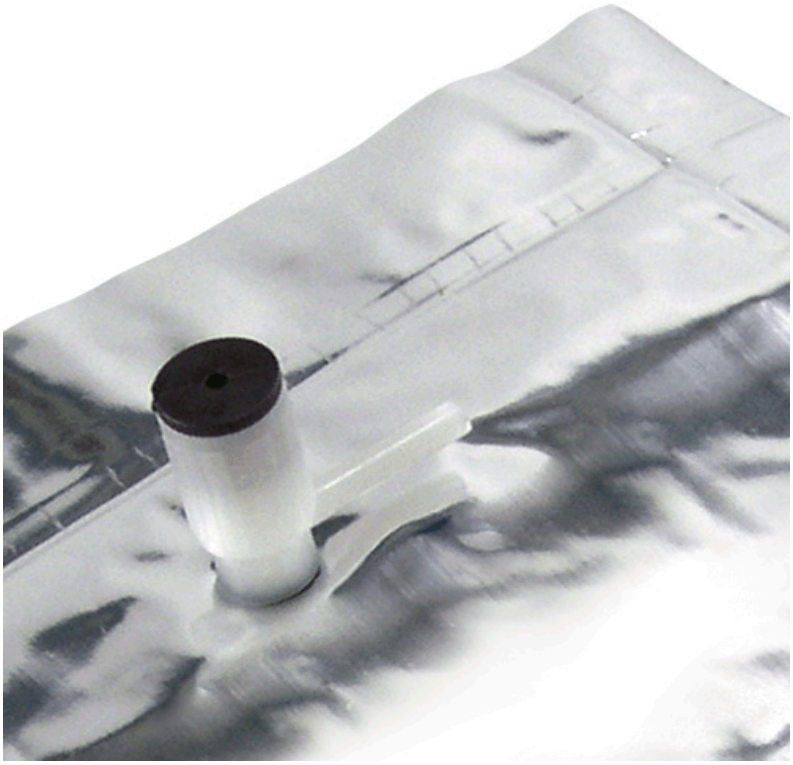
ANALYT MESSTECHNIK



TECHNICAL NOTE

SKC Sample Bags

How well four sample bag films hold VOCs, sulphur compounds and low-molecular-weight gases over two days, what background they add, and which film to choose: FlexFoil PLUS, Tedlar, SamplePro FlexFilm and FluoroFilm FEP.

AMTC-TN-0007

About this note

A sample bag is only as good as its film. Some compounds slowly disappear into or through the bag wall, and some films release compounds of their own that end up in the sample. This note gives the results of a laboratory study by SKC that measured both effects for four bag films over two days of storage:

- **SKC FlexFoil® PLUS** — a specially cleaned four-ply foil;
- **SKC Tedlar®** — a long-established sample bag film;
- **SamplePro® FlexFilm** and **FluoroFilm FEP**, the two other films in the study.

The test compounds cover three groups: 32 volatile organic compounds (VOCs), 20 sulphur compounds at ppb level, and eight low-molecular-weight gases from ammonia to sulphur hexafluoride. Choosing a bag film (p. 5) sums up which film suits which compounds; How the bags were tested (p. 7) and Test results (p. 8) give the method and every measured value.

The note is written for occupational hygienists, environmental laboratories and anyone who collects grab samples in bags — for odour complaints, landfill gas, compounds too volatile for sorbent tubes, or calibration standards for direct-reading instruments and gas chromatographs.

How to read the tables

% recovery	Share of the test concentration still found in the bag on the day of analysis. A higher value means more of the compound was still found.
Day 1, Day 2	Analysis one and two days after the bag was filled.
*	Blank corrected: the film's own background was subtracted.
ND	Not detected.
—	Not tested.

How this note marks information

NOTICE

Practices not related to personal injury — damage to the product, the process or the sample.

Document information

Title	SKC Sample Bags — Technical note
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Revision	Rev. 2 — October 2026
Applies to	SKC FlexFoil PLUS and SKC Tedlar sample bags
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Manufacturer	SKC Inc.

Revision history

Rev.	Date	Change
2	October 2026	Quality programme: new document type, number and identity pages.
1	October 2026	First issue.

The results apply to the test conditions described in this note. Your own compounds, concentrations, humidity and storage conditions can give different results; validate the bag for critical applications.

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CHAPTER 1

Choosing a bag film

No film suits every compound. The right bag depends on what you sample, at what concentration, and how long the sample waits before analysis. Table 1-1 sums up the test results by compound group; the measured values are in Test results (p. 8).

