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

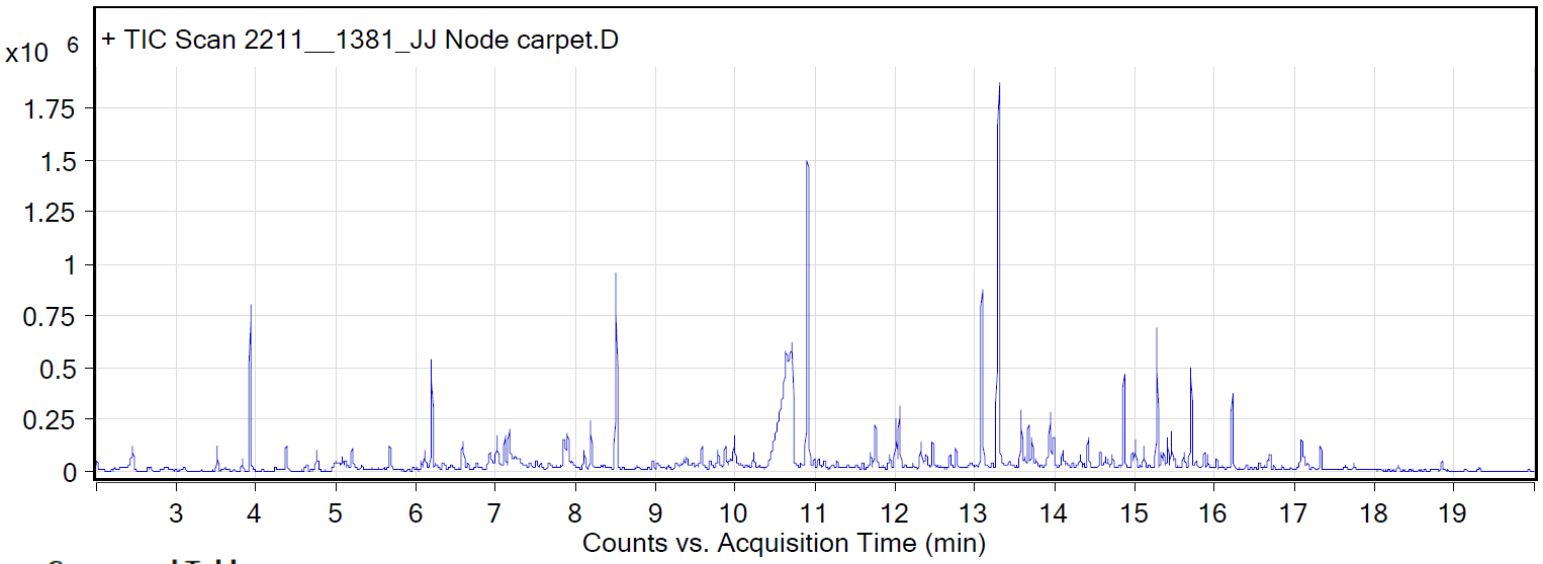
Halogenated compounds – can become reactive with exposure to heat and UV light

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

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

Sample: J&J Transit node carpet
Oddy test result: Temporary
Date collected: 8/15/2016
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) 12.1 min: 2-methyl-, 3-hydroxyl-2,4,4-trimethylpentyl ester propanoic acid



Compound Table

RT	Score (Lib)	Area	Name	Formula
3.51	98.62	117894	Benzene, methyl-	C7H8
3.83	92.5	70682	2,4 PENTADIENAL	C5H6O
3.93	91.19	748497	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
4.38	95.3	169871	2-Pentanone, 4-hydroxy-4-methyl-	C6H12O2
4.76	97.43	161337	o-Xylene	C8H10
5.08	94.62	63925	XYLENE	C8H10
5.2	96.98	141408	Ethanol, 2-butoxy-	C6H14O2
6.11	97.83	120554	Benzaldehyde	C7H6O
6.2	97.16	552509	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
6.25	96.01	45149	Phenol	C6H6O
6.58	94.21	106302	Mesitylene	C9H12
7.02	92.96	220725	1-Hexanol, 2-ethyl-	C8H18O
7.12	97.61	203129	dl-Limonene	C10H16
7.17	96.79	290762	Benzyl Alcohol	C7H8O
7.86	86.82	300592	Cyclotrisiloxane, hexamethyl-	C6H18O3Si3
8.11	88.15	111316	Undecane	C11H24
8.19	97.5	292648	Nonanal	C9H18O
9.39	88.86	72954	Ethanol, 2-[2-(2-butoxyethoxy)ethoxy]-	C10H22O4
9.58	86.57	143673	Dodecane	C12H26
9.99	95.47	181573	Cyclotetrasiloxane, octamethyl-	C8H24O4Si4
10.71	91.28	4406965	Caprolactam	C6H11NO
12.06	92.3	431612	Propanoic acid, 2-methyl-, 3-hydroxy-2,2,4-trimethylpentyl ester	C12H24O3
12.32	93.95	167695	Tetradecane	C14H30
12.39	88.8	105433	5,9-Dimethylundec-1-ene	C13H26
12.47	94.2	181305	Dodecanal	C12H24O
12.76	92.02	121289	2-Methyl-1-undecanol	C12H26O
13.3	97.66	3206984	1-Dodecanol	C12H26O
13.58	94.34	391712	bis(2-Ethylhexyl) ether	C16H34O

14.1	88.99	97504	Benzene, (1-propylheptyl)-	C16H26
14.32	86.98	73707	Benzene, (1-ethyloctyl)-	C16H26
14.42	95.63	164350	n-Tridecan-1-ol	C13H28O
14.57	88.84	69509	PENTAN-1,3-DIOLDIISOBUTYRATE, 2,2,4-TRIMETHYL-	C16H30O4
15.01	88.92	158648	Benzene, (1-butylheptyl)-	C17H28
15.12	89.99	115103	Benzene, (1-propyloctyl)-	C17H28
15.28	96.75	812128	Octane, 1,1'-oxybis-	C16H34O
15.33	85.33	77103	Benzene, (1-ethylnonyl)-	C17H28
15.41	95.6	153890	1-Dodecanol	C12H26O
15.71	94.4	537189	1,2-Cyclohexanedicarboxylic acid, ethyl isobutyl ester	C14H24O4
15.87	86.71	72063	Benzene, (1-pentylheptyl)-	C18H30
15.91	88.24	63127	Benzene, (1-butyloctyl)-	C18H30
18.85	86.57	51968	2-Ethylhexyl methyl isophthalate	C17H24O4