Residuals: Supplementary Information

1)

Standard Recovery (GC/MS VOLATILES-WHOLE AIR: 37.784749 °; -122.414129 °)
2013 - 2014
6 Litre SUMMA canister air analysis with 7 day sampling duration
dimensions variable

"IT-VAPORTTIC/Vapor Intrusion List" Gas Chromatography-Mass Spectroscopy analysis performed on air sample taken from location: 37.784749 °; -122.414129 °. 6 litres of air was collected with a 7 day flow rate. Analysis was performed by Galson Laboratories, 6601 Kirkville Road, East Syracuse, NY 13057.

A liquid mixture was prepared from the information resulting from the analysis. This liquid mixture contains the same compounds and relative proportions of those that were detected in the initial air space.

Selected results below (All results meet the AIHA-LAP and NELAC quality control requirements):

Compound detected	CAS number	Abundance: micrograms/ cubic meter	Percentage
Ethanol	64-17-5	22.61	9.922324132
Pentane	109-66-0	6.2	2.720849607
1-Butanol	71-36-3	3.64	1.597402027
Hexanal	66-25-1	15.16	6.652916136
1R-.alpha.-Pinene	7785-70-8	30.09	13.20489753
D-Limonene	138-86-3	6.69	2.935884496
Isopropyl alcohol	67-63-0	24.58	10.78685215
Acetone	67-64-1	47.51	20.84960723
Methyl ethyl ketone	78-93-3	3.24	1.421863343
Ethyl acetate	141-78-6	3.24	1.421863343
Tetrahydrofuran	109-99-9	2.95	1.294597797
Cyclohexane	110-82-7	24.09	10.57181726
Heptane	142-82-5	1.23	0.539781454
Toluene	108-88-3	25.25	11.08087945
Tetrachloroethylene	204-825-9	1.36	0.596831527

Ethyl benzene	100-41-4	1.3	0.570500724
m & p xylene	108-38-3; 106-42-3	3.47	1.522798087
Styrene	100-42-5	2.98	1.307763198
o-Xylene	95-47-6	1.3	0.570500724
1,2,4-Trimethyl-benzene	95-63-6	0.98	0.430069777

SMILES (Simplified Molecular Input Line-Entry System) format of detected compounds in descending order by percentage in overall air space:

CC(=O)C
C\1=C(\[C@@H]2C[C@H](C/1)C2(C)C)C
Cc1ccccc1
CC(O)C
C1CCCCC1
CCO
CCCCCC=O
CC1=CCC(CC1)C(=C)C
CCCCC
CCCCO
Cc1cc(C)ccc1; Cc1ccc(C)cc1
CCC(=O)C
O=C(OCC)C
c1ccccc1C=C
C1CCOC1
Cl/C(Cl)=C(/Cl)Cl
CCc1ccccc1
CC1=C(C)C=CC=C1
CCCCCCC
c1c(ccc(c1C)C)C

Additional information:

All compounds that were present in the initial analysis from Galson Laboratories and that are gases at room temperature have been removed from the above list (ca. 2 compounds, odorless or nearly odorless). In addition, 3 unknown compounds were included in the initial results and have not been included in these results. Based on the relative odor thresholds of the different substances with respect to their quantities, the dominant olfactory compounds within the resulting formulation are likely to be hexanal, alpha-pinene, limonene and toluene. Despite the abundance of hydrocarbons detected, their relatively high odor threshold (the amount needed to register an olfactory perception), make them less of a relative sensory component in the overall formulation. Hexanal, for example has a very low odor threshold (i.e. only a very small amount is needed to trigger an olfactory response) of 4.5 – 5 parts per billion, whereas heptane, which has a similar molecular weight has an odor threshold of 230000 parts per billion. Likewise alcohols and ketones such as acetone (500000 ppb odor threshold) make up a smaller relative proportion of the olfactory profile of the mixture, despite their abundance.

2)

Micro-encapsulated Surface Coating (Encapsulated Contents: Standard Recovery [GC/MS VOLATILES-WHOLE AIR: 37.784749 °; -122.414129 °])
2014
spray-coated micro-encapsulated fragrance/chemical formulation
dimensions variable

The liquid mixture resulting from *Standard Recovery (GC/MS VOLATILES-WHOLE AIR: 37.784749 °; -122.414129 °)* above, was formulated into a microencapsulated (or “scratch and sniff”) emulsion. This emulsion was then spray-coated onto the surfaces (walls, floor, desk, equipment, etc.) of the gallery space using a pressurized paint sprayer.

Additional Information:

The microencapsulation process works by creating an oil in water emulsion of the fragrance material. The primarily oil-soluble fragrance materials form small droplets of approximately 30 microns in diameter. The outer, surface layer of these droplets then go through a chemical process that produces hardened deposits on their surface, which eventually forms a shell-like envelope layer on the outside of each droplet that contains the fragrance contents in an almost egg-like manner. After application to a surface, the fragrance contents can be released by rupturing these capsules (i.e. through scraping the surface). Due to the chemical process needed to microencapsulate a fragrance material, many of the more polar or water-soluble compounds (such as acetone and various alcohols) are likely to be partially lost in the encapsulation process. As mentioned above, these compounds form a relatively small proportion of the overall scent profile of the formulation due to their high odor thresholds and any losses in the encapsulation do not noticeably affect the scent of the resulting formulation.

