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

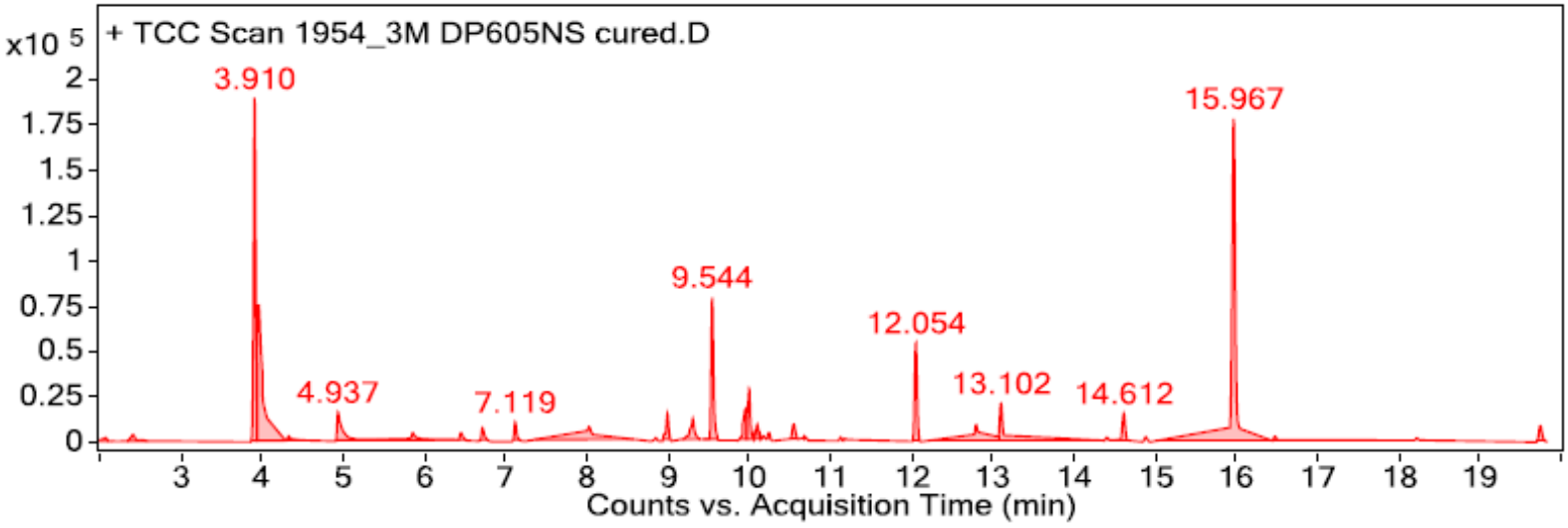
Sample: 3M Scotchweld urethane adhesive DP605NS; off-white; cured

Oddy test result: Temporary

Date collected: 12/22/2017

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 crotrapped 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) 13.1 min: 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester propanoic acid



Library results

RT	Score	Formula	MW	Area	CAS #	Name
2.076	86.1	C6H13NO2	131.1	18654	999037-92-5	N-Acetyl-1-hydroxybutan-2-ylamide
3.910	94.9	C7H8	92.1	463712	108-88-3	Benzene, methyl-
4.331	80.7	C6H12O	100.1	7411	999011-02-8	1-(Vinyloxy)-1-methyl-propane
4.939	89.5	C6H12O2	116.1	74093	123-42-2	2-Pentanone, 4-hydroxy-4-methyl-
5.859	93.4	C7H14O	114.1	14877	111-71-7	Heptanal
7.120	87.1	C16H11NO2S	281.1	24035	70453-75-7	2-methoxy[1]benzothieno[2,3-c]quinolin-6(5H)-one
8.032	86.1	C7H16O	116.1	66220	111-70-6	1-Heptanol
8.851	87.0	C10H12O4	196.1	5843	0-00-0	.alpha.-methoxy-.alpha.-phenylacetone
8.994	96.5	C8H8O2	136.1	40976	93-58-3	Benzoic acid, methyl ester
9.304	97.8	C16H32	224.3	41741	629-73-2	1-Hexadecene
9.546	88.4	C10H30O5Si5	370.1	168421	541-02-6	Cyclopentasiloxane, decamethyl-
10.001	83.6	C12H24O2	200.2	68064	112-17-4	Acetic acid, decyl ester
10.099	84.0	C12H24O2	200.2	23992	112-17-4	Acetic acid, decyl ester
10.546	97.2	C12H26O	186.2	23496	112-53-8	1-Dodecanol
11.180	81.5	C7H10N2O	138.1	8035	129884-35-1	2,3,3a,4,7,7a-Hexahydro-1H-benzimidazol-2-one
12.054	89.1	C12H36O6Si6	444.1	119780	540-97-6	Cyclohexasiloxane, dodecamethyl-
12.792	88.2	C10H18O	154.1	37352	562-74-3	3-Cyclohexen-1-ol, 4-methyl-1-(1-methylethyl)-
13.105	97.1	C12H24O3	216.2	50624	74367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester
15.942	85.6	C14H24N4	248.2	10625	69856-67-3	3,3,5,5,3',3',5',5'-OCTAMETHYL-DI-(.DELTA.'-PYRAZOLINYLIDENE)
15.967	91.7	C16H30O4	286.2	460098	74381-40-1	Propanoic acid, 2-methyl-, 1-(1,1-dimethylethyl)-2-methyl-1,3-propanediyl ester
18.216	87.9	C14H30O3Si2	302.2	7684	999462-17-5	Methyl 5-[3,3-bis(trimethylsilyl)oxiran-2-yl]pentanoate
19.743	90.3	C12H10O2S	218.0	26455	127-63-9	Benzene, 1,1'-sulfonylbis-