

# **QUALITY ASSURANCE AUDIT REPORT**

## **North Texas Commission Ambient Air and Meteorological Monitoring**

**Prepared for:**

**North Texas Commission  
8445 Freeport Parkway  
Irving, TX 75063**

**Prepared by:**

**AECOM  
9400 Amberglen Boulevard (78729)  
P.O. Box 201088  
Austin, TX 78720-1088**

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## EXECUTIVE SUMMARY

On May 20<sup>th</sup> – 23<sup>rd</sup>, 2019, an audit team from the AECOM ambient air group in Austin, Texas conducted performance and technical system audits of the North Texas Commission (NTC) ambient air monitoring network. The audits provide an independent assessment of the monitoring program.

The monitoring program at NTC consists of continuous gas chromatographs (GC), volatile organic compound (VOC) canister collection systems, and meteorological sensors including wind speed, wind direction, and temperature.

The performance audit results indicate acceptable responses for measurement systems with the exceptions summarized below.

The wind direction sensor at Abilene was found to be outside the total maximum error specification of  $\pm 5^\circ$ . The wind direction sensor was realigned and found to be within the audit objective. Following realignment, there is no further field action required.

The wind speed sensor bearings were outside of the audit guidance of 0.3 g-cm for the starting threshold at Benbrook. This issue was resolved by installing new bearings on the wind speed sensor.

Out of the 48 compounds being analyzed, seven compounds (ethylene, acetylene, styrene, 1,3,5-trimethylbenzene, 1,2,3-trimethylbenzene, and n-undecane) were found to be outside of the audit objective of 70% - 130% recovery at several sites. In addition, the DISH, Kennedale, and Rushing sites had the following GC compound recoveries outside of the audit specification:

Locations	Compounds
DISH	Isopropylbenzene, n-propylbenzene
Kennedale	1,2,4-trimethylbenzene
Rushing	2-methylhexane

These network GC audit results are comparable historically to other AECOM auto-GC audits. No problems were identified in the quality control procedures at any of these sites that would indicate a persistent measurement error. The GC audit results are contained in table ES-2.

Technical systems audit results demonstrate satisfactory operational procedures for collecting valid data.

A performance evaluation (PE) sample is prepared by the AECOM QA group on a quarterly basis and submitted to the VOC laboratory for analysis. This performance evaluation sample contained known (spiked) concentrations of the target VOCs. Starting this quarter, AECOM has requested an expanded list of target compounds that include additional analysis of twenty-seven compounds. A review of the sample recoveries for the spiked target VOCs shows that eighteen of the seventy-one compounds were not within the range of expected values (70-130%). Sixteen of these compounds were below the acceptable sample recovery, while two compounds were above the acceptable sample recovery.

- 1,2,4-trichlorobenzene (37.5%),
- 1,2,4-trimethylbenzene (37.5%),
- 1,2-dichlorobenzene (54.6%),
- 1,3,5-trimethylbenzene (50.4%),
- 1,3-dichlorobenzene (59.3%),
- 1,4-dichlorobenzene (54.5%),
- 1-hexene (59.4%),
- 2-propanol (68.1%),
- 4-ethyltoluene (43.6%),
- Acetone (356.2%),
- Benzyl chloride (43.8%),
- Ethene (55.8%),
- Ethylbenzene (69.1%),
- Hexachloro-1,3-butadiene (35.6%),
- M&P-xylene (67.2%),
- o-xylene (65.3%),
- Styrene (63.4%),
- Vinyl acetate (134%).

With the expanded target compound list, AECOM QA staff expected to have additional recoveries outside of the tolerable range. Over the past year, the PE sample recoveries have been lower than expected for heavier, non-halogenated VOCs. AECOM QA staff and the sampling lab have been working together to investigate the low recoveries of these compounds. 1-hexene and Acetone have historically been problematic compounds for VOC work and typically have lower and higher recoveries, respectively. The percent recovery for ethene and other C2 compounds can be challenging for lower concentrations due to the lab's level of quantification limit being higher than the theoretical input. AECOM QA staff shared the performance evaluation results with the VOC laboratory, and no other corrective action was taken. We will continue to evaluate these compounds in our PE samples and work with the lab to resolve these discrepancies. GD Air's most recent performance evaluation canister results for the second quarter of 2019 are contained below in Table ES-1.