3)

Hydrocarbon Reformulations

From left to right on wall:

A)
*Hydrocarbon Reformulation (Reconstituted Crude Oil with 2-Point Resolution: Carbon Number/Molecular Weight Average)**
2014
branched and normal alkanes
dimensions variable; 4 litres displayed

The number of carbon atoms for an average molecule of crude oil was calculated to be:
11.47788899

Proportions per 1000 grams in resulting formulation:

IUPAC name	CAS number	Quantity
Undecane	1120-21-4	456.8804024 g
Isododecane (mixture of isomers)	31807-55-3	543.1195976 g

SMILES (Simplified Molecular-Input Line-Entry System):

CCCCCCCCCCC
CCCCCCCCCC(C)C

(includes additional isomers of isododecane)

*Crude oil analysis based on information from:

OPEN-FILE REPORT 467
Utah Geological Survey
a division of UTAH DEPARTMENT OF NATURAL RESOURCES
December 2005
Whole Oil Gas Chromatograph

B)
*Hydrocarbon Reformulation (Reconstituted Crude Oil with 24-Point Resolution: Most Abundant Compounds with Relative Proportions)**
2014
branched, normal, cyclic and aromatic alkanes and alkenes
dimensions variable; 4 litres displayed

24 most prevalent compounds with relevant proportions (compounds that are gases at room temperature have been eliminated due to constraints of the project)

Grams per kilogram

Compound Name	IUPAC NAME	CAS number	Quantity
Normal Alkane C7	heptane	142-82-5	52.3961519
Normal Alkane C8	octane	111-65-9	57.00172024
Normal Alkane C6	hexane	110-54-3	42.32708867
Normal Alkane C9	nonane	111-84-2	57.93254032
Normal Alkane C10	decane	124-18-5	55.83320697
Normal Alkane C11	undecane	1120-21-4	59.50258447
Normal Alkane C5	pentane	109-66-0	27.34031976
Normal Alkane C12	dodecane	112-40-3	54.19441032
Methylcyclohexane	methylcyclohexane	108-87-2	30.82331196
Normal Alkane C13	tridecane	629-50-5	54.74630341
Normal Alkane C14	tetradecane	629-59-4	55.89397646
Normal Alkane C15	pentadecane	629-62-9	57.25111301
2-Methylpentane	2-methylpentane	107-83-5	21.73848027
Normal Alkane C16	hexadecane	544-76-3	53.60097752
Iso-alkane C5	2-methylbutane	78-78-4	16.5396828
Normal Alkane C17	heptadecane	629-78-7	53.34046317
Normal Alkane C18	octadecane	593-45-3	51.01624009
3-Methylhexane	3-methylhexane	589-34-4	19.42151061
Normal Alkane C19	nonadecane	629-92-5	47.50911488

Normal Alkane C20	icosane	112-95-8	48.99773128
3-Methylpentane	3-methylpentane	96-14-0	14.21997965
Cyclohexane	cyclohexane	110-82-7	13.28355789
Normal Alkane C21	henicosane	629-94-7	41.55366508
2-Methylhexane	2-methylhexane	591-76-4	13.5358693

SMILES:

CCCCCCC
CCCCCCCC
CCCCCC
CCCCCCCCC
CCCCCCCCCC
CCCCCCCCCCC
CCCCC
CCCCCCCCCCCC
CC1CCCCC1
CCCCCCCCCCCCC
CCCCCCCCCCCCCC
CCCCCCCCCCCCCCC
CCCC(C)C
CCCCCCCCCCCCCCCC
CCC(C)C
CCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCC
CCCC(C)CC
CCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCC
CCC(C)CC
C1CCCCC1
CCCCCCCCCCCCCCCCCCCCC
CCCCC(C)C

*Crude oil analysis based on information from:

OPEN-FILE REPORT 467
Utah Geological Survey
a division of UTAH DEPARTMENT OF NATURAL RESOURCES
December 2005
Whole Oil Gas Chromatograph

C)
Hydrocarbon Reformulation (Gasoline Fraction: n-alkanes with Corresponding Carbon Numbers in Equal Proportions)
2014
normal alkanes with carbon numbers 5 - 12
dimensions variable; 4 litres displayed

Proportions per 1000 mL:

IUPAC name	CAS number	Quantity
pentane	109-66-0	125 mL
hexane	110-54-3	125 mL
heptane	142-82-5	125 mL
octane	111-65-9	125 mL
nonane	111-84-2	125 mL
decane	124-18-5	125 mL
undecane	1120-21-4	125 mL
dodecane	112-40-3	125 mL

SMILES:

