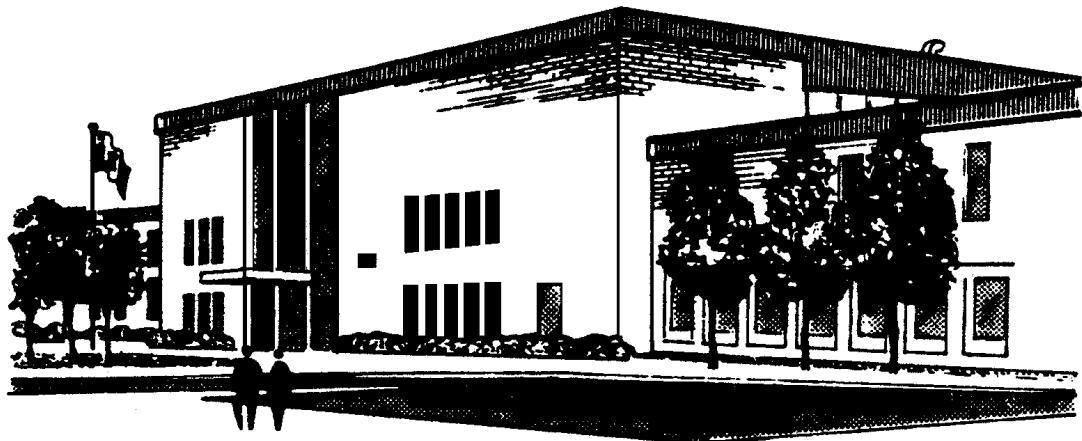


Indoor Air Sampling for Infiltration of Vehicle Emissions  
to the House from the Attached Garage

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**ERMD Report #99-26768-2**

*Prepared by: Lisa Graham, Kevin O'Leary and Lianne Noseworthy*  
ENVIRONMENTAL TECHNOLOGY CENTRE  
EMISSIONS RESEARCH AND MEASUREMENT DIVISION

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## **Summary**

This report summarises the chemical characterisation results from the two phases of house testing conducted for the project titled “Contribution of Vehicle Emissions from an Attached Garage to Residential Indoor Air Pollution Levels”. The work was conducted over two winter seasons, 1997-98 and 1998-99 in the Ottawa Carleton Region. In total, 16 different homes were studied. One of the homes was tested twice, once during each phase. Samples of indoor and garage atmosphere air were characterised for carbon monoxide, carbon dioxide, volatile organic compounds and carbonyl compounds. During the second phase, real-time measurements of carbon monoxide, carbon dioxide and total hydrocarbons as methane were made to provide temporal information on when and for how long the vehicle emissions plume infiltrates the house. Based on calculating net increases in concentration of compounds known to be emitted by the vehicle during the two different modes of operation studied, there is strong evidence that the indoor air quality is influenced by the vehicle emissions. The largest influence was observed during the cold start of the vehicle which was conducted in the morning. The contribution of volatile organic compounds, mostly non-methane hydrocarbons, to the indoor air is significant. In contrast, the contribution of carbonyl compounds produced by the vehicle was not found to be significant due to the already significant levels found in the house. The small increment added to the indoor air concentration by the vehicle emissions was difficult to detect.

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## **1. Introduction**

As part of the larger project entitled “Contribution of Vehicle Emissions from an Attached Garage to Residential Indoor Air Pollution Levels”, the Emissions Research and Measurement Division (ERMD) of Environment Canada has analysed samples collected in the garage and house during the hot soak and cold start operation of a vehicle in the attached garage. These samples were analysed for CO, CO<sub>2</sub>, carbonyl compounds, and volatile organic compounds emitted from the vehicle.

The larger project has the following objectives:

- To qualify and quantify cold start, hot start and evaporative emissions emitted from a vehicle in a residential garage due to daily use of the vehicle
- To qualify and quantify those vehicle emissions products which reach an adjacent room in the residence via an attached garage, i.e. through the common door, walls, or attic of the house
- To determine the concentrations of vehicle emission products in the attached garage relative to an adjacent room inside the house
- To model movement/path of entry of vehicle emissions in an attached garage into the house
- To determine the removal efficiency of vehicle emissions in the air of the house versus the air of the attached garage
- To assess human exposure to levels of emissions found in the residence that have originated from vehicle start-up and cool-down in the attached garage.

This report summarises the results of the work conducted over two seasons of field testing. Phase 1 was conducted during the winter of 1997-98 and Phase 2 was conducted during the winter of 1998-99.

## **2. Testing Protocol**

Tests were conducted at 16 test houses over the course of two winters. The test protocols used during the two phases are described in companion documents\*. The sample coding and test house identifications used in this report are given in these field reports. Sample collection and coding of the ambient samples is different for the two phases of testing. During phase 1 testing, two canisters were used to collect ambient air samples. One canister was used to collect ambient air during the cold start test and the other during the hot soak test. During phase 2, only one canister was used to sample the ambient air over the duration of the two tests. The exception to this occurred during phase 2, the SV ambient air sample was collected using two canisters as the cold start and hot soak tests were conducted days apart. The descriptions for the sample codes are summarised in Table 1.

**Table 1. Sample codes and their descriptions.**

Sample Description	Sample Code
Cold Start Background (Ambient)	CSB
Cold Start Pre-Test	CSPT
Cold Start House	CSH
Cold Start Garage	CSG
Hot Start Background (Ambient)	HSB
Hot Start Pre-Test	HSPT
Hot Start House	HSH
Hot Start Garage	HSG
Background (Ambient) for both test segments	AMB

Briefly, samples of the garage atmosphere, indoor air and outdoor (ambient) air were collected during different modes of vehicle operation in the attached garage. The test sequence began in the afternoon of the first test day with the hot soak test. The vehicle was parked in the garage after having been driven on a road route sufficiently long to bring the vehicle

\* The 1997-98 testing (phase 1) is described in “Infiltration of Vehicle Exhaust into Homes with Attached Garages” by Kevin O’Leary. The 1998-99 testing (phase 2) is described in “Contribution of Vehicle Emissions from Attached Garages to Residential Indoor Air Pollution Levels: Winter 1998-99 Field Report” by Lianne Noseworthy.

up to normal operating temperatures. When parked in the garage with the garage door closed, hot soak emissions are generated by the vehicle which fill the garage and infiltrate into the home. In-house air samples are collected before the vehicle is brought into the garage and for 4 hours during the hot soak emission period. The vehicle is left in the garage overnight as would be usual practice for the homeowner. The next morning the vehicle is started, backed out of the garage and parked on the street. The garage door is closed as would be done during normal activities and the cold start emissions are trapped in the garage potentially infiltrating into the home. Again in-house air samples are collected before the vehicle is started and for 4 hours following the cold start. Additional samples are collected of the outdoor air to account for the infiltration of outdoor air into the house during the test period and of each of the garage atmospheres – hot soak and cold start. In the last three houses of the Phase 2 study, additional in-house samples were collected at different locations throughout the homes to evaluate differences in compound concentrations at different locations in the home.

The samples collected were submitted for analysis of approximately 175 volatile organic compounds, 24 carbonyl compounds and three permanent gases – CH<sub>4</sub> CO and CO<sub>2</sub>. Samples for volatile organic compound and permanent gas analyses were collected in SUMMA™ canisters while samples for carbonyl compound analysis were collected on 2,4-dinitrophenylhydrazine (2,4-DNPH) coated silica cartridges. During the first phase, SF<sub>6</sub> was used as a tracer gas in an effort to have an independent measure of the infiltration rate. Due to less than satisfactory results, this procedure was discontinued in the second phase and a real-time monitor was used to make measurements of the CO, CO<sub>2</sub> and total hydrocarbon as CH<sub>4</sub> concentrations every 3-4 minutes during the test sequence.

### **3. Analytical Methodology**

#### **3.1. Canister Pressurisation**

The sample canisters were returned to the laboratory after sampling under slight vacuum. The canisters were pressurised to approximately 3 psig before analysis using ultra-high purity (UHP) nitrogen. The canister pressure was measured before and after pressurisation to accurately calculate the dilution factor for each canister sample. Analysis of the nitrogen using the same methods as the samples showed that there were no correction was needed for any compounds due to the concentrations of compounds present in the nitrogen.

#### **3.2. CO and CO<sub>2</sub> Analysis**

The concentrations of CO and CO<sub>2</sub> in the canister samples were determined by gas chromatography. A Nickel Catalyst was used to convert the CO and CO<sub>2</sub> to methane as they eluted from the column so that the flame ionisation detector would show a response. This method gave a detection limit of 0.1 ppm for each compound. Two separate methods using two different columns were needed to determine CO and CO<sub>2</sub> in the presence of water vapour, oxygen and methane. Standards were prepared from individual certified standards purchased from Matheson Gas Products (Whitby, Ontario). Calibration linearity was confirmed by dilution of the stock standards with UHP nitrogen. Improvements in the analytical method between Phase 1 and Phase 2 allowed CH<sub>4</sub> to be determined during this analysis for the Phase 2 samples. This method is referred to as the NiCat method.

#### **3.3. Volatile Organic Compound Analysis**

Approximately 175 volatile organic compounds (non-methane hydrocarbons and halogenated compounds) were determined by high-resolution gas chromatography with dual detectors - flame ionisation detection and electron conductivity detection (GC-FID-ECD) following cryogenic preconcentration. An Entech M7000 cryogenic concentrator, operating in the microscale purge and trap mode, was used as an inlet to the GC, allowing a sample volume of 200 mL to be used. This method is referred to as the VOC method. The complete list of target compounds for this analysis is given in Appendix 1.

A Hewlett Packard 5890 Series II gas chromatograph with a flame ionisation detector and an electron conductivity detector was used for the analysis. The effluent of the GC column was split 10:1 with one tenth of the flow directed to the ECD for detection of the halogenated compounds and the remaining flow directed to the FID for determination of all hydrocarbons and some halogenated compounds. Data from the two detectors was acquired simultaneously using the Hewlett Packard 3365 Series II DOS ChemStation multi-instrument software.

The analytical method was calibrated using external standards on a per component basis. Compound identification was confirmed on selected samples by GC-FTIR analysis. The hydrocarbon gas phase standards used were prepared in-house using a permeation tube gas standard generator (Kin-Tek Laboratories, LaMarque, Texas) and the halogenated compound standard (TO-14 mix, 1 ppm nominal) was purchased from Matheson Gas Products (Whitby, Ontario). A secondary standard (10 ppb) was prepared in a canister by stepwise dilution of the TO-14 mix using the same UHP nitrogen as was used for the canister samples.

The preconcentrator system does not allow for the determination of methane and sometimes the C<sub>2</sub> hydrocarbons are not well retained on the trap. Methane must be determined using an alternate method and in certain instances, confirmation of the C<sub>2</sub> and C<sub>3</sub> hydrocarbon concentrations determined using the preconcentrator method is required. During Phase 1, methane analysis and the C<sub>2</sub> and C<sub>3</sub> hydrocarbon confirmation were accomplished by simple gas loop injection onto a capillary column. The sample loop was flushed with sample and the contents of the loop were injected directly onto the capillary column. This method is referred to as the light hydrocarbon (LHC) method. A Hewlett Packard 5890 Series II gas chromatograph with a flame ionisation detector was used for the analysis. Data was acquired using the Hewlett Packard 3365 Series II DOS ChemStation multi-instrument software. This system was also calibrated using external standards generated from the Kin-Tek bench. As mentioned above, for the Phase 2 samples methane could be determined simultaneously with the CO and CO<sub>2</sub> analysis. The C<sub>2</sub> and C<sub>3</sub> confirmation analysis was only required on the garage atmosphere samples. The concentrations of the C<sub>2</sub> and C<sub>3</sub> hydrocarbons were below detection limits of LHC method for all other samples. The detection limits for the three methods used for the samples of this project are given in Table 2.

**Table 2. Detection limits for VOCs in the canister samples.**

	<b>Detection Limit</b>
CO, CO <sub>2</sub> , CH <sub>4</sub> (NiCat Method)	0.1 ppm
Methane (LHC method)	100 ng/L
all other VOCs	0.2 – 0.5 ng/L

### **3.4. Carbonyl Compound Analysis**

During sampling, air is drawn through silica gel Sep-Pak cartridges coated with 2,4-DNPH. The carbonyl compounds selectively react with the 2,4-DNPH forming hydrazones which are retained on the cartridge. The hydrazones are removed from the cartridge using a solvent and the liquid sample that results is analysed by high performance liquid chromatography (HPLC).

After sample collection, the 2,4-DNPH-carbonyl hydrazones were eluted from each Sep-Pak cartridge and the solution was made up to volume in a graduated centrifuge tube with HPLC grade Acetonitrile (J.T. Baker). An aliquot of this solution was analyzed by reverse phase HPLC with UV-Visible detection. A Hewlett Packard 1090M HPLC with a diode-array detector, 100 vial autosampler and the DOS HPLC-3D ChemStation software was used for sample analysis. The ratio of transmitted light intensity at two wavelengths is used as the signal for quantitation. The method reports 24 carbonyl compounds, though 8 of the 24 individual compounds are reported as pairs as they co-elute. External calibration standards were prepared in-house from the pure carbonyl compounds and purified 2,4-DNPH. A calibration check mix was run after every 10th sample to monitor detector response and retention time drifts. Near baseline resolution was obtained for the acrolein-acetone-propionaldehyde triplet.

An important difference between this type of sampling and canister sampling is that the detection limits (expressed as air concentrations) that can be achieved depend on sample collection time. Sample is drawn through the cartridge at a constant rate of approximately 1 lpm. A sample collected for 2 hours will have a detection limit 4 times better than a sample collected for only 30 minutes. Table 3 shows the detection limits for the analysis and the detection limits scaled to air concentration for the different sample collection times used in this study. The complete list of target compounds for this analysis is given in Appendix 1.

**Table 3. Detection limits for the analysis of carbonyl compounds.**

<b>Analysis detection limit</b>	
µg/mL of hydrazone in the extract	0.1-0.2
<b>Air Concentration Detection Limit (ng/L)</b>	
30 minute sample	16-32
2 hour sample	4-8
4 hour sample	2-4
18 hour sample	0.5-1

### **3.5. Real-time Measurement of CO, CO<sub>2</sub>, and THC**

During the 1998-99 phase of testing, the concentrations of CO, CO<sub>2</sub>, and total hydrocarbons (THC as CH<sub>4</sub>) were determined every 3-4 minutes throughout the test sequence using an Innova Model 1302 photoacoustic multigas monitor.

A sample of air is drawn into the measurement cell of the analyser using an on-board pump. The measurement cell is sealed and infra-red radiation of selected wavelengths is focused into the cell. Each compound to be determined has a specific wavelength of light required and the wavelength selection is made using appropriate optical filters mounted in a carousel in the instrument. As each filter is placed in the light beam, the target gas absorbs the radiation and emits an acoustic signal which is detected by a pair of ultrasensitive microphones connected to the sealed measurement chamber. The intensity of the signal is proportional to the concentration of the gas in the cell. Cross-interference corrections were made using the on-board software/calibration procedure. Cross-interference results when a gas other than the target gas is present and produces an acoustic signal. Water vapour is the most important of the gases that causes a cross-interference signal. The complete measurement cycle – rotating the filter into position and acquiring the signal for each gas – takes approximately 4 minutes to complete. After this measurement cycle a new sample of air is drawn into the measurement cell and the process repeats. CO and CO<sub>2</sub> were determined as individual gases while the change in volatile organic compound or hydrocarbon concentration was monitored as a concentration equivalent to methane. This concentration cannot be compared to the total of the named volatile organic compound concentrations as determined from the canister analyses, but it can be compared to itself throughout the test and between homes. The reason for not being able to directly compare to canister concentration values is that different organic compounds have different response factors for this instrument. In other words, 1 ppm of benzene does not necessarily show the same response as 1 ppm of methane – it may have a greater or smaller response factor.

In the last three houses tested, additional real-time measures of CO and CO<sub>2</sub> concentrations at different locations in the house were made using two Q-Trak indoor air quality monitors (TSI Incorporated). The Q-Trak monitor used a non-dispersive infrared sensor for CO<sub>2</sub> measurement and an electrochemical sensor for CO.

Further information on these two instruments can be found in Appendix 6.

## **4. Results and Discussion**

### **4.1. CO and CO<sub>2</sub>**

The measured CO and CO<sub>2</sub> concentrations for the cold start tests and hot soak tests are shown in Table 4 through Table 7. A statistical analysis of this data is presented in Appendices 3 and 4.

**Table 4.** Phase 1 cold start test CO and CO<sub>2</sub> concentrations (ppm).

House Code	CO				CO <sub>2</sub>			
	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
GM	0.5	0.3	1.6	107	405	1048	970	863
PT	0.2	0.1	0.5	14	546	649	582	549
JR	0.6	0.4	0.9	23	392	785	790	567
HD	1.0	0.6	33	256	406	784	916	1244
MM	0.3	0.2	0.4	63	422	1167	1398	683
TR	0.6	0.7	1.5	18	420	704	1026	547

**Table 5.** Phase 2 cold start test CO and CO<sub>2</sub> concentrations (ppm).

House Code	CO				CO <sub>2</sub>			
	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
JE	0.5	0.3	2.3	127	383	653	608	898
SV	0.7	0.5	2.2	131	418	1005	1089	985
MH	0.6	0.7	16.4	175	431	670	617	924
SR	1.8	1.1	7	138	381	708	786	830
JS	0.7	0.5	2.8	25	424	885	904	618
PB	0.7	0.6	2.2	151	415	771	920	840
GS	0.4	0.4	4.7	73	387	617	711	619
RW	0.3	0.3	10.0	125	401	551	618	706
KR	0.4	0.4	3.4	125	398	917	923	807
FA	0.2	0.2	3.0	57	386	725	788	536
HD	0.5	0.2	9.5	149	390	1034	1277	1010

**Table 6.** Phase 1 hot soak test CO and CO<sub>2</sub> concentrations (ppm).

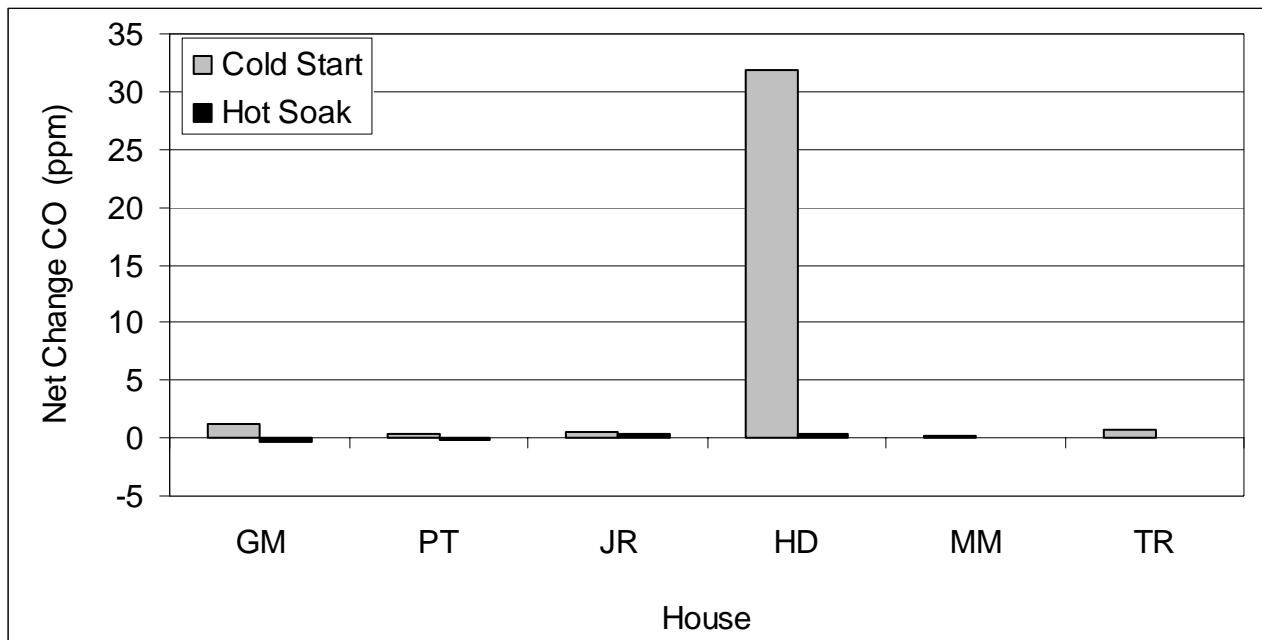
House Code	CO				CO <sub>2</sub>			
	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG
GM	0.4	0.5	0.3	0.4	416	670	876	523
PT	0.2	0.8	0.7	0.7	408	833	742	476
JR	0.3	0.3	0.7	0.5	554	803	744	422
HD	0.4	0.2	0.7	0.9	715	567	688	539

**Table 7.** Phase 2 hot soak CO and CO<sub>2</sub> concentrations (ppm).

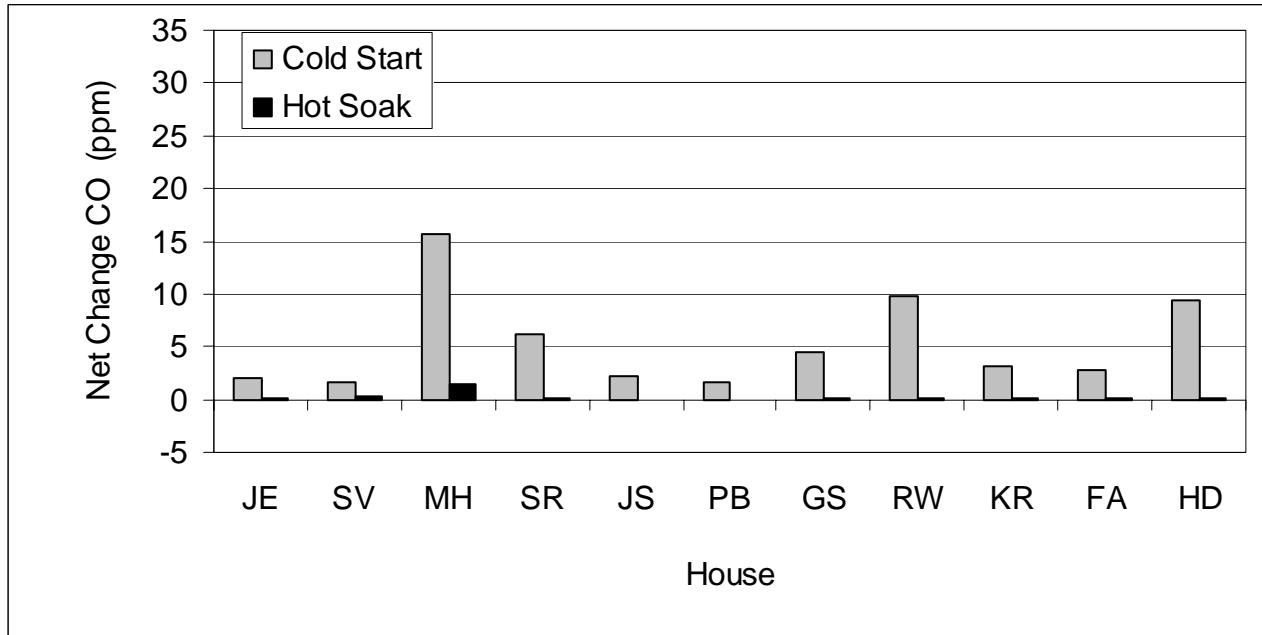
House Code	CO				CO <sub>2</sub>			
	AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG
JE	0.5	0.3	0.4	0.4	383	638	792	457
SV	0.8	0.5	0.8	1.0	410	731	804	445
MH	0.6	0.5	1.9	1.5	431	767	692	560
SR	1.8	0.6	0.8	1.4	381	713	784	443
JS	0.7	0.8	0.8	0.4	424	858	924	448
PB	0.7	0.7	0.6	0.4	415	768	833	436
GS	0.4	0.4	0.5	0.4	387	635	818	426
RW	0.3	0.1	0.3	0.3	401	561	559	478
KR	0.4	0.5	0.5	0.7	398	895	1001	501
FA	0.2	0.2	0.2	0.3	386	757	806	451
HD	0.5	0.4	0.4	0.7	390	897	1163	520

The net change in CO and CO<sub>2</sub> concentrations between the pre-test and house samples were calculated. These results are shown in Figure 1 through Figure 4.

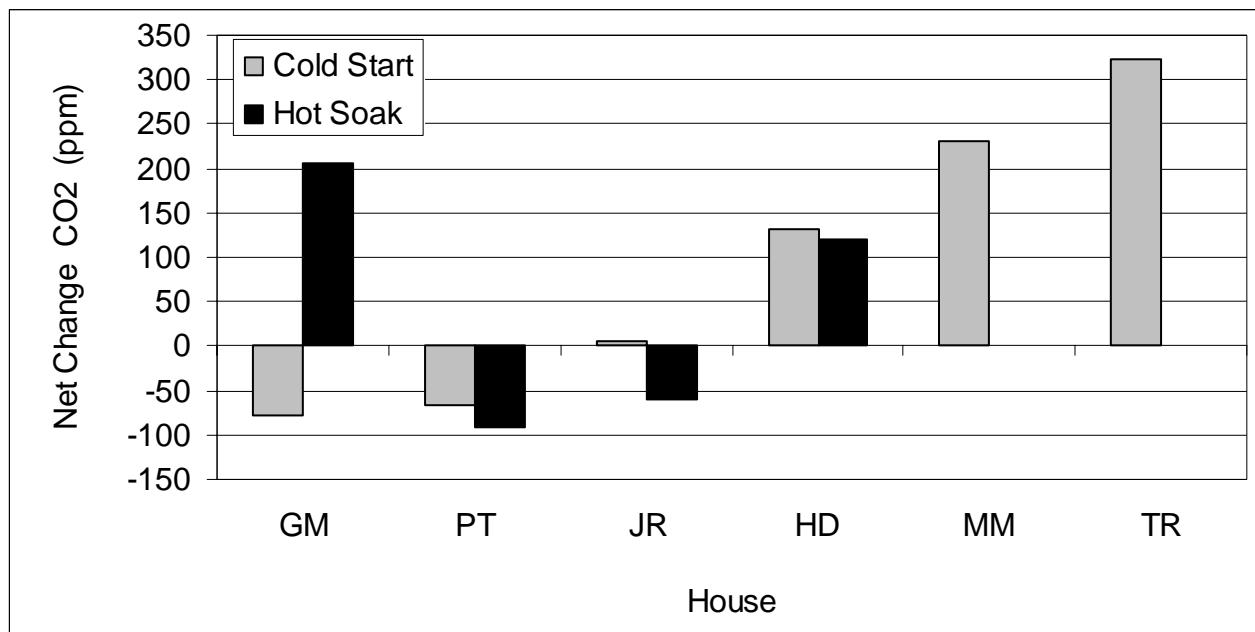
**Figure 1.** Net change in CO concentrations between house and pre-test samples for the phase 1 cold start and hot soak tests.



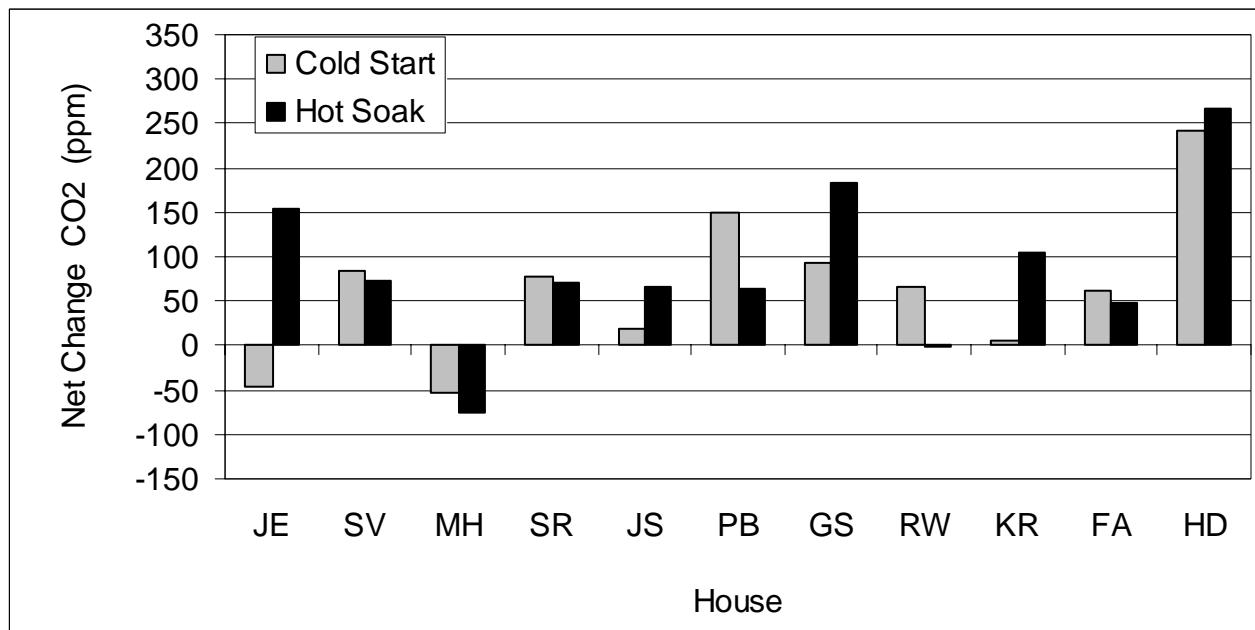
**Figure 2.** Net change in CO concentrations between house and pre-test samples for the phase 2 cold start and hot soak tests.



**Figure 3.** Net change in CO<sub>2</sub> concentrations between house and pre-test samples for the phase 1 cold start and hot soak tests.



**Figure 4.** Net change in CO<sub>2</sub> concentrations between house and pre-test samples for the phase 2 cold start and hot soak tests.



The cold start tests typically show a positive net change in both CO and CO<sub>2</sub>, as would be expected as both compounds are produced by the vehicle during normal engine operation. The net change observed for CO for the hot soak tests typically shows no change as would be expected since the vehicle's engine is not operating during the test. Any changes in CO<sub>2</sub> that are observed are not purely due to vehicle operation. Changes in the number of people present in the house or their activity level will have an impact on the measured CO<sub>2</sub> level.

## 4.2. Volatile Organic Compounds

As an independent method of measuring the amount of air transported into the house from the attached garage, a known amount of SF<sub>6</sub> was injected into the garage at the beginning of each test. The measured concentrations of SF<sub>6</sub> in the house and garage samples are summarised in Table 8. No detectable amounts of SF<sub>6</sub> were found in the background or pre-test samples. A statistical analysis of this data is presented in Appendices 3 and 4. The SF<sub>6</sub> tracer gas was used during phase 1 only.

**Table 8. SF<sub>6</sub> tracer concentrations for phase 1 cold start and hot start tests (ng/L).**

House	CSH	CSG	HSH	HSG
GM	2.7	162	2.7	1284
PT	9.0	187	9.8	783
JR	3.3	310	6.0	793
HD	14	86	27	893
MM	0.4	180		
TR	9.0	187		

Each of the canister samples was analysed for volatile organic compound concentrations. The complete data set is presented in Appendix 1. Selected compounds of interest are presented in Table 9 though Table 12. A missing value indicates compound was below detection limits in the sample.