**Table ES-1. Results of Performance Standard for Off-Site Analytical Lab**

Compound Name	CAS Number	Concentration (ppb-v)	Concentration Results (ppb-v)	Percent Recovery
1,1,1-Trichloroethane	71-55-6	2.0	1.8	89.4%
1,1,2,2-Tetrachloroethane	79-34-5	2.0	1.5	76.2%
1,1,2-Trichloroethane	79-00-5	2.0	1.8	89.0%
1,1,2-Trichlorotrifluoroethane (Freon-113)	76-13-1	1.9	1.8	93.1%
1,1-Dichloroethane	75-34-3	2.0	1.7	84.2%
1,1-Dichloroethene	75-35-4	2.0	1.8	86.5%
1,2,4-Trichlorobenzene	120-82-1	1.7	0.6	37.5%
1,2,4-Trimethylbenzene	95-63-6	1.9	0.9	45.3%
1,2-Dibromoethane	106-93-4	2.0	1.7	85.5%
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	1.9	1.0	54.6%
1,2-Dichloroethane	107-06-2	2.0	1.7	85.9%
1,2-Dichloropropane	78-87-5	2.0	1.7	86.0%
1,2-Dichlorotetrafluoroethane (Freon-114)	76-14-2	2.0	1.6	81.1%
1,3,5-Trimethylbenzene	108-67-8	1.9	1.0	50.4%
1,3-Butadiene	106-99-0	4.0	3.3	82.2%
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	1.9	1.1	59.3%
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	1.9	1.1	54.5%
1,4-Dioxane	123-91-1	2.0	1.6	77.9%
1-Butene	106-98-9	2.0	1.6	81.1%
1-Hexene	592-41-6	1.9	1.1	59.4%
1-Pentene	109-67-1	2.0	1.7	85.5%
2,2,4-Trimethylpentane	540-84-1	2.0	1.7	83.4%
2-Butanone (Methyl Ethyl Ketone -- MEK)	78-93-3	4.0	4.5	111.1%
2-Hexanone (Methyl Butyl Ketone)	591-78-6	2.0	1.8	86.5%
2-Propanol (Isopropyl Alcohol)	67-63-0	2.0	1.4	68.1%
3-Chloropropene (Allyl chloride)	107-05-1	1.9	1.5	75.6%
4-Ethyltoluene (p-Ethyltoluene)	622-96-8	1.9	0.8	43.6%
4-Methyl-2-pentanone (Methyl Isobutyl Ketone -- MIK)	108-10-1	3.9	3.4	86.1%
Acetone	67-64-1	2.1	7.5	356.2%
Benzene	71-43-2	2.0	1.7	83.3%
Benzyl chloride (alpha-Chlorotoluene)	100-44-7	3.4	1.5	43.8%
Bromodichloromethane	75-27-4	2.0	1.7	83.8%
Bromoform	75-25-2	2.0	1.6	81.2%
Bromomethane	74-83-9	1.9	1.6	81.0%
c-1,2-Dichloroethene	156-59-2	2.1	1.8	86.4%
c-1,3-Dichloropropene	10061-01-5	2.0	1.8	90.4%