CCCCC
CCCCCC
CCCCCCC
CCCCCCCC
CCCCCCCCC
CCCCCCCCCC
CCCCCCCCCCC
CCCCCCCCCCCC

D)
Hydrocarbon Reformulation (Reconstituted Crude Oil: End of Line Products Recombination)
2014
naptha, kerosene, gasoline (ethanol free), jet fuel (diesel #1), distillate fuel oil (diesel #2), lubricating oil, residual fuel oil, asphalt, and petroleum coke
dimensions variable; 4 litres displayed

Products with corresponding crude oil fractions by relative volume (per 5 gallons):

Oil Fraction	Product Name	Volume
Kerosene	Klean-Strip Kerosene 1-K Heater Fuel	2.88 oz
Lubricants	Lubricating Oil Jankovich Co.	7.232 oz
Feedstocks	Klean-Strip Varnish Maker & Painters (VM&P) Naptha	17.28 oz
Asphalt/Road Oil	Quikrete Commercial Blacktop Patch (asphalt component extracted with solvent)	18.56 oz
Petroleum Coke	Asbury Coke Breeze, Loresco Type SC3, 50#	26.24 oz
Residual Fuel Oil	Residual Fuel Oil Jankovich Co.	33.28 oz
Jet Fuel	Diesel #1 Jankovich Co.	59.52 oz
Distillate Fuel Oil	Diesel #2	134.4 oz
Gasoline	Ethanol Free Gasoline	282.24 oz

E)
Hydrocarbon Reformulation (Reconstituted Crude Oil: End of Line Products Recombination with Selected Biomarkers and C8 - C40 Hydrocarbon Standard Solution)
2014
naptha, kerosene, gasoline (ethanol free), jet fuel (diesel #1), distillate fuel oil (diesel #2), lubricating oil, residual fuel oil, asphalt, and petroleum coke, biomarkers (pristane, phytane, and phenanthrene) and C8 - C40 hydrocarbon calibrated standard solution (see supporting documentation for relative proportions)
dimensions variable; 4 litres displayed

Products with corresponding crude oil fractions by relative volume (per 5 gallons):

Oil Fraction	Product Name	Volume
Kerosene	Klean-Strip Kerosene 1-K Heater Fuel	2.88 oz
Lubricants	Lubricating Oil Jankovich Co.	7.232 oz
Feedstocks	Klean-Strip Varnish Maker & Painters (VM&P) Naptha	17.28 oz
Asphalt/Road Oil	Quikrete Commercial Blacktop Patch (asphalt component extracted with solvent)	18.56 oz
Petroleum Coke	Asbury Coke Breeze, Loresco Type SC3, 50#	26.24 oz
Residual Fuel Oil	Residual Fuel Oil Jankovich Co.	33.28 oz
Jet Fuel	Diesel #1 Jankovich Co.	59.52 oz
Distillate Fuel Oil	Diesel #2	134.4 oz
Gasoline	Ethanol Free Gasoline	282.24 oz

Additionally, this formulation includes the compounds pristine (CAS number 1921-70-6), and phytane (CAS number 638-36-8), which are common “biomarkers” utilized in crude oil forensic analysis. Biomarkers are molecules (often trace compounds) found in crude oil that occur in specific proportions and ratios relative to the location of origin of a crude oil sample. They can be used to pinpoint not only the origin of the sample, but the age of the oil, the geological features and processes the oil has been subject to, and often information on the predominant species from which the oil was derived. (For example the molecule 4,23,24-trimethylcholestane is indicative of oil that has been derived from dinoflagellate plankton.) The ratio of pristane and phytane within an

oil sample is especially useful in determining the age of a specific crude oil sample. In *Hydrocarbon Reformulation (Reconstituted Crude Oil: End of Line Products Recombination with Selected Biomarkers and C8 - C40 Hydrocarbon Standard Solution)* the compounds pristine and phytane have been added to the above mixture of manufactured petroleum-based products in a ratio of .96 pristane/phytane. In the OPEN-FILE REPORT 467 of the Utah Geological Survey this ratio corresponds to the Jurassic geological age for the Navajo Sandstone oil formation that was analyzed.

In addition to the added biomarker compounds, the commercially reconstituted petroleum has also been modified with a standard hydrocarbon mixture containing alkanes with carbon numbers from C8 to C40 in equal proportions, used for petroleum analysis.

4)

Atmospheric Reformulation (Reconstituted Atmosphere with 4-Point Resolution)
2014
Nitrogen (78.08%), Oxygen (20.95%), Argon (0.93%) and Carbon Dioxide (0.04%)
dimensions variable; flow rate 100 mL per minute

Cylinders supplied by Praxair, Dixon regulators set to 5 - 25 psig and each output to a 4 gas parallel inlet/common outlet flowmeter that emits the gases in the above mL/min proportions.

5)

Negative Air
2014
pressure differential generated by Omni-Aire OA2200C negative air machine with HEPA filter and activated carbon VOC/odor filter
dimensions variable; flow rate 2000 cfm

6)

Re-condensed VOC Residual Fragrance Cleaning Solution
2014
cleaning formulation with fragrance component extracted from Omni-Aire OA2200C activated carbon filter
dimensions variable; 7.5 gallons displayed