Metropolitan Museum of Art
Gas Chromatography- Mass Spectrometry (GC-MS) Results from Material Analysis

This document includes (1) a mass spectrum and (2) the volatile organic compounds (VOCs) emitted from samples using GC-MS analysis. The data is not interpreted; however, several classes of chemicals are highlighted because they are potential risks for artwork in an enclosed environment. A basic key, provided below, indicates those classes. The amount of each chemical identified has not been determined; similarly, it is not known how much of each chemical is necessary to do damage to art. Finally, peaks may be present that are the result of the sample adsorbing chemicals from the air and reemitting them during testing rather than being inherent to the sample. Research is ongoing to determine specifically which chemicals and amounts are required to negatively affect artifacts.

Highlighted data:

Pink – chemicals currently known to be hazardous to art

Green – amines; can raise the pH, are suspected to react with acids and may form crystals in an enclosed environment

Yellow – chemicals of the following type, which *may* be hazardous to art:

Acids – lower the pH, corrosive to metals, degrade organic materials

Aldehydes – can convert to acids with heat or exposure to UV light

Esters – can hydrolyze into acids with heat and humidity

Sulfur-containing compounds – known to tarnish and corrode some metals

Halogenated compounds – can become reactive with exposure to heat and UV light

Nitrogen-containing, not amine – can react with other off-gassed chemicals

Alkynes – can become reactive when exposed to heat or UV light

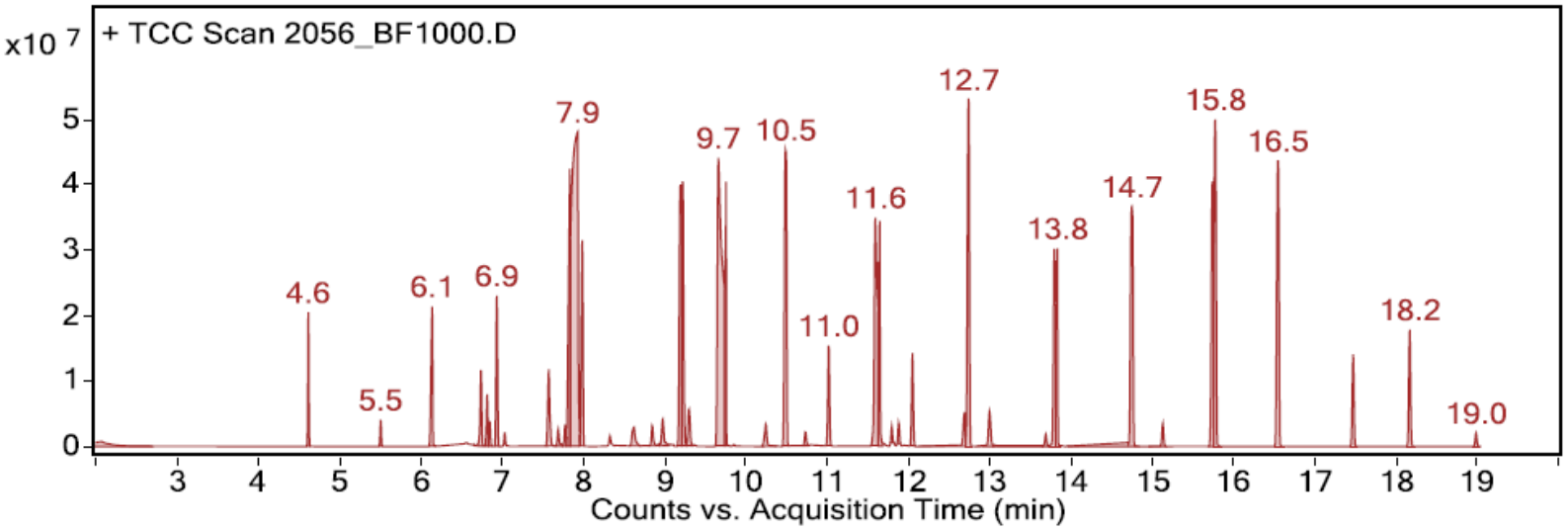
Sample: Rogers Corporation Bisco BF-1000 white ultra soft foamed silicone with PSA

Oddy test result: Temporary

Date GC-MS collected: 03/09/2018

Technique used: SPME Arrow with a PDMS/DVB fiber; Agilent 7890B GC and 5977B MS fitted with a GL Sciences OPTIC-4 multimode inlet and LEAP PAL RTC autosampler; Pre-heated sample at 60°C for 20 minutes; fiber exposure to sample at 60°C for 20 minutes; fiber injected into 220°C inlet and cryotrapped for 2 min at -15°C; GC ramped from 40°C to 225 °C at 10°C/min. Data analyzed in Masshunter Qualitative. Samples > 80% match with a NIST library are reported.