**Table 9. Selected toxic compound concentrations for the phase 1 cold start tests (ng/L).**

	House	CSB	CSPT	CSH	CSG
13-butadiene	GM			1.8	106
	PT	1.0		1.5	25
	JR	1.6		1.0	35
	HD		0.4	29	145
	MM			0.4	51
	TR	0.3	0.6	2.4	22
Benzene	GM	1.7	2.5	8.2	393
	PT	4.8	7.7	8.2	77
	JR	2.2	3.2	5.6	123
	HD	3.0	8.4	133	1157
	MM	1.4	4.6	5.5	229
	TR	2.4	14	13	100
Toluene	GM	2.5	8.0	20	925
	PT	16	31	27	190
	JR	3.9	16	19	301
	HD	4.4	65	318	2879
	MM	1.9	11	13	600
	TR	4.1	16	36	232
m&p-xylene	GM	1.3	4.3	12	706
	PT	14	27	24	145
	JR	3.0	7.9	8.4	241
	HD	2.8	28	183	2252
	MM	1.4	8.6	10	494
	TR	2.9	14	27	170
o-xylene	GM	0.6	1.7	5.1	295
	PT	6.7	11	11	63
	JR	3.2	3.7	4.2	102
	HD	1.4	13	75	920
	MM	0.3	3.6	4.8	203
	TR	2.1	6.3	11	71
ethylbenzene	GM	0.5	1.6	3.6	220
	PT	4.5	7.4	9.8	44

	<b>House</b>	<b>CSB</b>	<b>CSPT</b>	<b>CSH</b>	<b>CSG</b>
	JR	0.9	2.0	2.7	74
	HD	1.3	11	59	675
	MM	0.4	2.5	3.4	146
	TR	1.2	4.1	7.8	52
styrene	GM		1.4	3.5	58
	PT	1.4	1.8	2.7	16
	JR		1.5	1.4	20
	HD		1.1	11	157
	MM	0.8	0.9	1.3	35
	TR		1.2	1.5	13

**Table 10. Selected toxic compound concentrations for the phase 2 cold start tests (ng/L).**

	<b>House</b>	<b>AMB</b>	<b>CSPT</b>	<b>CSH</b>	<b>CSG</b>
13-butadiene	JE	0.1	0.3	2.1	166
	SV	0.3	0.4	3.6	39
	MH	0.5		15.2	163
	SR		0.7	7.6	58
	JS	0.4	0.5	2.9	33
	PB	0.6		2.0	140
	GS	0.4	0.3	5.1	85
	RW		0.3	9.1	91
	KR	0.2	0.2	2.7	109
	FA		0.2	2.2	44
Benzene	HD	0.1	0.5	9.8	145
	JE	1.4	2.0	8.5	708
	SV	2.4	7.3	13.9	603
	MH	3.4	8.4	72.8	749
	SR	1.9	6.9	34.6	647
	JS	3.6	5.5	13.5	140
	PB	2.9	4.3	10.1	607
	GS	2.3	5.7	23.8	372
	RW	2.8	8.0	39.2	466
	KR	2.1	9.8	14.4	284
Toluene	FA	1.1	3.2	8.0	126
	HD	1.3	16.8	29.0	403
	JE	2.0	8.6	25.7	1639
	SV	5.4	23.7	40.2	1554
	MH	8.1	23.0	157.6	1803
	SR	4.5	21.8	75.1	1582
	JS	7.1	28.8	44.5	335
	PB	7.8	29.5	41.3	1379
	GS	4.2	21.6	56.6	845
	RW	4.8	28.5	90.0	1140
m&p-xylene	KR	4.3	43.4	45.8	422
	FA	2.1	12.6	21.5	163
	HD	3.8	61.1	65.3	562
	JE	1.2	4.0	13.2	1247
	SV	2.5	20.6	38.4	1245
	MH	4.0	20.2	101.9	1407
	SR	1.9	14.5	48.0	1336
	JS	4.4	29.8	40.2	281

	<b>House</b>	<b>AMB</b>	<b>CSPT</b>	<b>CSH</b>	<b>CSG</b>
	KR	2.5	30.6	35.6	577
	FA	1.2	7.1	14.7	214
	HD	1.8	45.0	50.3	754
o-xylene	JE	0.5	1.6	4.9	512
	SV	1.2	8.0	14.2	519
	MH	1.9	9.2	42.6	578
	SR	1.0	5.8	20.1	559
	JS	2.1	13.3	17.8	118
	PB	1.7	11.7	12.2	435
	GS	1.2	5.6	14.5	283
	RW	1.2	6.5	22.4	367
	KR	1.4	11.7	15.0	243
	FA	0.8	3.0	5.9	90
ethylbenzene	HD	1.1	18.6	21.0	320
	JE	0.3	1.3	3.8	377
	SV	0.8	6.0	11.3	379
	MH	1.1	6.2	33.5	416
	SR	0.5	4.2	14.4	401
	JS	1.2	8.3	12.4	84
	PB	1.3	7.8	7.9	316
	GS	0.7	3.6	10.4	202
	RW	1.0	4.8	17.2	269
	KR	0.7	8.6	11.2	169
styrene	FA	0.5	2.1	4.5	64
	HD	0.7	15.2	15.9	226
	JE	0.3	1.2	0.8	95
	SV		3.0	3.7	21
	MH		2.0	8.1	94
	SR		1.7	10.0	44
	JS		1.7	2.3	21
	PB		2.5	1.7	67
	GS		0.7	2.2	51
	RW	0.5	0.2	1.9	53

**Table 11.** Selected toxic compound concentrations for the phase 1 hot soak tests (ng/L).

	<b>House</b>	<b>HSB</b>	<b>HSPT</b>	<b>HSH</b>	<b>HSG</b>
13-butadiene	GM		0.3	0.8	2.0
	PT	0.5	0.5	0.5	2.1
	JR		0.3	0.3	1.1
	HD	2.0	0.2	1.0	2.3
Benzene	GM	1.6		7.5	239
	PT	3.1	4.4	14	175
	JR	3.3	2.9	7.0	88
	HD	10	5.3	44	170
Toluene	GM	2.6	4.5	21	796
	PT	5.7	13	42	607
	JR	11	19	25	309
	HD	129	32	170	612
m&p-xylene	GM	1.8	3.5	12	426
	PT	3.5	17	28	338

	<b>House</b>	<b>HSB</b>	<b>HSPT</b>	<b>HSH</b>	<b>HSG</b>
o-xylene	JR	5.7	6.1	12	164
	HD	32	15	76	337
ethylbenzene	GM	0.5	1.6	6.0	176
	PT	1.5	8.5	13	141
	JR	2.4	3.0	5.4	68
	HD	14	6.5	32	138
styrene	GM	1.2	1.2	4.3	137
	PT	1.3	4.4	8.6	109
	JR	1.5	1.5	3.4	53
	HD	10	5.1	27	110

**Table 12.** Selected toxic compound concentrations for the phase 2 hot soak tests (ng/L).

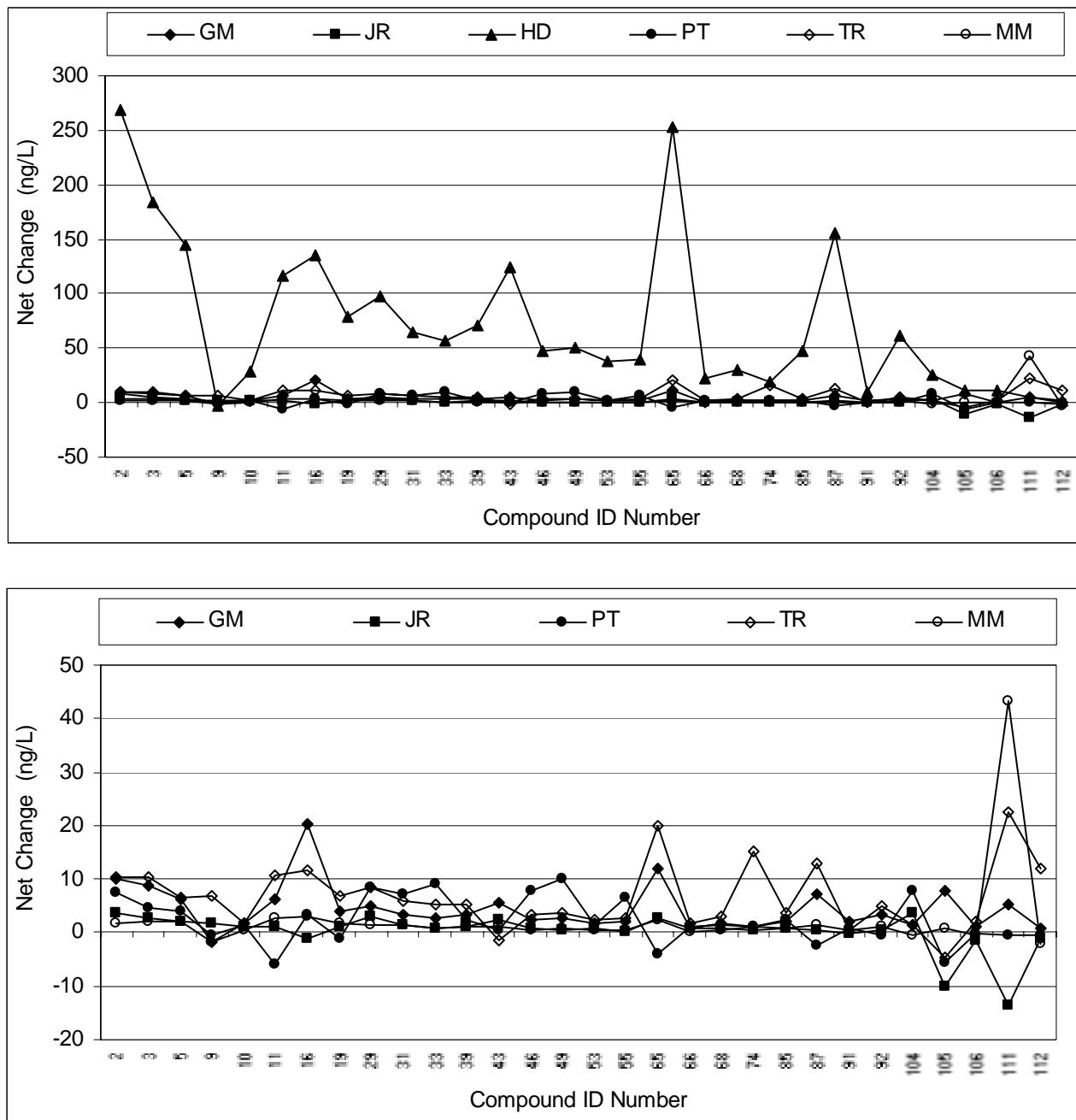
	<b>House</b>	<b>AMB</b>	<b>HSPT</b>	<b>HSH</b>	<b>HSG</b>
13-butadiene	JE	0.1	0.2		1.0
	SV	0.4	0.6		
	MH	0.5	0.5		1.8
	SR		0.2	0.9	
	JS	0.4	0.8	1.2	1.1
	PB	0.6	0.2		0.8
	GS	0.4	0.5	0.6	0.8
	RW			0.8	1.7
	KR	0.2	0.7	0.7	3.2
	FA				1.2
Benzene	HD	0.1		0.5	1.4
	JE	1.4	2.3	3.1	57
	SV	2.9	5.2	5.5	97
	MH	3.4	6.1	13.5	60
	SR	1.9	2.5	12.4	74
	JS	3.6	5.6	9.8	67
	PB	2.9	3.2	4.4	75
	GS	2.3	4.0	9.9	65
	RW	2.8	1.8	15.6	124
	KR	2.1	4.0	14.0	257
Toluene	FA	1.1	3.2	9.3	91
	HD	1.3	2.3	30.8	170
	JE	2.0	8.7	21.0	269
	SV	6.2	18.4	28.4	344
	MH	8.1	13.1	34.3	190
	SR	4.5	8.1	35.0	256
	JS	7.1	27.7	42.5	233
	PB	7.8	29.5	34.0	251
	GS	4.2	13.9	32.4	222
	RW	4.8	6.2	48.1	403
m&p-xylene	KR	4.3	24.5	51.0	762
	FA	2.1	17.1	26.8	217
	HD	3.8	26.5	80.6	394
	JE	1.2	4.6	7.9	160
SV					
	MH	3.9	40.3	44.4	221

	<b>House</b>	<b>AMB</b>	<b>HSPT</b>	<b>HSH</b>	<b>HSG</b>
SR JS PB GS RW KR FA HD	SR	1.9	5.0	15.8	150
	JS	4.4	29.1	37.8	143
	PB	3.6	25.6	24.5	149
	GS	2.2	8.4	16.4	132
	RW	3.2	4.7	24.6	220
	KR	2.5	20.3	35.5	580
	FA	1.2	6.8	16.1	195
	HD	1.8	15.1	60.9	419
o-xylene	JE	0.5	1.8	3.0	70
	SV	1.8	15.0	15.8	94
	MH	1.9	5.1	10.0	41
	SR	1.0	2.5	6.4	61
	JS	2.1	13.2	12.3	61
	PB	1.7	10.1	9.8	61
	GS	1.2	4.3	7.5	54
	RW	1.2	2.4	10.8	89
	KR	1.4	8.9	15.4	243
	FA	0.8	3.1	5.4	80
ethylbenzene	HD	1.1	6.7	25.1	174
	JE	0.3	1.4	2.5	50
	SV	1.2	11.0	11.6	69
	MH	1.1	3.9	6.7	32
	SR	0.5	1.4	4.7	50
	JS	1.2	8.3	9.3	45
	PB	1.3	7.2	6.9	47
	GS	0.7	2.6	4.7	42
	RW	1.0	1.3	8.3	71
	KR	0.7	6.4	11.5	181
styrene	FA	0.5	2.2	6.7	61
	HD	0.7	5.1	20.8	133
	JE	0.3	0.4	1.8	1.8
	SV	0.5	2.3	1.4	2.3
	MH		1.1	0.6	0.5
	SR		0.7	0.5	3.7
	JS		1.6	0.8	0.9
	PB		2.1	0.8	1.2
	GS		0.9	1.0	0.4
	RW	0.5	1.1	0.4	0.4

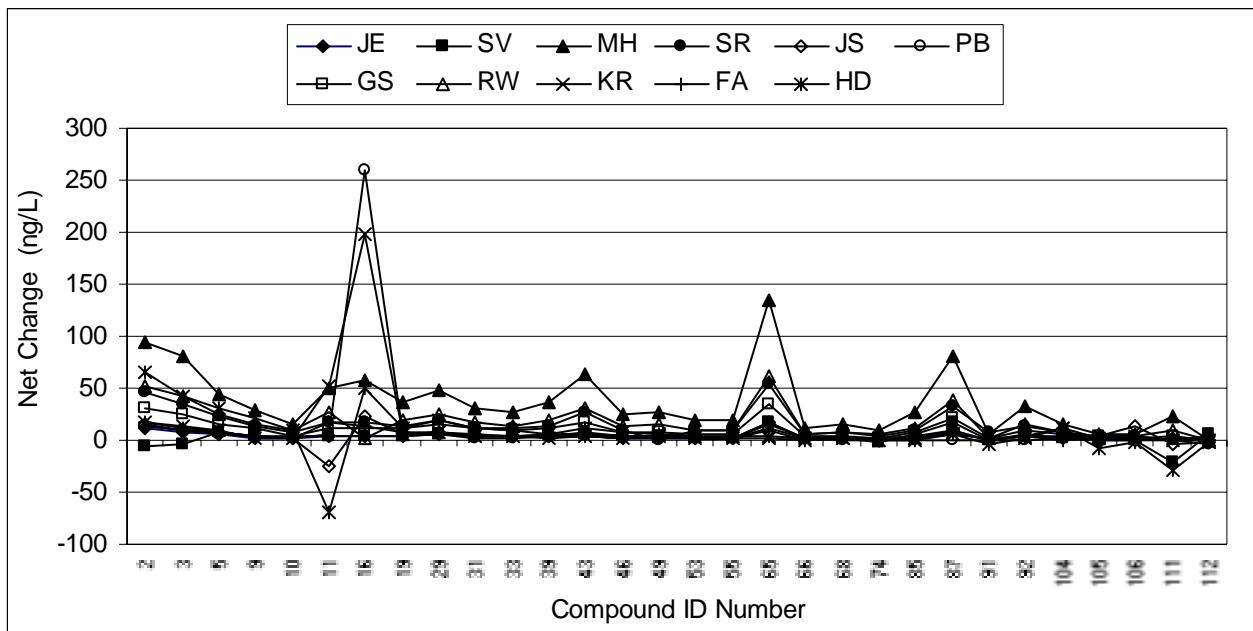
The net change in concentration between the pre-test and house samples for the hydrocarbon compounds representative of cold start and hot soak vehicle emissions were calculated. These results are presented graphically in Figure 5 through Figure 8. They show at a first glance the extent of infiltration of the vehicle emissions into the house. The names of the compounds and their corresponding compound ID number as used in these figures are given in Appendix 1.

**Figure 5. Net change in selected hydrocarbon compounds during the phase 1 cold start tests.**

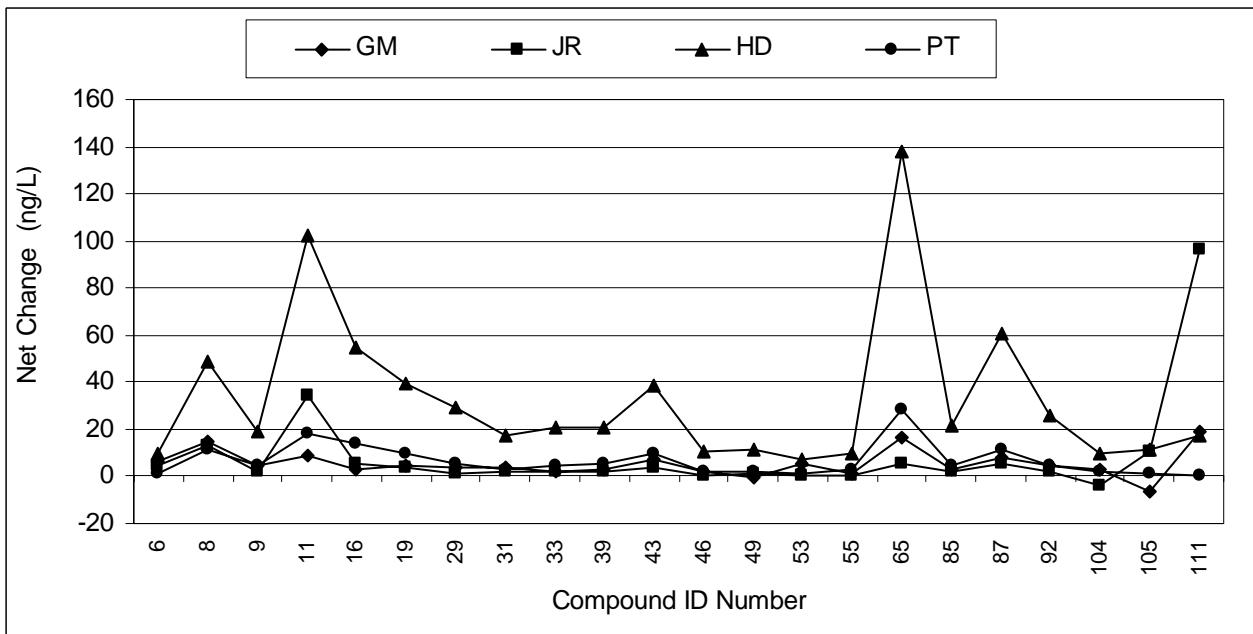
(The second panel in this figure shows on an expanded scale the data for all houses except HD)



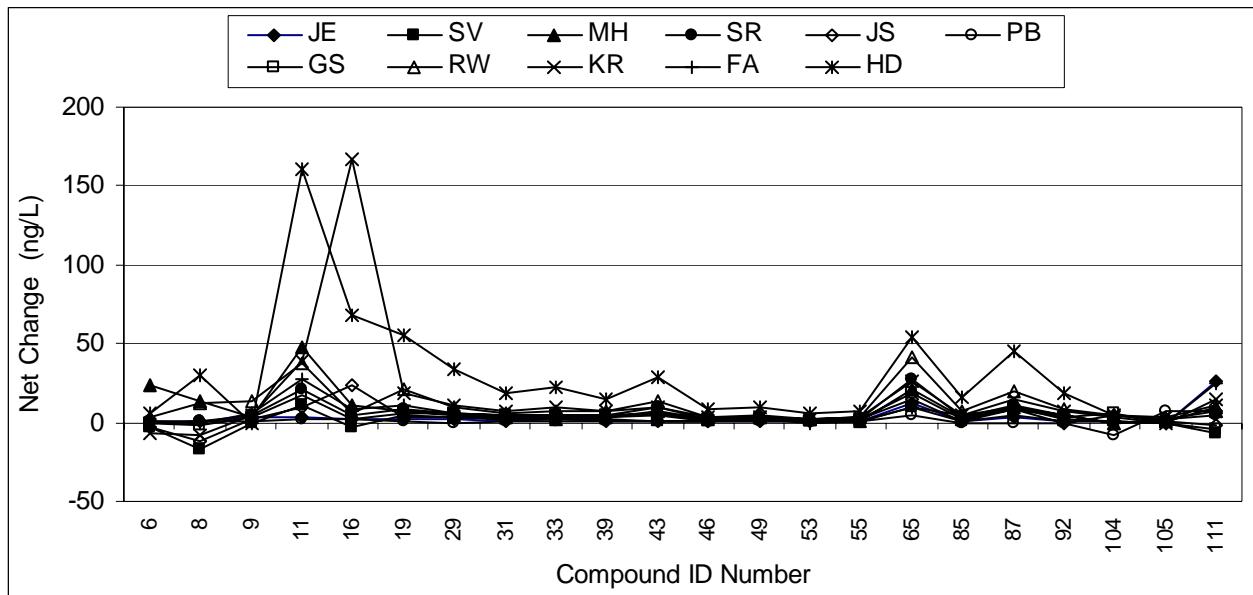
**Figure 6. Net change in selected hydrocarbon compounds during the phase 2 cold start tests.**



**Figure 7. Net change in selected hydrocarbon compounds during the phase 1 hot soak tests.**



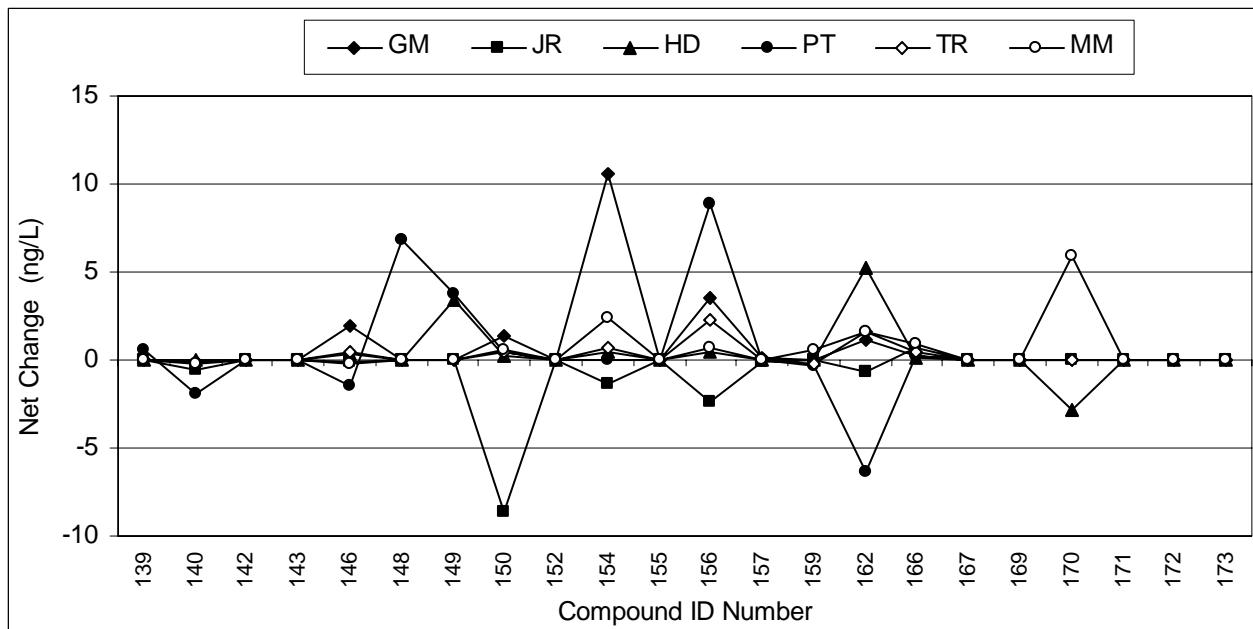
**Figure 8. Net change in selected hydrocarbon compounds during the phase 2 hot soak tests.**



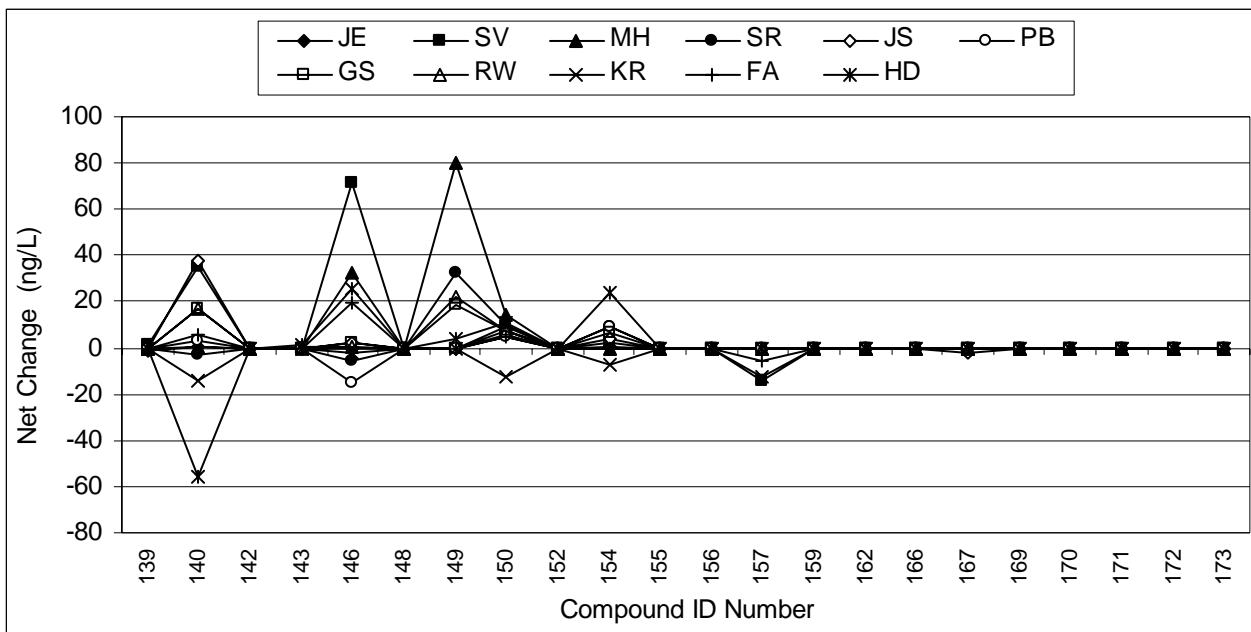
For the Phase 1 cold start and hot soak tests, one house stands out showing a clear indication of infiltration – the HD house. The net change in concentration of those volatile organic compounds found in the vehicle exhaust plume and in the hot soak emissions is very large (100 ng/L or greater in the cold start test and 20 ng/L or greater in the hot soak test). The remaining houses of Phase 1 and those of Phase 2 all show positive net changes but the changes are not as pronounced as the Phase 1 test at the HD house. The net change in concentration seen for the Phase 2 HD house test is not as dramatic as in Phase 1 but is still a positive change. As would be expected, the net change patterns are similar between houses – further supporting the indication of infiltration of vehicle emissions from the attached garage.

The net change in concentrations between the pre-test and house samples for selected halocarbons are illustrated in Figure 9 through Figure 12.

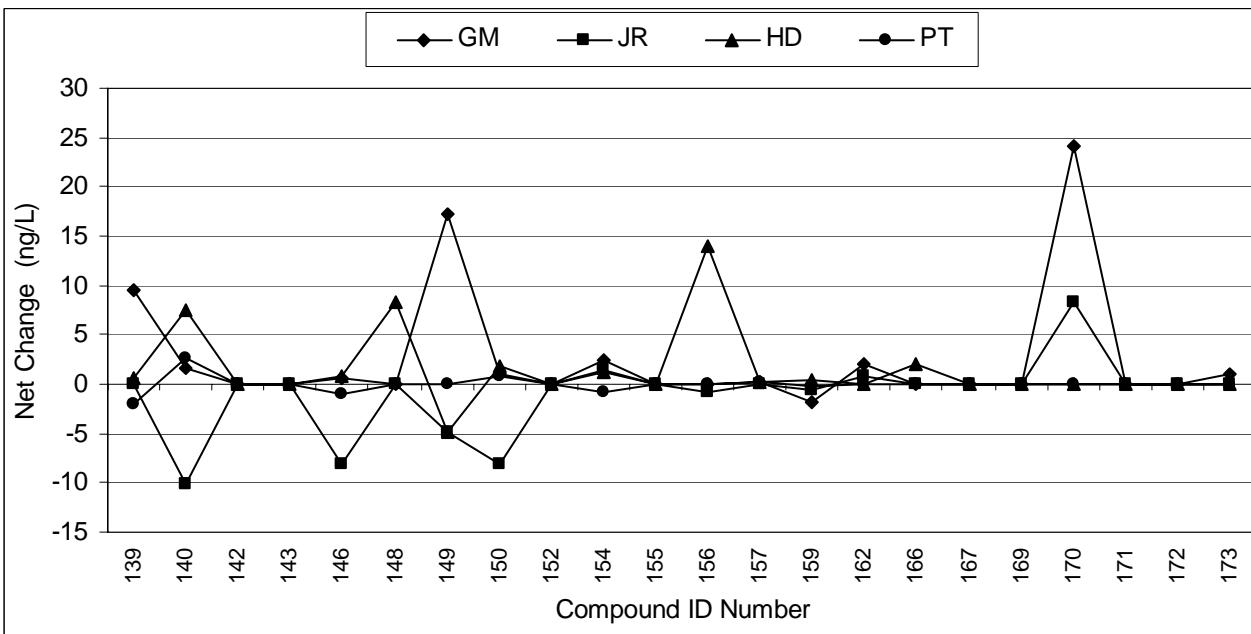
**Figure 9. Net change of halocarbon compounds during the phase 1 cold start tests.**



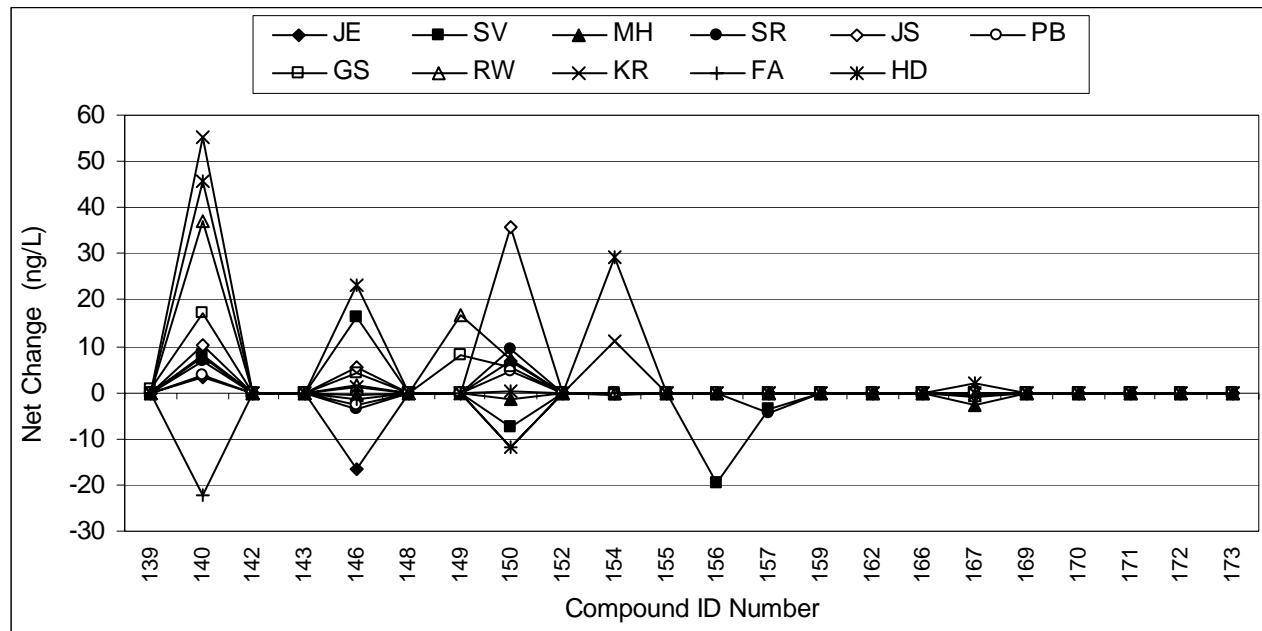
**Figure 10. Net change of halocarbon compounds during the phase 2 cold start tests.**



**Figure 11. Net change of halocarbon compounds during the phase 1 hot soak tests.**



**Figure 12. Net change of halocarbon compounds during the phase 2 hot soak tests.**



As can be seen in the above figures, no clear trend in change in halocarbon concentration can be seen. This is expected as these compounds are not related to the vehicle operation, but are present in the indoor air from other sources. Compound ID 140 corresponds to Freon-12 (CFC-12) which is the refrigerant used in the vehicle's air conditioner. A positive net change in this compound might be explained by leakage from the vehicle air conditioner, but other sources of this refrigerant may be present due to older household appliances. No strong conclusions can be drawn from this data.

