0121-08MS	Water	03/19/24
MW-5MSD	24C0121-08MSD	Water	03/19/24

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-24 Environmental Data Quality Workgroup (October 2022) and the Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using Environmental Protection Agency (EPA) Method 537 (November 2018). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 1633

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) and relative standard errors (%RSE) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

The bile salts interference check was performed as required by the method and the retention time requirements were met.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the method, initial calibration and continuing calibration blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration (ng/L)	Associated Samples
BDC0337-BLK1	03/22/24	PFOA PFOS	0.270 0.112	All samples in SDG 24C0121

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-20-4	PFOA PFOS	0.70 0.34	0.70J 0.37U
MW-20-3	PFOA	0.95	0.95J
MW-20-1	PFOA	0.68	0.68J
MW-6	PFOA PFOS	0.83 0.23	0.83J 0.38U
MW-10	PFOA	0.85	0.85J
DUP-5-031924	PFOA	0.93	0.93J
MW-5	PFOA	1.2	1.2J
EB-7-031924	PFOA PFOS	0.93 0.27	0.93J 0.36U
FB-7-031924	PFOA PFOS	0.29 0.13	0.37U 0.37U

VI. Field Blanks

Sample EB-7-031924 was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
EB-7-031924	03/19/24	PFHpA PFOA PFOS	0.051 0.93 0.27	MW-20-4 MW-20-3 MW-20-2 MW-20-1 MW-6 MW-10 DUP-5-031924 MW-5

Sample FB-7-031924 was identified as a field blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
FB-7-031924	03/19/24	PFHpA PFOA PFOS	0.048 0.29 0.13	MW-20-4 MW-20-3 MW-20-2 MW-20-1 MW-6 MW-10 DUP-5-031924 MW-5

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-20-4	PFHpA PFOA PFOS	0.081 0.70 0.34	0.37U 0.70J 0.37U
MW-20-3	PFHpA PFOA PFOS	0.22 0.95 1.0	0.37U 0.95J 1.0J
MW-20-2	PFOA	1.7	1.7J
MW-20-1	PFHpA PFOA PFOS	0.22 0.68 0.62	0.36U 0.68J 0.62J
MW-6	PFOA PFOS	0.83 0.23	0.83J 0.38U
MW-10	PFHpA PFOA	0.14 0.85	0.36U 0.85J
DUP-5-031924	PFHpA PFOA	0.13 0.93	0.37U 0.93J
MW-5	PFHpA PFOA	0.23 1.2	0.37U 1.2J

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Low-Level Laboratory Control Samples

Laboratory control samples (LCS) and minimal risk level (MRL) reported as low-level laboratory control samples (LLLCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples MW-10 and DUP-5-031924 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD
	MW-10	DUP-5-031924	
PFHxA	0.074	0.083	11
PFHpA	0.14	0.13	7
PFOA	0.85	0.93	9
PFDA	0.26	0.23	12
PFBS	0.81	0.76	6
PFPeS	0.057U	0.058	2
PFHxS	0.87	0.92	6
PFHpS	0.12	0.12	0
PFOS	13	14	7

X. Internal Standards

All extracted internal standard percent recoveries (%R) were within QC limits with the following exceptions:

Sample	Internal Standard	%R (Limits)	Affected Analyte	Flag	A or P
DUP-5-031924	13C8-PFOA	32.8 (40-130)	PFOSA	UJ (all non-detects)	P
DUP-5-031924	d3-NMeFOSA d5-NEtFOSA	5.45 (10-130) 6.47 (10-130)	NMeFOSA NEtFOSA	R (all non-detects) R (all non-detects)	P
EB-7-031924	13C8-PFOA	17.5 (40-130)	PFOSA	UJ (all non-detects)	P
EB-7-031924	d3-NMeFOSA d5-NEtFOSA	4.63 (10-130) 4.28 (10-130)	NMeFOSA NEtFOSA	R (all non-detects) R (all non-detects)	P
FB-7-031924	13C8-PFOA	14.1 (40-130)	PFOSA	UJ (all non-detects)	P
FB-7-031924	d3-NMeFOSA d5-NEtFOSA	5.42 (10-130) 5.93 (10-130)	NMeFOSA NEtFOSA	R (all non-detects) R (all non-detects)	P

All non-extracted internal standard areas and retention times were within QC limits.