Table 1-1. Results at a glance (storage up to two days)

Compounds	FlexFoil PLUS	Tedlar	SamplePro FlexFilm	FluoroFilm FEP
VOCs	Good	Good	Good	Negligible background; 11 of 32 below 80 % on day 2
Hydrogen sulphide, carbonyl sulphide, mercaptans	Best: low background; H_2S, COS, methyl, ethyl, isopropyl and tert-butyl mercaptan at 97.8–108 % on day 2	Not tested	Not for ppb levels: H_2S, COS and methyl mercaptan background	Lowest background; 48–78 % on day 2
Sulphides, disulphides, thiophenes	Poor: 0–44 % on day 2 for 8 of 11; the other three 54–74 %	Not tested	Moderate: 54–90 % on day 2	Moderate on day 1, falls by day 2
CO, CO_2, methane	Good	Good	Good	Down to 50–72 % on day 2
Hydrogen	Good	Not tested	Not tested	Not tested
Sulphur hexafluoride	Good	Good	Good	Good
Sulphur dioxide	Not retained	67 % on day 2	67 % on day 2	Not retained on day 2
Ammonia	Poor	Poor	Poor	Poor
Nitrogen dioxide	Not suitable	Not suitable	Not suitable	Not tested

VOCs

FlexFoil PLUS, Tedlar and SamplePro FlexFilm all held the 32 test VOCs well over two days and are the films to choose for VOC sampling. FlexFoil PLUS and FlexFilm add little: their total VOC background is in the mid-ppb range or lower. FluoroFilm FEP adds almost nothing, but by the second day 11 of the 32 compounds were below 80 %, down to 42 % for acetonitrile.

Sulphur compounds

For sulphur compounds at ppb level, FlexFoil PLUS is the film to choose for **hydrogen sulphide, carbonyl sulphide and the light mercaptans**: it has a low background and gave the best overall stability for H_2S and COS. It is not a film for every sulphur compound, though: it held **sulphides, disulphides and thiophenes** poorly, tetrahydrothiophene not at all. For these, check the values in Table 3-2 (p. 10) against your hold time before you choose a bag. Tedlar was not part of the sulphur tests.

Hold time matters most here. If the sample can be analysed within 24 hours, several films may do; for two days of storage the choice narrows.

NOTICE

SamplePro FlexFilm itself releases hydrogen sulphide, carbonyl sulphide and methyl mercaptan. At ppb levels this is enough to distort the result for the tested sulphur compounds (see Table 3-3 (p. 11)). Do not use SamplePro FlexFilm bags for these compounds at ppb levels.

Low-molecular-weight gases

For **carbon monoxide, carbon dioxide and methane**, FlexFoil PLUS, Tedlar and SamplePro FlexFilm held the gas well for two days. FlexFoil PLUS is the choice for **hydrogen**, the only film tested with it, and it kept the full concentration for two days. **Sulphur hexafluoride** stayed stable in all four films.

Three gases are difficult in every bag tested. **Ammonia** fell to 8–37 % by day 2 in all four films. **Sulphur dioxide** was lost completely in FlexFoil PLUS and, by day 2, in FluoroFilm FEP; Tedlar and FlexFilm kept 67 %. **Nitrogen dioxide** is covered by the caution below.

NOTICE

Nitrogen dioxide does not keep in any of the films tested: FlexFoil PLUS and SamplePro FlexFilm lost it within two days, and Tedlar kept only about a third. Do not rely on any of these films for nitrogen dioxide.

NOTICE

FluoroFilm FEP bags hold many compounds poorly by the second day — VOCs, sulphur compounds, CO, CO_2 and methane. If you use them, analyse the sample as soon as possible.

CHAPTER 2

How the bags were tested

Every test used 1 L bags of each film with a single polypropylene fitting, filled with a known concentration of the test compounds and analysed after storage. VOCs and gases were also analysed on the day of filling (day 0); this note gives the results for day 1 and day 2. A film is judged on two results: how much of the compound stays in the bag (stability) and what the film adds to the sample (background).

VOCs

SKC's laboratory tested 32 VOCs from the main compound classes: aromatic and aliphatic hydrocarbons, chlorinated hydrocarbons, ketones, acetates and alcohols, in all four films.

- Bags filled with nitrogen, then a known volume of each compound injected: 200 to 300 ppm depending on the compound; equilibration 20 to 30 minutes.
- Analysis on day 0, day 1 and day 2: 100 µL of gas withdrawn from the bag and injected directly into a gas chromatograph with flame ionisation detector (GC-FID).

