



E X T E R N A L M E M O R A N D U M

DATE: April 11, 2019
PROJECT: 1709950.000
SUBJECT: Residual Per- and Polyfluorinated Alkyl Substances (PFAS) measured on the surface of Lion Apparel branded turnout coat

To understand the presence of PFAS on the surface of the outer shell of Lion branded turnout gear, a screening assessment was initiated. One exemplar, a V-Force Coat¹ was supplied for evaluation.

Sampling

Using a wipe sampling method, three (3) 100-cm² areas on the outside shell of the coat were marked and sampled as follows:

- Each of the areas marked for wiping were gently wiped with a clean gauze² moistened with deionized (DI) water to remove any dust from storage.
- Using a glass dropper, approximately 2 mL methanol was applied to each wipe in preparation of wiping.
- Using the National Institute of Occupational Health (NIOSH) 9100 wiping technique of 3 “s” stroke in 3 different directions, the 100-cm² designated sample area was wiped.
- After appropriate wiping of the designated area, the wipe was placed in a laboratory provided PFAS-free sample container.
- Including a blank wipe also wetted with methanol, the four samples were submitted to AXYS-SGS (AXYS) laboratory for PFAS analysis. The blank wipe sample (Wipe 1) served as a quality control marker for any PFAS that may be present on the wipe or in the methanol used, enabling appropriate accounting of any result obtained in the test wipe samples (Wipe 2, Wipe 3, and Wipe 4).

¹ REQ: 391953; MFG Date: 12/2018; Cut: 17183500029; Model: CVBM; Size: 42323XI; Photo documentation of the exemplar product and sampling is appended.

² Johnson and Johnson - Band-Aid Brand Sterile Gauze Pads, Medium, 10.

Laboratory Analysis

Laboratories with PFAS analytical capabilities generally apply their established methods developed for solid materials (e.g., soil, sediments, etc.) to PFAS extraction and analysis of consumer products. AXYS applied the extraction procedures described in their method MLA-110 R07.³ The laboratory sample handling is briefly described:

- Each wipe sample was removed from the sample container using clean, solvent rinsed forceps and placed in an extraction vessel. The entire wipe sample was extracted.
- To ensure accurate analysis, the sample container was rinsed with extraction solvent, and the rinsate was added to the extraction vessel containing the wipe.
- A quantification standard was added to each sample.
- The sample was extracted as per method MLA-110 R07 three (3) times.
- Following extraction steps, the extracts were assessed using liquid chromatography tandem mass spectrometry (LC-MS-MS) as detailed in the MLA-110 R07 method description.

PFAS Sample Results

Table 1 lists the individual PFAS detected in the extracts of the wipes used on the coat outer shell and in the blank sample. Appended tables 2 and 3 provide the complete list of PFAS analytes assessed and acronym definitions, respectively.

Table 1. Individual PFAS measured in wipe samples. Non-detects (ND) are presented with the reporting limit in parenthesis (i.e. the lowest calibration level).

Sample Name	Wipe 1*	Wipe 2	Wipe 3	Wipe 4
Wipe location	blank	sleeve right side	pocket right side	upper chest left side
UNITS	(ng/wipe)	(ng/wipe)	(ng/wipe)	(ng/wipe)
PFHxA	ND (0.410)	0.912	1.41	0.802
PFHpA	ND (0.410)	ND (0.410)	0.482	ND (0.410)
PFOA	0.799	0.592	0.736	0.585
PFDA	0.629	ND (0.400)	0.495	ND (0.400)

*Wipe 1 refers to the blank wipe wetted with methanol and not wiped across the outer shell.

The results are summarized as follows:

- The three wipe samples were collected from the right-side sleeve, right-side pocket, and left-side upper chest areas of the exemplar coat. Only the outer

³ The method (SUMMARY OF SGS AXYS METHOD MLA-110 REV. 01 VER. 08) as provided by the laboratory are available for review.

shell was sampled. The resulting concentrations are reported in a mass ng/wipe. Note that an area of approximately 100 cm² on the coat was wiped, so concentrations per area would be ng/100cm². However, there are no thresholds or standards for these compounds on the surface of commercial products, the concentrations are reported as determined by the laboratory.

- Two to four individual PFAS were measured in all samples. The detected compounds included PFHxA, PFHpA, PFOA, and PFDA.
- The results indicate that the blank wipe sample contained PFOA and PFDA at higher concentrations than measured in the coat samples. As a result, the concentrations of PFOA and PFDA measured in the sample wipes (Wipe 2, Wipe 3 and Wipe 4) are likely a result of the background concentrations observed in the blank wipe.
- The results however indicated the presence of PFHxA and PFHpA on the outer shell. PFHxA was measured in all wipe samples. PFHpA was detected in one sample, Wipe 2, from the right-side pocket.

Summary

Even though only one coat was sampled, the results indicate the presence of very low concentrations of PFAS on the outer shell of the coat. PFOA was detected in the three coat samples but at concentrations less than that found in the blank wipe sample. Thus, the PFOA found is likely from background concentrations and not from the surface of the coat's outer shell.

It is important to note that no information was provided regarding previous storage of the product provided, and the sample was shipped in a cardboard box without additional protective wrapping. As a result, we are unable to conclusively document whether the PFAS that were detected came from chemical treatment of the product or from other sources. PFAS has been used in the treatment of paper and cardboard products; however without testing, it is unknown whether the cardboard box used for shipping contributed to the presence of PFAS observed.