XI. Target Analyte Quantitation

Raw data were not reviewed for Level III validation.

XII. Target Analyte Identification

Raw data were not reviewed for Level III validation.

All target analyte ion ratios met validation criteria with the following exceptions:

Sample	Finding	Flag	A or P
MW-20-4 MW-20-3 DUP-5-031924 MW-5	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Data rejected due to internal standard %R are summarized and presented in the Data Qualification Summary.

Data qualified due to laboratory blank contamination, equipment blank contamination, field blank contamination, internal standard %R, and ion ratio are summarized and presented in the Data Qualification Summary.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG
24C0121**

Sample	Analyte	Flag	A or P	Reason
DUP-5-031924 EB-7-031924 FB-7-031924	PFOSA	UJ (all non-detects)	P	Internal standard (%R)
DUP-5-031924 EB-7-031924 FB-7-031924	NMeFOSA NEtFOSA	R (all non-detects) R (all non-detects)	P	Internal standard (%R)
MW-20-4 MW-20-3 DUP-5-031924 MW-5	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio)

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification
Summary - SDG 24C0121**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-20-4	PFOA PFOS	0.70J 0.37U
MW-20-3	PFOA	0.95J
MW-20-1	PFOA	0.68J
MW-6	PFOA PFOS	0.83J 0.38U
MW-10	PFOA	0.85J
DUP-5-031924	PFOA	0.93J
MW-5	PFOA	1.2J
EB-7-031924	PFOA PFOS	0.93J 0.36U
FB-7-031924	PFOA PFOS	0.37U 0.37U

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification
Summary - SDG 24C0121**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-20-4	PFHpA PFOA PFOS	0.37U 0.70J 0.37U
MW-20-3	PFHpA PFOA PFOS	0.37U 0.95J 1.0J
MW-20-2	PFOA	1.7J
MW-20-1	PFHpA PFOA PFOS	0.36U 0.68J 0.62J
MW-6	PFOA PFOS	0.83J 0.38U
MW-10	PFHpA PFOA	0.36U 0.85J
DUP-5-031924	PFHpA PFOA	0.37U 0.93J
MW-5	PFHpA PFOA	0.37U 1.2J

LDC #: 59041G96

VALIDATION COMPLETENESS WORKSHEET

SDG #: 24C0121

Level III

Laboratory: APPL, Inc., Clovis, CA

Date: *4/1/24*

Page: *1* of *1*

Reviewer: *[Signature]*

2nd Reviewer: *[Signature]*

METHOD: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 1633)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	$RSD/RSE \leq 20\%$ Y^2 $ICV \leq 30\%$
IV.	Continuing calibration/ISC <i>pile salt</i>	A	$\delta \leq 30/30\%$
V.	Laboratory Blanks	W	
V.I	Field blanks	W	EB = 9. FB = 10
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples <i>LCS</i>	A	LCS, MRL
IX.	Field duplicates	W	D = 6+7
X.	Internal Standards	W	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	SW	
XIII.	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	MW-20-4	24C0121-01	Water	03/19/24
2	MW-20-3	24C0121-02	Water	03/19/24
3	MW-20-2	24C0121-03	Water	03/19/24
4	MW-20-1	24C0121-04	Water	03/19/24
5	MW-6	24C0121-05	Water	03/19/24
6	MW-10	24C0121-06	Water	03/19/24
7	DUP-5-031924	✓ 24C0121-07	Water	03/19/24
8	MW-5	24C0121-08	Water	03/19/24
9	EB-7-031924	✓ 24C0121-09	Water	03/19/24
10	FB-7-031924	✓ 24C0121-10	Water	03/19/24
11	MW-6MS	24C0121-05MS	Water	03/19/24
12	MW-6MSD	24C0121-05MSD	Water	03/19/24
13	MW-5MS	24C0121-08MS	Water	03/19/24
14	MW-5MSD	24C0121-08MSD	Water	03/19/24
15				
16				