#### 4.3. Carbonyl Compounds

Carbonyl compounds are emitted by vehicles only as a result of combustion. Thus, emissions are expected from the vehicle during the cold start test but not during the hot soak test. In Table 13 through Table 16, the analytical results for the pre-test and house samples are presented for the cold start and hot soak tests for each phase, along with the net change between the house test sample and the pre-test sample. The complete data set and the compound names that correspond to the ID numbers are presented in Appendix 1. A statistical analysis of this data is presented in Appendices 3 and 4. Values presented in italics indicate that the reported concentrations are at or below quantitation limits and have large uncertainties ( $\pm 100\%$ ). Missing values indicate that the compound was not detected in the sample. As mentioned earlier, the detection limit of the carbonyl compounds in the air samples is dependent on the length of time the sample is collected.

Where one or both of the sample concentrations for the pre-test or house samples is either not detected or below quantitation limits, the net change is given as "na" or not available as it could not be determined from the data available. The effect of the changing detection limit as a function of sample time can be seen very clearly in the cold start test for the JE house (Table 14). For compound 179-acetone, the pre-test concentration is reported as 31.4 ng/L, very close to the upper bound for the quantitation limit of 16-32 ng/L for a 30 minute sample. The corresponding house sample collected for 2 hours during the cold start test gives a concentration of 13.7 ng/L, well above the 4-8 ng/L quantitation limit for a 2-hour sample. The net change of -17.7 ng/L is suspect, both because it is negative and because the pre-test sample concentration is near the upper limit of quantitation. An example of a valid pre-test concentration result for acetone is found in the cold start test at the SV house (also Table 14). In this case, the pre-test and house samples show nearly identical results for acetone concentration and this concentration is well above the quantitation limits of both samples. This is further reflected in the very small and also negative net change, indicating that the concentration did not increase during the test. The garage concentration reported for this test (a 30-minute sample) is low as compared to other

compounds emitted by the vehicle and also below quantitation limits at 14.9 ng/L, further suggesting that the concentration should not change over the test.

Overall, the net changes observed range from very small to not measurable. This is a result of the low emission rate of these compounds from the vehicle during cold start and due to the relatively high initial concentration in the house. A small increase due to infiltration of a small amount of material from the garage is very difficult to measure as the difference between two relatively large concentrations, especially where one of the measured concentrations is highly uncertain.

In general, the outdoor air samples show concentrations of carbonyl compounds near or below the quantitation limit. In all cases, the reported concentration for acrolein is below the quantitation limit, and therefore highly uncertain.

**Table 13. Concentrations of carbonyl compounds and the net change for the phase 1 cold start tests (ng/L).**

ID	GM			PT			JR		
	CSPT	CSH	Net Change	CSPT	CSH	Net Change	CSPT	CSH	Net Change
175	29.3	28.4	-0.9	8.5	49.0	na	22.9	23.3	na
176	16.3	17.0	0.7	7.1	15.5	na	14.9	17.6	na
177				0.5	na				
178									
179	24.9	25.9	1.0	7.8	36.2	na	48.6	42.0	-6.6
180		1.7	na		2.8	na		2.2	na
181					1.3	na			
182									
183									
184									
185	8.2	3.9	na		13.1	na		7.4	na
186		1.2	na						
187		1.7	na		1.8	na		1.5	na
188									
189		1.5	na		1.5	na		1.3	na
190		1.7	na		3.6	na		2.5	na
191									
192									
193									
194					0.6	na			
195									
196	12.9	7.3	na		16.4	na	10.0	12.6	na
ID	HD			MM			TR		
	CSPT	CSH	Net Change	CSPT	CSH	Net Change	CSPT	CSH	Net Change
175	13.1	13.2	na	31.4	40.4	9.0	7.6	14.3	na
176	11.6	16.5	na	26.5	29.5	3.0	6.3	12.7	na
177		0.6	na		0.9	na			
178									
179	28.9	34.1	5.2	29.6	36.0	6.3	26.2	58.5	32.3
180		2.3	na		2.4	na		2.3	na
181									
182									
183									
184		0.9	na		0.7	na		0.7	na
185	6.1	11.6	na					4.1	na
186					4.6	na			
187		1.4	na		2.9	na			
188					1.2	na			
189		2.9	na		2.9	na			

190		1.4	na		2.9	na		1.8	na
191		0.9	na						
192									
193									
194									
195									
196		4.7	na	7.4	10.8	na		6.4	na

**Table 14.** Concentrations of carbonyl compounds and the net change for the phase 2 cold start tests (ng/L).

ID	JE			SV			MH			SR		
	CSPT	CSH	Net Change									
175	19.3	15.3	-4.0	24.3	26.4	2.1	8.5	7.8	na	19.4	22.1	2.7
176	6.4	5.2	na	15.4	15.7	na	6.0	6.9	na	10.9	14.9	na
177												
178					0.7	na		0.6	na		0.7	na
179	31.4	13.7	-17.7	57.4	50.5	-6.9	24.3	11.9	-12.3	43.6	37.9	-5.7
180		0.9	na		2.0	na		1.0	na		1.2	na
181												
182												
183												
184					0.8	na					0.5	na
185												
186		0.9	na	9.8	10.4	na					1.9	na
187		0.9	na	8.1	1.9	na	6.2	1.4	na		1.3	na
188												
189					1.3	na					1.4	na
190		0.8	na		1.5	na					1.0	na
191		0.9	na									
192												
193												
194												
195												
196		2.3	na		4.4	na		1.4	na		3.1	na
ID	JS			PB			GS			RW		
	CSPT	CSH	Net Change									
175	33.3	34.5	1.1	32.4	38.6	6.2	23.0	21.7	-1.3	14.7	14.8	na
176	14.3	15.0	na	15.8	21.2	na	62.6	34.8	-27.8	10.4	13.7	na
177												
178		0.8	na		0.9	na		0.7	na		0.4	na
179	43.2	32.0	-11.1	56.4	49.1	-7.4	42.5	32.5	-10.0	20.8	13.0	-7.8
180		1.8	na		2.9	na		1.5	na		1.3	na
181												
182												
183												
184		0.4	na		0.8	na		0.4	na		1.4	na
185		3.5	na	15.9	10.7	na	4.2	2.0	na		1.1	na
186								1.9	na		0.7	na
187		1.0	na		1.4	na		1.1	na		0.7	na
188								0.6	na			
189		1.1	na		2.2	na		1.8	na		0.9	na
190		1.8	na		2.7	na		1.6	na		0.7	na
191												
192												

193		<i>1.0</i>	na					<i>1.2</i>	na				
194		6.8	na	6.7	8.8	na	6.2	4.9	na			2.6	na
195													
196													
ID	KR			FA			HD						
	CSPT	CSH	Net Change	CSPT	CSH	Net Change	CSPT	CSH	Net Change				
175	46.3	43.0	-3.2	18.3	21.2	2.9	21.1	20.8	-0.3				
176	21.6	20.7	-0.8	<i>10.7</i>	12.2	na	20.6	27.9	7.3				
177		0.9	na					<i>1.3</i>	na				
178		<i>1.4</i>	na	<i>0.8</i>	na			<i>1.7</i>	na				
179	80.6	73.2	-7.4	16.9	16.5	-0.4	76.8	74.1	-2.7				
180		2.9	na	<i>1.1</i>	na			<i>3.1</i>	na				
181													
182													
183													
184		<i>1.0</i>	na	<i>0.4</i>	na			<i>0.6</i>	na				
185	10.2	13.2	na	<i>2.5</i>	na		<i>5.1</i>	<i>5.7</i>	na				
186				<i>0.7</i>	na			<i>2.7</i>	na				
187		<i>2.1</i>	na	<i>1.0</i>	na			<i>1.7</i>	na				
188		<i>0.6</i>	na					<i>1.2</i>	na				
189		<i>2.2</i>	na				<i>7.4</i>	<i>6.6</i>	na				
190		<i>4.5</i>	na		<i>1.1</i>	na		<i>2.7</i>	na				
191													
192													
193													
194		<i>0.9</i>	na					<i>1.3</i>	na				
195													
196	19.7	20.7	1.1	<i>4.1</i>	na		<i>10.5</i>	9.9	na				

**Table 15.** Concentrations of carbonyl compounds and the net change for the phase 1 hot soak tests (ng/L).

	GM			PT			JR			HD		
	HSPT	HSH	Net Change	HSPT	HSH	Net Change	HSPT	HSH	Net Change	HSPT	HSH	Net Change
175	23.7	24.4	0.7	27.9	51.5	23.6	18.2	16.6	-1.6	9.2	11.3	na
176	19.4	15.0	-4.4	59.9	20.0	-39.9	<i>13.8</i>	16.0	na	7.5	12.5	na
177					<i>0.9</i>	na						
178					<i>1.2</i>	na						
179	19.0	17.9	-1.1	40.5	39.7	-0.8	36.1	42.7	6.6	19.2	26.3	7.1
180		<i>1.8</i>	na	<i>11.5</i>	3.9	na		<i>1.3</i>	na		<i>2.3</i>	na
181					<i>1.0</i>	na						
182												
183												
184								<i>0.3</i>	na			
185		5.9	na		<i>8.1</i>	na		<i>2.9</i>	na		<i>7.6</i>	na
186								<i>1.5</i>	na			
187		<i>1.0</i>	na		<i>1.9</i>	na		<i>0.9</i>	na		<i>0.9</i>	na
188					<i>0.8</i>	na		<i>0.5</i>	na			
189		<i>1.1</i>	na	<i>5.5</i>	<i>1.7</i>	na		<i>1.3</i>	na		<i>2.2</i>	na
190		<i>1.9</i>	na	<i>6.7</i>	<i>4.6</i>	na		<i>1.5</i>	na		<i>1.7</i>	na
191												
192												
193												
194				<i>7.6</i>	<i>0.7</i>	na		<i>0.9</i>	na		<i>1.0</i>	na
195												

196		6.3	na	14.2	20.3	na	9.5	7.6	na	5.0	6.0	na
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**Table 16. Concentrations of carbonyl compounds and the net change for the phase 2 hot soak tests (ng/L).**

ID	JE			SV			MH			SR		
	HSPT	HSH	Net Change									
175	24.4	24.7	0.3	30.5	31.3	0.8	9.4	7.5	na	19.6	21.4	1.8
176	9.3	8.2	na	15.4	19.4	na	4.5	5.3	na	9.3	10.8	na
177												
178	0.7	na		0.7	na		0.4	na		0.6	na	
179	29.8	20.5	-9.3	51.7	44.4	-7.3	19.2	12.2	-7.0	48.5	40.8	-7.7
180		1.7	na				0.7	na		1.0	na	
181												
182												
183												
184	0.7	na		0.9	na					1.4	na	
185										1.3	na	
186	1.5	na		11.8	12.1	na	1.1	na		1.0	na	
187	0.9	na		1.7	na		1.4	na				
188												
189	1.4	na		1.5	na		0.7	na		1.4	na	
190	1.2	na		1.8	na		0.6	na		1.4	na	
191												
192												
193												
194												
195												
196	4.0	na		6.0	na		1.7	na		2.9	na	
ID	JS			PB			GS			RW		
	HSPT	HSH	Net Change									
175	36.1	35.7	-0.4	34.3	35.5	1.3	20.6	23.8	3.2	10.7	12.9	2.3
176	14.1	17.3	na	14.7	15.2	na	17.2	21.5	4.3	6.8	8.2	na
177												
178	0.9	na		0.8	na		0.8	na		0.3	na	
179	41.2	33.9	-7.3	57.0	50.5	-6.4	43.7	40.7	-3.0	16.4	12.0	-4.4
180	2.4	na		2.3	na		1.9	na		1.1	na	
181							0.5	na				
182												
183												
184				1.4	na		0.4	na				
185	3.2	na		10.0	10.2	na	2.6	na		1.4	na	
186	1.7	na					2.3	na		0.8	na	
187	1.0	na		1.8	na		2.0	na				
188							0.8	na				
189	1.0	na		2.2	na		2.1	na		0.9	na	
190	1.7	na		2.3	na		2.0	na		0.7	na	
191												
192												
193												
194							1.3	na				
195							5.7	na		2.2	na	
196	6.7	7.2	na	8.4	8.6	na						

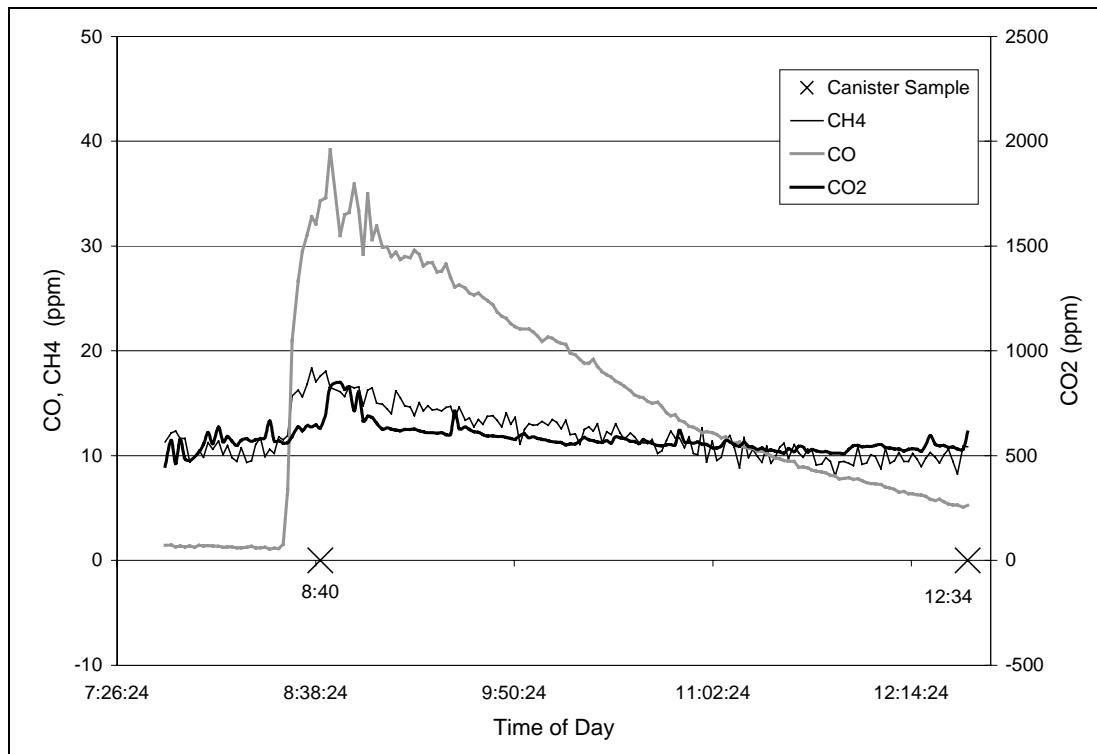
ID	KR			FA			HD		
	HSPT	HSH	Net Change	HSPT	HSH	Net Change	HSPT	HSH	Net Change
175	44.6	44.3	-0.3	24.8	24.7	-0.1	13.6	16.4	na
176	19.0	22.6	3.5	11.0	12.7	na	10.6	17.9	na
177		0.9	na					0.8	na
178		1.4	na		1.0	na		1.1	na
179	72.5	76.3	3.8	20.3	20.2	-0.1	51.7	61.1	9.5
180		3.0	na		1.3	na		2.9	na
181									
182									
183									
184									
185	8.6	12.0	na		4.0	na		6.7	na
186									
187		2.2	na		1.2	na		2.0	na
188		0.8	na						
189		2.1	na		0.8	na		5.6	na
190		4.5	na		1.7	na		2.3	na
191									
192									
193									
194								1.3	na
195									
196	20.6	21.6	1.0		4.7	na		7.9	na

#### 4.4. Real-time Measurements

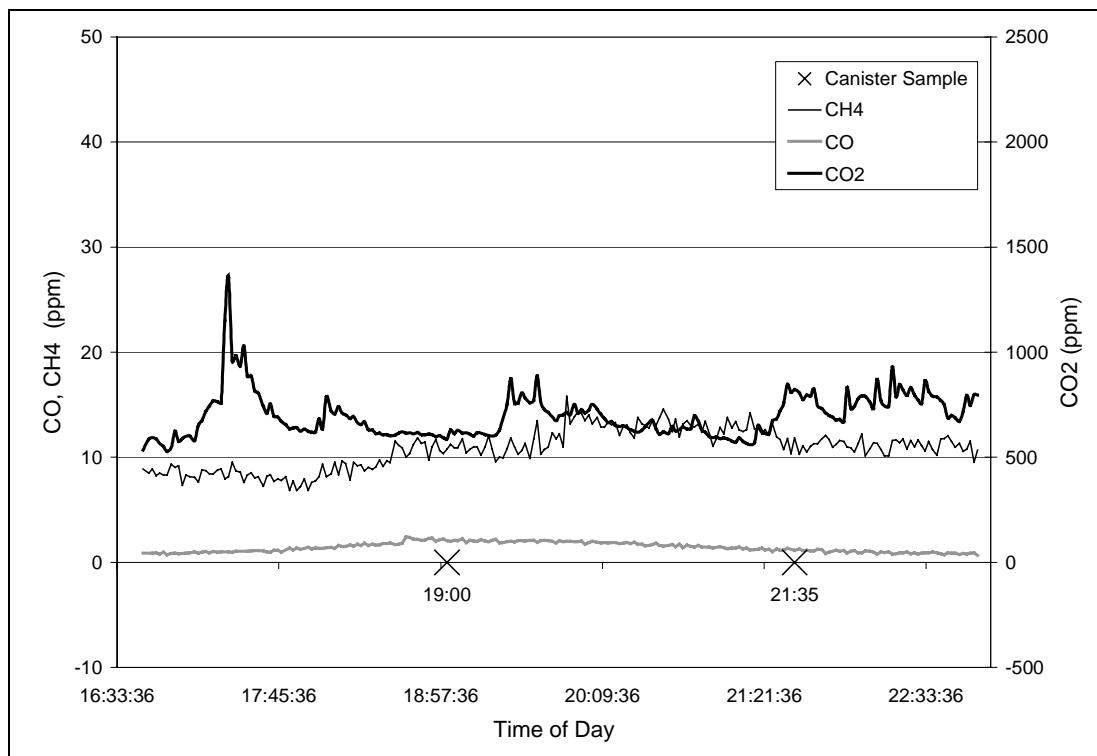
During phase 2, the Innova monitor was used to sample air at the in-house location previously determined to have the highest air infiltration rate from the attached garage. The CO, CO<sub>2</sub>, and THC as CH<sub>4</sub> concentrations measured with time during the cold start and hot soak tests are presented graphically in Appendix 5. The time interval over which the corresponding in-house canister collected air is also indicated on these graphs. Examples of typical real-time concentration profiles are shown in Figure 13 and Figure 14. The cold start tests appear to follow a similar pattern in that the CO concentration shows an increase some time after the vehicle is started and backed out of the garage. In some instances, the THC as CH<sub>4</sub> trace follows the same pattern. The concentrations of THC as CH<sub>4</sub> are very low, and in some instances, no detectable increase is observed. The pattern for CO<sub>2</sub> often reflects the human occupant activity level than the vehicle activity. For the hot soak tests, no trends in CO are observed that can be linked to vehicle operation as CO is not produced by the vehicle during this segment of the test. The THC and CH<sub>4</sub> trace again shows some indication of the fuel vapour infiltration, but the sensitivity was not sufficient to be able to give a strong indication of that event.

The first 45 minutes of the data in Figure 33 are not presented as a technical difficulty interfered with the downloading of the complete dataset from the instrument to the computer. In Figure 50, the time interval over which the canister sample is indicated does not correspond to the four hour following the start of the cold start test. The canister did not sample air for the first 2 hours due to a faulty inlet particle filter.

**Figure 13. Real-time concentration measurements during the cold start test at the MH house.**



**Figure 14. Real-time concentration measurements during the hot soak test at the MH house.**



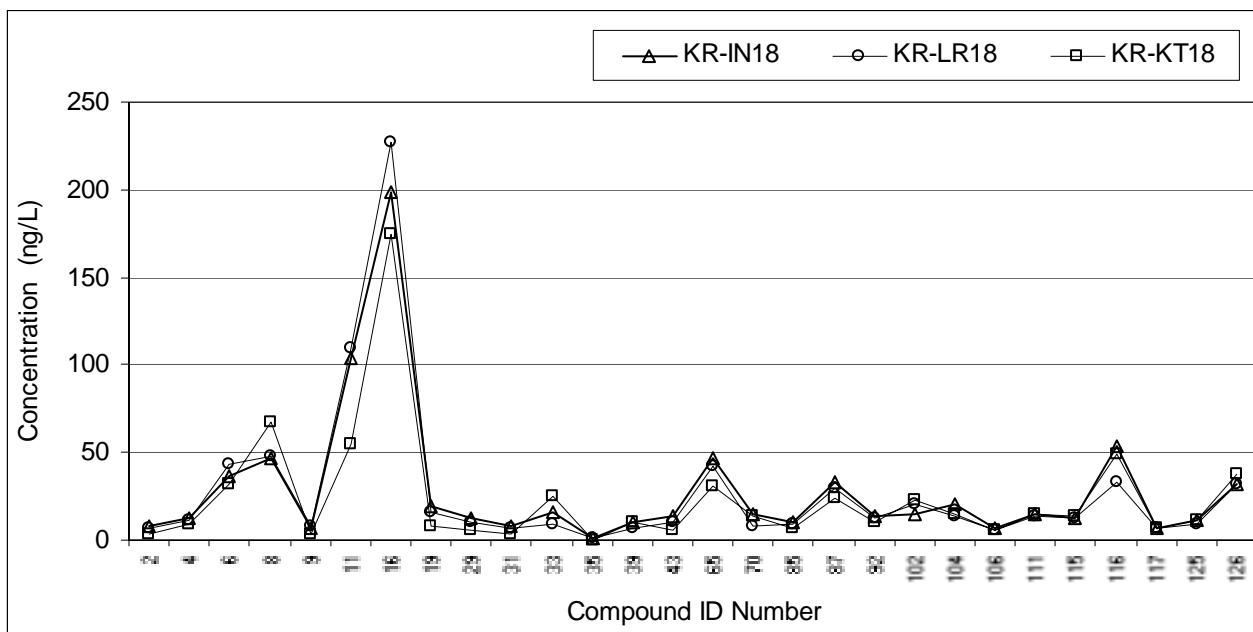
#### 4.5. Additional Sampling

Additional canister samples were collected at the last three houses (KR, FA, and HD) tested during phase 2. Three additional canister samples per house were collected for approximately 18 hours over the duration of the hot soak and cold start tests at different locations in each house. CO, CO<sub>2</sub>, and VOC analyses were performed on these canisters. The CO and CO<sub>2</sub> concentrations are presented in Table 17. The VOC chemical profiles are presented in Figure 15 through Figure 20. The compounds shown in the hydrocarbon chemical profiles (Figure 15, Figure 16, and Figure 17) are those hydrocarbons with concentrations greater than 5 ng/L.

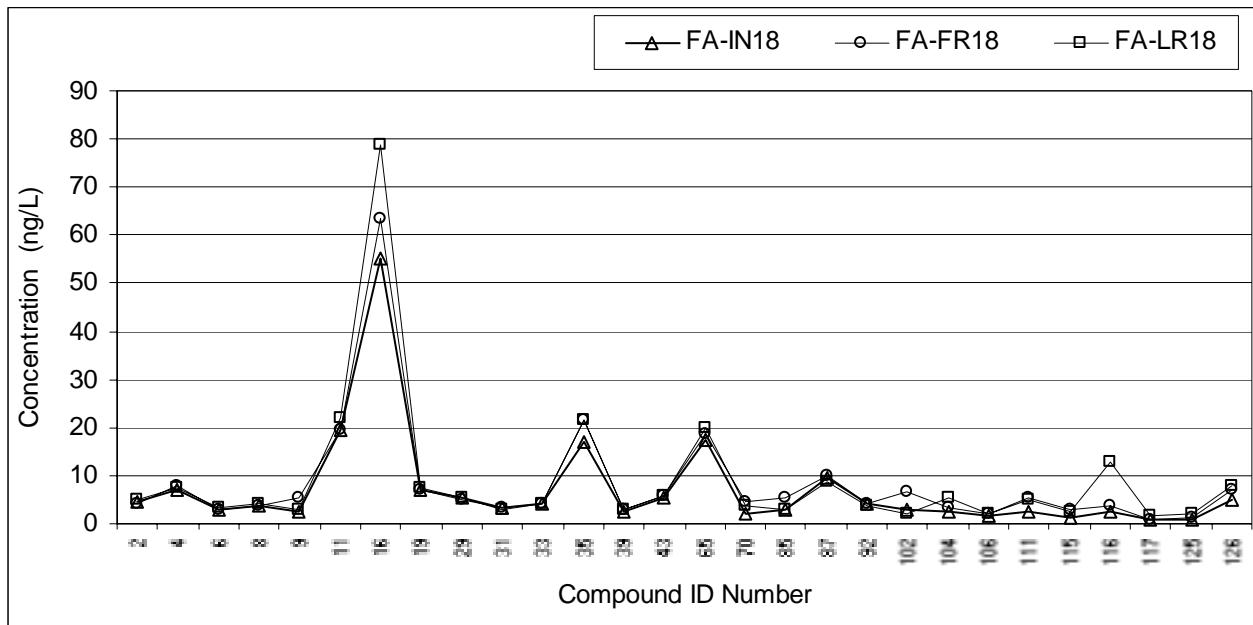
**Table 17. 18-hour CO and CO<sub>2</sub> concentrations at KR, FA, and HD houses.**

	CO	CO <sub>2</sub>
KR-IN18	1.1	974
KR-LR18	0.7	1035
KR-KT18	0.3	1057
FA-IN18	0.6	775
FA-FR18	0.3	858
FA-LR18	0.6	848
HD-IN18	2.6	1181
HD-LR18	1.8	1481
HD-FR18	1.5	1176

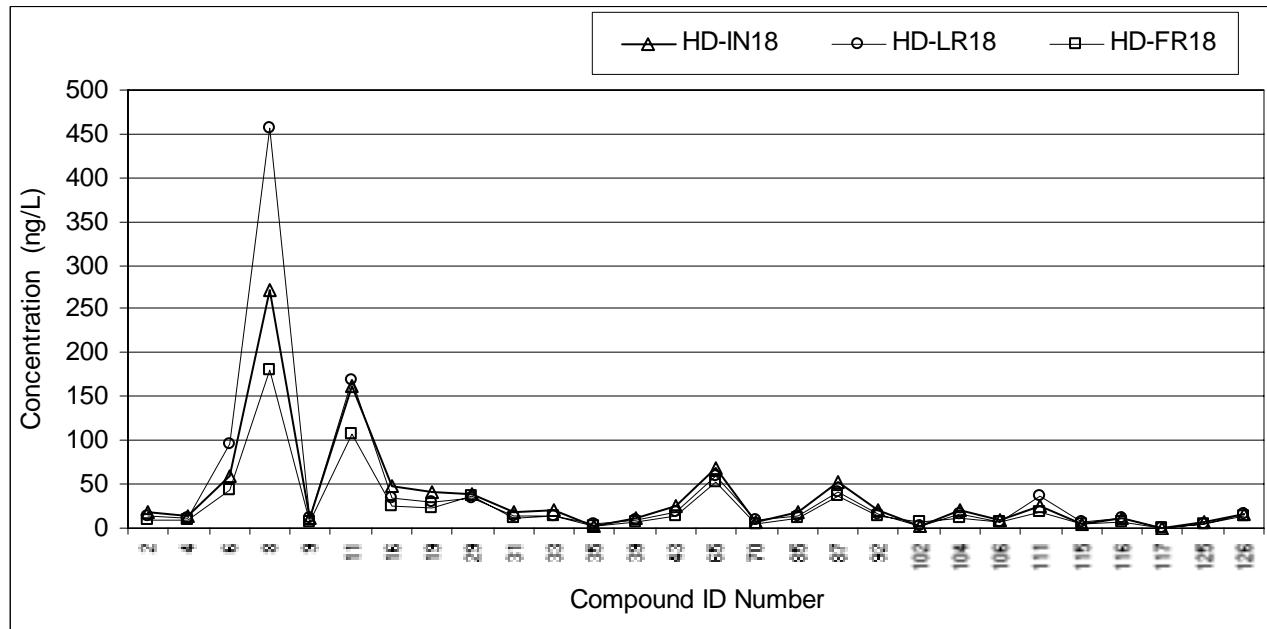
**Figure 15. 18-hour hydrocarbon concentrations at KR house.**



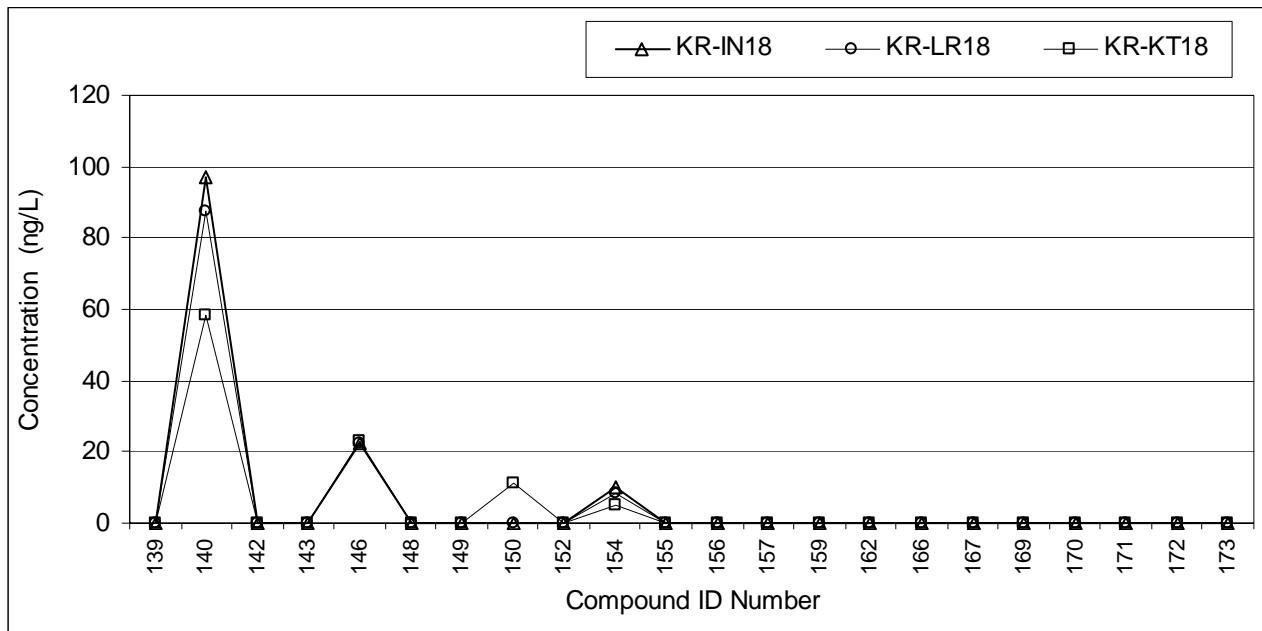
**Figure 16. 18-hour hydrocarbon concentrations at FA house.**