VOCs not highlighted are because they were also observed in blanks: (1) 12.7 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Library results

RT	Score	Formula	MW	Area	CAS #	Name
2.100	94.2	C3H10OSi	90.1	10686668	1066-40-6	Silanol, trimethyl-
5.500	93.5	C8H24O2Si3	236.1	4055440	107-51-7	Trisiloxane, octamethyl-
6.100	80.3	C10H5F17O	464.0	29771304	678-39-7	1H,1H,2H,2H-Perfluorodecan-1-ol
6.600	90.4	C4H10O2	90.1	2569647	110-63-4	1,4-Butanediol
6.700	80.1	C13H28	184.2	2282240	62108-23-0	Decane, 2,5,6-trimethyl-
6.800	97.9	C7H6O	106.0	9247803	100-52-7	Benzaldehyde
6.900	96.3	C8H24O4Si4	296.1	29312579	556-67-2	Cyclotetrasiloxane, octamethyl-
7.000	93.3	C7H14O3	146.1	2261221	763-69-9	Propanoic acid, 3-ethoxy-, ethyl ester
7.700	97.4	C8H18O	130.1	3557226	104-76-7	1-Hexanol, 2-ethyl-
7.800	92.5	C10H16	136.1	2876504	138-86-3	dl-Limonene
8.000	96.4	C10H30O3Si4	310.1	43514480	141-62-8	Tetrasiloxane, decamethyl-
8.300	87.9	C8H8O	120.1	2310374	98-86-2	Ethanone, 1-phenyl-

8.600	92.3	C9H12O	136.1	8111716	617-94-7	Benzenemethanol, .alpha.,.alpha.-dimethyl-
8.800	97.6	C9H18O	142.1	4682126	124-19-6	Nonanal
9.200	91.6	C10H30O5Si5	370.1	93107598	541-02-6	Cyclopentasiloxane, decamethyl-
9.200	82.4	C12H34O4Si4	354.2	41974056	72182-11-7	3-Isopropoxy-1,1,1,5,5,5-hexamethyl-3-(trimethylsiloxy)trisiloxane
9.300	91.0	C8H24O4Si4	296.1	10549351	556-67-2	Cyclotetrasiloxane, octamethyl-
9.700	96.4	C12H36O4Si5	384.1	212856297	141-63-9	Pentasiloxane, dodecamethyl-
10.200	84.8	C12H36O4Si5	384.1	2195548	141-63-9	Pentasiloxane, dodecamethyl-
10.200	92.0	C12H26	170.2	3720084	112-40-3	Dodecane
10.500	98.0	C12H36O4Si5	384.1	87629538	141-63-9	Pentasiloxane, dodecamethyl-
11.600	92.8	C12H36O6Si6	444.1	112733795	540-97-6	Cyclohexasiloxane, dodecamethyl-
11.700	92.9	C13H28	184.2	2356703	629-50-5	Tridecane
12.000	95.6	C14H42O5Si6	458.2	19884616	107-52-8	Hexasiloxane, tetradecamethyl-
12.700	88.4	C12H24O3	216.2	3402867	77-68-9	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester
12.700	96.1	C14H42O5Si6	458.2	68717030	107-52-8	Hexasiloxane, tetradecamethyl-
13.000	85.2	C14H30	198.2	4411803	629-59-4	Tetradecane
13.800	82.5	C14H42O7Si7	518.1	82423005	107-50-6	Cycloheptasiloxane, tetradecamethyl-
15.100	81.1	C18H52O7Si7	576.2	5092330	71579-69-6	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane
15.800	87.7	C16H48O8Si8	592.2	61825984	556-68-3	Cyclooctasiloxane, hexadecamethyl-
17.500	85.9	C18H54O9Si9	666.2	20901142	556-71-8	Cyclononasiloxane, octadecamethyl-
19.000	80.1	C18H54O9Si9	666.2	2998903	556-71-8	Cyclononasiloxane, octadecamethyl-