**Table ES-1. (Continued) Results of Performance Standard for Off-Site Analytical Lab**

Compound Name	CAS Number	Concentration (ppb-v)	Concentration Results (ppb-v)	Percent Recovery
Carbon disulfide	75-15-0	2.0	2.1	103.4%
Carbon tetrachloride	56-23-5	2.0	1.8	89.4%
Chlorobenzene	108-90-7	2.0	1.6	76.9%
Chloroethane	75-00-3	1.9	2.0	102.9%
Chloroform	67-66-3	2.0	1.8	91.3%
Chloromethane (Methyl Chloride)	74-87-3	2.0	1.7	84.9%
Cyclohexane	110-82-7	2.0	1.8	87.2%
Dibromochloromethane	124-48-1	2.1	1.8	83.8%
Dichlorodifluoromethane (Freon-12)	75-71-8	1.9	1.7	87.9%
Ethane	74-84-0	12.1	13.2	109.2%
Ethene	74-85-1	4.1	2.3	55.8%
Ethylbenzene	100-41-4	2.0	1.4	69.1%
Hexachloro-1,3-Butadiene	87-68-3	1.7	0.6	35.6%
Methyl Tert Butyl Ether (MTBE)	1634-04-4	2.0	1.7	82.4%
Methylene Chloride (Dichloromethane)	75-09-2	1.9	1.7	87.4%
m-Xylene & p-Xylene	106-42-3+108-38-3	3.9	2.6	67.2%
n-Butane	106-97-8	2.0	1.7	84.2%
n-Heptane	142-82-5	2.0	1.7	86.4%
n-Hexane	110-54-3	6.0	5.4	90.7%
n-Pentane	109-66-0	2.0	1.7	83.9%
o-Xylene	95-47-6	2.0	1.3	65.3%
Propane	74-98-6	2.0	1.7	86.9%
Propylene	115-07-1	4.1	3.3	80.4%
Styrene	100-42-5	2.0	1.3	63.4%
t-1,2-Dichloroethene	156-60-5	1.9	1.6	82.8%
t-1,3-Dichloropropene	10061-02-6	2.0	1.7	83.4%
Tetrachloroethene	127-18-4	2.0	1.6	78.6%
Toluene	108-88-3	2.0	1.6	77.4%
Trichloroethene	79-01-6	2.0	1.8	86.7%
Trichlorofluoromethane (Freon-11)	75-69-4	2.1	1.6	79.6%
Vinyl Acetate	108-05-4	3.2	4.4	134.0%
Vinyl Bromide	593-60-2	2.0	2.1	105.9%
Vinyl Chloride	75-01-4	2.0	1.7	85.4%
Ethyl Acetate	141-78-6	2.2	2.2	96.6%
Tetrahydrofuran	109-99-9	2.0	1.6	81.0%