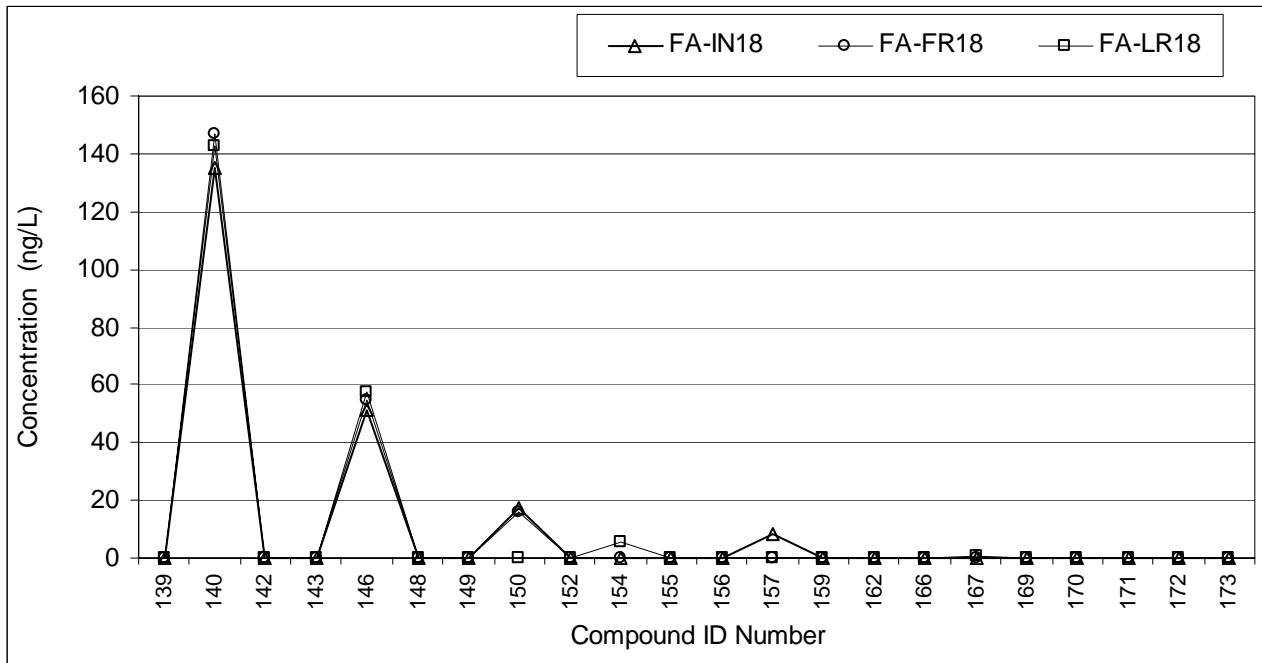
**Figure 17. 18-hour hydrocarbon concentrations at HD house.**



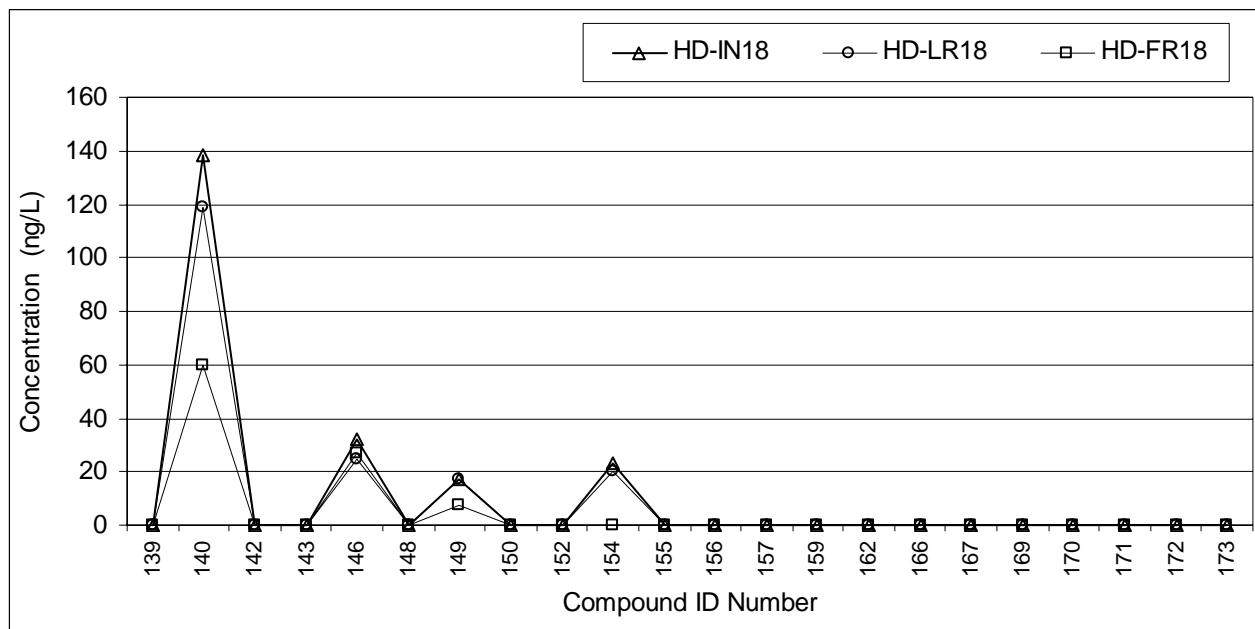
**Figure 18. 18-hour halocarbon concentrations at KR house.**



**Figure 19. 18-hour halocarbon concentrations at FA house.**



**Figure 20. 18-hour halocarbon concentrations at HD house.**

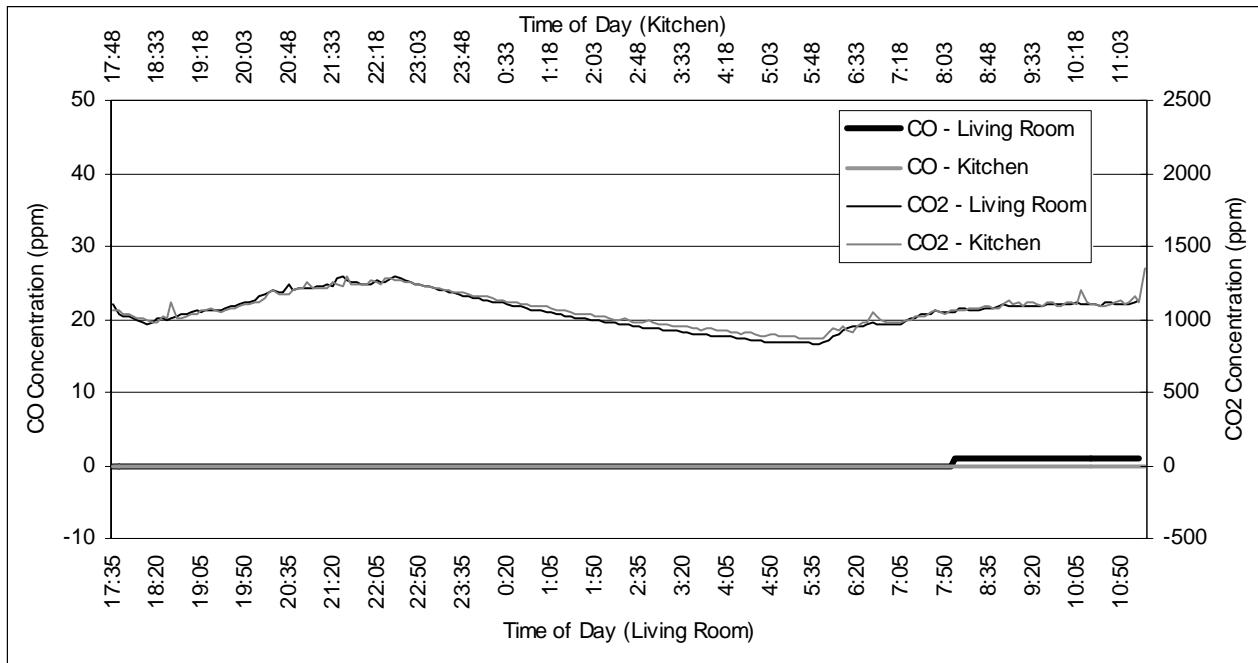


These figures show the uniformity of the volatile organic compound concentrations throughout the house, with two exceptions. In Figure 17 and Figure 20, the concentrations of several compounds measured at the HD-FR18 locations are lower. This is likely an effect of air flow dynamics and location selection of the samples. Sample HD\_FR18 was located in the family room in the basement and furthest away from the garage of all three samples. HD-IN18 was located beside the garage in the basement furnace/laundry room and HD-LR18 was located at the top of the staircase, at the edge of the living room, next to the fireplace. According to Ken Ruest of Canada Mortgage and House Corporation (CMHC) (formerly of Scanada Consultants), there is a natural air flow of basement air up the staircase. This places sample HD-LR18 in the direct path of air flow from the basement. It is therefore conceivable that the concentrations seen in sample HD-IN18 are similar to that seen in sample HD-LR18. Since the natural air flow pattern is that of air flowing **from** the basement, it is less likely that the garage air that had infiltrated into the furnace/laundry room would go against the air flow pattern into the basement family room rather than up the stair case. Thus, compounds that are indicative of gasoline combustion should be found in lower concentrations in sample HD-FR18.

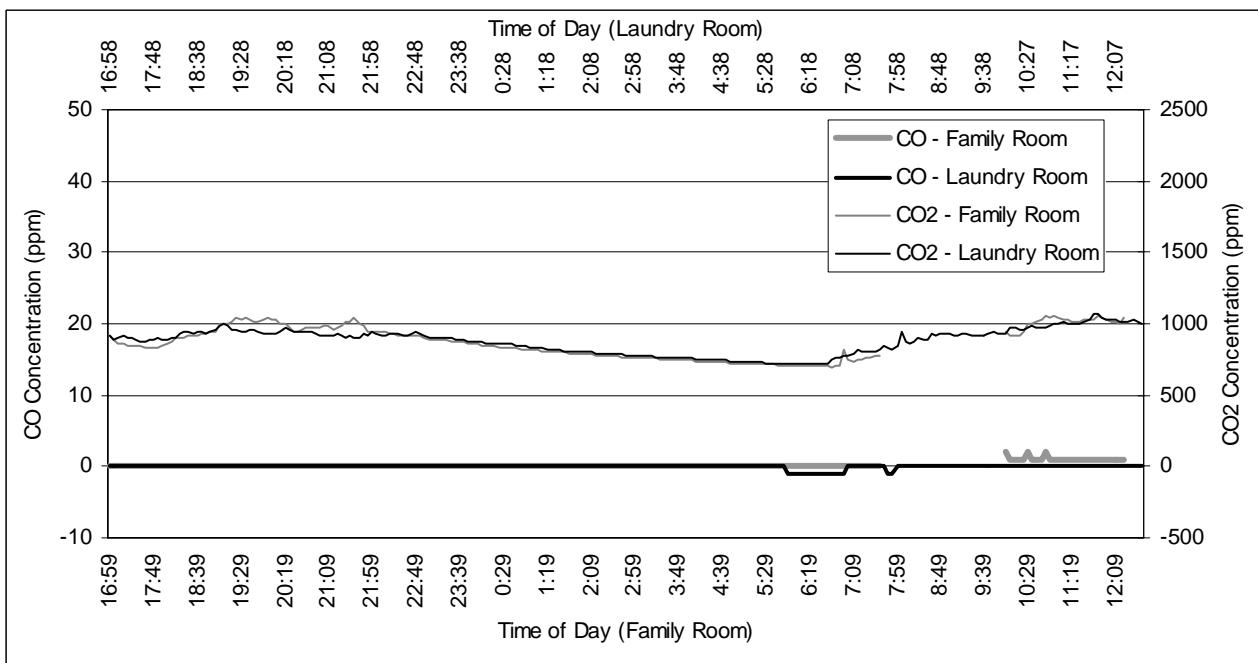
The canister used for sample KR-KT18 filled prematurely (i.e., the canister completely filled in less than the 18 hours that it was intended to sample over). This shorter sampling time causes a different averaging effect on the sample and possibly misses the sampling of compounds that were only present at the end of the sampling period. This will cause the concentrations of some compounds to be higher or lower than that observed at other locations where there were 18-hour samples collected. This can be observed in Figure 15 and Figure 18.

Additional real-time CO and CO<sub>2</sub> measurements were also performed at two locations within the test house using the Q-Trak indoor air quality monitor. The concentrations are presented graphically in Figure 21 through Figure 23.

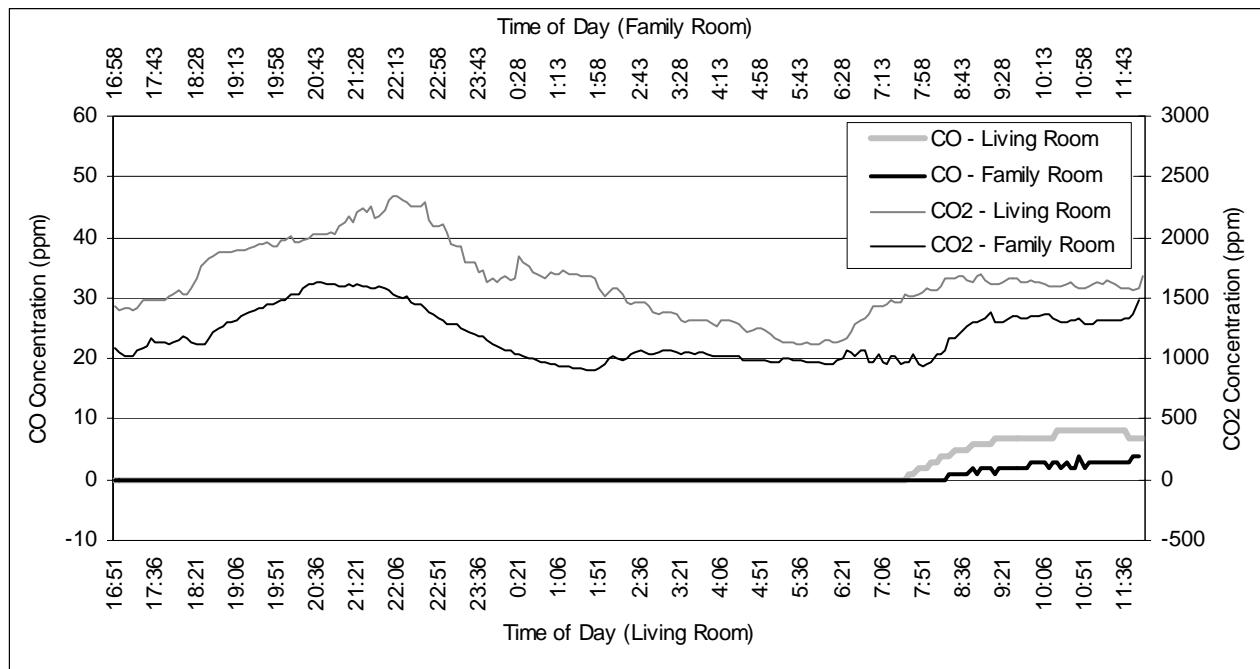
**Figure 21. Real-time CO and CO<sub>2</sub> concentrations at KR test house during hot soak and cold start tests.**



**Figure 22. Real-time CO and CO<sub>2</sub> concentrations at FA test house during hot soak and cold start tests.**



**Figure 23. Real-time CO and CO<sub>2</sub> concentrations at HD test house during hot soak and cold start tests.**

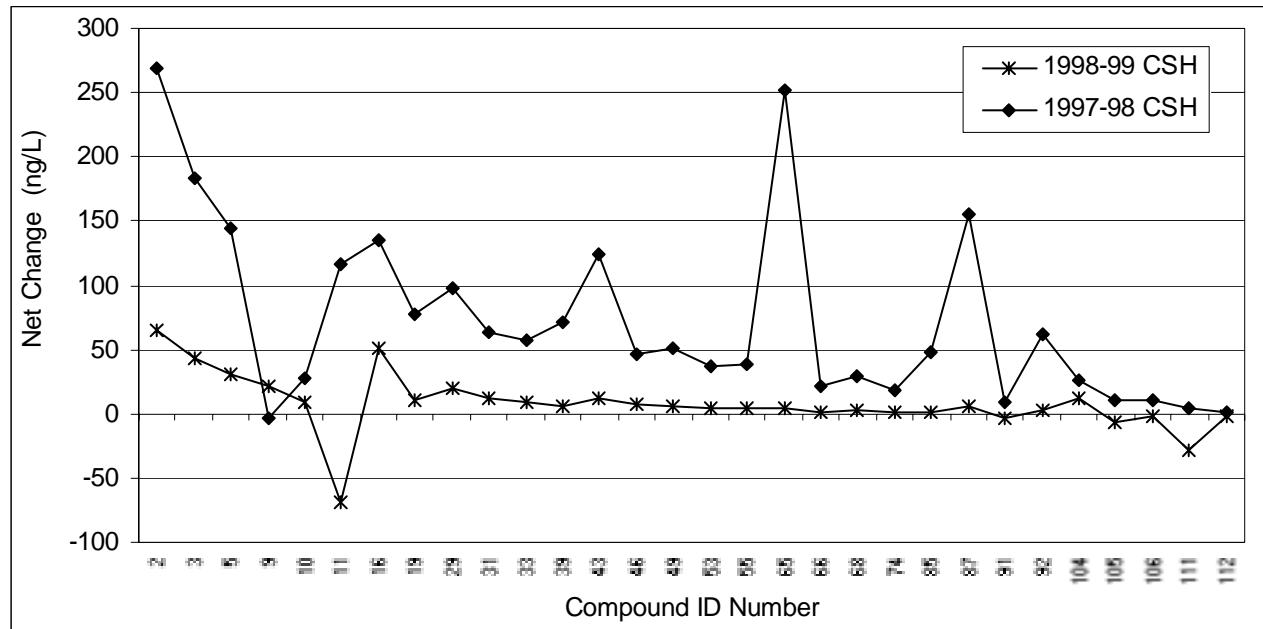


As discussed previously, CO<sub>2</sub> concentrations are often a function of human occupant activity. This is again evident in the above figures. At all sample locations, the CO concentration remained at zero for the duration of the hot soak test through to the beginning of the cold start test. Figure 21 shows a small increase in CO concentration occurred at the living room location in KR house and Figure 22 shows a small CO concentration increase occurred at the family room location in FA house at the beginning of the cold start tests. Figure 23 shows an increase in CO concentrations at both locations in the HD house. The concentration was lower in the family room than in the living room, which is consistent with the previous discussion on air flow dynamics and sample location.

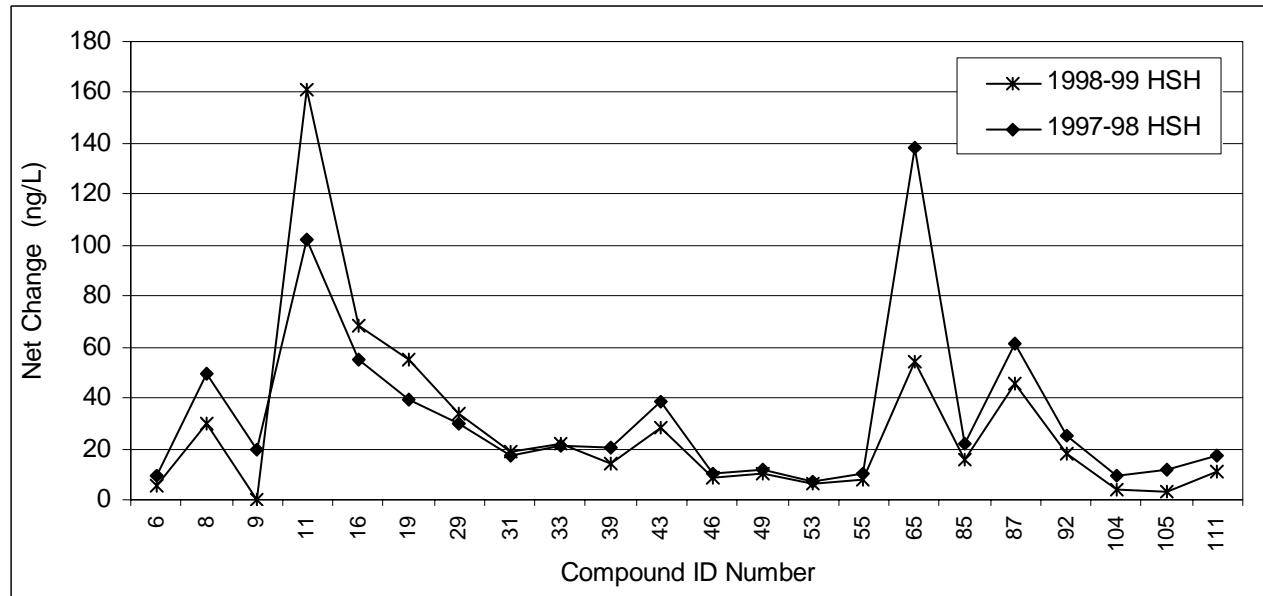
#### **4.6. Comparison of Tests Conducted on HD House**

Two sets of hot soak and cold start tests were conducted at the HD test house. The first set was conducted during phase 1 and the second during phase 2. The figures below compare the net change in house concentrations (house test – pre-test) for the tests conducted during each phase.

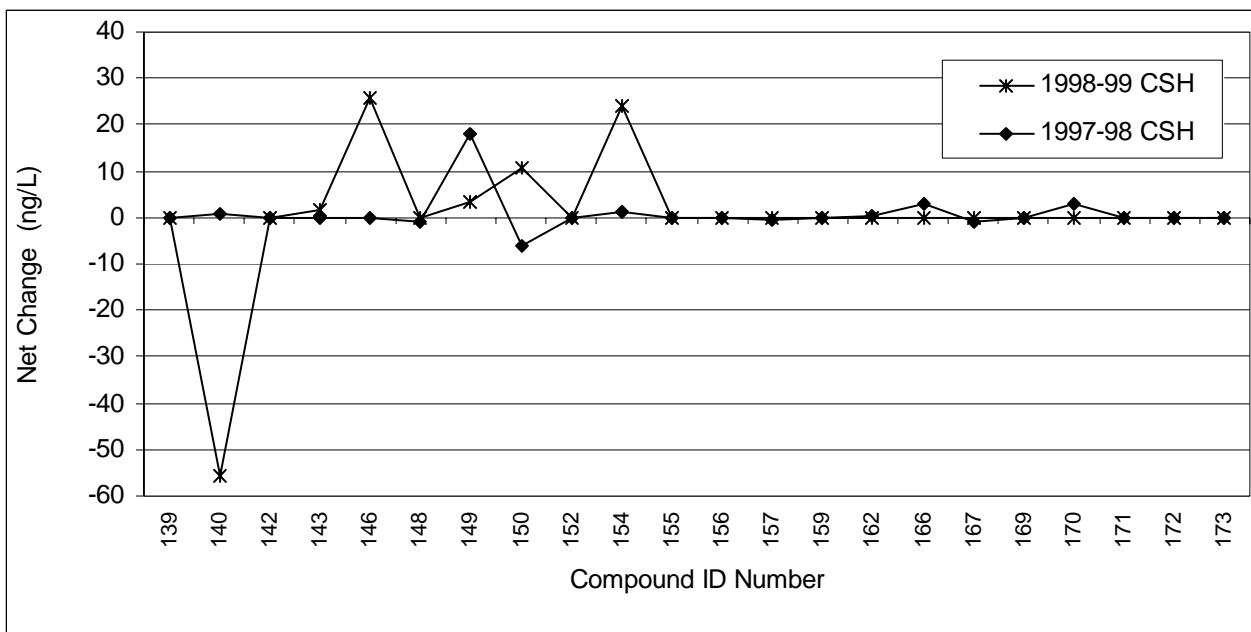
**Figure 24.** Net change in hydrocarbon concentrations for phase 1 and phase 2 HD house cold start tests.



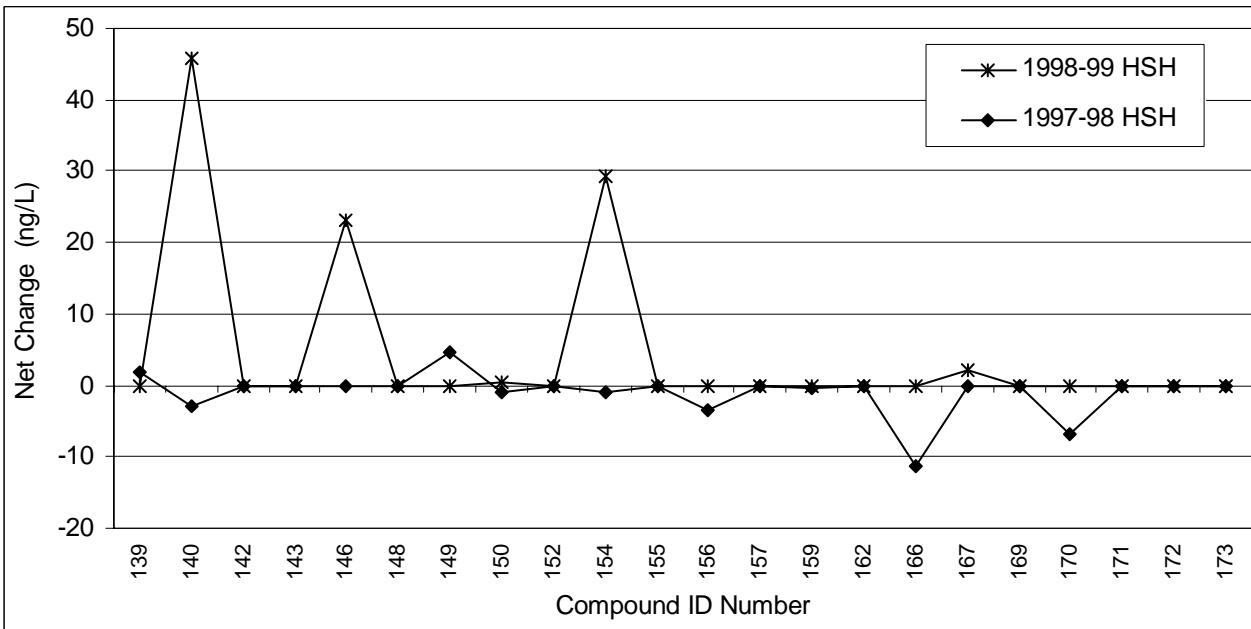
**Figure 25.** Net change in hydrocarbon concentrations for phase 1 and phase 2 HD house hot soak tests.



**Figure 26.** Net change in halocarbon concentrations for phase 1 and phase 2 HD house cold start tests.



**Figure 27.** Net change in halocarbon concentrations for phase 1 and phase 2 HD house hot soak tests.



**Table 18. Net change in carbonyl concentrations for phase 1 and phase 2 HD house cold start tests.**

ID #	Carbonyl Concentrations (ng/L)		Net Change (ng/L)	Carbonyl Concentrations (ng/L)		Net Change (ng/L)
	1998-99 CSPT	1998-99 CSH		1997-98 CSPT	1997-98 CSH	
175	21.1	20.8	0	<i>13</i>	13	na
176	20.6	<i>27.9</i>	7	<i>12</i>	16	na
177	0.0	<i>1.3</i>	na	0	<i>1</i>	na
178	0.0	<i>1.7</i>	na	0	0	0
179	76.8	<i>74.1</i>	-3	29	34	5
180	0.0	<i>3.1</i>	na	0	2	na
181	0.0	0.0	0	0	0	0
182	0.0	0.0	0	0	0	0
183	0.0	0.0	0	0	0	0
184	0.0	0.6	1	0	<i>1</i>	na
185	<i>5.1</i>	5.7	na	6	12	na
186	0.0	2.7	na	0	0	0
187	0.0	<i>1.7</i>	na	0	<i>1</i>	na
188	0.0	<i>1.2</i>	na	0	0	0
189	7.4	6.6	na	0	<i>3</i>	na
190	0.0	2.7	na	0	<i>1</i>	na
191	0.0	0.0	0	0	0	0
192	0.0	0.0	0	0	0	0
193	0.0	0.0	0	0	0	0
194	0.0	<i>1.3</i>	na	0	<i>1</i>	na
195	0.0	0.0	0	0	0	0
196	10.5	9.9	na	0	5	5

Notes:

Values in italics indicate results below detection limit.

Na indicates net change not determinable due to CSPT or CSH results below detection limit

**Table 19. Net change in carbonyl concentrations for phase 1 and phase 2 HD house hot start tests.**

ID #	Carbonyl Concentrations (ng/L)		Net Change (ng/L)	Carbonyl Concentrations (ng/L)		Net Change (ng/L)
	1998-99 HSPT	1998-99 HSH		1997-98 HSPT	1997-98 HSH	
175	21	21	0	9	11	na
176	21	28	7	7	13	na
177	0	1	na	0	0	0
178	0	2	na	0	1	na
179	77	74	-3	19	26	na
180	0	3	na	0	2	na
181	0	0	0	0	0	0
182	0	0	0	0	0	0
183	0	0	0	0	0	0
184	0	1	na	0	0	0
185	5	6	na	0	8	8
186	0	3	na	0	0	0
187	0	2	na	0	1	na
188	0	1	na	0	0	0
189	7	7	na	0	2	na
190	0	3	3	0	2	na
191	0	0	0	0	0	0
192	0	0	0	0	0	0
193	0	0	0	0	0	0
194	0	1	Na	0	1	na
195	0	0	0	0	0	0
196	10	10	Na	5	6	1

As seen in Figure 26, the concentrations of a hydrocarbon compounds from the phase 1 cold start test are much greater than that seen in the phase 2 results. This can be explained by the difference in the garage-house differential pressure experienced during the phase 1 and phase 2 tests. In the phase 1 test, the average differential pressure during the cold start test was 4.5 Pa. During the phase 2 test, the differential pressure was 1.0 Pa (since the outdoor temperature was 0 to +3 °C). Assuming the equivalent leakage area between the house and garage did not change from year to year, the lower concentrations observed during phase 2 testing can be explained by the much lower differential pressures that occurred. The differential pressure is the driving force for the infiltration of garage air into the house (i.e., the pressure in the garage is higher than that of the house and air flows from regions of high pressure to low pressure). Thus, since the driving force of the infiltration was lower during phase 2, the concentrations of compounds detected in the house were lower.

The results were similar during the hot soak test. The majority of the hydrocarbon concentrations are lower during phase 2 than during phase 1. Again, the difference can be explained by a much lower differential pressure of 1.1 Pa during phase 2 compared to 4.6 Pa during phase 1.

Only one halocarbon presence can be attributed to the vehicle, namely CFC-12 (Compound ID Number 140). A net positive change would be observed only if the air conditioner of the vehicle was leaking refrigerant. If the vehicle was leaking refrigerant, then the leakage rate would be greatest just after the vehicle was turned off (i.e. compressor or air conditioner was running while vehicle was operating). As the vehicle cools down and the pressure inside the compressor decreases, the leakage rate decreases. This might explain a net positive increase in CFC-12 during the hot soak tests and no change during the cold start test.

Table 18 and Table 19 show no substantial increase in carbonyl compounds during the cold start and hot soak tests.

#### **4.7. Methane Source Other Than Test Vehicle**

From the analytical results presented in this report it can be seen that there is a substantial source of methane contributing to all of the samples taken at the test homes. Indoor air levels are significantly higher than outdoor levels and in some instances, do not appear to change substantially due to vehicle operation. Table 20 and Table 21 show the measured methane concentrations of all samples taken at each test home.

