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

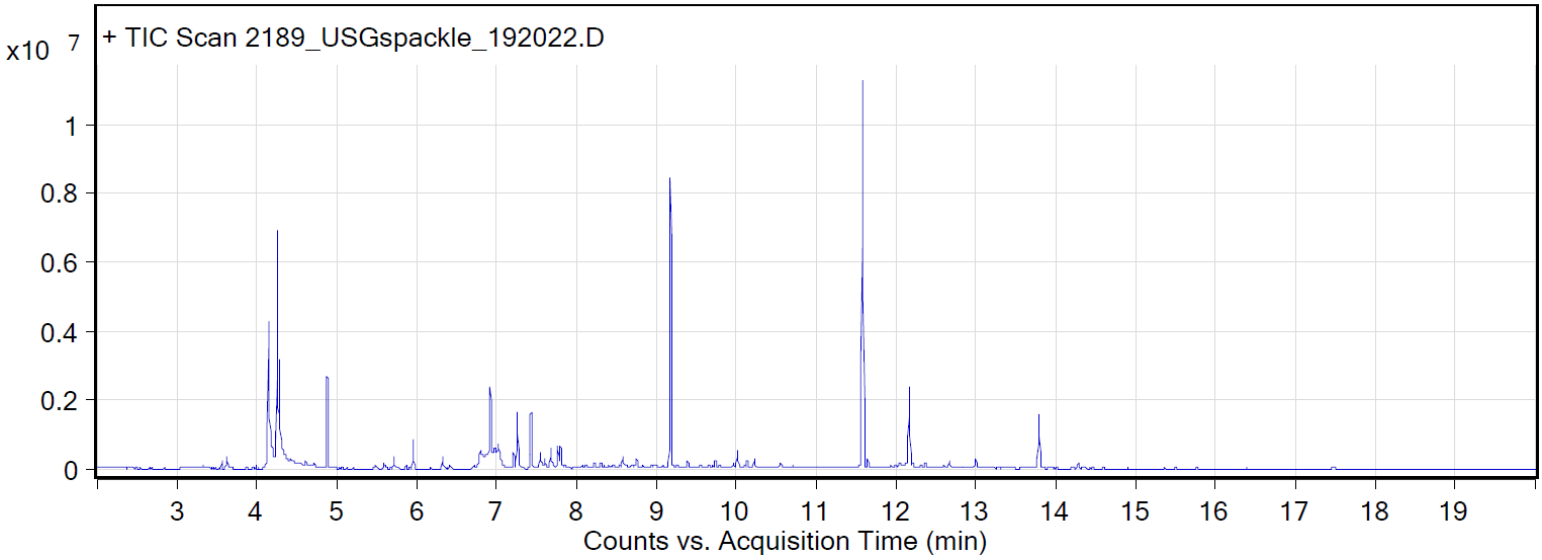
Halogenated compounds – can become reactive with exposure to heat and UV light

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

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

Sample: USG spackle
Oddy test result: Unsuitable
Date collected: 6/26/2018
Technique used: SPME 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 at 60°C for 20 minutes; fiber exposure at 60°C for 20 minutes; sample injected into 220°C inlet and cryo-trapped for 2 min at -15°C; GC ramped from 35°C to 250 °C at 10°C/min. Data analyzed in Masshunter Qualitative Analysis. Deconvoluted data with > 85% match with a NIST 17.0 or Wiley 9 library are reported.

VOCs not highlighted are because they were also observed in blanks: (1) 5.7 min: methoxyphenyl oxime; (2) 12.7 min: 2-methyl-, 3-hydroxyl-2,2,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
3.12	87.01	169614	1,1-Dichloro-1a,2,4,5,6,6a-hexahydro-1H,3H-cycloprop[f]inden-4-yl methanesul...	C11H14Cl2O3S
3.62	97.2	384938	Acetic acid	C2H4O2
4.14	93.61	7343557	Oxazolidine	C3H7NO
4.23	92	875344	Ethanol, 2-(dimethylamino)-	C4H11NO
4.25	96.29	6391029	Oxazolidine, 3-methyl-	C4H9NO
4.28	90.73	1850542	1,2-Propanediol	C3H8O2
4.88	92.49	2098783	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
5.59	97.36	260689	Benzene, 1,4-dimethyl-	C8H10
5.72	85.68	368182	Oxime-, methoxy-phenyl-_	C8H9NO2
5.95	96.93	822462	Ethanol, 2-butoxy-	C6H14O2
6.32	92.89	398900	Ethanol, 2-(2-methoxyethoxy)-	C5H12O3
6.8	85.38	376894	Benzaldehyde	C7H6O
6.91	85.25	349999	Phenol	C6H6O
6.92	96.38	1799633	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
7.21	97.98	491883	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.26	91.17	2001487	Ethanol, 2-(2-ethoxyethoxy)-	C6H14O3
7.43	98.19	1921973	dipropylene glycol monomethyl ether isomer, STRUCTURE UNKNOWN	C7H16O3
7.55	93.87	590331	2-Propanol, 1,1'-oxybis-	C6H14O3
7.68	97.51	728019	1-Hexanol, 2-ethyl-	C8H18O
7.77	96.77	683004	dl-Limonene	C10H16
7.8	90.26	790717	Benzyl Alcohol	C7H8O
8.22	89.53	193433	Octane, 2,6-dimethyl-	C10H22
8.4	85.48	152388	Sulfurous acid, decyl 2-pentyl ester	C15H32O3S
8.75	91.63	469413	Undecane	C11H24
9.18	94.84	9026125	Cyclopentasiloxane, decamethyl-	C10H30O5Si5

10.01	95.97	645105	Ethanol, 2-(2-butoxyethoxy)-	C8H18O3
10.13	95.99	277334	Azulene	C10H8
10.22	89.93	362574	Dodecane	C12H26
11.58	95.96	13792963	Cyclohexasiloxane, dodecamethyl-	C12H36O6Si6
11.64	94.77	341809	Tridecane	C13H28
12.16	94.78	3347506	1,3,5-Triazine-1,3,5(2H,4H,6H)-triethanol	C9H21N3O3
12.67	91.4	290771	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	C12H24O3
13	94.65	404823	Tetradecane	C14H30
14.28	94.96	179845	pentadecane	C15H32