**Table ES-2. Audit Standard Results for all Network GCs**

Compound Name	CAS Number	Audit Concentration (ppbc)	Benbrook		Decatur		Dish		Eagle Mountain Lake	
			Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery
Ethane	74-84-0	49.0	50.5	103.1%	47.6	97.0%	45.1	91.9%	48.7	99.3%
Ethylene	74-85-1	15.9	14.6	92.2%	14.1	88.8%	9.8	61.5%	14.4	90.4%
Propane	74-98-6	11.7	11.2	95.6%	10.4	89.0%	10.5	90.4%	10.9	93.3%
Propylene	115-07-1	11.7	10.2	87.4%	9.9	85.1%	9.7	83.3%	9.8	84.0%
Iso-Butane	75-28-5	15.3	17.7	115.7%	15.3	100.3%	15.3	100.2%	15.9	104.2%
N-Butane	106-97-8	15.6	18.4	118.2%	16.1	103.7%	15.8	101.7%	16.4	105.2%
Acetylene	74-86-2	7.6	5.4	71.6%	6.1	80.2%	5.4	71.5%	5.5	72.5%
Trans-2-Butene	624-64-6	15.0	17.7	117.7%	15.8	105.6%	15.6	104.0%	15.8	105.0%
1-Butene	106-98-9	15.3	17.7	115.6%	15.8	103.5%	15.4	100.5%	15.9	103.9%
Cis-2-Butene	590-18-1	15.6	18.2	117.0%	16.3	105.0%	16.2	103.8%	16.1	103.2%
Cyclopentane	287-92-3	18.9	22.8	120.7%	19.9	105.0%	19.2	101.4%	20.3	107.2%
Iso-Pentane	78-78-4	19.3	23.0	119.7%	20.1	104.6%	19.7	102.4%	20.5	106.5%
N-Pentane	109-66-0	19.5	23.3	119.8%	20.4	104.9%	19.9	102.5%	21.4	109.8%
1,3-Butadiene	106-99-0	14.8	15.5	104.4%	13.0	87.4%	14.9	100.2%	15.7	105.5%
Trans-2-Pentene	646-04-8	19.5	22.2	113.9%	18.2	93.4%	18.4	94.8%	20.8	106.9%
1-Pentene	109-67-1	19.5	20.5	105.2%	15.3	78.7%	16.7	85.8%	20.5	105.4%
Cis-2-Pentene	627-20-3	18.1	17.3	95.8%	13.6	75.6%	15.2	84.5%	18.0	99.8%
2,2-Dimethylbutane	75-83-2	23.1	26.7	115.6%	21.2	91.6%	20.7	89.8%	23.9	103.5%
2-Methylpentane	107-83-5	22.5	26.0	115.5%	22.2	98.5%	21.5	95.5%	23.4	104.0%
Isoprene	78-79-5	19.5	16.1	82.9%	14.1	72.7%	14.1	72.5%	16.7	85.7%
n-Hexane	110-54-3	23.3	22.0	94.1%	24.1	103.2%	21.4	91.6%	21.3	91.3%
Methylcyclopentane	108-87-2	23.3	20.7	88.5%	18.5	79.1%	18.5	79.1%	20.1	86.1%
2,4-Dimethylpentane	108-08-7	27.2	28.0	103.0%	26.6	97.7%	24.7	90.6%	27.6	101.4%
Benzene	71-43-2	23.3	20.3	87.0%	20.6	88.5%	20.0	85.6%	20.0	85.9%
Cyclohexane	110-82-7	23.3	22.6	96.9%	22.0	94.2%	21.0	90.2%	21.4	91.7%
2-Methylhexane	591-76-4	27.2	21.9	80.5%	19.9	73.1%	20.0	73.6%	22.2	81.7%
2,3-Dimethylpentane	565-59-3	26.2	28.0	106.8%	28.6	109.2%	25.6	97.5%	27.2	103.7%
3-Methylhexane	589-34-4	27.2	25.2	92.6%	25.7	94.3%	23.7	87.1%	25.4	93.1%
2,2,4-Trimethylpentane	540-84-1	31.1	28.7	92.2%	27.6	88.6%	25.4	81.8%	28.6	91.9%
n-Heptane	142-82-5	27.2	25.1	92.3%	24.1	88.5%	22.6	83.0%	25.3	93.1%
Methylcyclohexane	108-87-2	27.0	25.3	93.8%	23.9	88.4%	22.5	83.4%	25.2	93.5%
2,3,4-Trimethylpentane	565-75-3	31.1	28.7	92.1%	27.2	87.4%	25.0	80.3%	29.3	94.3%
Toluene	108-88-3	27.0	24.2	89.7%	24.0	88.9%	21.0	77.7%	24.9	92.4%
2-Methylheptane	592-27-8	30.8	27.5	89.3%	26.0	84.3%	24.5	79.5%	28.4	92.3%
3-Methylheptane	589-81-1	31.1	28.1	90.3%	25.8	82.9%	24.9	80.2%	28.8	92.5%
n-Octane	111-65-9	31.1	28.1	90.4%	26.8	86.1%	25.2	81.0%	28.6	91.8%
Ethylbenzene	100-41-4	31.1	26.0	83.5%	25.6	82.3%	22.2	71.5%	25.7	82.8%
M&P-Xylene	108-38-3	61.7	49.7	80.6%	49.1	79.7%	43.2	70.1%	49.4	80.1%
Styrene	100-42-5	30.5	22.0	72.1%	20.5	67.0%	22.6	73.9%	20.7	67.8%
O-Xylene	95-47-6	30.5	26.9	88.2%	26.7	87.3%	23.4	76.6%	26.6	87.0%
N-Nonane	111-84-2	34.0	30.2	88.8%	29.4	86.5%	26.8	78.6%	29.8	87.6%
Isopropylbenzene	98-82-8	33.4	28.9	86.6%	27.4	81.9%	22.4	67.2%	28.2	84.3%
n-Propylbenzene	103-65-1	32.8	27.6	84.1%	26.2	79.8%	22.7	69.3%	27.3	83.2%
1,3,5-Trimethylbenzene	108-67-8	34.0	28.7	84.4%	27.6	81.1%	21.8	64.2%	28.4	83.4%
1,2,4-Trimethylbenzene	95-63-6	34.7	28.4	81.9%	26.4	76.1%	27.1	78.3%	29.5	85.2%
n-Decane	124-18-5	34.3	30.3	88.3%	29.6	86.2%	25.1	73.2%	31.1	90.8%
1,2,3-Trimethylbenzene	526-73-8	34.4	25.0	72.7%	23.0	67.0%	21.3	61.9%	25.9	75.3%
n-Undecane	1120-21-4	41.6	27.8	66.9%	26.0	62.6%	24.9	60.0%	30.3	72.8%