**Table 20.** Methane concentrations in phase 1 cold start and hot soak samples.

	<b>CSB</b>	<b>CSPT</b>	<b>CSH</b>	<b>CSG</b>	<b>HSB</b>	<b>HSPT</b>	<b>HSH</b>	<b>HSG</b>
GM	1318	1637	1836	1872	1381	1790	2105	1470
PT	1940	2026	2172	1878	1605	1459	1529	1340
JR	1777	1252	1715	1478	1678	2221	1844	1431
HD	1396	1611	2026	3043	1463	1345	1558	1500
MM	1323	2512	2752	1651				
TR	1400	1401	1474	1610				

**Table 21.** Methane concentrations in phase 2 cold start and hot soak samples.

	<b>CSAMB</b>	<b>AMB</b>	<b>CSPT</b>	<b>CSH</b>	<b>CSG</b>	<b>HSAMB</b>	<b>HSPT</b>	<b>HSH</b>	<b>HSG</b>
JE		1346	1480	1487	2473		1528	1632	1451
SV	1428		1760	1781	2174	1384	1536	1634	1428
MH		1473	1518	1583	2521		1438	1552	1515
SR		1469	1565	1951	3137		1700	1708	1471
JS		1467	1651	1681	1762		1563	1591	1443
PB		1502	1977	1903	2402		1700	1722	1421
GS		1261	1336	1362	1875		1362	1368	1487
RW		1295	1371	1491	2083		1328	1410	1522
KR		1314	1487	1594	2052		1479	1532	1453
FA		1274	1347	1424	1634		1329	1400	1396
HD		1329	1521	1917	2160		1429	1488	1352

In general, the methane concentrations are higher inside the home compared to the ambient concentrations. However, the garage concentrations are in some cases significantly greater than the in-home samples and in some cases not. This indicates that there are other methane sources contributing to the in-home atmosphere and thus the levels seen inside the homes are sometimes greater than inside the garages. These sources include the infrastructure used to supply local end-users with natural gas. These gas lines and associated equipment do have some degree of leakage, and since they are present in practically every home in the Ottawa region, these levels are to be expected. The gas lines inside an enclosed structure, such as a house, only contribute to the methane levels seen in the homes. As the garage is often more efficiently vented to the outside than the house, the levels observed inside the garage tend not to be as influenced by these other sources as inside the home.

#### **4.8. SF<sub>6</sub> Concentrations Measured During House Tests**

An SF<sub>6</sub> tracer gas introduced into the garage was used as a unique tracer that would have no source normally present in the ambient environment. The tracer was injected into the flow of air from the mixing fan and three minutes were allowed to elapse before the sampling equipment was started. The measured SF<sub>6</sub> concentrations in the house and garage are presented previously in this report. There appears to be some problems with the measured values, especially with the cold start values. The measured cold start concentrations are significantly less than those expected from the theoretical concentrations. The measured hot soak concentrations, although less than expected, seem to agree when exfiltration of the garage SF<sub>6</sub> is accounted for. The measured and theoretical SF<sub>6</sub> concentrations for each test are shown in Table 22. The method used to calculate these values is also shown below.

**Table 22. Measured and theoretical SF<sub>6</sub> concentrations.**

	Measured SF <sub>6</sub> Concentration (ng/L)		Volume Injected (cm <sup>3</sup> )	Injection Temperature (°C)		Atmospheric Pressure (kPa)		Garage Volume (m <sup>3</sup> )	Theoretical Garage Concentration (ng/L)	
	CSG	HSG		CSG	HSG	CSG	HSG		CSG	HSG
GM	162	1284	50	-2.8	-1.4	101.9	10.1	67.7	4890	4779
PT	232	783	50	-7.8	-1.8	99.8	100.6	77.2	4279	4218
JR	310	793	50	-6.4	-7.9	100.3	103.5	103.3	3197	3318
HD	86	893	50	-16.2	-1.5	100.3	102.6	69.4	4940	4780
MM	180	-	50	0.5	-	99.9	-	96.9	3309	-
TR	187	-	50	-8.5	-	101.5	-	115.7	2911	-

#### Calculation Method

Molecular Weight SF<sub>6</sub>: 146.05 g/mol, Injection Volume = 50 cm<sup>3</sup>

$$PV = nRT \quad R = 8.2057 \times 10^{-5} \text{ atm m}^3/\text{mol K}$$

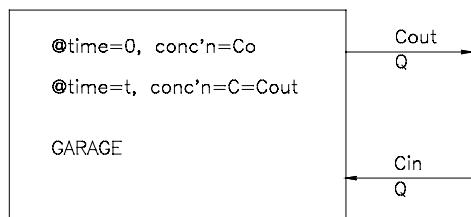
$$n = \frac{P_{\text{ATMOSPHERE}} V_{\text{INJECTION}}}{R T_{\text{INJECTION}}} = \frac{\left( \frac{101.9 \text{ kPa}}{101.325 \text{ kPa}} \right) \left( 50 \text{ cm}^3 \right) \left( \frac{\text{m}^3}{10^6 \text{ cm}^3} \right)}{\left( 8.2057 \times 10^{-5} \frac{\text{atm m}^3}{\text{mol K}} \right) (-2.8 + 273.15) \text{ K}} = 2.667 \times 10^{-3} \text{ mole}$$

$$m = n * (\text{Molecular Weight}) = (2.667 \times 10^{-3} \text{ mol})(146.05 \text{ g/mol}) = 0.3310 \text{ g} = 3.310 \times 10^8 \text{ ng}$$

$$\text{SF}_6 \text{ Concentration} = m / (\text{Volume of Garage}) = 3.310 \times 10^8 \text{ ng} / 67700 \text{ L} = 4890 \text{ ng/L}$$

It can be seen from the results that there is something significant affecting the cold start and hot soak tests. Mixing is not expected to be a significant problem with the hot soak sample so the difference in the measured versus theoretical initial garage concentration may be due to the exfiltration of garage air during the course of the 2 hour hot soak test. To examine the effects of exfiltration from the garage, a simple model of the garage's dynamic behaviour can be examined. This approach is outlined in the following.

Assuming the garage can be modelled as a simple box model, the following schematic can describe the system.



where:

C<sub>0</sub>: initial concentration of SF<sub>6</sub> in the garage (uniformly mixed)

C, C<sub>OUT</sub>: concentration of SF<sub>6</sub> at time = t

Q: air exchange rate

$C_{IN}$ : concentration of SF<sub>6</sub> in ambient air

$V_{GARAGE}$ : volume of the garage

For SF<sub>6</sub>,  $C_{IN}$  can be assumed to be zero. Assume that the garage is well mixed, therefore  $C_{OUT}$  = concentration inside the garage. A mass balance can be performed on the garage yielding the following differential equation.

Mass In - Mass Out +/- sources/sinks = accumulation

$$0 - (Q)*(C_{OUT}) = V_{GARAGE} * dC/dt$$

$$\frac{dC}{C} = -\frac{Q}{V_{GARAGE}} dt \quad \text{Let } Q/V_{GARAGE} = k$$

$$C = C_0 * e^{-k*t}$$

From the HD residence where CO data for the start and completion of the cold start tests, some measure of the decay factor k (turnover rate) can be determined.

$$@ \text{time} = 0, C = C_0 = 280 \text{ ppm}, @ \text{time} = 258 \text{ min}, C = 22 \text{ ppm}$$

$$22 = 280 * e^{-(k*258 \text{ min})} \quad k = 9.859 \times 10^{-3} \text{ min}^{-1} = 0.592 \text{ hr}^{-1}$$

Assume the same k holds from the cold start test to the hot soak test.

Using the theoretical initial SF<sub>6</sub> concentration for the HD residence hot soak and determining the SF<sub>6</sub> concentration at the completion of the end of a 2-hour sample.

$$C = C_0 * \exp^{-(k(t_{SAMPLE}))} = 4780 * \exp^{-(9.859 \times 10^{-3})(120 \text{ min})} = 1464 \text{ ng/L}$$

The air exchange rate for a typical home can vary between 0.1 and 1.0 hr<sup>-1</sup>. Garages can have wider variations in their air exchange rate. The leakier the garage, the higher the turnover rate. So the final concentration can range from

$$@ k = 0.1 \text{ hr}^{-1}, C_{2hr} = 3914 \text{ ng/L}$$

$$@ k = 1.0 \text{ hr}^{-1}, C_{2hr} = 647 \text{ ng/L}$$

In order to compare the measured canister concentrations a time-averaged value needs to be calculated from the theoretical SF<sub>6</sub> garage loading.

The equation describing the behaviour SF<sub>6</sub> concentration within the garage can be described using the following

$$C = C_0 * \exp^{-(k*t)}$$

the average value obtained over a given sampling period ( $t_{SAMPLE}$ ) is given by

$$C_{AVERAGE} = \left( \frac{1}{t_2 - t_1} \right) \int_{t_1}^{t_2} (C_0 * \exp^{-kt}) dt = \left( \frac{1}{-k} \right) \left( \frac{C_0}{t_2 - t_1} \right) \exp^{-kt}$$

This also assumes that the flow rate into the sampling canister is constant over the sampling period. Since a flow controlling mechanism was used this assumption holds true.

The theoretical average concentration measured in the HD residence hot soak test is therefore

$$C_{AVERAGE} = \left( \frac{1}{-0.5916 \text{ hr}^{-1}} \right) \left( \frac{4780 \text{ ng/L}}{2 \text{ hr}} \right) \left( \exp^{-(0.5916 \text{ hr}^{-1})(2 \text{ hr})} - \exp^{-(0.5916 \text{ hr}^{-1})(0 \text{ hr})} \right) = 2802 \text{ ng/L}$$

Table 23 shows the theoretical initial and measured garage concentrations, along with the theoretical canister concentrations expected for a number of air exchange rates. In the final column of the table, the required air exchange

rate required to obtain the measured canister concentration is calculated. The values range from 1.81 to 2.68, which is greater than the typical rates for homes that lie between 0.1 and 1.0 air exchange rates per hour. However, according to representatives at the Canada Mortgage and Housing Corporation (CMHC), air exchange rates for garages can vary over a much wider range than the home values.

**Table 23. Theoretical initial SF<sub>6</sub> concentrations and calculated air exchange rates required to attain measured SF<sub>6</sub> concentrations for hot soak tests.**

House	Theoretical Initial Garage Concentration (ng/L)	Sample Time (min)	Measured Canister Concentration (ng/L)	Required k to Obtain Canister Concentration (hr <sup>-1</sup> )
GM	4779	120	1284	1.81
PT	4218	120	783	2.68
JR	3318	120	793	2.06
HD	4780	120	893	2.56

Theoretical Canister Concentration (ng/L)								
	k=0.1 hr <sup>-1</sup>	k=0.25 hr <sup>-1</sup>	k=0.5 hr <sup>-1</sup>	k=1.0 hr <sup>-1</sup>	k=2.0 hr <sup>-1</sup>	k=3.0 hr <sup>-1</sup>	k=5.0 hr <sup>-1</sup>	k=10.0 hr <sup>-1</sup>
GM	4331	3021	2475	2066	1173	794	478	239
PT	3832	2666	2184	1824	1035	701	422	211
JR	3007	2097	1718	1434	814	552	332	166
HD	4315	2969	2418	2009	1129	763	459	229

The garages were in various states of completion: the GM residence was completely finished, the PT residence had only insulation and a vapour barrier and some completed walls, the JR residence had drywall up but had poorly fitting exterior doors, and the HD residence was quite leaky based on the CO measurements taken in the laundry room with a hand-held CO meter. This is seen indirectly in the required k to obtain measured canister concentration.

The cold start measurements cannot be explained using the same method. The samples were grab samples taken over less than one minute of sampling time very close to the beginning of the test. This means that the concentrations measured in the grab samples should be very close to the actual concentration in the garage at the given sample time. Since there is practically no time for the concentration within the garage to drop there are other factors affecting the canister SF<sub>6</sub> concentrations. Since the hot soak results seem reasonable given the test conditions the most probable factor is inadequate mixing within the garage. The mixing time was three minutes after which the samples were started. The SF<sub>6</sub> was injected directly into the flow of air from an oscillating fan and was injected over the time it took the fan to make one complete sweep. This ensured that the distribution from one side of the garage to the other was the same. However, it appears that there was not enough time to mix the garage air from front to back. The mixing time was determined in part from the results of the Winter 1997 vehicle characterization study. This means that the measured garage concentrations cannot be used directly. However, the theoretical concentrations (if required) can be used because the SF<sub>6</sub> purity was known and a high quality injection syringe was used. The in house measured SF<sub>6</sub> concentrations should be valid since the garage will mix through diffusion and convective currents in the garage.

The mixing can be investigated in a garage or an evaporative emission test cell. The procedure use to introduce the SF<sub>6</sub> (or other tracer) into the enclosure would be the same. The samples required would have to be taken over some time interval to determine how long the SF<sub>6</sub> concentration takes to stabilize inside the enclosure.

#### **4.9. Comparing Measured House/Garage Emission Profiles to Test Vehicle Profile**

A source apportionment study is the topic of two separate reports (Phase 1 prepared by Kevin O'Leary and Phase 2 prepared by Lianne Noseworthy) which will attempt to quantify the sources contributing to the in-house measured VOCs. For the data from Phase 1, a simple visual inspection shows that the chemical profiles measured in the house and garage look very similar to the vehicle emission profile that is producing the emissions. That is, if a car is started in the garage, the measured VOCs in the home are expected to show indications of the cold start emissions profile established in the vehicle characterisation study conducted in December 1997. For this discussion, a profile is defined as the pattern of relative concentrations of selected compounds. The compounds selected to produce the profiles must be the same for the house, garage and vehicle emission samples.

The concentration of each chemical species in each sample is reported in absolute concentrations (ng/L). In order to compare the measured house and garage profiles to the vehicle emission profiles, the absolute emission measurements (species mass/volume) have to be converted to a relative measurement (mass percent). A least-squares measure of similarity to the vehicle emission profile is then calculated for each measured house and garage profile by adding the sum of the squared differences between house (or garage) relative mass and the vehicle emission relative mass for each compound selected for the profile. The smaller the sum of squared differences, the more similar the sample is to the emission profile. The results of the profile comparison are shown below. Since the analytical method used for the vehicle characterisation is different than the one used for the house/garage samples common species from both methods were selected. This process can be summarised using the following relation:

$$\sum_{i=1}^n \left( M_i^{house} - M_i^{vehicle} \right)^2$$

Table 24 shows the results of this similarity measure. The vehicle emission profiles used for this comparison are cold start, the hot start and hot soak. As expected the house/garage samples taken during the hot soak test are most similar to the hot soak vehicle profile. The cold start house/garage samples are most similar to the cold start vehicle profile. Table 24 shows the garage atmosphere samples are much more similar (i.e. lower similarity measure value) to their respective vehicle emission profiles than the samples collected inside the home. This is expected since the garage has a smaller volume and less interferences. The in-house sample is due to the infiltration of a smaller amount of exhaust/evaporative emissions and the presence of more interfering sources. In addition, the HD residence showed much more infiltration than the other homes and shows a better fit to the appropriate vehicle profile. This is due to the more rapid infiltration of garage air into the home.

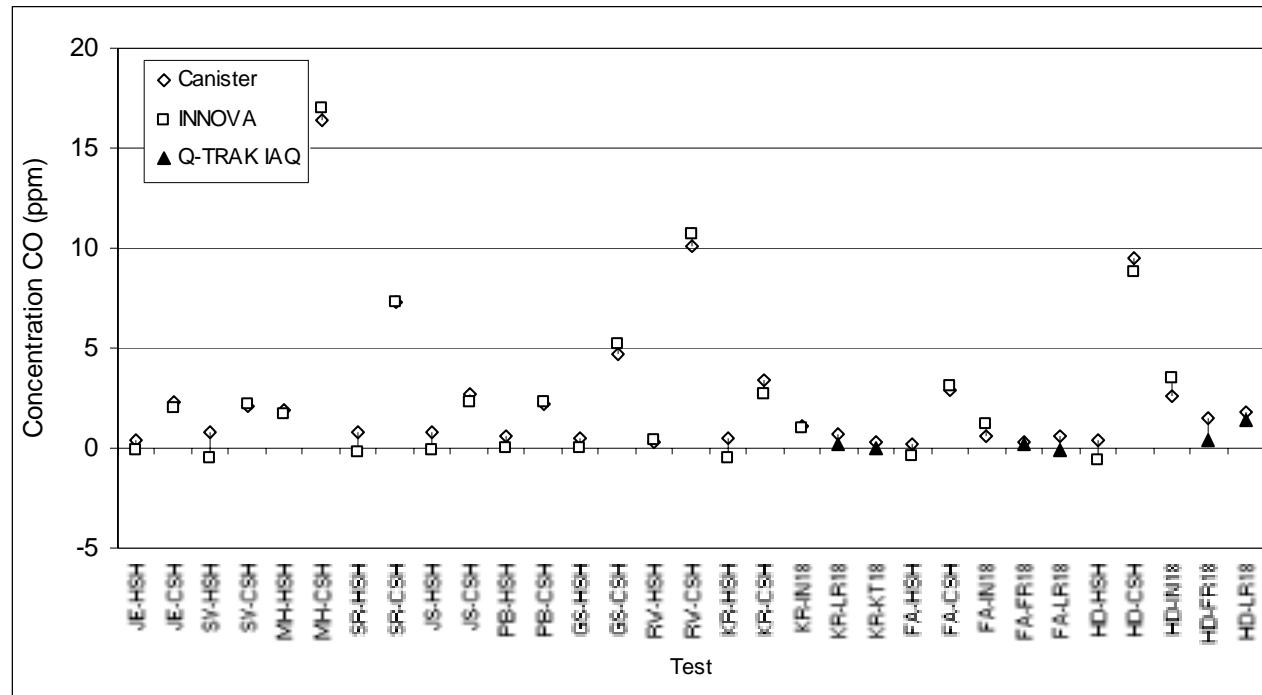
**Table 24. Similarity measures of the phase 1 house samples to the vehicle emission profiles.**

	HSH			HSG		
	Cold Start Emissions	Hot Start Emissions	Hot Soak Emissions	Cold Start Emissions	Hot Start Emissions	Hot Soak Emissions
GM	250	329	<b>213</b>	209	215	<b>24</b>
HD	201	201	<b>18</b>	200	209	<b>28</b>
PT	168	250	<b>107</b>	194	203	<b>31</b>
JR	387	431	<b>164</b>	199	199	<b>24</b>
	CSH			CSG		
	Cold Start Emissions	Hot Start Emissions	Hot Soak Emissions	Cold Start Emissions	Hot Start Emissions	Hot Soak Emissions
GM	<b>198</b>	300	212	<b>17</b>	122	247
HD	<b>86</b>	191	245	<b>30</b>	141	183
PT	<b>329</b>	475	423	<b>13</b>	118	214
JR	<b>204</b>	285	285	<b>13</b>	119	239
MM	<b>623</b>	739	634	<b>29</b>	141	173
TR	<b>228</b>	348	321	<b>26</b>	132	185

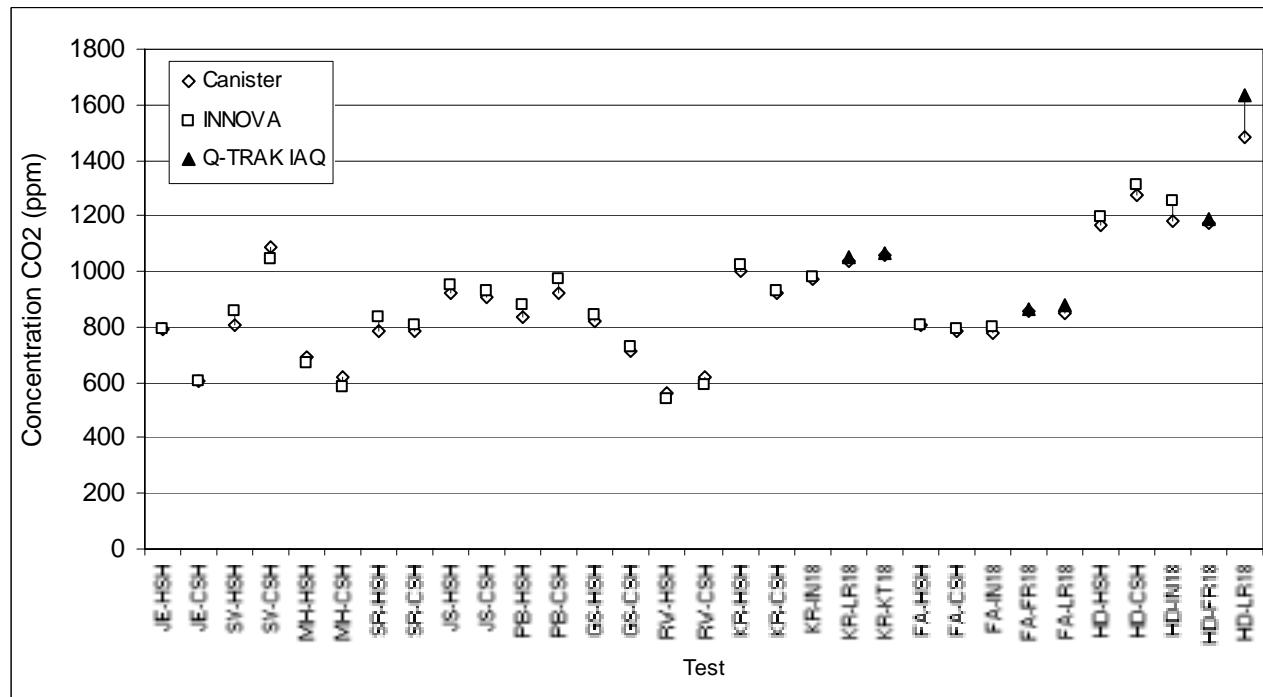
#### **4.10. Comparison of CO and CO<sub>2</sub> Measurements Obtained using Various Instruments**

A comparison of the CO and CO<sub>2</sub> measurements obtained using various instruments is presented graphically in Figure 28 and Figure 29. During phase 2, CO and CO<sub>2</sub> concentrations were measured using SUMMA™ canisters, an Innova real-time monitor, and Q-Trak indoor air quality monitors. As the figures show, there was agreement between the concentrations obtained using the various instruments.

**Figure 28. CO measurements using various instruments.**



**Figure 29. CO<sub>2</sub> measurements using various instruments.**



## 5. Conclusions

This study showed that the vehicle emissions in the attached garage do have a measurable impact on the indoor air quality of houses with attached garages. Evidence of this is clear in the positive net changes of hydrocarbon concentrations between the pre-test and during-test samples collected in the houses. The contribution of vehicle produced carbonyl compounds appears to be very small, approaching not measurable, due to the high initial concentrations of these compounds in the house and the difficulty in measuring a small change by difference between two relatively large signals.

The comparison of the normalised in-house VOC profile to the various vehicle emission profiles obtained during the vehicle characterisation study showed that the measured house and garage profiles were most similar to the vehicle profile that was giving rise to the emissions. That is, during the hot soak tests the measured in house and in-garage profiles were most similar to the hot soak profiles measured in the vehicle characterisation study. The same holds true for the cold start tests.

During phase 1, the measured hot soak canister SF<sub>6</sub> concentrations in the garage agreed with the theoretical concentrations that were calculated using reasonable assumed air exchange rates. These reasonable air exchange rates were determined by back-calculating the air exchange rates necessary to obtain agreement between the theoretical and measured canister concentrations. The air exchange rates ranged in value from 1.81 to 2.68 hr<sup>-1</sup>, in agreement with the values obtained upon discussion with the CMHC.

The measured cold start canister SF<sub>6</sub> concentrations in the garage were significantly different from the calculated theoretical values. Since the hot soak values were in some agreement, it is probable that the garage was not well mixed prior to the start of the garage samples. The garage was allowed to mix for three minutes with an oscillating fan. This mixing time was based in part on the vehicle characterisation study performed in December 1997.

As a result of the less than satisfactory results for the SF<sub>6</sub> tracer gas in Phase 1, it was not used for the phase 2 testing. Instead, a real-time monitor was used to track CO, CO<sub>2</sub> and THC as CH<sub>4</sub> concentrations. This instrument performed well and provided useful insight into the time delay and duration of the infiltration of emissions from the garage into the house. It further confirmed that the canister samples were indeed capturing the desired events.

The additional sampling conducted in the last three houses of Phase 2 showed how uniform the in-house air concentrations were over the 18 hour sampling period. Some effects due to infiltration could be seen in the HD house due to the unusual air flow characteristics of the house.

## **Appendix 1**

Tables of complete analytical results.



**Table 25. Hydrocarbon compound concentrations for the Phase 1 cold start tests (ng/L).**

ID	Compound Name	GM				JR				HD			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
1	methane	1318	1637	1836	1872	1777	1252	1715	1478	1396	1611	2026	3043
2	ethylene	1.5	1.3	11.4	729.8	2.4	2.8	6.5	228.0	3.3	4.0	273.0	1047.3
3	acetylene	1.3	1.2	9.9	503.1	2.1	2.5	5.2	117.4	2.7	8.0	191.5	1380.6
4	ethane	2.5	0.2	0.6	123.9	2.1	0.4	0.7	1.7	1.7	0.2		160.7
5	propylene	3.9		6.2	345.5	1.6	1.0	3.1	105.4	2.2	2.1	146.2	835.0
6	propane	2.2	4.3	8.6	11.6	6.4	6.8	8.0	7.3	2.8	59.2	42.3	28.1
7	propyne				38.3				11.4		0.2	13.8	107.8
8	isobutane	2.3		20.6	108.1	2.8			31.4	2.7	281.6	228.0	321.3
9	1-butene & isobutene	2.5	1.7			3.4		1.7		1.7	2.9		
10	13-butadiene				1.8	106.3	1.6		1.0	34.7		0.4	28.6
11	n-butane	4.0	5.6	11.9	295.4	10.4	9.2	10.2	88.9	6.3	25.7	141.6	886.2
12	t2-butene & 22-dm-propane		0.5	1.4	62.4	0.3	0.8	1.0	19.0	0.4	1.8	23.1	
13	1-butyne				7.5				0.8			1.0	7.2
14	c2-butene	0.5	0.7	1.2	38.3	2.7	0.4	0.6	11.1	0.4	1.0		101.7
15	3m1-butene				13.3				4.2			4.7	32.1
16	2m-butane	2.0	3.2	23.4	342.6	2.8	3.2	1.9	99.3	3.0	8.5	143.1	991.2
17	1-pentene				0.7	32.4	1.4		0.9	9.3		3.1	65.2
18	2m1-butene				1.0	50.4		0.4	1.1	16.7	0.4	1.2	19.6
19	n-pentane			2.0	6.0	208.8	0.8	3.0	4.1	60.4	1.8	5.7	83.9
20	2m13-butadiene	1.6				3.9							602.7
21	t2-pentene		0.5	1.4	43.8				0.7	13.6	0.2	1.5	17.5
22	c2-pentene			0.6	24.9				0.2	7.6		3.8	12.3
23	2m2-butene	0.4		4.9	65.0	0.7	0.8	1.0	21.5			22.7	180.2
24	22-dm-butane			1.3	46.0	0.3	0.1	0.6	13.1		0.8	18.8	130.8
25	cyclopentene		0.6	0.5	15.6		0.2	0.5	4.9	1.5	0.3	5.3	37.9
26	4m1&3m1-pentene				9.1				2.8				3.2
27	cyclopentane		0.9	1.5	40.5	0.4	0.5	0.8	12.3	0.7	0.8	16.5	113.6
28	23-dm-butane	0.2	0.3	1.3	59.0	0.5	0.4	0.7	17.1	0.4	1.1	23.2	168.9
29	2m-pentane & t-4m2-pentene	1.6	1.4	6.4	259.6	2.6	1.7	4.8	76.0	2.4	4.0	101.4	764.9
30	MTBE & c-4m2-pentene		0.6	1.0	10.0				3.3	0.8		4.3	24.3
31	3m-pentane	1.1	0.8	4.2	170.6	1.2	1.2	2.7	49.8	0.6	3.4	67.4	503.9
32	1-hexene & 2m1-pentene		4.9	5.2	15.5		4.5	4.8	9.3			13.7	77.9
33	n-hexane	0.7	1.0	3.7	153.6	0.8	1.8	2.7	45.7	0.9	3.3	59.8	466.2
34	t2-hexene			0.4	20.7				0.3	6.5		7.4	59.5
35	2m2-pentene & 2e1-butene		0.3	0.7	20.3		5.8	5.1	6.4		1.4	5.5	63.3
36	c2-hexene			0.4	10.9				0.4	3.5	0.6	0.3	4.3
37	c/t-3m2-pentene			0.4	22.7				7.1		0.5	8.8	66.0
38	22-dm-pentane				9.3				2.8			4.4	27.7
39	m-cyclopentane	0.5	0.9	4.2	190.8	0.6	1.4	2.4	55.3	0.6	2.9	74.3	579.0
40	24-dm-pentane		1.0	1.4	33.1	0.2		1.8	10.3		1.4	12.0	95.1
41	223-dm-butane		0.0	0.1	16.7			0.1	4.4	0.6	0.3	1.7	7.9

ID	Compound Name	GM				JR				HD			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
42	1m-cyclopentene			0.5				0.4			5.5	57.4	
43	benzene	1.7	2.5	8.2	393.4	2.2	3.2	5.6	122.7	3.0	8.4	132.9	1156.8
44	33-dm-pentane			0.3	14.2			0.2	4.6		0.5	5.6	41.8
45	cyclohexane	0.1	0.3	1.2	41.7	0.2	0.6	0.9	12.3	0.3	0.6	16.7	128.1
46	2m-hexane	0.2	0.4	2.8	128.1	0.6	1.8	2.5	52.0	0.6	3.0	50.0	404.9
47	23-dm-pentane			0.8	41.2	0.3	0.7	1.0		0.2	1.8	17.0	126.6
48	11-dm-cyP			8.4				2.8			3.5	23.4	
49	3m-hexane & cyclohexene	0.4	1.0	3.7	140.7	0.6	3.6	4.2	43.3	1.5	3.9	55.0	441.6
50	c-13-dm-cyP	0.4		0.7	26.8	0.5	0.4	0.6	8.1		0.5	10.7	83.3
51	t-13-dm-cyP & 3e-pentane			1.0	41.6	0.3	0.7	0.9	12.7	0.7	0.7	16.4	127.6
52	t-12-dm-cyP	0.4											
53	224-tm-pentane & 1-heptene	0.6	0.2	2.0	102.8	0.7	0.9	1.5	32.2	0.8	3.6	41.2	317.5
54	c3-heptene			9.1				2.1	0.2	1.7	3.8	27.1	
55	n-heptane	0.3	0.9	2.9	110.7	0.7	3.5	3.5	44.1	0.6	2.4	41.5	351.8
56	t3-heptene			0.5	32.6					0.7	12.3	97.8	
57	t2-heptene			10.0				3.4	1.5	0.5	3.8	29.9	
58	c2-heptene	0.7	1.0	1.4	10.5		0.3	3.4	0.3		4.1	25.0	
59	m-cyH & 22-dmC6	0.8	1.2	61.7		0.3	1.4	1.6	18.1	0.2	1.0	24.0	187.8
60	25-dm-C6 & e-cyP	0.2	0.5	22.5				1.1	0.3	0.8	8.5	69.9	
61	24-dm-C6 & 223-tm-C5			1.1	45.5			20.6	0.1	1.1	17.4	142.2	
62	ctc-124-tm-cyP			1.4									
63	ctc-123-tm-cyP			8.7				2.8		0.3	3.4	25.8	
64	234-tm-pentane	0.7	0.6	1.6	30.8	0.2	0.5	0.5	9.6	0.5	1.7	12.4	97.2
65	toluene	2.5	8.0	19.9	925.3	3.9	16.0	18.6	301.0	4.4	65.2	317.6	2879.5
66	2m-heptane	0.4	1.1	65.3		0.2		0.6	20.7	0.2	1.3	23.4	211.0
67	4m-heptane & 1m-cyhexene	0.4	0.5	32.1				0.3	10.1		0.7	11.4	100.5
68	3m-C7 & 3e-C6			1.9	88.3	0.3		0.7	27.9	0.2	1.8	31.2	284.5
69	cct-124-tm-cyP & c-13-dm-cyH			0.3	17.9			5.8			6.6	56.6	
70	t-14-dm-cyH	0.1	3.1	3.1	6.0	0.2	5.9	6.6	2.0	0.7	4.0	4.7	17.2
71	225-tm-C6			10.2			0.3	0.4	3.4		0.3	4.0	31.5
72	1-octene	0.3		16.6				1.3	0.5	1.1	6.9	52.3	
73	1e-1m-cyP			3.6				2.5		0.8	3.8	28.4	
74	n-octane & t-12-dm-cyH	0.3	0.5	1.6	61.2	0.3	0.7	1.1	19.5	0.5	2.1	20.7	201.8
75	t2-octene			7.7			0.2	0.4	2.6		0.8	3.5	23.8
76	ccc-123-tm-cyP												
77	?t-13-dm-cyH & c-14-dm-cyH			0.4	0.8	12.8		0.6	0.6	4.1	1.1	4.6	43.3
78	c2-octene				7.2				0.8				9.4
79	ip-cyP				13.5				1.6	0.3	1.0	2.8	14.2
80	c-12-dm-cyH				4.8			0.3	4.6		0.3	4.9	41.0
81	np-cyP				26.1			0.5	8.3			1.8	15.4
82	25-dm-heptane				5.0			0.4	1.6			9.1	84.3
83	33-dm-heptane				6.7			2.1			0.4	2.1	16.3
84	114-tm-cyH										2.3	20.8	