Although conclusions from this analysis are limited by the fact that only one exemplar was evaluated, the data indicate that several PFAS were present at extremely low levels. The concentrations would likely have been even lower if, for example, water, rather than methanol, was used as the solvent for wiping.

The methodology, results, and associated discussion presented in this memorandum are intended for the use of Thompson Hine and Lion Apparel to assist their decision-making regarding the potential presence of PFAS on or in Lion branded turnout gear. Proper application of this report requires recognition and understanding of the limitations of the scope, sample size, and methodology of the assessment.

Table 2. Individual PFAS analytes and associated concentrations measured in wipes used on the outer shell of coat. Non-detects (ND) is presented with the reporting limit in parenthesis (i.e. the lowest calibration level).

Sample Name UNITS	Wipe 1* (ng/wipe)	Wipe 2 (ng/wipe)	Wipe 3 (ng/wipe)	Wipe 4 (ng/wipe)
PFBA	ND (1.64)	ND (1.64)	ND (1.64)	ND (1.64)
PFPeA	ND (0.820)	ND (0.820)	ND (0.820)	ND (0.820)
PFHxA	ND (0.410)	0.912	1.41	0.802
PFHpA	ND (0.410)	ND (0.410)	0.482	ND (0.410)
PFOA	0.799	0.592	0.736	0.585
PFNA	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.400)
PFDA	0.629	ND (0.400)	0.495	ND (0.400)
PFUnA	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.400)
PFDoA	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.400)
PFTTrDA	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.400)
PFTeDA	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.400)
PFBS	ND (0.410)	ND (0.410)	ND (0.410)	ND (0.410)
PFPeS	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.380)
PFHxS	ND (0.410)	ND (0.410)	ND (0.410)	ND (0.410)
PFHpS	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.380)
PFOS	ND (0.410)	ND (0.410)	ND (0.410)	ND (0.410)
PFNS	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.380)
PFDS	ND (0.410)	ND (0.410)	ND (0.410)	ND (0.410)
PFDoS	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.380)
4:2 FTS	ND (1.60)	ND (1.60)	ND (1.60)	ND (1.60)
6:2 FTS	ND (1.44)	ND (1.44)	ND (1.44)	ND (1.44)
8:2 FTS	ND (1.60)	ND (1.60)	ND (1.60)	ND (1.60)
PFOSA	ND (0.410)	ND (0.410)	ND (0.410)	ND (0.410)
N-MeFOSA	ND (0.460)	ND (0.460)	ND (0.460)	ND (0.460)
N-EtFOSA	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
MeFOSAA	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.400)
EtFOSAA	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.400)
N-MeFOSE	ND (4.08)	ND (4.08)	ND (4.08)	ND (4.08)
N-EtFOSE	ND (3.06)	ND (3.06)	ND (3.06)	ND (3.06)

Table 3. List of PFAS analyzed and reported

Acronym	Definition	Formula
PFBA	Perfluorobutanoic acid	C3F7COOH
PFPeA	Perfluoropentanoic acid	C4F9COOH
PFHxA	Perfluorohexanoic acid	C5F11COOH
PFHpA	Perfluoroheptanoic acid	C6F13COOH
PFOA	Perfluorooctanoic acid	C7F15COOH
PFNA	Perfluorononanoic acid	C8F17COOH
PFDA	Perfluorodecanoic acid	C9F19COOH
PFUnA	Perfluoroundecanoic acid	C10F21COOH
PFDoA	Perfluorododecanoic acid	C11F23COOH
PFTTrDA	Perfluorotridecanoic acid	C12F25COOH
PFTeDA	Perfluorotetradecanoic acid	C13F27COOH
PFBS	Perfluorobutane sulfonic acid	C4F9SO3H
PFPeS	Perfluoropentane sulfonic acid	C5F11SO3H
PFHxS	Perfluorohexane sulfonic acid	C6F13SO3H
PFHpS	Perfluoroheptane sulfonic acid	C7F15SO3H
PFOS	Perfluorooctane sulfonic acid	C8F17SO3H
PFNS	Perfluorononane sulfonic acid	C9F19SO3H
PFDS	Perfluorodecane sulfonic acid	C10F21SO3H
PFDoS	Perfluorododecane sulfonic acid	C12F25SO3H
4:2 FTS	4:2 Fluorotelomer sulfonic acid	C4F9CH2CH2SO3H
6:2 FTS	6:2 Fluorotelomer sulfonic acid	C6F13CH2CH2SO3H
8:2 FTS	8:2 Fluorotelomer sulfonic acid	C8F17CH2CH2SO3H
PFOSA	Perfluorooctane sulfonamide	C8F17SO2NH2
N-MeFOSA	<i>N</i> -Methyl perfluorooctane sulfonamide	C8F17SO2NH(CH3)
N-EtFOSA	<i>N</i> -Ethyl perfluorooctane sulfonamide	C8F17SO2NH(C2H5) (sulfluramid)
MeFOSAA	<i>N</i> -Ethyl perfluorooctane sulfonamidoacetic acid	C8F17SO2N(C2H5)CH2COOH
EtFOSAA	<i>N</i> -Methyl perfluorooctane sulfonamidoacetic acid	C8F17SO2N(CH3)CH2COOH
N-MeFOSE	<i>N</i> -Methyl perfluorooctane sulfonamidoethanol	C8F17SO2N(CH3)CH2CH2OH
N-EtFOSE	<i>N</i> -Ethyl perfluorooctane sulfonamidoethanol	C8F17SO2N(C2H5)CH2CH2OH