<sup>a</sup> Compound order based on elution time.

**Table ES-2. (Continued) Audit Standard Results for all Network GCs**

Compound Name	CAS Number	Audit Concentration (ppbc)	Elm Fork		Everman		Flower Mound		Godley	
			Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery
Ethane	74-84-0	49.0	51.0	104.0%	49.0	100.0%	48.2	98.4%	48.6	99.1%
Ethylene	74-85-1	15.9	12.3	77.8%	12.3	77.6%	15.4	97.1%	13.9	87.4%
Propane	74-98-6	11.7	11.3	96.8%	10.9	93.4%	10.7	91.9%	10.7	91.4%
Propylene	115-07-1	11.7	10.2	87.5%	9.7	82.9%	10.5	89.8%	9.6	82.0%
Iso-Butane	75-28-5	15.3	17.4	113.7%	17.3	113.2%	15.5	101.2%	16.1	105.7%
N-Butane	106-97-8	15.6	18.1	116.6%	18.4	118.5%	16.0	102.5%	16.8	108.2%
Acetylene	74-86-2	7.6	6.1	80.0%	5.4	71.9%	6.4	84.8%	6.0	78.8%
Trans-2-Butene	624-64-6	15.0	17.5	116.7%	17.7	117.9%	16.0	106.4%	15.7	104.7%
1-Butene	106-98-9	15.3	17.4	113.7%	17.3	113.3%	15.8	103.1%	16.0	104.9%
Cis-2-Butene	590-18-1	15.6	18.2	116.9%	18.6	119.2%	16.5	106.0%	16.8	108.0%
Cyclopentane	287-92-3	18.9	21.8	115.1%	22.1	117.0%	19.5	102.9%	20.6	108.7%
Iso-Pentane	78-78-4	19.3	22.4	116.5%	23.0	119.4%	20.1	104.5%	21.0	109.1%
N-Pentane	109-66-0	19.5	22.7	116.6%	22.9	117.7%	20.2	103.7%	21.6	111.0%
1,3-Butadiene	106-99-0	14.8	16.0	108.1%	17.1	115.1%	15.2	102.4%	14.7	99.1%
Trans-2-Pentene	646-04-8	19.5	22.0	113.3%	22.0	112.9%	19.6	100.9%	19.9	102.2%
1-Pentene	109-67-1	19.5	19.8	102.0%	21.2	108.8%	18.0	92.7%	19.6	101.0%
Cis-2-Pentene	627-20-3	18.1	17.9	99.3%	18.9	104.5%	16.7	92.5%	16.1	89.4%
2,2-Dimethylbutane	75-83-2	23.1	26.5	114.8%	25.2	109.2%	22.0	95.1%	25.1	108.6%
2-Methylpentane	107-83-5	22.5	25.9	114.9%	23.3	103.4%	22.3	99.1%	23.9	106.0%
Isoprene	78-79-5	19.5	16.2	83.2%	16.9	86.9%	15.2	78.0%	15.6	80.3%
n-Hexane	110-54-3	23.3	25.9	110.8%	20.4	87.5%	21.0	89.9%	22.6	97.0%
Methylcyclopentane	108-87-2	23.3	21.4	91.9%	20.1	86.3%	19.3	82.7%	19.1	82.0%
2,4-Dimethylpentane	108-08-7	27.2	27.3	100.3%	27.6	101.5%	26.1	96.0%	30.7	112.6%