LDC #: 59041996

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: A

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Draft Method 1633

Blank extraction date: 3/2/04

Conc. units: ng/L Associated Samples: All

Analyte	Blank ID	Sample Identification								
	BDC03T-BK	5X	1	2	4	5	6	7	8	9
PFOA	0.270	1.35	0.70/5	0.95/5	0.68/5	0.83/5	0.85/5	0.93/5	1.2/5	0.93/5
PFO5	0.112	0.56	0.34/ 0.3TU			0.23/0.3TU				0.27/0.3TU
				10						
	0.270			0.29/0.3TU						
	0.112			0.13/0.3TU						

Blank extraction date: _____

Conc. units: _____ Associated Samples: _____

Analyte	Blank ID	Sample Identification								

VALIDATION FINDINGS WORKSHEET
Field Blanks

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Method 1633

Y **N** **N/A** Were field blanks identified in this SDG?
 Y **N** **N/A** Were target compounds detected in the field blanks?

Blank units: NS/L Associated sample units: NS/L

Sampling date: 3/19/24

Field blank type: (circle one) Trip Blank/Field Blank / Rinsate / Other: _____ Associated Samples: 1-8

Compound	Blank ID		Sample Identification							
	9 (LB)	10 (FB)	1	2	3	4	5	6	7	8
PFHPA	0.051	0.048	0.081/0.3TU	0.22/0.3TU		0.22/0.36U		0.14/0.36U	0.13/0.3TU	0.23/0.3TU
PFDA	0.93	0.29	0.70/5	0.95/5	1.7/5	0.68/5	0.83/5	0.85/5	0.93/5	1.2/5
PFOA	0.27	0.13	0.34/0.3TU	1.0/5		0.62/5	0.23/0.3TU			

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID		Sample Identification							

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NASA JPL, 2024 PFAS

LDC Report Date: June 6, 2024

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Level III

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 24C0131

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
MW-15	24C0131-01	Water	03/20/24
MW-8	24C0131-02	Water	03/20/24
MW-9	24C0131-03	Water	03/20/24
EB-8-032024	24C0131-04	Water	03/20/24
FB-8-032024	24C0131-05	Water	03/20/24
MW-15MS	24C0131-01MS	Water	03/20/24
MW-15MSD	24C0131-01MSD	Water	03/20/24
MW-8MS	24C0131-02MS	Water	03/20/24
MW-8MSD	24C0131-02MSD	Water	03/20/24

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-24 Environmental Data Quality Workgroup (October 2022) and the Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using Environmental Protection Agency (EPA) Method 537 (November 2018). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 1633

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) and relative standard errors (%RSE) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

The bile salts interference check was performed as required by the method and the retention time requirements were met.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the method, initial calibration and continuing calibration blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration (ng/L)	Associated Samples
BDC0337-BLK1	03/22/24	PFOA PFOS	0.270 0.112	All samples in SDG 24C0131

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-8	PFOA	0.54	0.54J
EB-8-032024	PFOA PFOS	0.42 0.16	0.42J 0.37U
FB-8-032024	PFOA PFOS	0.29 0.13	0.38U 0.38U

VI. Field Blanks

Sample EB-8-032024 was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
EB-8-032024	03/20/24	PFOA PFOS PFOSA	0.42 0.16 0.18	MW-15 MW-8 MW-9

Sample FB-8-032024 was identified as a field blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
FB-8-032024	03/20/24	PFOA PFOS	0.29 0.13	MW-15 MW-8 MW-9

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-8	PFOA	0.54	0.54J
MW-9	PFOSA	0.15	0.36U