ID	Compound Name	GM				JR				HD			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
85	e-benzene	0.5	1.6	3.6	220.3	0.9	2.0	2.7	74.0	1.3	11.4	59.3	674.7
86	ctt-124-tm-cyH & 35-dm-C7	1.2			3.5	1.8	0.4	0.9	1.1		5.0	1.3	11.7
87	m&p-xylene & 23-dm-heptane	1.3	4.3	11.6	705.8	3.0	7.9	8.4	241.3	2.8	28.4	183.4	2251.8
88	34-dm-C7 & 4m-C8							1.3			0.4		9.6
89	2m-octane		0.5	0.9	30.7	0.5	1.0	0.9	10.1	0.8	0.8	10.2	106.1
90	3m-octane & ctc-124-tm-cyH	0.3			5.3	2.9	2.0	0.9	2.4	0.7			17.5
91	styrene		1.4	3.5	58.1		1.5	1.4	19.9		1.1	10.7	156.7
92	o-xylene	0.6	1.7	5.1	295.3	3.2	3.7	4.2	101.7	1.4	12.8	74.5	919.6
93	1-nonene & 112-tm-cyH												
94	t3-nonene				5.6		0.4	0.5	1.7		0.3	1.7	17.4
95	c3-nonene & ib-cyP				3.7				1.1				
96	n-nonane	0.4	0.4	0.8	20.8	0.8		3.7	7.0	0.3	2.9	8.8	74.0
97	t2-nonene				2.9				0.8		0.3	0.7	8.9
98	c2-nonene				5.9		0.5	0.4	1.7		0.5	2.3	19.1
99	ip-benzene				20.2			0.6	6.7		1.1	5.2	62.6
100	ip-cyH				7.4		0.6	0.6	2.3		0.8	2.5	23.8
101	nb-cyP	0.1			8.5		1.3	1.4	3.2		1.5	4.4	25.2
102	33 & 36- dm-octane	0.8	19.7	24.3	1.2	0.4	9.2	8.5	2.2	1.0	7.6	11.4	6.5
103	np-benzene	0.4		1.1	52.2	0.3	1.1	1.0	17.8		2.8	11.6	158.9
104	3e-toluene & 23-dm-octane	0.5	1.4	2.9	174.6			3.7	61.9	0.6	9.2	35.1	511.9
105	4e-toluene	2.3	0.8	8.7	73.9	6.3	12.6	2.4	28.0	2.5	4.8	15.5	215.5
106	135-tm-benzene & 2m-nonane			1.0	72.3	0.4	3.3	1.8	25.7	0.4	5.0	15.7	209.5
107	3e-octane				2.8		0.2		1.1		1.9	0.8	8.0
108	3m-nonane				10.0		0.8	0.6	3.4		1.0	2.9	32.0
109	2e-toluene	0.3	0.5	1.2	60.0	0.3	0.8	0.7	21.2		3.8	11.8	172.2
110	1-decene & ib-cyH	0.3	3.2	1.7	20.0		2.3	1.5	6.3	0.3	2.8	1.9	40.3
111	124-tm-benzene & tb-benzene	0.3	13.1	18.2	247.4	0.7	17.7	4.2	89.0	2.4	41.1	45.8	685.1
112	n-decane	0.4	0.7	1.4	8.6	0.7	7.7	6.4	3.5	0.4	6.0	7.2	26.2
113	ib-benzene		0.5	0.4	4.1	0.5	1.1	0.8	1.7	0.4			1.9
114	sb-benzene				4.0		0.4		1.1		1.1		0.7
115	3-ip-toluene	2.2	4.5	3.8	8.4	3.8	4.9	4.6	3.9	0.9	4.4	3.8	20.7
116	4-ip-toluene & 123-tm-benzene	0.8		1.2	48.6	1.2	2.4	2.6	17.8	0.4	8.6	14.0	129.8
117	indan	7.0		5.6	3.5		0.4	0.2	1.2				9.0
118	2-ip-toluene				27.8		1.0	12.4	9.7		25.7	104.3	77.3
119	3-np-toluene & 13de-benzene	0.8	0.9	11.8		0.4	0.4	4.2			1.1	1.9	28.4
120	4-np-tol/nb&13dm5e&14de-benz	0.7	0.8	46.5		0.3	1.2	16.6			1.0	7.7	110.4
121	12-de-benzene				0.9	4.3		0.8	1.6		1.0	0.9	10.9
122	2-np-toluene		0.6	0.5	10.9		0.9	0.8	3.6		1.4	2.1	26.9
123	14-dm-2e-benzene		0.5	0.5	17.5	2.5	0.3	1.0	6.3		1.0	2.2	39.3
124	12-dm-4e-benzene	1.2			28.7		0.6	0.8	10.4		2.8	4.0	64.4
125	13-dm-2e-benzene	1.2		0.6	6.9	0.6	1.0	0.9	1.8		2.8	1.7	12.4
126	n-undecane	0.3	0.7	1.4	7.9	0.3	7.3	5.9	2.9		3.7	3.6	16.0
127	1245-ttm-benzene				7.0	1.1	0.7	0.4	2.4	1.6	0.8		14.4

ID	Compound Name	GM				JR				HD			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
128	2mb-benzene			1.2	13.1	2.0	1.1	0.9	4.8		1.6	1.7	26.3
129	tb-2m-benzene				3.0		0.5		0.9		0.4	0.8	6.2
130	n-pentylbenzene	0.7			8.1	1.2	7.5	1.0	6.6	1.2	19.9	2.3	40.0
131	tb-35dm-benzene	0.6			2.0	1.0			1.1				5.9
132	tb-4e-benzene												
133	naphthalene	0.5	0.8	3.8	31.3		2.9	1.5	11.5		2.6	2.6	56.7
134	n-dodecane			0.6	9.2		2.4	2.2	3.2		1.6	1.2	15.2
135	135-te-benzene				1.5				0.4				0.9
136	124-te-benzene				1.4								1.9
137	n-hexylbenzene				2.0								3.1
138	n-tridecane			0.6	0.9	0.6	1.2	1.0	0.7		1.1		1.3

ID	Compound Name	PT				TR				MM			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
1	methane	1940	2026	2172	1878	1399.6	1400.6	1474.0	1610.5	1323	2512	2752	1651
2	ethylene	4.0	1.1	8.5	128.7	2.6	3.8	14.2	147.7	1.1	1.8	3.7	367.2
3	acetylene	2.9	1.0	5.7	70.3	2.3	2.8	13.2	104.3	1.3	1.0	3.0	254.7
4	ethane	0.8	0.2	0.4	1.5	2.5	0.2	0.4		0.9	0.5	0.6	
5	propylene	3.5	0.6	4.5	76.6	1.0	1.9	8.5	61.8	1.9	0.5	2.6	164.5
6	propane	4.6	4.7	4.8	4.3	3.1	5.5	10.2	15.4	3.0	13.4	12.9	10.1
7	propyne				7.8				7.7			0.3	18.9
8	isobutane	5.3	5.2	6.8	22.0	2.8		7.0	29.0	2.2	19.1	18.5	103.6
9	1-butene & isobutene	5.2	6.7	6.2	15.4	6.7	2.6	9.5		2.0	5.7	3.8	
10	13-butadiene	1.0			1.5	24.6	0.3	0.6	2.4	21.8		0.4	51.0
11	n-butane	8.8	17.4	11.4	59.7	9.6	10.1	20.9	89.7	5.8	6.9	9.5	275.8
12	t2-butene & 22-dm-propene	1.1	2.5	1.7	13.5	0.7	3.9	2.6	14.3	0.3	0.8	1.1	42.8
13	1-butyne				0.5				0.6				4.5
14	c2-butene	0.5			6.0	8.4		1.8	2.2	9.2			28.6
15	3m1-butene					2.9			0.4	3.2			8.4
16	2m-butane	8.7	7.2	10.6	69.3	7.1	1.8	13.3	95.2	2.4	6.7	9.6	277.4
17	1-pentene				0.5	4.8	1.6		1.9	8.2	0.9	0.4	16.5
18	2m1-butene	0.7	0.8	0.9	10.7			0.3	2.1	14.6		0.5	32.4
19	n-pentane	3.8	7.1	6.1	41.5	4.2	3.3	10.2	57.5	1.7	2.8	4.4	163.0
20	2m13-butadiene												
21	t2-pentene	0.7	1.8	1.1	9.3	0.5	1.0	2.7	13.0		0.6	0.9	31.5
22	c2-pentene	0.4	0.8	0.4	5.5	0.4	0.5	0.7	7.2				18.0
23	2m2-butene			0.5	2.2		0.3	30.4	23.4	19.3		0.4	47.7
24	22-dm-butane	1.2	2.0	2.9	9.4	0.7	0.5	2.2	12.8		0.4	0.5	33.8
25	cyclopentene		0.3	0.5	3.5	0.3	0.3	0.4	3.9		0.9	0.3	9.4
26	4m1&3m1-pentene					2.3			0.8	2.6			5.9
27	cyclopentane	1.0	2.4	1.8	8.5	0.7	0.7	2.0	11.2	0.2	0.6	0.7	30.1

ID	Compound Name	PT				TR				MM			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
28	23-dm-butane	1.6	3.6	4.9	12.1	1.0	0.6	2.3	16.2	0.2	0.3	0.6	42.3
29	2m-pentane & t-4m2-pentene	10.4	22.0	30.3	60.4	4.6	3.3	11.5	71.7	1.3	3.1	4.4	182.7
30	MTBE & c-4m2-pentene		0.3		3.4		0.3	0.9	4.1	0.3			7.0
31	3m-pentane	8.6	19.6	26.7	35.4	2.1	2.0	8.0	47.1	0.4	1.3	2.8	119.0
32	1-hexene & 2m1-pentene				4.3		1.4	4.6	4.7		1.7	2.0	9.1
33	n-hexane	10.5	27.4	36.6	31.7	1.5	2.0	7.2	41.6	0.6	1.4	2.1	104.3
34	t2-hexene	0.3	0.7	0.8	6.6		0.3	0.8	6.3				12.5
35	2m2-pentene & 2e1-butene	0.9	0.9	2.3	2.3		0.6	3.2	5.7				10.8
36	c2-hexene	0.4	0.5	0.6	2.2		0.2	0.6	3.5	1.1			7.5
37	c/t-3m2-pentene	0.3	1.8	0.9	4.5		0.3	0.8	6.9		0.3	1.0	15.2
38	22-dm-pentane	1.2	3.0	3.9	1.8			0.3	2.5			0.3	6.0
39	m-cyclopentane	4.8	9.4	11.7	38.2	1.5	1.5	6.8	51.2	0.2	1.5	2.5	129.3
40	24-dm-pentane	2.1	3.8	5.6	6.7			1.8	9.1		1.2	2.0	21.2
41	223-dm-butane	0.4	0.7	0.8	1.0			0.6	2.9	0.9	0.1	0.4	7.0
42	1m-cyclopentene	0.5	0.2	0.5	5.0				5.9				11.2
43	benzene	4.8	7.7	8.2	77.1	2.4	14.2	12.9	99.5	1.4	4.6	5.5	228.5
44	33-dm-pentane	1.3	3.4	4.6	2.9				4.3				7.0
45	cyclohexane	0.6	1.2	1.4	8.2	0.3	0.4	1.8	11.7		0.4	0.6	26.3
46	2m-hexane	9.1	24.8	32.7	25.1	0.8	1.3	4.5	36.2	0.2	0.8	1.3	106.7
47	23-dm-pentane	3.5	9.2	12.3	8.1	0.3	0.4	1.8	12.0		0.3	0.4	
48	11-dm-cyP		0.6	0.8	1.5				2.5				4.4
49	3m-hexane & cyclohexene	11.8	31.4	41.5	28.1	0.7	1.5	5.2	39.7		1.4	2.2	88.3
50	c-13-dm-cyP	0.6	1.4	1.6	5.2	0.2	0.3	1.0	8.1	0.9	0.5	0.6	16.3
51	t-13-dm-cyP & 3e-pentane				7.9	0.3	0.4	1.4	12.2			0.4	25.9
52	t-12-dm-cyP	1.8	4.6	5.8						0.3			
53	224-tm-pentane & 1-heptene	1.3	2.0	3.4	19.4	0.8	1.0	3.5	30.0	0.5	0.6	1.1	63.8
54	c3-heptene				1.7		0.3	0.6	3.0				5.2
55	n-heptane	7.8	22.7	29.2	20.8	0.5	1.3	3.9	30.3	0.3	0.7	1.1	70.3
56	t3-heptene	0.5		1.7	6.1		0.4	1.2	9.8				20.0
57	t2-heptene			1.9	1.7			0.8	3.1		0.2	0.4	5.8
58	c2-heptene	3.3	1.0	0.8	1.6	5.4		0.8	3.7		3.9	2.5	5.6
59	m-cyH & 22-dmC6	0.6	0.1	2.5	11.4		0.6	1.9	18.3		0.1	0.6	36.3
60	25-dm-C6 & e-cyP	0.5	0.9	1.2	4.2			0.7	6.2		0.3	0.7	15.3
61	24-dm-C6 & 223-tm-C5	1.0	2.0	2.5	8.5	0.5		2.2	13.2				25.6
62	ctc-124-tm-cyP									0.1			0.3
63	ctc-123-tm-cyP		0.6	0.4	1.6			2.7	2.7				4.7
64	234-tm-pentane	0.4	0.6	1.2	5.6	0.4	0.4	2.9	9.9		0.3	0.7	18.8
65	toluene	16.0	31.2	27.3	190.0	4.1	16.0	35.8	232.4	1.9	10.7	13.0	600.5
66	2m-heptane	1.1	1.2	2.3	12.3	0.2	0.6	2.2	18.0		0.3	0.3	62.1
67	4m-heptane & 1m-cyhexene	0.4	0.5	1.0	6.0		0.2	0.8	8.8		0.2		
68	3m-C7 & 3e-C6	1.6	2.0	3.3	12.9	0.4	0.6	3.6	24.5	0.4	0.5	1.1	55.9
69	cct-124-tm-cyP & c-13-dm-cyH			1.1	3.2				5.1				9.9
70	t-14-dm-cyH	7.7	9.8	9.6	1.8		1.3	6.0	3.5	0.9	6.1	7.0	3.7

ID	Compound Name	PT				TR				MM			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
71	225-tm-C6	0.6	1.7	1.5	1.9			1.1	3.1				5.3
72	1-octene		0.6	1.6	4.0			5.9	1.1		0.7	0.6	9.1
73	1e-1m-cyP			1.2	0.7			5.4	2.1		0.2		2.0
74	n-octane & t-12-dm-cyH	2.3	3.9	5.0	11.7		1.1	16.3	16.2	0.2	0.6	1.5	39.5
75	t2-octene		0.4	0.9	1.4			7.3	2.5		0.7	0.7	3.7
76	ccc-123-tm-cyP												
77	??t-13-dm-cyH & c-14-dm-cyH	0.6	2.7	1.5	2.3		2.4	50.4	3.7		0.8	3.4	7.1
78	c2-octene		0.5	1.5				8.6					1.2
79	ip-cyP							1.2	2.4				2.1
80	c-12-dm-cyH			0.4	2.4		0.3		3.6		1.2		1.9
81	np-cyP				1.0		0.2		1.7		0.6	0.4	2.6
82	25-dm-heptane	0.8	1.3	1.5	4.8		0.4		6.9		0.6	0.8	16.1
83	33-dm-heptane		0.3	0.6			0.1		1.4			0.3	2.5
84	114-tm-cyH						0.1	0.9	1.9				3.2
85	e-benzene	4.5	7.4	9.8	44.5	1.2	4.1	7.8	52.0	0.4	2.5	3.4	146.2
86	ctt-124-tm-cyH & 35-dm-C7	0.4		0.6	0.4		0.6		0.9		0.4	0.4	2.1
87	m&p-xylene & 23-dm-heptane	14.4	26.5	24.1	144.7	2.9	13.7	26.6	170.4	1.4	8.6	10.0	494.1
88	34-dm-C7 & 4m-C8		0.3				0.1					1.0	1.9
89	2m-octane	0.7	0.8	2.0	5.2	0.8	0.5	14.0	7.9	0.2	0.3	1.0	19.8
90	3m-octane & ctc-124-tm-cyH			2.2									3.0
91	styrene	1.4	1.8	2.7	16.2		1.2	1.5	13.4	0.8	0.9	1.3	35.2
92	o-xylene	6.7	11.1	10.7	63.3	2.1	6.3	11.2	70.9	0.3	3.6	4.8	203.2
93	1-nonene & 112-tm-cyH		1.1										
94	t3-nonene		0.6	0.8	1.2		0.4	1.5	1.3				3.6
95	c3-nonene & ib-cyP				0.7				0.9				2.5
96	n-nonane	2.1	3.1	2.4	4.3		2.9	7.1	5.2	0.3	0.8	1.0	14.2
97	t2-nonene				0.6				0.6				1.9
98	c2-nonene	1.0	1.3	1.2	1.4		1.4	3.8	1.6		0.4	0.4	3.4
99	ip-benzene	0.4	0.6	0.7	4.0		0.7	1.6	4.7		0.2	0.4	13.9
100	ip-cyH	0.7	0.8	0.9	1.4		1.2	2.7	1.8		0.2	0.3	5.0
101	nb-cyP	1.4	2.2	2.1	1.7		2.8	6.5	2.5		0.4	0.6	5.6
102	33 & 36- dm-octane				5.6		0.4	59.7	4.7	2.5	3.8	12.9	1.5
103	np-benzene	1.9	2.4	2.7	10.6		1.9	3.6	11.4	0.4	1.0	1.0	36.8
104	3e-toluene & 23-dm-octane	5.0	14.5	22.3	37.7		10.0	11.5	38.3		5.6	5.0	170.8
105	4e-toluene	12.2	5.5		16.8	6.1	8.4	3.6	21.3	8.2	2.9		3.5
106	135-tm-benzene & 2m-nonane	3.2	4.2	4.2	15.6	0.5	2.9	4.8	16.5		1.7	1.3	50.3
107	3e-octane	2.0	2.3	1.8			2.0	1.8			1.4	0.7	2.5
108	3m-nonane	0.9	1.4	1.2	2.0		1.6	3.4	2.1		0.3	0.2	7.0
109	2e-toluene	1.5	2.2	2.2	13.0		1.7	2.3	12.9	0.4	1.2	1.3	40.5
110	1-decene & ib-cyH	12.8	2.7	7.5	4.9			11.3	2.4	0.3	2.6	3.6	11.3
111	124-tm-benzene & tb-benzene	41.1	10.6	10.1	54.5	1.3	10.2	32.6	51.5	0.5	5.1	48.4	167.0
112	n-decane	4.7	11.1	10.5	2.3	0.7	10.0	21.8	2.5	0.5	2.2		6.3
113	ib-benzene	0.5	2.1	1.7		0.6	1.3	2.5	0.9		0.4		3.3

ID	Compound Name	PT				TR				MM			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
114	sb-benzene					2.0	0.6					2.4	
115	3-ip-toluene	7.2	8.6	8.2	2.5	0.8	2.6	18.4	4.3	2.2	6.5	4.1	6.2
116	4-ip-toluene & 123-tm-benzene	3.1	5.2	4.8	11.7		16.6	6.0	10.5		3.6	3.7	32.0
117	indan			0.8	0.7	2.2		1.2	0.7		0.9	0.7	2.3
118	2-ip-toluene	1.6	3.0	2.1	6.3		1.8	17.8	6.1		2.0	47.1	19.1
119	3-np-toluene & 13de-benzene	0.6	0.8	0.8	2.6		1.4	3.2	2.1		1.1	1.3	7.3
120	4-np-tol/nb&13dm5e&14de-benz	0.6	3.3	3.1	11.1		2.2	4.8	8.7		1.5	1.6	30.1
121	12-de-benzene	0.9	1.3	1.0			1.4	4.2			0.9	0.7	1.8
122	2-np-toluene	1.0	1.6	1.4	2.1		1.2	3.0	2.0		1.3	1.3	7.1
123	14-dm-2e-benzene	0.4	1.2	0.6	3.9		0.4	5.4	3.1		0.3	0.3	10.7
124	12-dm-4e-benzene	1.0	1.6	1.5	6.6		0.6	2.8	5.0		1.2	0.8	17.7
125	13-dm-2e-benzene	2.9	3.4	2.6	2.6		0.8	1.4	2.0	0.7	2.5	4.2	3.7
126	n-undecane	5.1	7.5	7.4	1.8		7.4	14.5	1.4	0.7	2.1	2.1	5.0
127	1245-ttm-benzene	0.4	0.7	1.3	1.2		1.1	2.7	0.8		0.6	0.8	4.1
128	2mb-benzene	0.6	1.3	0.9	3.1		1.4	2.7	2.1	0.7	0.8	2.3	7.6
129	tb-2m-benzene	0.9	0.3	0.9	0.6		0.2	2.7	1.6		0.2	0.5	1.7
130	n-pentylbenzene	11.1	1.1	3.9	2.7		1.5	0.4	2.5		0.6	1.5	5.3
131	tb-35dm-benzene				0.7		0.6	0.5			1.4		1.9
132	tb-4e-benzene												
133	naphthalene	3.1	3.9	1.7	9.9		2.6	1.0	6.5	2.6	2.9	2.9	20.0
134	n-dodecane	1.6	2.2	2.2	2.5		1.6	1.8	1.3	0.5	1.2	1.6	4.2
135	135-te-benzene				0.4								1.2
136	124-te-benzene										0.1		0.8
137	n-hexylbenzene	0.4									0.2		0.6
138	n-tridecane	0.6	1.1		1.0						3.0	1.7	1.5

**Table 26. Hydrocarbon compound concentrations for the Phase 2 cold start tests (ng/L).**

ID	Compound Name	JE				SV				MH				SR				
		AMB	CSPT	CSH	CSG	CSAMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	
1	methane	1346	1480	1487	2473	1428	1760	1781	2174	1473	1518	1583	2521	1469	1565	1951	3137	
2	ethylene	2.2	3.0	14.9	1114.9	3.5	4.8		1131.4	5.0	6.2	100.0	1030.3	0.1	5.0	50.4	1032.6	
3	acetylene	1.4	1.8	10.0	703.5	2.8	3.8		693.2	3.8	4.2	85.0	896.6		3.4	37.3	713.9	
4	ethane	5.4	12.7	8.6	128.9	5.7	8.8		113.5	6.9	2.7	15.5	84.8	4.7	22.8	28.3	93.0	
5	propylene	0.5	0.6	6.5	508.3	1.5	1.3	9.3	597.8	2.1	2.9	47.6	543.0	0.8	1.7	23.9	435.5	
6	propane	3.2	12.8	5.1	15.0	3.4	7.5	7.7	14.2	4.7	5.2	6.6	22.5	4.8	6.3	13.4	17.3	
7	propyne			0.7	88.5	0.1		0.9	185.3	0.2	81.2	6.0	80.2		0.2	2.5	705.5	
8	isobutane		1.3	51.9	13.8	142.4	3.3	6.4	7.5	123.4	3.9	7.1	24.6		2.7	7.1	35.1	161.3
9	1-butene & isobutene	1.0	2.4	4.5	279.3	1.9	3.1	7.0	253.3	2.7		29.4	302.2	1.0	3.8	17.4	256.2	
10	13-butadiene	0.1	0.3	2.1	166.5	0.3	0.4	3.6	38.9	0.5		15.2	163.4		0.7	7.6	58.3	
11	n-butane	3.4	5.7	9.3	415.5	7.4	13.0	17.7	375.1	8.6	19.3	69.5	601.9	4.5	14.4	32.1	446.5	
12	t2-butene & 22-dm-propane	0.2	0.3	1.3	94.7	0.3	1.3	2.2	81.2	0.6	1.7	11.2	114.9	0.4	1.8	5.2		
13	1-butyne				3.0				2.8				3.2				2.8	
14	c2-butene	0.2	0.3	0.9	71.7	0.2	1.0	2.0	60.3	0.3		6.9	75.6		1.4	3.4	44.9	
15	3m1-butene			0.3	20.3		0.2	0.5	18.3		0.4	2.4	22.7		0.2	1.1	18.2	
16	2m-butane	1.6	1.7	6.1	525.4	3.4	6.8	10.7	511.6	4.7	13.6	70.5	701.4	2.1	5.2	23.0	507.4	
17	1-pentene			0.7	42.3	0.6	0.6	0.9	37.2	0.1	1.4	4.4	57.8	0.2	0.5	3.9	29.3	
18	2m1-butene	0.1	0.5	1.6	63.5	0.3	0.6	1.5	51.3	0.3	0.7	6.4	60.3		1.0	2.9	44.8	
19	n-pentane	1.1	1.9	6.2	331.3	2.1	5.0	8.7	317.5	2.8	9.7	45.8	429.1	1.6	5.9	19.0	313.4	
20	2m13-butadiene																	
21	t2-pentene	0.1	0.4	1.2	74.0	0.2	1.4	1.7	62.0	0.3	1.9	9.5	89.4		1.6	4.4	62.4	
22	c2-pentene		0.1	0.5	42.9		2.1	0.6	34.9	0.1	0.9	5.1	51.1		0.8	5.1	35.8	
23	2m2-butene	0.1	0.2	1.8	124.3	0.3	2.0	3.3	41.0	0.3	0.3	1.0	159.1	0.4	2.0	0.8	89.1	
24	22-dm-butane	0.1	0.3	1.2	76.3	0.3	0.5	1.7	70.5	0.6	1.6	10.8	93.7	0.2	0.7	4.2	70.3	
25	cyclopentene		0.1	0.4	24.4	0.3	0.3	0.6	21.4	0.5	0.4	2.8	27.0		0.3	1.3	21.1	
26	4m1&3m1-pentene			0.2	19.4		0.3	0.5	19.0		0.6	1.8	21.3		0.2	0.8	20.9	
27	cyclopentane	0.2	0.3	1.2	65.8	0.6	0.9	1.8	65.9	0.6	1.9	8.7	82.0	0.3	1.2	3.8	62.3	
28	23-dm-butane	0.2	0.3	1.5	103.4	0.4	0.8	2.2	93.0	0.6	2.1	12.8	124.9	0.3	0.8	5.0	93.1	
29	2m-pentane & t-4m2-pentene	0.9	2.2	7.2	463.2	1.8	5.0	10.9	409.8	3.3	10.4	58.2	553.6	1.6	4.9	24.1	414.1	
30	MTBE & c-4m2-pentene	0.2		0.4	2.8	0.3	1.8	1.1	14.0	0.2	0.5	2.6	20.0	0.3	0.6	1.4	14.9	
31	3m-pentane	0.5	1.5	5.2	305.4	0.9	2.3	6.5	272.3	2.5	7.6	38.1	362.3	1.0	3.1	15.5	272.1	
32	1-hexene & 2m1-pentene	0.7	1.1	0.9	23.9	2.4			34.4	1.4	1.4	6.9	46.7	1.0	2.4	5.4	24.0	
33	n-hexane	0.6	1.8	4.7	283.5	1.2	2.8	6.4	246.2	1.8	9.4	36.2	329.0	1.0	3.2	14.0	250.1	
34	t2-hexene		0.2	0.5	37.5		0.5	0.8	28.4	0.4	0.7	4.4	42.8		0.5	2.2	29.5	
35	2m2-pentene & 2e1-butene		2.8	2.5	36.4		2.9	3.1	13.9		0.6	4.6	40.0		5.1	7.2	18.9	
36	c2-hexene		0.1	0.5	20.4		0.2	0.5	16.4		0.4	2.6	23.2		0.3	1.3	17.1	
37	c/t-3m2-pentene			0.9	44.3		0.3	1.0	13.6		0.8	5.4	51.0		0.4	2.6	32.2	
38	22-dm-pentane		0.2	0.3	17.1		7.4	6.9	14.2	0.2	0.5	2.2	20.1		0.2	1.0	15.0	
39	m-cyclopentane	0.3	1.1	5.3	355.3	0.8	3.3	8.4	316.8	1.1	6.6	42.3	411.8	0.6	2.8	17.1	313.2	