Sulphur compounds

An external laboratory, Air Toxics Inc., tested 20 sulphur compounds in three films: SamplePro FlexFilm, FlexFoil PLUS and FluoroFilm FEP. Because bag sampling of sulphur compounds is mainly an environmental application, the test level was low: 90 ppb of each compound.

- Bags filled from a certified cylinder of the 20 sulphur compounds in nitrogen; equilibration about 2 hours.
- Analysis on day 1 and day 2 to ASTM D5504: gas chromatograph with sulphur chemiluminescence detector (SCD), sample injected directly through a fixed 2.0 mL sampling loop.

Low-molecular-weight gases

SKC filled each bag with one gas from a certified cylinder (hydrogen from a 2 % mixture in air), let it equilibrate for 20 to 30 minutes and analysed it on day 0, day 1 and day 2, as Table 2-1 sets out.

Table 2-1. Test gases, concentrations and analysis

Gas	Test concentration	Analysis
Ammonia (NH_3)	50 ppm	Dräger colour detector tube
Carbon monoxide (CO)	50 ppm	Dräger colour detector tube
Carbon dioxide (CO_2)	1000 ppm	Dräger colour detector tube
Hydrogen (H_2)	2 %	Dräger colour detector tube
Methane (CH_4)	5000 ppm	GC-FID, 100 µL injected
Nitrogen dioxide (NO_2)	10 ppm	Dräger colour detector tube
Sulphur hexafluoride (SF_6)	1 ppm	Gas chromatograph with electron capture detector (GC-ECD)
Sulphur dioxide (SO_2)	20 ppm	Dräger colour detector tube

Not every gas was tested in every film: hydrogen only in FlexFoil PLUS, nitrogen dioxide not in FluoroFilm FEP.

CHAPTER 3

Test results

All values are percent recovery after one and two days of storage, except Table 3-3, which gives the film's own sulphur background in ppb. The films appear in the same order throughout: the two standard films first, then the two comparison films. About this note (p. 2) explains the symbols.

VOCs

FlexFoil PLUS, Tedlar and SamplePro FlexFilm kept most of the 32 VOCs close to their test concentration for two days. The total VOC background of FlexFoil PLUS and FlexFilm was in the mid-ppb range or lower; the VOC background of Tedlar was not measured in this study. FluoroFilm FEP had a negligible VOC background, but after two days many values had fallen — eleven below 80 %. Acetonitrile was the hardest compound to keep for every film except FlexFoil PLUS.

Table 3-1. Stability of 32 VOCs in four bag films, % recovery

	FlexFoil PLUS		Tedlar		SamplePro FlexFilm		FluoroFilm FEP	
Compound	Day 1	Day 2	Day 1	Day 2	Day 1	Day 2	Day 1	Day 2
Acetone	99.0	97.8	99.0	95.0	96.7	88.9	89.0	85.0
Acetonitrile	94.2	84.5	74.0	66.0	69.0	55.1	65.0	42.0
Acrylonitrile	98.2	99.5	90.0	80.0	76.1	62.2	77.0	59.0
Allyl chloride	98.5	95.6	102.0	94.0	95.6	91.9	92.0	89.0
Benzene	93.1	98.2	104.0	98.0	96.0	95.2	93.0	79.0
Bromoethane	95.2	98.0	99.0	100.0	95.2	90.9	88.0	86.0
1,3-Butadiene	89.0	92.0	99.0	95.0	80.0	86.0	84.0	73.0
Butane	86.0	88.0	98.0	94.0	91.0	96.0	94.0	94.0
Butyl acetate	88.1	88.7	104.0	102.0	85.1	91.8	72.0	66.0
Carbon tetrachloride	99.1	95.0	104.0	102.0	101.0	94.3	95.0	91.0
Chloroform	96.2	97.1	98.0	95.0	98.7	95.9	96.0	93.0
1,2-Dichloroethane	92.0	88.0	100.0	97.0	91.5	82.9	89.0	79.0
Dichloropropane	99.3	98.5	105.0	101.0	86.2	76.7	90.0	86.0
Ethyl acetate	100.0	97.3	98.0	96.0	94.9	95.4	94.0	94.0
Ethylene	108.0	94.0	100.0	102.0	104.0	100.0	99.0	94.0
Heptane	99.2	101.0	100.0	100.0	96.7	106.0	88.0	87.0
Hexane	95.8	99.4	101.0	101.0	99.0	98.9	98.0	95.0
Isooctane	87.5	86.1	100.0	97.0	100.0	97.9	97.0	96.0
Isopropyl alcohol	101.0	100.0	101.0	99.0	99.1	91.7	102.0	98.0
Methyl ethyl ketone (MEK)	96.5	101.0	99.0	98.0	96.2	95.8	90.0	83.0
Methylene chloride	98.7	101.0	102.0	97.0	93.2	87.2	84.0	77.0
Methyl tert-butyl ether (MTBE)	92.0	88.0	101.0	101.0	99.2	99.1	99.0	97.0
Octane	98.4	93.1	100.0	97.0	104.0	98.7	91.0	84.0
Perchloroethylene	85.3	82.4	105.0	94.0	94.8	84.9	81.0	69.0