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS %R (Limits)	MSD %R (Limits)	Flag	A or P
MW-15MS/MSD (MW-15)	PFOA	176 (70-150)	-	J (all detects)	A
MW-15MS/MSD (MW-15)	NMeFOSA NEtFOSA NMeFOSE NEtFOSE	163 (60-150) 152 (65-145) 165 (70-145) 140 (70-135)	- - - -	NA	-

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (≤30)	Flag	A or P
MW-15MS/MSD (MW-15)	PFODA NMeFOSE	30.4 43.4	NA	-

VIII. Laboratory Control Samples/Low-Level Laboratory Control Samples

Laboratory control samples (LCS) and minimal risk level (MRL) reported as low-level laboratory control samples (LLLCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Internal Standards

All extracted internal standard percent recoveries (%R) were within QC limits with the following exceptions:

Sample	Internal Standard	%R (40-130)	Affected Analyte	Flag	A or P
FB-8-032024	13C8-PFOA	27.3	PFOA	UJ (all non-detects)	P

All non-extracted internal standard areas and retention times were within QC limits.

XI. Target Analyte Quantitation

Raw data were not reviewed for Level III validation.

XII. Target Analyte Identification

Raw data were not reviewed for Level III validation.

All target analyte ion ratios met validation criteria.

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Data qualified due to laboratory blank contamination, equipment blank contamination, field blank contamination, MS/MSD %R, and internal standard %R are summarized and presented in the Data Qualification Summary.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG 24C0131**

Sample	Analyte	Flag	A or P	Reason
FB-8-032024	PFOSA	UJ (all non-detects)	P	Internal standard (%R)

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification Summary - SDG 24C0131**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-8	PFOA	0.54J
EB-8-032024	PFOA PFOS	0.42J 0.37U
FB-8-032024	PFOA PFOS	0.38U 0.38U

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification Summary - SDG 24C0131**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-8	PFOA	0.54J
MW-9	PFOSA	0.36U

LDC #: 59041H96
 SDG #: 24C0131
 Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET
 Level III

Date: 4/14/24
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 1633)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A-A	RSD / RSD2 < 20%. Y ² 12/15/20
IV.	Continuing calibration/ISC	A	DC 30/3070
V.	Laboratory Blanks	SW	
V.I	Field blanks	SW	EB=4. FB=5
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples / LLS	A	LES MRL
IX.	Field duplicates	N	
X.	Internal Standards	SW	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	N	
XIII.	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
 N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
 SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	MW-15	24C0131-01	Water	03/20/24
2	MW-8	24C0131-02	Water	03/20/24
3	MW-9	24C0131-03	Water	03/20/24
4	EB-8-032024	24C0131-04	Water	03/20/24
5	FB-8-032024	24C0131-05	Water	03/20/24
6	MW-15MS	24C0131-01MS	Water	03/20/24
7	MW-15MSD	24C0131-01MSD	Water	03/20/24
8	MW-8MS	24C0131-02MS	Water	03/20/24
9	MW-8MSD	24C0131-02MSD	Water	03/20/24
10				
11				
12				

Notes:

EDC033T					

LDC #: 59041H96

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: [Signature]

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Draft Method 1633

Blank extraction date: 3/22/24

Conc. units: NS/L Associated Samples: All

Analyte	Blank ID	Sample Identification							
	BDC037-BK	5X	2	4	5				
PFOA	0.210	1.35	0.54/S	0.42/S	0.29/0.38U				
PFOS	0.112	0.56		0.16/0.31U	0.13/0.38U				

Blank extraction date: _____

Conc. units: _____ Associated Samples: _____

Analyte	Blank ID	Sample Identification							

VALIDATION FINDINGS WORKSHEET
Field Blanks

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Method 1633

Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Blank units: NS/L Associated sample units: NS/L

Sampling date: 3/20/24

Field blank type: (circle one) Trip Blank/Field Blank / Rinsate / Other: _____ Associated Samples: 123

Compound	Blank ID		Sample Identification						
	4 (LB)	5 (FB)	(5X)	2	3				
PFDA	0.42	0.29	2.1	0.5A/5					
PFOS	0.16	0.13	0.8						
PFOSA	0.18		0.9		0.15/26U				

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification						

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

METHOD: LC/MS PFAS (Draft EPA Method 1633 Compliant with Table B-24 of DoD QSM 5.4)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

N N/A Were matrix spike (MS) and matrix spike duplicate (MSD) or duplicate sample analyzed in this SDG?