ID	Compound Name	JE				SV				MH				SR			
		AMB	CSPT	CSH	CSG	CSAMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
40	24-dm-pentane		0.5	1.2	58.4	0.2	0.8	1.5	42.6	0.3	1.1	7.3	67.8		0.8	4.1	49.1
41	223-dm-butane	0.1	0.3	0.5	4.3	0.5	0.7	0.7	4.0		0.5	2.3	7.6		0.9	1.7	4.6
42	1m-cyclopentene				2.5				2.6			0.9	37.8		0.1	0.8	2.3
43	benzene	1.4	2.0	8.5	707.6	2.4	7.3	13.9	602.6	3.4	8.4	72.8	749.3	1.9	6.9	34.6	646.7
44	33-dm-pentane			0.3	25.3		1.3	1.0	22.1		0.5	3.8	29.4		2.1	23.4	
45	cyclohexane	0.2	0.4	1.0	78.9	0.6	0.9	1.9	70.2	2.8	2.8	11.1	91.2	1.0	0.7	4.3	69.3
46	2m-hexane	0.3	1.2	2.9	246.2	0.7	1.7	4.8	214.8	1.0	4.3	28.9	281.0	0.6	2.0	12.2	218.3
47	23-dm-pentane	0.1	0.4	0.7	76.7	0.3	0.7	1.6	68.1	0.4	1.6	9.9	89.0	0.2	0.7	4.4	69.2
48	11-dm-cyP		0.1		14.4		0.3	0.3	12.6	0.4	0.4	3.0	16.6		0.3	1.5	12.8
49	3m-hexane & cyclohexene	0.6	1.8	4.0	267.7	1.2	2.8	5.8	235.8	1.4	5.4	32.4	305.4	1.3	2.7	3.0	240.3
50	c-13-dm-cyP		0.3	0.7	50.9		0.5	1.0	45.2	0.2	1.8	7.2	57.9		0.6	3.8	46.6
51	t-13-dm-cyP & 3e-pentane	0.1	0.4	1.0	77.3	0.3	0.5	1.3	66.9	0.3	1.9	10.0	86.7		0.6	4.4	67.3
52	t-12-dm-cyP																
53	224-tm-pentane & 1-heptene	0.3	0.8	2.7	191.2	0.8	1.8	3.7	167.5	1.2	3.4	22.9	214.1	0.6	1.5	11.0	170.0
54	c3-heptene		0.2		16.3		0.6	0.4	14.2			2.5	19.3		0.3	1.4	14.6
55	n-heptane	0.3	2.0	3.2	213.8	0.7	1.7	4.2	180.8	0.7	5.4	25.6	239.4	0.6	1.9	10.6	189.4
56	t3-heptene			0.1	59.0		0.6	1.1	31.5			7.6	69.4		0.5	3.6	46.9
57	t2-heptene		0.9	0.4	17.7		0.4	0.4	15.3			2.6	20.2		0.2	1.5	15.5
58	c2-heptene		0.2	0.2	18.0		0.4	0.5	12.6			3.1	21.3		0.3	2.4	14.3
59	m-cyH & 22-dmC6	0.2	1.7	2.5	116.1	0.3	0.7	2.3	105.0	0.8	6.3	14.9	130.8	0.3	0.9	7.3	102.4
60	25-dm-C6 & e-cyP		0.2	0.2	41.0	0.2	0.4	0.8	36.8	0.2	0.8	5.1	46.0		0.3	2.8	37.8
61	24-dm-C6 & 223-tm-C5		0.4	0.3	83.8	0.2	0.8	1.6	75.5	0.4	2.1	10.9	94.5		0.7	5.3	77.7
62	ctc-124-tm-cyP				1.3								1.5				
63	ctc-123-tm-cyP		0.4	0.2	14.9		0.4	0.5	12.9		2.2	2.9	16.9		0.1	1.3	14.1
64	234-tm-pentane	0.1	0.3	0.7	57.9	0.3	1.0	1.4	43.8	0.4	1.5	7.8	65.7		0.7	3.8	47.7
65	toluene	2.0	8.6	25.7	1639.2	5.4	23.7	40.2	1553.7	8.1	23.0	157.6	1803.2	4.5	21.8	75.1	1581.8
66	2m-heptane	0.1	1.1	2.2	120.1	0.3	0.9	2.2	112.2	0.4	3.3	14.4	136.7	0.1	0.9	6.2	114.3
67	4m-heptane & 1m-cyhexene	0.2	0.4	0.8	57.7		0.7	1.1	49.3		1.2	6.9	65.4		0.4	4.8	53.5
68	3m-C7 & 3e-C6	0.1	1.2	2.9	161.2	0.3	1.8	2.8	150.0	0.2	4.5	19.0	183.4	0.1	1.4	9.0	154.5
69	cct-124-tm-cyP & c-13-dm-cyH			1.0	32.9				30.4		2.2	5.3	37.1				30.7
70	t-14-dm-cyH	0.3	3.1	2.1	9.6	0.2	4.0	3.3	9.8	0.3	2.6	4.5	10.9	0.3	2.7	12.2	10.3
71	225-tm-C6			0.2	17.4		0.8	0.4	16.5		1.1	3.2	19.8		0.2	1.5	16.7
72	1-octene		0.5	0.7	30.1	0.3	0.6	0.8	32.7		1.5	5.6	39.6		0.8	3.8	34.8
73	1e-1m-cyP		1.3	0.1	14.0		1.9		13.4		0.5	2.6	16.2			1.5	18.0
74	n-octane & t-12-dm-cyH	0.3	5.4	4.7	112.6	0.5	3.9	2.5	104.1	0.7	4.6	14.4	128.4	0.6	1.7	6.4	111.1
75	t2-octene		0.7	0.2	13.3		3.8	0.9	11.1		0.7	2.3	15.4		0.9	2.0	14.2
76	ccc-123-tm-cyP																
77	?t-13-dm-cyH & c-14-dm-cyH		1.7	0.4	23.5		3.2	0.7	21.1		1.3	3.5	26.7		0.8	2.2	30.4
78	c2-octene		0.9				2.3		4.3						0.6	7.2	
79	ip-cyP				11.6		1.2		7.6		1.0	2.3	13.8		0.8	7.8	
80	c-12-dm-cyH		0.1	0.2	23.2		0.2	0.6	21.8		0.4	3.6	26.7		0.1	2.4	23.1
81	np-cyP		0.2	0.1	8.4		0.3	0.3	8.3	0.7	0.6	1.6	9.8		0.2	1.1	8.9
82	25-dm-heptane		0.4	0.6	46.3	0.5	1.1	43.6		3.4	6.8	53.3		0.4	2.5	46.5	

ID	Compound Name	JE				SV				MH				SR			
		AMB	CSPT	CSH	CSG	CSAMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
83	33-dm-heptane		0.1	0.2	8.6		0.2	0.5	8.5		1.3	2.3	10.0		0.1	0.9	9.2
84	114-tm-cyH				11.5		0.1		10.1		0.7	2.2	13.2			0.9	11.3
85	e-benzene	0.3	1.3	3.8	377.0	0.8	6.0	11.3	379.4	1.1	6.2	33.5	416.3	0.5	4.2	14.4	400.7
86	ctt-124-tm-cyH & 35-dm-C7			0.2	6.5		0.3	0.5	6.4		1.0	1.4	7.5		0.3	1.1	6.6
87	m&p-xylene & 23-dm-heptane	1.2	4.0	13.2	1246.9	2.5	20.6	38.4	1245.4	4.0	20.2	101.9	1406.9	1.9	14.5	48.0	1336.4
88	34-dm-C7 & 4m-C8		0.1		7.3		0.2				1.3				0.1		5.2
89	2m-octane	0.2	0.9	0.5	55.4	0.8	0.5	1.2	53.8	0.4	2.2	10.3	65.6	0.7	0.7	5.7	61.1
90	3m-octane & ctc-124-tm-cyH				6.8	0.3			6.4	0.3			7.8	0.5			6.7
91	styrene	0.3	1.2	0.8	94.6		3.0	3.7	21.5		2.0	8.1	93.9		1.7	10.0	44.2
92	o-xylene	0.5	1.6	4.9	512.4	1.2	8.0	14.2	519.0	1.9	9.2	42.6	578.4	1.0	5.8	20.1	559.1
93	1-nonene & 112-tm-cyH																
94	t3-nonene				9.6		0.3	0.5	8.6		0.8	1.6	11.1				9.8
95	c3-nonene & ib-cyP						7.2				1.0		8.1				7.3
96	n-nonane	0.2	0.3	0.6	35.5	0.3	1.7	2.4	35.8	0.4	4.9	7.7	42.0	0.2	0.7	1.5	39.8
97	t2-nonene						4.6						5.4				4.8
98	c2-nonene		0.3	0.3	10.0		0.5	0.5	10.0		1.6	2.3	11.8		0.4	0.6	10.8
99	ip-benzene		0.2	0.6	34.7		0.8	1.0	35.2		1.6	3.8	39.4		0.4	1.3	39.5
100	ip-cyH		0.2	0.3	13.0		1.8	0.7	12.6		1.5	2.3	15.0		0.3	0.6	13.9
101	nb-cyP		0.3	0.5	17.4		1.2	1.5	17.0	0.4	2.7	3.7	17.0		0.6	1.2	16.4
102	33 & 36- dm-octane	0.3	8.9	5.2	8.0	0.4	14.0	10.9	13.5	0.4	4.1	7.9	3.1		6.0	7.1	2.8
103	np-benzene	0.1	0.5	1.1	93.5	0.2	1.6	2.3	94.7	0.4	3.4	8.0	103.3	1.1	1.3	3.0	107.9
104	3e-toluene & 23-dm-octane	0.4	1.7	5.0	316.3	0.6	6.1	7.3	314.6	1.3	6.9	22.4	335.9	0.5	3.5	11.9	354.5
105	4e-toluene	0.3	0.7	1.5	131.8	0.4		3.3	133.4	0.5	3.3	9.7	140.6		1.8	4.7	151.2
106	135-tm-benzene & 2m-nonane		0.6	1.5	132.7		3.0	3.9	130.7	0.3	3.9	10.2	141.8	0.2	1.7	4.6	145.4
107	3e-octane		0.4		5.3			1.5	5.3		1.6		5.8		0.7	1.3	7.0
108	3m-nonane		0.2	0.3	16.7		1.0	1.2	17.2		1.2	2.0	18.8		0.6	0.9	19.5
109	2e-toluene	0.1	0.5	1.2	109.4	0.2	1.9	2.8	110.0	0.3	2.4	7.6	113.9		1.3	4.3	121.8
110	1-decene & ib-cyH	0.2	1.9	0.6	26.9		2.0	2.4	5.4	1.0	1.3	0.9	21.8		4.4	11.7	5.1
111	124-tm-benzene & tb-benzene	3.7	1.6	3.9	462.1	0.7	35.1	13.4	448.4	1.0	6.5	30.6	479.4	2.5	13.4	13.5	496.7
112	n-decane	0.2	2.2	1.8	15.8	0.2	1.8	7.1	15.5	0.3	3.2	4.1	17.8	0.3	0.4	4.5	17.0
113	ib-benzene				7.5		3.0	3.0	8.4	0.5	1.1	1.1	7.1				8.8
114	sb-benzene		0.6		6.6		0.6		7.1		0.6	0.8		0.4			7.5
115	3-ip-toluene	1.8	2.6	2.3	14.3	0.8	11.5	5.1	16.8	0.3	1.6	3.2	94.5		3.8	5.0	15.6
116	4-ip-toluene & 123-tm-benzene	0.3	1.6	2.1	92.7		2.5	8.4	94.5		3.2	6.6	4.6	0.7	2.1	4.1	102.1
117	indan				5.3	0.1	30.9	1.3	5.8	0.7	0.5	0.8	57.0		3.5	16.1	6.7
118	2-ip-toluene		14.3	25.0	55.5		1.5	102.7	60.2		1.8	3.9	46.7		1.1	1.9	67.2
119	3-np-toluene & 13de-benzene	0.4	0.7	1.0	21.4		1.4	3.2	22.5		0.7	1.4	82.7		0.3	0.7	48.0
120	4-np-tol/nb&13dm5e&14de-benz	1.4	1.4		82.4		3.8	3.4	89.9		3.1	5.3	4.5	0.6	1.5	3.5	8.3
121	12-de-benzene		0.8	0.9	7.5		1.9	1.6	8.0	1.1	0.6	0.7	5.0		0.5	0.9	22.5
122	2-np-toluene	0.1	1.3	1.4	19.3	0.7	0.9	5.3	22.0		1.0	2.1	27.6		0.9	1.9	33.4
123	14-dm-2e-benzene		1.0	1.0	4.9		1.2	1.6	32.2		0.9	1.6	17.2		0.3	0.9	19.4
124	12-dm-4e-benzene		0.6	1.0	51.2		2.2	3.0	54.7		1.7	3.4	10.3		0.6	1.3	11.8
125	13-dm-2e-benzene		0.9	1.6	17.5		2.8		7.3		0.7	1.1	11.0		0.5	0.8	13.2

ID	Compound Name	JE				SV				MH				SR			
		AMB	CSPT	CSH	CSG	CSAMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
126	n-undecane	0.2	12.7	9.4	10.4		5.0	11.1	12.1		2.5	3.3	20.5		3.7	4.2	23.5
127	1245-ttm-benzene		1.0	1.0	11.5		1.6	4.8	13.2		0.7	1.2	27.6		0.5	0.6	31.7
128	2mb-benzene		1.6	1.2	20.5		4.5	2.3	22.7		0.9	1.3	4.0		0.6	1.0	2.4
129	tb-2m-benzene		0.4	0.4	4.7		1.3	0.6	5.6		0.3	1.0	5.1		0.5	1.3	25.2
130	n-pentylbenzene	0.3	5.0	1.4	31.1		0.3	4.2	32.9		1.4	2.2	39.0		17.4	25.7	5.7
131	tb-35dm-benzene	0.3	0.6		7.6			1.9	4.8				10.3				8.1
132	tb-4e-benzene						3.7										
133	naphthalene		6.6	5.0	47.8		2.9	1.7	49.6		1.3	1.6	1.6		0.9	2.2	
134	n-dodecane		2.5	2.0	10.5			2.0	12.0		1.3	1.4	0.9		1.4	1.7	44.5
135	135-te-benzene				0.5				0.6								11.4
136	124-te-benzene				1.5				1.6						0.4	0.7	1.7
137	n-hexylbenzene				1.7				3.0								0.7
138	n-tridecane		0.6	0.4	0.4		0.3				0.6				0.5	0.6	1.8

ID	Compound Name	JS				PB				GS				RW			
		AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
1	methane	1466.8	1650.6	1680.9	1762.5	1502	1977	1903	2402	1261	1336	1362	1875	1295	1371	1491	2083
2	ethylene		4.7	19.9	245.8		4.4	17.2	1056.2	0.1	4.5	35.7	595.3		2.5	55.2	800.0
3	acetylene		2.9	12.7	153.8		3.8	13.8	751.2		3.1	27.3	413.4	2.1	1.5	44.5	548.1
4	ethane		11.8	15.1	23.5	6.1	18.2	18.0	127.9	6.9	5.9	10.2	57.8	5.8	4.9	11.6	74.9
5	propylene	2.2	1.6	8.8	92.4	2.1	1.4	7.0	406.2	1.7	1.6	17.1	286.4	1.6	0.9	26.6	307.9
6	propane	5.6	80.1	80.6	14.5	5.8	11.8	11.2	21.7	4.4	8.8	6.7	14.7	3.8	5.6	6.2	16.5
7	propyne				9.8		0.1	0.7	52.4			1.9	29.7	47.7		3.0	149.8
8	isobutane				38.5	3.8	11.2	13.5	198.2	2.2	5.3	10.6	108.5	1.4	6.7	16.5	160.1
9	1-butene & isobutene	2.8	4.0	8.7	59.7	2.6	2.8	5.7	261.4	1.9	2.5	13.2	162.3	1.7	3.7	18.3	194.3
10	13-butadiene	0.4	0.5	2.9	33.2	0.6		2.0	139.7	0.4	0.3	5.1	84.7		0.3	9.1	90.6
11	n-butane	15.4	310.6	285.4	112.1	11.1	13.9	19.1	544.6	9.6	15.8	28.0	312.2	4.3	20.7	47.2	435.2
12	t2-butene & 22-dm-propane	0.7	1.8	3.0	19.1	0.7	0.7	1.8	95.0	0.4	1.5	4.5	61.7	0.4	2.7	6.9	70.9
13	1-butyne				0.7				5.2				1.4				1.9
14	c2-butene	0.6	0.9	1.9	14.6	0.3		1.1	68.9	0.2	0.9	14.6	44.0		1.8	4.3	50.1
15	3m1-butene		0.3	0.7	4.4		0.1	0.4	19.0		0.2	0.9	11.9	0.7	0.2	1.2	14.5
16	2m-butane	5.6	65.9	89.1	111.6	3.6	5.5	265.6	576.9	5.8	5.5	16.5	373.5	7.0	25.9	27.5	453.3
17	1-pentene	0.4	0.4	1.2	10.9			5.4	38.0	0.3	0.5	2.0	31.9	0.2	2.0	3.3	38.1
18	2m1-butene	0.3	0.8	2.8	13.1	0.2	0.4	2.0	50.8	0.3	0.7	2.3	28.0	0.1	1.5	3.7	37.9
19	n-pentane	3.5	6.1	12.7	70.0	3.6	4.4	9.4	354.0	2.3	5.7	17.3	228.8	1.6	35.6	54.8	273.3
20	2m13-butadiene																
21	t2-pentene	0.6	1.3	2.4	16.5	0.2	0.8		72.8	0.3	1.1	3.9	46.5	0.5	1.7	5.6	54.7
22	c2-pentene	0.3	0.4	1.1	8.7		1.4	0.7	41.9		0.4	1.8	26.5	0.2	1.0	3.1	34.2
23	2m2-butene	0.5	3.3	5.1	24.0	0.6	4.1	4.9	117.0	0.4	0.5	1.2	75.9	0.4	2.9	4.9	77.7
24	22-dm-butane	0.4	1.1	2.3	14.9	0.4	0.5	1.4	76.4	0.3	0.7	3.9	47.8	0.3	0.7	5.8	63.0
25	cyclopentene	0.3	0.3	0.7	5.1		0.2	0.4	22.1	0.4	0.3	1.2	13.9		0.4	1.5	16.7
26	4m1&3m1-pentene		0.3	0.4	3.4		0.3	0.3	17.3		0.4	0.7	8.7		1.0	13.5	

ID	Compound Name	JS				PB				GS				RW			
		AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
27	cyclopentane	0.6	1.1	2.2	13.0	0.6	0.9	1.4	67.1	0.6	0.8	3.6	42.3	0.4	1.4	4.9	51.4
28	23-dm-butane	0.7	1.7	3.2	21.7	0.7	0.8	2.0	71.2	0.4	1.2	4.7	62.2	0.3	0.9	6.6	77.4
29	2m-pentane & t-4m2-pentene	3.5	9.7	16.5	95.3	3.2	4.9	11.0	442.1	1.7	7.5	23.0	272.8	1.7	5.0	30.0	342.2
30	MTBE & c-4m2-pentene	0.4	0.3	0.7	0.6			0.5	1.9	0.4	1.6	1.6	1.1		0.5	1.7	1.6
31	3m-pentane	1.7	6.6	11.2	62.5	1.5	4.7	7.2	289.8	0.9	5.9	16.8	178.0	1.3	3.2	19.9	223.6
32	1-hexene & 2m1-pentene	0.6	1.8	3.5	10.5		10.1	11.4	34.6		2.8	1.2	1.5	2.4	2.2	4.0	26.4
33	n-hexane	1.7	8.7	12.7	56.1	1.8	6.6	9.2	261.2	1.0	9.5	19.5	158.5	0.9	3.6	17.9	202.1
34	t2-hexene	0.2	0.4	0.8	8.5		0.2	0.6	33.7		0.4	1.4	20.6	0.3	0.5	2.2	25.1
35	2m2-pentene & 2e1-butene		7.8	8.1	8.5		3.6	3.9	31.6		0.5	2.2	33.5		0.6	3.5	40.0
36	c2-hexene		0.3	0.6	4.9		0.2	0.5	18.2		0.3	0.8	11.1		0.4	1.2	13.7
37	c/t-3m2-pentene		0.4	0.9	9.9		2.7	0.7	39.7		0.4	1.7	2.2	1.0	0.4	2.6	1.4
38	22-dm-pentane		0.4	0.6	3.6		0.4	0.4	15.4		0.9	9.1	0.2		1.0	12.0	
39	m-cyclopentane	1.0	3.5	7.3	62.6	1.2	3.7	7.8	327.9	0.9	4.1	15.3	199.0	0.6	4.1	22.5	251.6
40	24-dm-pentane	0.3	1.4	2.5	13.1	0.3	0.5	2.2	53.3	0.3	2.0	2.9	32.4		0.5	3.5	40.3
41	223-dm-butane		1.9	1.9	0.5		3.3	3.3	5.7	0.1	0.4	0.9	2.3	0.3	0.5	0.9	4.0
42	1m-cyclopentene				0.9				1.9			0.4	1.2	0.4		0.2	19.9
43	benzene	3.6	5.5	13.5	139.9	2.9	4.3	10.1	607.2	2.3	5.7	23.8	371.9	2.8	8.0	39.2	466.2
44	33-dm-pentane	0.3		0.9	5.8		0.5	0.7	22.9		0.5	1.4	14.0			1.9	18.2
45	cyclohexane	0.7	1.1	2.0	14.0	1.1	3.3	4.2	71.7	0.6	0.7	3.4	43.1	0.9	1.7	5.5	55.1
46	2m-hexane	1.1	3.8	7.0	48.9	1.0	3.3	5.6	219.1	0.7	3.4	11.1	129.2	0.6	2.0	14.5	172.7
47	23-dm-pentane	0.4	1.5	2.6	16.7	0.4	1.2	2.1	69.3	0.3	1.1	3.6	41.5	0.3	0.6	4.7	55.2
48	11-dm-cyP		0.5	0.6	3.2		0.6	0.8	12.8		0.2	0.7	7.9		0.1	1.0	10.0
49	3m-hexane & cyclohexene	2.0	4.9	8.3	53.9	1.3	5.2	7.1	238.0	1.3	4.5	13.1	141.1	1.9	2.4	16.9	189.1
50	c-13-dm-cyP	0.2	1.1	1.7	10.1	0.5	1.5	2.0	45.1		0.6	2.2	27.0	0.3	0.5	3.4	35.8
51	t-13-dm-cyP & 3e-pentane	0.3	1.3	2.4	15.5		1.6	2.3	66.8	0.3	0.9	3.2	39.8	0.4	0.6	4.7	53.5
52	t-12-dm-cyP				0.4												
53	224-tm-pentane & 1-heptene	1.2	3.8	6.6	42.9	1.6	3.1	5.1	168.5	0.8	1.6	7.2	98.7	0.9	1.4	11.5	134.3
54	c3-heptene				4.0			0.5	15.1			0.6	9.1		0.2	1.3	11.9
55	n-heptane	0.8	5.3	8.0	41.7	0.8	4.8	7.1	187.0	0.4	3.8	10.1	109.8	0.7	2.0	12.4	149.0
56	t3-heptene		1.0	1.8	13.4				54.6		0.4	2.1	33.0		0.4	3.6	41.9
57	t2-heptene		0.6	0.9	4.2		0.2	0.5	15.6		0.2	0.7	9.6		0.2	1.3	12.4
58	c2-heptene		1.9	1.4	4.5			0.6	16.0	0.3	0.5	0.9	10.5	0.2	0.4	1.5	12.9
59	m-cyH & 22-dmC6	0.5	5.7	7.3	22.1	0.5	3.2	4.6	101.8	0.4	1.8	5.4	60.3	0.3	0.9	7.8	81.1
60	25-dm-C6 & e-cyP		0.9	1.6	9.0		0.2	0.7	35.7		0.5	1.3	21.1		0.2	2.6	29.1
61	24-dm-C6 & 223-tm-C5	0.3	2.1	3.6	17.7	0.4	0.7	1.7	74.3	0.3	0.9	2.8	44.0		0.5	5.2	60.2
62	ctc-124-tm-cyP					0.2			0.9								1.0
63	ctc-123-tm-cyP		1.0	1.1	3.4		0.2		13.1		0.2	0.6	8.2	0.5	0.2	1.4	10.6
64	234-tm-pentane	0.4	1.6	2.7	14.7	0.6	0.6	1.7	49.7	0.2	0.7	2.0	30.0	0.5	0.4	3.6	40.0
65	toluene	7.1	28.8	44.5	335.2	7.8	29.5	41.3	1378.8	4.2	21.6	56.6	844.6	4.8	28.5	90.0	1140.4
66	2m-heptane	0.4	2.3	3.9	24.6	0.3	0.7	1.7	105.7	0.2	1.0	4.1	62.3	0.3	0.9	7.0	87.2
67	4m-heptane & 1m-cyhexene	0.2	1.0	1.8	12.0		0.8	0.8	50.5		0.4	1.9	30.1	0.7	0.4	3.4	42.3
68	3m-C7 & 3e-C6	0.6	2.7	4.7	33.2	0.2	1.6	2.3	141.4	0.2	1.2	5.3	83.6	1.6	1.1	9.7	117.8
69	cct-124-tm-cyP & c-13-dm-cyH				6.8				28.2		1.1	17.1		0.3	2.2	23.9	

ID	Compound Name	JS				PB				GS				RW				
		AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	
70	t-14-dm-cyH	0.4	6.0	6.3	2.7		5.5	5.8	8.5		2.7	1.8	5.9	0.8	0.4	1.9	7.7	
71	225-tm-C6		0.7	1.0	4.4			0.4	14.1		0.4	0.6	9.1		0.1	1.3	12.9	
72	1-octene	0.3	1.6	2.2	7.6	0.2	0.7	1.0	29.2		0.7	1.1	18.7	0.8	0.3	3.3	25.5	
73	1e-1m-cyP		0.6	0.6	1.3	0.4	0.2	0.4	5.2			0.2	4.0	1.0		1.8	4.3	
74	n-octane & t-12-dm-cyH	0.7	4.6	5.9	23.7	1.8	1.9	2.5	98.8	0.5	2.1	4.5	59.2	2.0	1.1	6.9	83.5	
75	t2-octene		0.8	1.1	0.5	0.9	0.8	0.7	11.4		0.5	0.5	7.6	1.7	1.1	2.5	10.0	
76	ccc-123-tm-cyP																	
77	??t-13-dm-cyH & c-14-dm-cyH		1.5	1.6	5.1	0.9	0.7	0.6	20.8		0.5	1.0	13.1		0.1	2.3	17.5	
78	c2-octene						1.2	0.3	3.7							2.2		
79	ip-cyP		0.8		1.7	1.1	0.5		6.6			0.5	7.3				8.9	
80	c-12-dm-cyH		1.1	1.7	5.1		0.4	0.5	20.2		0.3	1.0	12.5		0.1	1.6	17.7	
81	np-cyP		0.7	0.8	2.0		0.4	0.3	7.3		0.3	0.4	4.9			0.7	6.5	
82	25-dm-heptane			2.6	10.0		1.0	0.9	40.7			1.8	24.9	1.0	0.4	3.1	35.2	
83	33-dm-heptane		1.0	1.2	1.9		0.5	0.4	7.5		0.1	0.5	4.9			0.7	6.8	
84	114-tm-cyH		0.6	0.8	2.7		0.3	0.2	10.0		0.1	0.5	6.6			0.8	8.7	
85	e-benzene	1.2	8.3	12.4	83.8	1.3	7.8	7.9	315.7	0.7	3.6	10.4	202.0	1.0	4.8	17.2	269.1	
86	ctt-124-tm-cyH & 35-dm-C7		0.8	0.9	1.5		0.5	0.3	5.4		0.4	0.5	3.6			0.5	5.0	
87	m&p-xylene & 23-dm-heptane	4.4	29.8	40.2	280.8	3.6	26.4	27.2	1056.8	2.2	12.5	33.7	679.2	3.2	15.6	54.7	892.2	
88	34-dm-C7 & 4m-C8		1.0				0.5				0.1							
89	2m-octane	0.4	2.8	3.3	12.0	0.4	1.3	1.5	49.5	0.5	0.9	2.7	32.8	1.7	0.6	3.8	43.5	
90	3m-octane & ctc-124-tm-cyH			1.0	1.9				6.0				4.1	0.7			5.4	
91	styrene		1.7	2.3	21.0		2.5	1.7	66.9		0.7	2.2	51.0	0.5	0.2	1.9	53.2	
92	o-xylene		2.1	13.3	17.8	118.3	1.7	11.7	12.2	434.7	1.2	5.6	14.5	282.7	1.2	6.5	22.4	367.2
93	1-nonene & 112-tm-cyH												0.4					
94	t3-nonene		1.1	1.2	2.2		0.8	0.7	8.2		0.3	0.5	5.6				7.5	
95	c3-nonene & ib-cyP				1.4				6.2				3.9				5.4	
96	n-nonane	0.4	10.9	11.0	8.5	0.9	9.2	8.4	31.7	0.3	1.5	2.5	20.2	0.3	0.7	2.1	27.6	
97	t2-nonene		0.5	0.6	1.1		0.5	0.5	3.8		0.2		3.0				3.6	
98	c2-nonene		1.8	1.9	2.4		1.8	1.7	8.5		0.8	1.0	6.0		0.1	0.6	8.1	
99	ip-benzene		0.3	2.4	8.1		1.8	2.0	29.9		0.7	1.2	19.8		0.4	1.6	25.7	
100	ip-cyH		0.6	2.7	2.9		2.5	2.4	11.3		0.6	0.8	7.4		0.2	0.7	9.9	
101	nb-cyP	0.3	11.0	7.8	3.7		7.5	7.1	12.6		1.3	1.7	8.2		0.3	0.9	13.1	
102	33 & 36- dm-octane	0.4	2.6	9.8	0.5		5.8	7.9	2.3		21.5	23.7	1.5	0.7	1.1	3.4	6.3	
103	np-benzene	0.4	13.9	6.6	21.1		5.7	4.8	76.5		1.5	2.9	52.0		1.0	3.2	64.8	
104	3e-toluene & 23-dm-octane	1.3	15.0	16.5	71.5	1.6	14.8	17.7	251.4	0.3	10.9	16.5	170.7	0.8	2.9	10.0	203.0	
105	4e-toluene	0.5	3.1	6.8	30.4		1.3	1.2	104.9	0.3			72.7	0.4	1.4	4.2	86.3	
106	135-tm-benzene & 2m-nonane	0.5		13.0	31.2	0.4	11.5	11.0	107.6		2.7	4.3	73.0	0.2	1.2	4.4	84.9	
107	3e-octane		3.9	4.3	1.0		7.0	6.4	4.3		0.7	0.9	2.8				4.0	
108	3m-nonane		5.7	3.8	3.8		4.5	3.8	14.0		1.1	1.5	9.6		0.2	0.8	12.2	
109	2e-toluene	0.4	2.0	5.9	24.9		4.5	4.3	85.8	0.2	1.5	2.8	59.1	0.4	0.9	3.3	69.0	
110	1-decene & ib-cyH	1.2	5.1	3.1	5.9		20.9	4.1	12.2		0.5	0.7	15.0	1.0			10.4	
111	124-tm-benzene & tb-benzene	3.5	37.8	34.8	106.4	1.1	31.0	31.1	361.1	0.2	8.1	12.7	250.6	2.1	4.2	13.5	276.2	
112	n-decane	0.4	32.0	30.3	5.9	0.4	36.5	33.0	13.4		4.3	5.3	10.2	0.5	1.0	1.5	10.4	

ID	Compound Name	JS				PB				GS				RW			
		AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
113	ib-benzene		1.4	1.3	2.3		1.8	1.4	6.1		0.1		4.8				5.0
114	sb-benzene		7.5	6.9	1.4		9.2	8.2	5.1				4.7				4.4
115	3-ip-toluene	0.4	6.8	6.4	4.0		9.1	8.2	10.7				4.7	7.9		0.4	9.1
116	4-ip-toluene & 123-tm-benzene	0.6	68.9	64.8	22.7	0.8	25.0	31.6	71.0	0.2	5.6	5.6	48.8	0.7	1.2	3.1	54.3
117	indan		7.7	7.5	10.9		12.5	11.6	4.0		0.9	3.5	3.1				4.0
118	2-ip-toluene		2.5	2.4	12.9		6.8	6.5	1.8		5.0	2.0	30.7		0.5	1.1	36.7
119	3-np-toluene & 13de-benzene		9.1	8.7	10.5		11.0	9.2	31.2		1.2	0.8	22.0		0.2	0.4	24.3
120	4-np-tol/nb&13dm5e&14de-benz	0.4	3.7	3.0	2.0		5.1	4.5	5.8		0.8	2.5	4.1		0.6	2.0	4.6
121	12-de-benzene		6.3	6.0	5.4		12.7	12.0	14.5		0.5	0.7	10.3	0.3	0.2	0.4	11.9
122	2-np-toluene	0.3	5.1	4.9	7.9	2.0	8.1	13.5	21.7		0.6	1.2	15.5		0.3	0.6	16.4
123	14-dm-2e-benzene		3.2	3.0	4.5	0.8	3.8	3.5	12.6		1.3	0.7	9.7	0.6	0.5	0.6	10.5
124	12-dm-4e-benzene		4.9	5.0	5.2	0.5	10.2	9.3	7.7		1.2	1.5	7.4		0.3	1.2	6.3
125	13-dm-2e-benzene		5.2	4.7	3.4		15.5	5.6	8.2		0.3	0.5	6.3			0.4	6.5
126	n-undecane	0.3	25.0	23.2	6.2	0.4	37.9	34.0	14.4		3.9	3.8	11.1	0.3	0.7	1.0	11.3
127	1245-ttm-benzene		3.5	3.4	8.3		16.0	15.4	19.5		0.5	0.7	15.0			0.3	15.3
128	2mb-benzene		3.6	3.3	0.8		9.9	9.1	1.4		1.0	1.1	1.2			0.3	1.2
129	tb-2m-benzene		1.0	0.9	0.4		6.0	4.9	15.1		0.6	0.7	11.6				12.8
130	n-pentylbenzene		5.6	4.6	1.3	0.9	4.4	1.8	3.3		0.9	1.1	2.9				2.8
131	tb-35dm-benzene		0.3	0.9	0.2		2.3	1.5	4.6		0.5	2.0	3.6				4.0
132	tb-4e-benzene						2.2	1.4									
133	naphthalene		2.7	2.3			1.1										
134	n-dodecane		3.6	3.2	10.6	0.9	36.0	23.9	22.1		1.9	3.3	17.4		0.6	19.4	
135	135-te-benzene		0.3		3.5		1.2	0.7	6.2		1.3	1.3	5.0				5.5
136	124-te-benzene				0.4		0.8		1.0				0.8				0.6
137	n-hexylbenzene				0.4		0.3		0.7				0.8				0.9
138	n-tridecane				0.5		0.5		0.7				0.7				0.8