Benzene	71-43-2	23.3	21.8	93.3%	21.9	93.8%	19.6	84.1%	22.0	94.3%
Cyclohexane	110-82-7	23.3	22.8	97.5%	24.8	106.5%	21.0	89.8%	24.3	104.0%
2-Methylhexane	591-76-4	27.2	23.6	86.6%	21.4	78.6%	22.3	81.9%	20.1	73.8%
2,3-Dimethylpentane	565-59-3	26.2	28.2	107.6%	31.1	118.4%	25.9	98.9%	32.2	122.9%
3-Methylhexane	589-34-4	27.2	26.2	96.4%	28.0	102.9%	24.4	89.7%	28.2	103.6%
2,2,4-Trimethylpentane	540-84-1	31.1	29.7	95.5%	30.5	98.2%	28.1	90.2%	30.2	97.1%
n-Heptane	142-82-5	27.2	26.3	96.6%	26.5	97.4%	24.6	90.4%	26.1	96.0%
Methylcyclohexane	108-87-2	27.0	26.0	96.3%	25.1	92.9%	24.5	90.8%	25.3	93.6%
2,3,4-Trimethylpentane	565-75-3	31.1	29.6	95.2%	28.8	92.5%	28.3	90.8%	28.9	92.8%
Toluene	108-88-3	27.0	24.8	92.1%	24.9	92.2%	24.2	89.7%	25.7	95.4%
2-Methylheptane	592-27-8	30.8	29.1	94.5%	28.1	91.3%	27.6	89.4%	28.1	91.1%
3-Methylheptane	589-81-1	31.1	29.6	95.1%	28.5	91.6%	28.0	90.1%	29.0	93.3%
n-Octane	111-65-9	31.1	29.5	94.8%	28.3	90.8%	27.8	89.4%	28.2	90.6%
Ethylbenzene	100-41-4	31.1	27.7	89.1%	25.7	82.6%	26.2	84.1%	25.1	80.5%
M&P-Xylene	108-38-3	61.7	53.7	87.1%	49.8	80.8%	50.0	81.0%	48.6	78.8%
Styrene	100-42-5	30.5	24.5	80.4%	22.0	72.1%	21.1	69.0%	21.2	69.4%
O-Xylene	95-47-6	30.5	28.1	92.1%	27.7	90.8%	24.6	80.6%	25.8	84.5%
N-Nonane	111-84-2	34.0	31.4	92.2%	31.3	91.9%	29.1	85.6%	28.3	83.2%
Isopropylbenzene	98-82-8	33.4	30.1	90.2%	28.5	85.3%	28.0	83.9%	28.2	84.3%
n-Propylbenzene	103-65-1	32.8	29.0	88.4%	26.9	82.0%	27.7	84.6%	27.1	82.8%
1,3,5-Trimethylbenzene	108-67-8	34.0	28.3	83.1%	28.5	83.7%	28.5	83.9%	29.7	87.4%
1,2,4-Trimethylbenzene	95-63-6	34.7	30.1	86.9%	29.2	84.3%	28.6	82.5%	29.4	84.8%
n-Decane	124-18-5	34.3	31.4	91.6%	29.8	86.8%	29.5	85.9%	29.9	87.2%
1,2,3-Trimethylbenzene	526-73-8	34.4	26.1	75.8%	24.6	71.5%	27.9	81.1%	26.7	77.8%
n-Undecane	1120-21-4	41.6	28.2	67.9%	27.4	66.0%	35.7	85.8%	34.3	82.5%

<sup>a</sup> Compound order based on elution time.