Y N N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R	MSD %R	%R Limits	RPD (Limits)	Associated Samples	Qualifications
	6/7	PFDA	176		70-150	()	1 (dots)	↓ N/A
		NMeFOSA	163		60-150	()	(ND)	
		NE+FOSA	152		65-145	()	↓	
		NMeFOSE	165		70-145	()	↓	
		NE+FOSE	140		70-135	()	↓	
		PFODA				30.4 (≤30)	(ND)	
		NMeFOSE				43.4 (↓)	↓	
						()		
						()		
						()		
						()		
						()		
						()		
						()		
						()		
						()		
						()		
						()		
						()		
						()		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: NASA JPL, 2024 PFAS

LDC Report Date: June 6, 2024

Parameters: Perfluoroalkyl & Polyfluoroalkyl Substances

Validation Level: Level III

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 24C0142

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
MW-13	24C0142-01	Water	03/21/24
DUP-6-032124	24C0142-02	Water	03/21/24
MW-16	24C0142-03	Water	03/21/24
DUP-7-032124	24C0142-04	Water	03/21/24
MW-7	24C0142-05	Water	03/21/24
DUP-8-032124	24C0142-06	Water	03/21/24
EB-9-032124	24C0142-07	Water	03/21/24
FB-9-032124	24C0142-08	Water	03/21/24

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the U.S. Department of Defense (DoD) Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-24 Environmental Data Quality Workgroup (October 2022) and the Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using Environmental Protection Agency (EPA) Method 537 (November 2018). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) by Environmental Protection Agency (EPA) Method 1633

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

- J (Estimated): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance was checked and the requirements were met.

III. Initial Calibration and Initial Calibration Verification

Initial calibration was performed as required by the method.

For analytes where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) and relative standard errors (%RSE) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 30.0% for all analytes.

IV. Continuing Calibration and Instrument Sensitivity Check

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 30.0% for all analytes.

The percent differences (%D) of the instrument sensitivity check (ISC) were less than or equal to 30.0% for all analytes.

The bile salts interference check was performed as required by the method and the retention time requirements were met.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the method, initial calibration and continuing calibration blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration (ng/L)	Associated Samples
BDC0363-BLK1	03/26/24	PFOA PFOS	0.256 0.0956	All samples in SDG 24C0142

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-13	PFOS	0.32	0.37U
DUP-6-032124	PFOS	0.35	0.37U
MW-16	PFOA PFOS	0.25 0.13	0.36U 0.36U
DUP-7-032124	PFOA PFOS	0.27 0.13	0.36U 0.36U
MW-7	PFOA PFOS	0.25 0.094	0.36U 0.36U
DUP-8-032124	PFOA PFOS	0.25 0.11	0.35U 0.35U
EB-9-032124	PFOA PFOS	0.24 0.071	0.37U 0.37U
FB-9-032124	PFOA PFOS	0.36 0.072	0.37U 0.37U

VI. Field Blanks

Sample EB-9-032124 was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
EB-9-032124	03/21/24	PFBA PFOA PFOS	0.37 0.24 0.071	MW-13 DUP-6-032124 MW-16 DUP-7-032124 MW-7 DUP-8-032124

Sample FB-9-032124 was identified as a field blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration (ng/L)	Associated Samples
FB-9-032124	03/21/24	PFBA PFOA PFOS	0.29 0.26 0.072	MW-13 DUP-6-032124 MW-16 DUP-7-032124 MW-7 DUP-8-032124