	FlexFoil PLUS		Tedlar		SamplePro FlexFilm		FluoroFilm FEP	
Compound	Day 1	Day 2	Day 1	Day 2	Day 1	Day 2	Day 1	Day 2
Propylene	98.6	97.9	103.0	104.0	100.0	99.0	97.0	91.0
Propylene oxide	102.0	101.0	96.0	95.0	93.3	90.1	94.0	89.0
Tetrahydrofuran	101.0	99.3	103.0	100.0	96.7	93.6	90.0	88.0
Toluene	90.5	91.5	96.0	92.0	107.0	92.9	81.0	74.0
1,1,1-Trichloroethane	86.5	84.6	104.0	101.0	94.9	93.6	100.0	97.0
Trichloroethylene	93.7	94.6	104.0	103.0	92.4	82.9	80.0	69.0
Vinylidene chloride	98.3	99.5	102.0	100.0	95.6	91.8	96.0	92.0
p-Xylene	97.0	89.0	89.0	83.0	85.9	82.7	76.0	65.0

Sulphur compounds

The 20 sulphur compounds were tested at 90 ppb in three films. FlexFoil PLUS gave the best results for hydrogen sulphide and carbonyl sulphide and kept methyl, ethyl, isopropyl and tert-butyl mercaptan above 90 % for two days. It held the sulphides, disulphides and thiophenes far less well; tetrahydrothiophene was not recovered at all. FluoroFilm FEP had the lowest background of the three films, but every compound was recovered less on day 2 than on day 1, between 36 and 78 %. SamplePro FlexFilm recovered most compounds moderately, but its own background makes it unsuitable at ppb level (see Table 3-3 (p. 11)).

Table 3-2. Stability of 20 sulphur compounds in three bag films, % recovery

	FlexFoil PLUS		SamplePro FlexFilm		FluoroFilm FEP	
Compound	**Day 1**	**Day 2**	**Day 1**	**Day 2**	**Day 1**	**Day 2**
n-Butyl mercaptan	47.8	50.0	69.5	50.0	74.5	60.2
tert-Butyl mercaptan	91.4	98.8	92.5	92.5	86.0	78.0
Carbon disulphide	58.9	54.4	80.0	74.1	58.3*	35.6*
Carbonyl sulphide	98.9*	108.0*	126.0*	135.0*	82.9*	71.2*
Diethyl disulphide	11.1	12.2	68.2	54.1	62.9	49.5
Diethyl sulphide	25.6	13.3	88.2	83.9	78.0	66.0
Dimethyl disulphide	42.2	44.4	77.3	69.3	74.0	62.0
Dimethyl sulphide	81.4	74.4	90.9	89.8	77.0	69.0
2,5-Dimethylthiophene	14.0	15.5	68.6	54.7	60.0	45.3
Ethyl mercaptan	92.1	97.8	81.3	76.9	78.0	65.0
Ethyl methyl sulphide	52.2	40.0	88.2	83.9	77.0	68.0
2-Ethylthiophene	17.8	17.8	72.2	60.0	65.0	53.0
Hydrogen sulphide	104.4	102.0	7.8*	2.2*	72.2	47.8
Isobutyl mercaptan	62.2	64.4	81.3	69.2	83.0	67.0
Isopropyl mercaptan	92.9	98.8	89.2	86.0	84.0	74.0
Methyl mercaptan	93.4	102.0	78.9*	67.8*	74.0	57.0
3-Methylthiophene	32.0	32.0	75.9	65.5	67.0	53.0
n-Propyl mercaptan	77.8	82.2	80.0	70.0	79.0	66.0
Tetrahydrothiophene	0.0	0.0	79.6	70.45	71.0	56.0
Thiophene	61.1	62.2	81.6	75.9	76.0	64.0

* Blank corrected.