**Table ES-2. (Continued) Audit Standard Results for all Network GCs**

Compound Name	CAS Number	Audit Concentration (ppbc)	Kennedale		Mansfield		Rhome		Rushing		UTA	
			Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery	Post Processed ppbc	Percent Recovery
Ethane	74-84-0	49.0	43.5	88.7%	49.1	100.2%	50.7	103.5%	50.3	102.6%	45.9	93.6%
Ethylene	74-85-1	15.9	12.9	81.0%	11.0	69.0%	15.9	100.3%	14.8	93.4%	11.3	71.0%
Propane	74-98-6	11.7	10.2	87.6%	11.1	95.1%	11.7	100.3%	11.0	94.5%	10.6	90.4%
Propylene	115-07-1	11.7	9.4	80.6%	9.7	82.9%	10.4	89.2%	9.7	82.9%	10.2	87.0%
Iso-Butane	75-28-5	15.3	16.1	105.6%	18.1	118.7%	17.7	115.6%	14.2	93.1%	17.0	111.5%
N-Butane	106-97-8	15.6	16.8	108.1%	19.3	123.9%	17.7	113.6%	14.7	94.7%	18.1	116.5%
Acetylene	74-86-2	7.6	5.1	67.6%	5.2	69.0%	5.4	72.0%	5.0	66.4%	3.3	43.5%
Trans-2-Butene	624-64-6	15.0	15.9	105.9%	18.6	124.2%	16.8	111.9%	13.8	92.1%	17.2	114.8%
1-Butene	106-98-9	15.3	15.9	104.3%	18.0	117.8%	17.1	111.9%	13.9	90.8%	16.9	110.7%
Cis-2-Butene	590-18-1	15.6	16.6	106.4%	19.3	124.0%	17.3	111.5%	13.9	89.6%	17.7	113.4%
Cyclopentane	287-92-3	18.9	20.2	107.1%	23.2	122.6%	21.2	112.2%	17.8	94.2%	21.8	115.5%
Iso-Pentane	78-78-4	19.3	20.8	108.1%	24.0	124.8%	22.0	114.4%	18.1	93.8%	22.2	115.6%
N-Pentane	109-66-0	19.5	21.1	108.4%	24.4	125.4%	22.4	115.1%	18.7	96.3%	22.5	115.7%
1,3-Butadiene	106-99-0	14.8	15.4	103.9%	18.2	122.4%	16.0	108.0%	11.8	79.4%	14.9	100.2%
Trans-2-Pentene	646-04-8	19.5	20.3	104.3%	23.6	121.3%	21.5	110.7%	17.2	88.3%	21.1	108.3%
1-Pentene	109-67-1	19.5	20.0	102.6%	23.3	120.0%	20.8	106.8%	16.0	82.0%	19.8	102.0%
Cis-2-Pentene	627-20-3	18.1	18.2	100.6%	21.1	117.1%	18.6	102.8%	14.9	82.3%	17.3	95.9%
2,2-Dimethylbutane	75-83-2	23.1	24.5	105.9%	28.3	122.5%	26.2	113.5%	22.4	96.8%	25.5	110.5%
2-Methylpentane	107-83-5	22.5	23.8	105.6%	26.9	119.7%	24.5	108.7%	21.0	93.3%	24.3	108.1%
Isoprene	78-79-5	19.5	17.5	90.0%	20.1	103.6%	17.8	91.5%	14.2	72.9%	16.1	82.9%
n-Hexane	110-54-3	23.3	21.1	90.3%	22.7	97.3%	21.7	92.8%	21.0	89.9%	21.1	90.3%
Methylcyclopentane	108-87-2	23.3	20.5	87.7%	21.5	92.1%	20.1	86.3%	18.0	77.2%	20.9	89.6%
2,4-Dimethylpentane	108-08-7	27.2	25.2	92.4%	26.6	97.7%	29.4	107.8%	27.5	100.9%	24.8	91.3%