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Analyte	Reported Concentration (ng/L)	Modified Final Concentration (ng/L)
MW-13	PFOS	0.32	0.37U
DUP-6-032124	PFOS	0.35	0.37U
MW-16	PFOA PFOS	0.25 0.13	0.36U 0.36U
DUP-7-032124	PFOA PFOS	0.27 0.13	0.36U 0.36U
MW-7	PFOA PFOS	0.25 0.094	0.36U 0.36U
DUP-8-032124	PFOA PFOS	0.25 0.11	0.35U 0.35U

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples/Low-Level Laboratory Control Samples

Laboratory control samples (LCS) and minimal risk level (MRL) reported as low-level laboratory control samples (LLLCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples MW-13 and DUP-6-032124, samples MW-16 and DUP-7-032124, and samples MW-7 and DUP-8-032124 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD
	MW-13	DUP-6-032124	
PFBA	11	9.6	14
PFPeA	12	12	0
PFHxA	7.5	6.5	14
PFHpA	2.4	2.3	4
PFOA	1.9	2.0	5
PFBS	1.2	1.2	0
PFPeS	0.23	0.21	9
PFHxS	0.96	0.94	2
PFOS	0.32	0.35	9

Analyte	Concentration (ng/L)		RPD
	MW-16	DUP-7-032124	
PFBA	4.7	4.9	4
PFPeA	7.3	7.6	4
PFOA	0.25	0.27	8
PFOS	0.13	0.13	0

Analyte	Concentration (ng/L)		RPD
	MW-7	DUP-8-032124	
PFBA	4.0	4.1	2
PFPeA	6.0	5.3	12
PFOA	0.25	0.25	0
PFOS	0.094	0.11	16

X. Internal Standards

All extracted internal standard percent recoveries (%R) were within QC limits.

All non-extracted internal standard areas and retention times were within QC limits.

XI. Target Analyte Quantitation

Raw data were not reviewed for Level III validation.

XII. Target Analyte Identification

Raw data were not reviewed for Level III validation.

All target analyte ion ratios met validation criteria with the following exceptions:

Sample	Finding	Flag	A or P
DUP-6-032124	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P

XIII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Data qualified due to laboratory blank contamination, equipment blank contamination, field blank contamination, and ion ratio are summarized and presented in the Data Qualification Summary.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Data Qualification Summary - SDG
24C0142**

Sample	Analyte	Flag	A or P	Reason
DUP-6-032124	All analytes flagged "IR1" or IR2" by the laboratory due to ion ratio outside QC limits.	J (all detects)	P	Target analyte identification (ion ratio)

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Laboratory Blank Data Qualification
Summary - SDG 24C0142**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-13	PFOS	0.37U
DUP-6-032124	PFOS	0.37U
MW-16	PFOA PFOS	0.36U 0.36U
DUP-7-032124	PFOA PFOS	0.36U 0.36U
MW-7	PFOA PFOS	0.36U 0.36U
DUP-8-032124	PFOA PFOS	0.35U 0.35U
EB-9-032124	PFOA PFOS	0.37U 0.37U
FB-9-032124	PFOA PFOS	0.37U 0.37U

**NASA JPL, 2024 PFAS
Perfluoroalkyl & Polyfluoroalkyl Substances - Field Blank Data Qualification
Summary - SDG 24C0142**

Sample	Analyte	Modified Final Concentration (ng/L)
MW-13	PFOS	0.37U

Sample	Analyte	Modified Final Concentration (ng/L)
DUP-6-032124	PFOS	0.37U
MW-16	PFOA PFOS	0.36U 0.36U
DUP-7-032124	PFOA PFOS	0.36U 0.36U
MW-7	PFOA PFOS	0.36U 0.36U
DUP-8-032124	PFOA PFOS	0.35U 0.35U