Table 3-3. Sulphur background of three bag films, ppb

	FlexFoil PLUS		SamplePro FlexFilm		FluoroFilm FEP	
Compound	**Day 1**	**Day 2**	**Day 1**	**Day 2**	**Day 1**	**Day 2**
n-Butyl mercaptan	ND	ND	ND	ND	ND	ND
tert-Butyl mercaptan	ND	ND	ND	ND	ND	ND
Carbon disulphide	ND	ND	ND	ND	6.5	9
Carbonyl sulphide	11	13	46	68	4.4	5.9
Diethyl disulphide	ND	ND	ND	ND	ND	ND
Diethyl sulphide	ND	ND	ND	ND	ND	ND
Dimethyl disulphide	ND	ND	ND	ND	ND	ND
Dimethyl sulphide	ND	ND	ND	ND	ND	ND
2,5-Dimethylthiophene	ND	ND	ND	ND	ND	ND
Ethyl mercaptan	ND	ND	ND	ND	ND	ND
Ethyl methyl sulphide	ND	ND	ND	ND	ND	ND
2-Ethylthiophene	ND	ND	ND	ND	ND	ND
Hydrogen sulphide	ND	ND	20	22	ND	ND
Isobutyl mercaptan	ND	ND	ND	ND	ND	ND
Isopropyl mercaptan	ND	ND	ND	ND	ND	ND
Methyl mercaptan	ND	ND	9	14	ND	ND
3-Methylthiophene	ND	ND	ND	ND	ND	ND
n-Propyl mercaptan	ND	ND	ND	ND	ND	ND
Tetrahydrothiophene	ND	ND	ND	ND	ND	ND
Thiophene	ND	ND	ND	ND	ND	ND

SamplePro FlexFilm released hydrogen sulphide, methyl mercaptan and, at the highest level, carbonyl sulphide — up to 68 ppb by day 2, about three quarters of the 90 ppb test level. FlexFoil PLUS showed only a little carbonyl sulphide; FluoroFilm FEP had the lowest background of the three.

Low-molecular-weight gases

Carbon monoxide, carbon dioxide and methane stayed at or near their test concentration for two days in FlexFoil PLUS, Tedlar and SamplePro FlexFilm; in FluoroFilm FEP they fell to between 50 and 72 %. FlexFoil PLUS kept hydrogen at 100 % for two days. Sulphur hexafluoride was stable in every film. Ammonia, nitrogen dioxide and sulphur dioxide were the difficult gases, as Low-molecular-weight gases (p. 6) in Chapter 1 explains.

Table 3-4. Stability of low-molecular-weight gases in four bag films, % recovery

	FlexFoil PLUS		Tedlar		SamplePro FlexFilm		FluoroFilm FEP	
Compound	**Day 1**	**Day 2**	**Day 1**	**Day 2**	**Day 1**	**Day 2**	**Day 1**	**Day 2**
Ammonia (NH_3)	16.0	8.0	62.0	37.0	18.0	10.0	59.0	28.0
Carbon monoxide (CO)	100.0	100.0	90.0	90.0	100.0	100.0	90.0	50.0
Carbon dioxide (CO_2)	99.0	100.0	100.0	100.0	100.0	90.0	90.0	50.0
Hydrogen (H_2)	100.0	100.0	—	—	—	—	—	—
Methane (CH_4)	99.0	100.0	101.0	99.0	96.0	92.0	84.0	72.0
Nitrogen dioxide (NO_2)	0.0	0.0	54.5	36.4	9.75	0.0	—	—
Sulphur hexafluoride (SF_6)	98.1	93.2	94.7	93.2	104.0	99.8	96.4	92.8
Sulphur dioxide (SO_2)	0.0	0.0	80.0	67.0	80.0	67.0	33.0	0.0

CHAPTER 4

Ordering information

Order from Analyt-MTC with the order codes.

The films and their bags

Film	Bags
SKC FlexFoil PLUS	Sample bags with a single polypropylene fitting (252-…) or a single stainless steel fitting (253-…), 1–50 L
SKC Tedlar	Sample bags with a single polypropylene fitting (232-…), 0.5–100 L, or dual stainless steel fittings (231-…), 1–100 L
SamplePro FlexFilm	As custom bags and breath-gas bags; ask Analyt-MTC
FluoroFilm FEP	Included in the study for comparison

CHAPTER 5

Contacts

Contact and support

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Sample bags and advice

Contact Analyt-MTC to order sample bags, fittings and replacement septa, and for advice on the right film for your compounds. Have at hand:

- the compounds and the concentration range you expect;
- how long the samples will be stored before analysis;
- the bag size and fitting you need — for example 252-01 (FlexFoil PLUS) or 232-01 (Tedlar), 1 L with polypropylene fitting.

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