Benzene	71-43-2	23.3	19.4	83.0%	21.2	91.1%	21.1	90.3%	18.0	77.1%	20.1	86.1%
Cyclohexane	110-82-7	23.3	21.2	90.9%	22.8	97.6%	23.9	102.5%	23.5	100.8%	22.0	94.3%
2-Methylhexane	591-76-4	27.2	22.2	81.6%	23.5	86.3%	22.0	81.0%	16.3	59.8%	22.9	84.2%
2,3-Dimethylpentane	565-59-3	26.2	24.3	92.5%	26.7	101.8%	29.4	112.1%	34.0	129.7%	24.5	93.4%
3-Methylhexane	589-34-4	27.2	23.7	87.1%	25.5	93.5%	28.2	103.7%	28.5	104.5%	23.9	87.7%
2,2,4-Trimethylpentane	540-84-1	31.1	26.3	84.5%	28.7	92.4%	29.3	94.0%	29.9	96.2%	26.6	85.5%
n-Heptane	142-82-5	27.2	23.1	85.0%	25.8	94.8%	25.0	92.0%	24.3	89.3%	23.3	85.8%
Methylcyclohexane	108-87-2	27.0	23.6	87.6%	25.3	93.9%	27.3	101.1%	25.1	93.1%	23.8	88.3%
2,3,4-Trimethylpentane	565-75-3	31.1	26.1	83.9%	28.1	90.2%	29.6	95.1%	29.6	95.2%	26.2	84.4%
Toluene	108-88-3	27.0	22.3	82.5%	24.0	89.0%	26.1	96.9%	23.1	85.5%	22.1	82.1%
2-Methylheptane	592-27-8	30.8	24.7	80.2%	27.3	88.7%	28.8	93.3%	29.9	96.8%	25.5	82.6%
3-Methylheptane	589-81-1	31.1	25.3	81.3%	27.9	89.8%	31.2	100.4%	31.0	99.6%	25.9	83.3%
n-Octane	111-65-9	31.1	24.5	78.6%	27.9	89.6%	27.9	89.8%	29.4	94.4%	25.8	82.8%
Ethylbenzene	100-41-4	31.1	23.4	75.3%	25.2	80.9%	26.3	84.6%	24.6	79.2%	24.9	80.2%
M&P-Xylene	108-38-3	61.7	44.4	72.0%	48.6	78.8%	53.5	86.7%	51.1	82.9%	47.3	76.7%
Styrene	100-42-5	30.5	19.3	63.3%	24.2	79.4%	21.6	70.8%	15.3	49.9%	21.1	69.1%
O-Xylene	95-47-6	30.5	23.5	76.8%	25.7	84.1%	26.8	87.8%	28.7	94.0%	24.8	81.2%
N-Nonane	111-84-2	34.0	26.7	78.3%	29.2	85.9%	30.0	88.1%	30.1	88.5%	27.7	81.4%
Isopropylbenzene	98-82-8	33.4	25.7	77.0%	25.8	77.3%	27.7	82.9%	27.8	83.2%	27.8	83.3%
n-Propylbenzene	103-65-1	32.8	23.7	72.2%	25.6	78.2%	27.5	84.0%	25.8	78.7%	26.1	79.5%
1,3,5-Trimethylbenzene	108-67-8	34.0	23.8	69.9%	25.1	73.8%	29.4	86.4%	28.8	84.8%	26.2	77.1%
1,2,4-Trimethylbenzene	95-63-6	34.7	23.6	68.1%	29.2	84.3%	28.0	80.9%	28.0	80.7%	26.9	77.7%
n-Decane	124-18-5	34.3	25.6	74.6%	28.4	82.9%	31.6	92.3%	29.4	85.8%	29.3	85.5%
1,2,3-Trimethylbenzene	526-73-8	34.4	21.3	61.9%	24.1	70.1%	24.2	70.3%	23.0	66.8%	25.5	74.1%
n-Undecane	1120-21-4	41.6	23.1	55.5%	29.8	71.6%	33.8	81.3%	28.6	68.9%	32.6	78.3%

<sup>a</sup> Compound order based on elution time.