LDC #: 59041196

VALIDATION COMPLETENESS WORKSHEET

SDG #: 24C0142

Level III

Laboratory: APPL, Inc., Clovis, CA

Date: 3/21/24

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: LC/MS Perfluoroalkyl & Polyfluoroalkyl Substances (EPA Method 1633)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	LC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A-A	RSD / RSE $\leq 20\%$ $\cdot Y^2$ $R^2 \leq 30\%$
IV.	Continuing calibration/ISC / <u>File salt</u>	A	$D \leq 30 / 30\%$
V.	Laboratory Blanks	W	
V.I	Field blanks	W	EB = 7. PB = 8
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples / <u>LCS</u>	A	LCS, LCS (NRK)
IX.	Field duplicates	W	D = 1+2, 3+4, 5+6
X.	Internal Standards	A	
XI.	Target analyte quantitation	N	
XII.	Target analyte identification	R N	
XIII.	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	MW-13	24C0142-01	Water	03/21/24
2	DUP-6-032124	24C0142-02	Water	03/21/24
3	MW-16	24C0142-03	Water	03/21/24
4	DUP-7-032124	24C0142-04	Water	03/21/24
5	MW-7	24C0142-05	Water	03/21/24
6	DUP-8-032124	24C0142-06	Water	03/21/24
7	EB-9-032124	24C0142-07	Water	03/21/24
8	FB-9-032124	24C0142-08	Water	03/21/24
9				
10				
11				
12				

Notes:

<u>B5C0363</u>					

VALIDATION FINDINGS WORKSHEET
Blanks

Method: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Draft Method 1633

Blank extraction date: 3/26/24
Conc. units: ng/L

Associated Samples: A11

Analyte	Blank ID	Sample Identification								
		(5x)	1	2	3	4	5	6	7	8
PF ₆ A	0.256	1.28			0.25/0.36U	0.27/0.36U	0.25/0.36U	0.25/0.35U	0.24/0.3TU	0.26/0.3TU
PF ₆ S	0.0956	0.4T8	0.33/0.3TU	0.35/0.3TU	0.13/0.36U	0.13/0.36U	0.094/0.36U	0.1/0.35U	0.071/0.3TU	0.07P/0.3TU

Blank extraction date: _____
Conc. units: _____

Associated Samples: _____

Analyte	Blank ID	Sample Identification								

VALIDATION FINDINGS WORKSHEET Field Blanks

METHOD: LC/MS/MS and Isotope Dilution Compliant with Table B-24 of DoD QSM 5.4/EPA Method 1633

Y **N** **N/A** Were field blanks identified in this SDG?
 Y **N** **N/A** Were target compounds detected in the field blanks?

Blank units: NS/K **Associated sample units:** NS/L

Sampling date: 3/21/24

Field blank type: (circle one) Trip Blank / Field Blank / Rinsate / Other: _____ **Associated Samples:** 1-6

Compound	Blank ID	Bk ID	Sample Identification							
			(5x)	1	2	3	4	5	6	
	T (24)	8 (FB)	(5x)							
PFBA	0.37	0.29	1.85							
PFOA	0.24	0.26	1.3			0.25/0.36U	0.27/0.36U	0.25/0.36U	0.25/0.35U	
PFOs	0.071	0.072	0.36	0.32/0.37U	0.35/0.37U	0.13/0.36U	0.13/0.36U	0.094/0.36U	0.11/0.35U	

Blank units: _____ **Associated sample units:** _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ **Associated Samples:** _____

Compound	Blank ID	Sample Identification								

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: LC/MS PFAS (EPA Method 1633)

Compound	Concentration (ng/L)		RPD
	1	2	
PFBA	11	9.6	14
PFPeA	12	12	0
PFHxA	7.5	6.5	14
PFHpA	2.4	2.3	4
PFOA	1.9	2.0	5
PFBS	1.2	1.2	0
PFPeS	0.23	0.21	9
PFHxS	0.96	0.94	2
PFOS	0.32	0.35	9

Compound	Concentration (ng/L)		RPD
	3	4	
PFBA	4.7	4.9	4
PFPeA	7.3	7.6	4
PFOA	0.25	0.27	8
PFOS	0.13	0.13	0

Compound	Concentration (ng/L)		RPD
	5	6	
PFBA	4.0	4.1	2
PFPeA	6.0	5.3	12
PFOA	0.25	0.25	0
PFOS	0.094	0.11	16