ID	Compound Name	KR				FA				HD			
		AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
14	c2-butene	0.1		2.6	47.9	0.1	0.6	1.4	19.0	0.1	4.3	4.6	61.0
15	3m1-butene		0.4		17.2			0.4	7.7		0.8	1.7	23.8
16	2m-butane	2.3	21.9	220.7	532.4	0.9	28.3	41.9	237.5	2.1		50.8	561.3
17	1-pentene		1.2	1.5	33.6	0.2	0.3	1.2	15.5		2.8	4.1	48.8
18	2m1-butene		2.1	3.1	45.9	0.1	0.6	1.3	19.7	0.1	5.0	5.2	51.8
19	n-pentane	1.8	14.8	20.1	407.7	0.8	4.0	12.2	179.7	1.3	27.0	37.8	430.9
20	2m13-butadiene												
21	t2-pentene	0.1	3.3	3.2	77.0		1.0	2.5	32.6	0.1	6.7	8.1	90.3
22	c2-pentene		1.4	1.9	42.2		0.3	0.9	17.4		3.7	4.7	49.6
23	2m2-butene	1.7	3.2	7.1	123.4	0.6	0.5	3.3	48.5	0.1	5.8	7.8	131.4
24	22-dm-butane	0.2	1.0	2.2	46.1		0.3	1.5	19.6	0.2	2.3	5.3	52.5
25	cyclopentene		1.0	1.4	29.2	0.4	0.2	0.8	12.6	0.4	1.9	3.4	35.9
26	4m1&3m1-pentene		0.4	0.5	14.9			0.4	5.2		0.6	1.3	23.5
27	cyclopentane	0.6	2.3	3.1	62.6	0.3	0.8	2.1	28.0	0.3	4.0	6.7	65.9
28	23-dm-butane	0.3	1.6	3.0	76.7		0.4	2.0	33.3	0.3	4.5	8.8	88.3
29	2m-pentane & t-4m2-pentene	1.6	8.7	16.1	372.0	0.7	2.6	10.6	160.1	1.2	26.2	46.1	435.5
30	MTBE & c-4m2-pentene		0.8	0.9	1.4		0.3	0.8	0.7	0.2	1.0	3.0	16.8
31	3m-pentane	0.8	6.2	10.0	220.5	0.6	1.7	6.6	95.7	0.4	10.7	22.8	258.3
32	1-hexene & 2m1-pentene	3.8	2.9	4.1	25.7	1.8	2.9	3.9	14.0	1.8	3.8	7.6	39.6
33	n-hexane	1.1	7.8	12.5	205.8	0.5	2.3	7.1	89.1	0.7	12.0	20.8	247.5
34	t2-hexene		0.9	1.2	26.9		0.3	0.7	12.1		1.8	2.6	33.4
35	2m2-pentene & 2e1-butene		0.9	1.7	43.7		0.2	11.2	18.6		2.5	3.6	29.7
36	c2-hexene		0.5	0.7	14.0		0.1	0.6	6.5		1.0	1.4	17.6
37	c/t-3m2-pentene		2.0	1.2	4.4		0.3	0.8	2.1		1.5	2.5	36.3
38	22-dm-pentane		0.3	0.4	11.2		0.1	0.3	5.0		0.4	1.1	14.4
39	m-cyclopentane	0.6	6.1	8.7	139.6	0.3	1.5	4.7	59.6	0.4	7.0	13.3	158.3
40	24-dm-pentane		0.8	2.3	37.3		0.4	1.2	16.2	0.2	1.8	4.0	44.9
41	223-dm-butane	0.6	1.1	1.5	2.9	0.3	1.6	1.6	2.9	0.2	1.1	1.8	4.7
42	1m-cyclopentene				22.8			0.5	1.0		0.3		23.7
43	benzene	2.1	9.8	14.4	284.3	1.1	3.2	8.0	125.9	1.3	16.8	29.0	402.6
44	33-dm-pentane			1.0	16.0			0.5	7.4			1.7	21.2
45	cyclohexane	0.6	1.8	2.4	31.0	0.3	0.4	1.5	13.8	0.2	1.9	3.5	35.4
46	2m-hexane	0.6	3.0	5.5	130.1	0.2	1.3	4.1	57.3	0.4	5.7	12.5	166.0
47	23-dm-pentane	0.2	1.0	2.0	46.2		0.4	1.5	21.0	0.4	2.1	4.6	59.2
48	11-dm-cyP		0.3	0.5	4.8				2.6		0.4	0.6	6.0
49	3m-hexane & cyclohexene	1.2	4.1	7.1	142.9	0.7	1.8	4.7	63.6	0.4	7.8	14.3	185.2
50	c-13-dm-cyP		1.2	1.6	23.9		0.3	0.9	10.8		1.6	2.4	30.3
51	t-13-dm-cyP & 3e-pentane	0.4	1.2	2.0	35.0		0.6	1.4	16.8		1.9	3.6	43.7
52	t-12-dm-cyP												
53	224-tm-pentane & 1-heptene	1.3	2.8	4.4	84.5	0.5	1.1	3.0	38.9	1.0	4.5	9.1	112.2
54	c3-heptene		0.3	0.6	9.8		0.6	0.4	4.8		0.8	1.0	12.6
55	n-heptane	0.6	3.8	5.2	97.4	0.1	0.9	3.1	42.9	0.3	6.6	10.7	125.0
56	t3-heptene		0.8	1.5	39.1			1.2	16.6		2.1	3.4	48.3

ID	Compound Name	KR				FA				HD			
		AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
57	t2-heptene		0.4	0.6	10.0		0.2	0.6	4.9		0.9	1.0	13.1
58	c2-heptene		0.6	1.9	11.9	0.2	0.2	0.8	5.7		2.4	1.7	15.3
59	m-cyH & 22-dmC6	0.3	2.1	3.0	47.2	0.1	0.5	1.7	21.1	0.5	3.0	5.5	58.9
60	25-dm-C6 & e-cyP	0.2	0.5	0.9	17.4	0.2	0.2	0.5	7.8		1.0	1.3	23.3
61	24-dm-C6 & 223-tm-C5		1.1	2.2	34.8		0.2	0.9	15.7	0.2	2.5	2.7	44.9
62	ctc-124-tm-cyP			0.4				0.6					
63	ctc-123-tm-cyP		0.3	0.4	6.9			0.2	3.5		0.5		8.9
64	234-tm-pentane	0.4	0.8	1.8	39.7	0.3	0.8	1.1	17.5	0.3	2.6	3.3	50.5
65	toluene	4.3	43.4	45.8	422.3	2.1	12.6	21.5	163.0	3.8	61.1	65.3	561.6
66	2m-heptane	0.2	1.3	2.2	46.4		0.6	1.4	20.4	0.2	2.3	3.9	60.8
67	4m-heptane & 1m-cyhexene		0.6	1.1	23.6	0.5	0.3	0.6	10.5		1.6	1.9	30.8
68	3m-C7 & 3e-C6	0.2	1.6	2.7	61.4	0.2	0.8	1.9	27.2	0.2	3.1	5.2	80.1
69	cct-124-tm-cyP & c-13-dm-cyH			13.8				6.6					18.8
70	t-14-dm-cyH	0.5	13.8	11.3	4.8	0.9	2.1	2.7	2.3	0.2	9.9	6.6	6.0
71	225-tm-C6		0.2	0.3	6.6			0.3	3.6		0.8	0.5	9.2
72	1-octene	0.4	0.4	0.6	15.3	0.4	0.3	0.6	8.0	0.3	2.4	1.4	21.3
73	1e-1m-cyP			7.0				1.7			0.9		8.3
74	n-octane & t-12-dm-cyH	0.6	2.9	3.3	41.5	0.4	1.8	2.6	17.8	0.4	3.4	4.0	54.0
75	t2-octene		0.8	0.9	7.9		0.5	0.4	3.8				10.2
76	ccc-123-tm-cyP												
77	??t-13-dm-cyH & c-14-dm-cyH		0.9	0.8	11.6			0.1	5.4		1.4		15.4
78	c2-octene				3.0				1.5		1.4		4.2
79	ip-cyP				3.4				1.9				4.7
80	c-12-dm-cyH		0.4	0.5	9.6			0.3	1.3		0.5	0.5	12.8
81	np-cyP		0.1	0.6	4.8		0.2		2.3		1.1		6.6
82	25-dm-heptane		1.5	2.1	18.7			0.6	8.0		1.1	1.3	24.3
83	33-dm-heptane		0.5	0.7	3.7			0.3	1.8		0.4	0.9	5.1
84	114-tm-cyH		0.1		7.1				3.2		0.7		8.7
85	e-benzene	0.7	8.6	11.2	169.3	0.5	2.1	4.5	64.0	0.7	15.2	15.9	225.7
86	ctt-124-tm-cyH & 35-dm-C7		0.1	0.5	3.7		0.2		1.6		1.2	0.5	5.0
87	m&p-xylene & 23-dm-heptane	2.5	30.6	35.6	577.4	1.2	7.1	14.7	213.6	1.8	45.0	50.3	754.0
88	34-dm-C7 & 4m-C8		0.5								0.4		
89	2m-octane	0.9	0.6	2.3	20.2	1.2	1.0	0.7	8.6	0.6	1.0	2.7	27.7
90	3m-octane & ctc-124-tm-cyH		0.6		4.0				1.9	0.3			5.1
91	styrene	0.4	1.2	2.3	44.9	0.4	1.0	0.5	16.8		6.0	2.6	55.3
92	o-xylene	1.4	11.7	15.0	243.1	0.8	3.0	5.9	89.7	1.1	18.6	21.0	320.0
93	1-nonene & 112-tm-cyH								2.3		0.5	0.7	7.0
94	t3-nonene		0.4	0.8	5.6								
95	c3-nonene & ib-cyP				4.2				1.8				5.6
96	n-nonane	0.4	5.1	5.8	14.6	0.2	0.6	0.9	5.8	0.2	3.6	3.4	18.9
97	t2-nonene		0.4	0.5	2.9				1.3				3.9
98	c2-nonene		0.2	2.4	6.3		0.4	0.3	2.9				8.8
99	ip-benzene		1.6	2.0	15.0		0.3	0.5	5.6		0.3	1.1	20.0

ID	Compound Name	KR				FA				HD			
		AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
100	ip-cyH		2.1	2.6	6.7		0.3	0.4	2.6		1.3	1.2	8.7
101	nb-cyP	0.2	5.7	7.2	9.7		0.6	0.8	4.0		0.6	1.3	12.9
102	33 & 36- dm-octane	0.2	10.3	3.8	3.2	1.8	2.9	3.8	1.5		2.7	2.6	6.1
103	np-benzene		2.6	4.7	38.3		0.6	1.1	13.2		21.9	8.2	49.9
104	3e-toluene & 23-dm-octane	0.6	14.4	25.3	143.8	0.3	3.2	3.8	46.7	0.5	15.6	27.4	188.8
105	4e-toluene	0.3	0.2	1.4	60.6	0.2		1.5	19.4	0.3	7.0		78.8
106	135-tm-benzene & 2m-nonane	0.3	7.0	11.1	61.0		1.4	2.0	18.5		9.3	8.0	73.8
107	3e-octane		3.1	6.1	1.7		0.9	1.0	1.6		2.4	2.1	2.3
108	3m-nonane		3.3	4.5	6.7		0.5	0.6	2.4		1.4	1.5	8.7
109	2e-toluene	0.3	2.9	4.3	49.7		0.7	1.2	15.9	0.2	6.4	4.9	65.3
110	1-decene & ib-cyH	0.8	2.8	15.7	10.2		0.6	0.5	3.6		22.1	0.9	7.3
111	124-tm-benzene & tb-benzene	1.2	15.8	16.2	208.5		2.2	5.0	57.4	0.6	51.9	23.6	244.3
112	n-decane	0.6	30.3	31.2	10.5	0.2	3.5	3.8	4.0	0.2	10.5	8.1	16.0
113	ib-benzene		0.2	1.9	3.4		0.6	0.3	1.5		0.6		5.9
114	sb-benzene		3.5	7.9	3.0		0.9	1.4	1.0		0.7		4.3
115	3-ip-toluene		8.7	12.5	7.0	0.3	1.5	1.5	2.4	0.3	11.5	4.9	9.1
116	4-ip-toluene & 123-tm-benzene	1.1	45.8	31.8	41.2		2.8	2.5	12.3		11.6	10.5	56.2
117	indan		4.2	7.2	3.0		0.7	0.7	1.3		24.3		4.6
118	2-ip-toluene		1.2	2.7	24.4		0.5	0.5	7.7		5.1	3.8	31.9
119	3-np-toluene & 13de-benzene		5.4	9.5	16.0		1.2	1.3	4.6		1.8	1.6	14.4
120	4-np-tol/nb&13dm5e&14de-benz		2.1	6.5	16.7	0.9	0.5	0.5	1.0		6.5	4.3	44.6
121	12-de-benzene		5.3	7.3	32.8		0.9	0.9	2.7		2.7	1.6	4.9
122	2-np-toluene		6.0	9.5	3.4		1.0	1.1	1.2		4.1	2.7	13.0
123	14-dm-2e-benzene		0.7	2.9	9.0		0.2	0.3	7.1		2.1	1.0	16.7
124	12-dm-4e-benzene		2.0	5.0	3.3		0.5	0.7	1.3		5.1	2.7	32.4
125	13-dm-2e-benzene		5.1	11.4	24.0	0.2	0.9	1.0	2.1		4.8	2.7	5.6
126	n-undecane	0.7	36.2	36.8	8.0		4.6	5.4	2.8		18.1	7.7	13.3
127	1245-ttm-benzene		2.4	6.2	3.4		0.7	1.0	2.2		4.0	2.1	7.6
128	2mb-benzene	0.4	4.4	6.1	4.9		0.5	0.7	0.5		4.6	1.0	10.9
129	tb-2m-benzene		1.1	1.3	10.2		0.5	0.6	2.6		1.7	2.0	3.3
130	n-pentylbenzene		3.7	5.0	8.5	0.6	0.7	1.1	3.5		13.1	1.7	3.2
131	tb-35dm-benzene		0.7	0.6	2.1		0.7		0.8		2.6		4.8
132	tb-4e-benzene				0.7								2.2
133	naphthalene		3.0	2.0							5.4		
134	n-dodecane		6.7	5.0	10.4		0.8	1.4	3.2		8.1		16.3
135	135-te-benzene		0.6		0.5				1.5		1.1		1.2
136	124-te-benzene									0.6			0.9
137	n-hexylbenzene								0.5		0.3		0.4
138	n-tridecane		2.7	1.4							0.9		0.2

**Table 27. Hydrocarbon compound concentrations for the Phase 1 hot soak tests (ng/L).**

ID	Compound Name	GM				JR				HD				PT			
		HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG
1	methane	1381	1790	2105	1470	1678	2221	1844	1431	1463	1345	1558	1500	1605	1459	1529	1340
2	ethylene	0.9	3.0	3.4	1.7	2.7	3.6	2.7	3.3	6.9	2.5	6.6	8.4	3.8	5.4	4.7	6.3
3	acetylene	1.0	2.6	1.7	1.2	1.8	2.8	2.1	3.0	4.0	2.5	3.5	4.6	4.3	11.0	7.0	6.7
4	ethane	1.9	0.4	0.6	0.7	0.7	0.3	0.4	0.7	0.7	0.1	0.3	0.6	4.3	0.2	0.3	0.5
5	propylene	2.0	1.2	1.9	1.2	2.7	1.4	1.4	1.6	4.3	1.0	4.8	4.5	14.4	2.0	4.6	3.1
6	propane	2.4	4.5	10.9	15.3	8.2	6.5	11.2	10.0	11.0	2.4	12.0	13.1	3.1	5.3	6.3	10.5
7	propyne																
8	isobutane		3.8	18.8	157.3	7.4		12.7	55.7	29.5	6.1	55.2	110.7			11.3	109.5
9	1-butene & isobutene	4.1	1.1	5.9		1.8	1.0	3.1	37.5	8.4	0.3	19.7		1.6	6.0		
10	13-butadiene		0.3	0.8	2.0		0.3	0.3	1.1	2.0	0.2	1.0	2.3	0.5	0.5	0.5	2.1
11	n-butane	3.5	5.9	15.1	496.0	23.2	6.9	40.9	184.6	32.7	11.9	114.2	384.5	7.4	15.6	33.8	348.9
12	t2-butene & 22-dm-propane	0.4		2.1	79.9				29.3	2.6		15.1	58.4	0.5	0.7		51.9
13	1-butyne																
14	c2-butene			2.1	55.4	0.6		1.2	20.2	1.7	0.8	10.5	40.3	0.3	0.5	2.5	36.9
15	3m1-butene				7.1				2.6			1.5	5.4			0.5	5.3
16	2m-butane	2.1	4.3	7.0	292.9	7.4	5.2	11.1	111.4	15.1	4.7	59.7	219.5	5.5	4.0	18.1	221.5
17	1-pentene			0.7	29.3		0.3		7.6	1.4	1.0	4.1	15.9	1.5	0.8	1.3	15.3
18	2m1-butene			1.0	40.5	0.6	0.6	1.2	14.2	0.7	0.6	8.3	29.7	0.7	1.0	2.5	29.4
19	n-pentane		1.6	5.9	214.5	2.7	1.7	5.5	77.1	9.9	2.9	42.5	156.4		6.2	16.2	154.9
20	2m13-butadiene	1.3												2.6			
21	t2-pentene	0.2	0.2	1.7	59.6					2.2	1.0	11.5	43.9	0.5	1.2	3.7	40.2
22	c2-pentene			5.3	31.5			1.4	11.3		0.5	6.1	23.5	0.4	0.5	2.3	21.9
23	2m2-butene	0.9			82.9	1.2	0.4	1.8	31.5	5.8	1.9	16.3	61.7	1.0	3.5	8.9	55.9
24	22-dm-butane	0.3		0.9	21.9			0.6	7.2	1.3	0.5	5.3	15.6	0.7	1.1	1.9	16.8
25	cyclopentene	0.3	0.2	2.3	13.1	0.5		0.7	4.5	0.6		2.4	9.8		0.3	0.9	8.5
26	4m1&3m1-pentene				5.5				1.9			1.1	3.9				4.0
27	cyclopentane	0.4	0.7	1.8	39.5	0.7	0.3	1.5	14.1	1.8	0.6	7.2	27.3	0.5	1.0	3.2	29.0
28	23-dm-butane	0.3		0.9	30.2	0.4	0.3	0.8	10.1	1.6	0.7	6.5	22.7	0.7	1.1	2.3	23.4
29	2m-pentane & t-4m2-pentene	1.8	3.2	7.4	154.0	4.2	4.4	5.9	53.6	8.1	3.3	32.9	116.7	4.2	6.1	11.6	118.4
30	MTBE & c-4m2-pentene	0.5		0.5	8.6				3.4	0.9	0.3	2.5	6.0			1.3	6.4
31	3m-pentane	0.6	0.5	4.6	96.3	1.1	1.2	3.4	32.3	5.5	1.9	19.5	73.5	2.0	3.5	6.4	74.7
32	1-hexene & 2m1-pentene	0.2			20.0	5.1	5.9	8.1	11.6			8.9	15.2			6.9	16.1
33	n-hexane	0.6	1.0	3.1	106.8	1.7	1.2	3.0	38.4	4.5	1.8	22.6	83.9	1.4	2.5	7.1	81.4
34	t2-hexene			2.1	17.6			0.4	6.3	0.6	0.3	3.4	13.2	0.2	0.4	1.1	13.0
35	2m2-pentene & 2e1-butene				13.1	1.1	1.4	2.3	4.9	0.3		3.9	9.6	0.2	1.3	0.6	9.4
36	c2-hexene				9.7			0.5	3.8	0.4		2.1	7.2	0.3	0.4	0.8	7.2
37	c/t-3m2-pentene			0.5	18.9			0.4	6.3	0.7	0.3	3.3	13.7	0.2	0.3	1.3	13.1
38	22-dm-pentane			0.3	2.6			0.4	0.8			0.7	2.4				2.0
39	m-cyclopentane	0.6	0.7	3.4	122.9	1.5	1.0	3.2	42.4	5.4	1.3	21.6	83.3	1.6	3.0	8.6	93.5
40	24-dm-pentane	0.7		1.1	13.7	0.5	2.4	1.2	4.5	0.8	0.4	3.2	11.8	0.2	1.2	1.6	9.8

ID	Compound Name	GM				JR				HD				PT			
		HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG
41	223-dm-butane		0.2	0.9	1.1	0.1	0.3	0.4	0.3	0.3	0.0	0.6		0.7	0.7	0.7	1.0
42	1m-cyclopentene		1.8		16.8				5.7	0.6	3.0	14.7	0.2		1.2		11.0
43	benzene	1.6		7.5	238.5	3.3	2.9	7.0	88.1	10.4	5.3	43.5	169.9	3.1	4.4	14.1	175.5
44	33-dm-pentane				6.0				2.4	0.4	0.2	1.4	4.8		0.8		4.7
45	cyclohexane	0.2	0.3	0.8	25.5	0.8	0.6	1.0	8.4	0.9	0.3	4.6	17.3	0.5	0.7	1.8	19.6
46	2m-hexane	0.3		2.1	54.1	1.1	1.2	1.9	18.8	3.0	1.4	11.8	42.0	0.9	1.6	3.9	43.1
47	23-dm-pentane				15.4	0.4	0.6	0.6	5.1	1.2	0.6	4.3	13.5	0.4	0.6	1.2	12.4
48	11-dm-cyP		0.8	0.6	3.1				1.0			0.5	2.0				2.4
49	3m-hexane & cyclohexene	0.2	5.1	4.8	57.4	1.9	2.2	3.6	20.7	3.7	1.8	13.2	44.6	1.2	2.5	4.7	45.8
50	c-13-dm-cyP				12.3	0.4	0.4	0.5	4.2	0.6	0.3	2.4	8.5	0.6	0.6	1.1	9.9
51	t-13-dm-cyP & 3e-pentane	0.3			18.2	0.6	0.3	0.8	6.5	0.8	0.4	3.6	13.0	0.5	0.5	1.4	14.5
52	t-12-dm-cyP		1.1														
53	224-tm-pentane & 1-heptene	0.5		5.2	30.5	0.9	0.7	1.4	10.4	2.9	1.4	8.2	24.8	1.3	1.1	2.7	25.3
54	c3-heptene		0.2	1.3	6.0				2.1	0.4		1.0	4.7				4.5
55	n-heptane	0.3	0.8	2.1	52.7	1.2	1.7	2.1	18.8	2.8	1.4	11.5	40.6	0.8	1.5	4.1	41.0
56	t3-heptene			1.3	20.4				6.7	0.7		3.3	14.5			0.9	14.3
57	t2-heptene			1.5	6.3				2.1			1.0	4.5				4.9
58	c2-heptene	1.5		3.0	6.4		0.3		2.1	1.2	1.1	1.0	4.0		0.6	0.6	4.3
59	m-cyH & 22-dmC6		0.3	0.8	24.3	0.9	0.9	1.3	8.7	1.1	0.6	5.0	16.9	0.5	0.8	1.9	19.8
60	25-dm-C6 & e-cyP	0.2	0.2	0.7	5.4	0.9	4.1		1.9	0.4	0.3	0.7	4.4	0.3	0.5	0.7	4.8
61	24-dm-C6 & 223-tm-C5			0.5	15.5				5.4	1.1	0.4	1.8	11.2	0.4	0.6	2.0	12.7
62	ctc-124-tm-cyP											1.1					
63	ctc-123-tm-cyP				3.1				1.0			0.5	2.9				2.5
64	234-tm-pentane	0.3	0.3	3.0	12.7	0.8	0.6	1.0	4.4	1.7	0.7	3.1	11.1	0.4	1.1	1.1	8.1
65	toluene	2.6	4.5	20.9	795.6	11.3	19.5	25.0	308.9	129.3	32.0	170.2	612.3	5.7	13.5	41.6	607.0
66	2m-heptane			0.8	19.5	0.3	0.4	0.4	6.9	1.3	0.7	4.0	14.8	0.4	0.3	1.1	16.1
67	4m-heptane & 1m-cyhexene				11.6				3.9	0.6	0.3	2.1	8.5	0.2		0.5	9.2
68	3m-C7 & 3e-C6	0.4	2.9	25.8	0.3	0.6	1.2	9.0	1.6	0.6	5.1	20.3	0.5	1.3	2.3	21.2	
69	cct-124-tm-cyP & c-13-dm-cyH				5.4				1.6	0.3	0.2	1.2	4.1				4.7
70	t-14-dm-cyH	0.7	3.8	6.5	4.5	2.6	4.5	5.4	1.4	3.1	2.4	2.5	2.8	0.2	10.5	6.5	2.4
71	225-tm-C6				2.9				0.5			0.6	2.6	0.1	1.3	1.8	2.3
72	1-octene	0.4	0.9	1.6					1.3		0.4		4.1	0.3	0.9	1.3	1.4
73	1e-1m-cyP			0.6	4.3				0.5		0.2		5.6		0.4	0.6	2.4
74	n-octane & t-12-dm-cyH	0.3	0.7	1.4	20.8	0.7	0.7	1.2	6.8	1.5	0.8	4.0	19.4	0.5	3.1	4.2	16.4
75	t2-octene				3.0	0.1	0.3	0.4	0.7	1.4		0.4	8.0		0.6	1.0	2.1
76	ccc-123-tm-cyP									0.2							
77	?t-13-dm-cyH & c-14-dm-cyH	0.6	2.4	4.8		0.5	0.6	1.3	0.8	0.5	0.3	30.4		1.0	1.1	4.4	
78	c2-octene											7.1		0.5	0.7		
79	ip-cyP	0.7		1.4	1.2				0.9							0.9	
80	c-12-dm-cyH				1.8				0.7			0.5	2.0				0.6
81	np-cyP			1.5	2.4				1.1			0.7	1.3		0.4		1.5
82	25-dm-heptane		0.8	6.0	0.7	0.5			2.7		0.6	1.6	4.9		0.9	1.0	5.1
83	33-dm-heptane				0.8							0.5					

ID	Compound Name	GM				JR				HD				PT			
		HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG
84	114-tm-cyH			1.5	2.8							2.4					1.3
85	e-benzene	1.2	1.2	4.3	136.7	1.5	1.5	3.4	53.0	10.0	5.1	26.7	109.8	1.3	4.4	8.6	109.1
86	ctt-124-tm-cyH & 35-dm-C7		0.3	1.3	1.5		0.5	0.6				0.5	1.4		0.6	0.8	1.4
87	m&p-xylene & 23-dm-heptane	1.8	3.5	11.8	425.5	5.7	6.1	11.9	164.4	31.8	14.6	75.6	336.9	3.5	17.3	28.5	337.6
88	34-dm-C7 & 4m-C8																
89	2m-octane	0.6	1.5	6.5	6.8	1.0	0.9	1.3	3.2	0.8	0.4	2.0	6.8	0.2	0.4	1.1	5.6
90	3m-octane & ctc-124-tm-cyH	0.6			3.1	0.6	0.7		1.3		0.6		1.7		2.0	0.5	1.8
91	styrene	1.4	0.8	6.5	4.5	0.6	0.7	1.4	1.6	2.0	0.6	2.3	3.7		1.6	1.9	2.9
92	o-xylene	0.5	1.6	6.0	175.8	2.4	3.0	5.4	67.7	14.1	6.5	31.9	137.6	1.5	8.5	12.9	140.9
93	1-nonene & 112-tm-cyH																
94	t3-nonene				1.3	0.4	0.6	0.6					2.6		0.7		1.0
95	c3-nonene & ib-cyP												1.1				0.9
96	n-nonane		0.6	1.1	4.9	2.0	3.0	3.5	2.4	2.5	1.9	3.9	4.2	0.3	1.6	1.4	4.5
97	t2-nonene			1.2									0.7				
98	c2-nonene			1.8	1.4		0.3	0.5	0.8	0.3	0.6	1.0	0.9		0.8	1.0	1.2
99	ip-benzene			0.7	8.1	0.6	0.4	0.6	3.3	0.8	0.9	2.1	6.4		0.7	0.9	6.6
100	ip-cyH			0.5	1.4	0.5	0.5	0.7	0.7	0.8	0.7	1.4	1.2	0.2	0.6	0.8	1.4
101	nb-cyP		0.2	1.1	1.4	1.1	1.0	1.0	0.9	1.7	1.5	2.8	1.5	0.3	1.5	1.4	1.8
102	33 & 36- dm-octane	1.7	1.5	3.9	4.8	6.2	9.8	0.3	2.1	0.3	7.3	2.7	0.8				3.7
103	np-benzene	0.6	0.7	27.6	0.7	0.7	1.2	10.7	2.2	1.7	5.8	21.9	0.3	1.7	2.4		22.1
104	3e-toluene & 23-dm-octane	0.4	0.7	4.0	78.4	2.1	3.6		29.6	7.4	5.7	15.3	63.3	0.9	8.5	10.5	60.6
105	4e-toluene	1.6	13.9	7.5	43.6	2.2	2.0	12.9	14.8	4.1	3.0	14.5	30.5	3.2	2.9	3.8	29.2
106	135-tm-benzene & 2m-nonane				27.3	1.7	2.2	2.8	9.8	3.9	3.0	7.8	23.0		3.0	3.2	20.4
107	3e-octane		0.7	1.4							1.3				1.2		
108	3m-nonane				1.7	0.6	0.7	0.5	0.6	0.9	0.6	1.3	1.4	0.3	0.9	0.9	1.6
109	2e-toluene		0.8	2.2	25.7	0.6	0.6	1.1	9.7	2.2	1.9	5.4	21.3	0.5	1.6	2.1	20.3
110	1-decene & ib-cyH	0.6	1.2	8.7	0.6	0.7	0.7	0.9		0.7	1.1		1.4	0.4	14.0	3.1	
111	124-tm-benzene & tb-benzene	0.5	2.5	21.3	109.8	12.5	1.3	97.3	44.3	64.9	9.0	26.5	94.7	3.3	9.4	9.9	83.4
112	n-decane	0.3	1.0	8.0	2.3	3.0	3.0		1.4	2.3	3.5	6.4	2.4	0.5	5.0	4.9	2.4
113	ib-benzene		0.4	2.2	1.2		0.2						1.9		0.5	0.5	1.5
114	sb-benzene				7.9	1.1			1.7				1.2				0.9
115	3-ip-toluene	2.0	6.6	5.1	5.5	4.4	8.9	3.7	2.3	2.2	1.9	3.9	7.7	2.1	12.6	21.0	4.3
116	4-ip-toluene & 123-tm-benzene	0.4	2.3	3.1	22.9	1.1	2.3	2.2	8.4	9.0	7.3	6.8	19.0	0.5	4.3	5.5	15.9
117	indan	0.7			0.6		0.7	0.7		0.7	0.9	3.5	0.5		0.7	0.8	
118	2-ip-toluene	0.5	12.8		1.6	2.8	6.6	6.3	7.3	1.3	2.9	2.3	14.0			3.9	12.4
119	3-np-toluene & 13de-benzene	0.9	1.4	3.6		0.8	0.9	0.7	0.6	1.1	0.2	3.1		0.8	0.8	2.5	
120	4-np-tol/nb&13dm5e&14de-benz	0.5	6.6	15.1	0.8	1.1	0.7	7.4		2.4	2.0	2.9	14.0		2.2	2.3	10.3
121	12-de-benzene	1.7	4.6		0.2	0.5		1.3	0.6	0.6	0.6				0.9		
122	2-np-toluene	0.6	0.5	2.8	0.2	0.5	0.6	1.4	1.0	1.1	1.3	2.9		1.2	1.1	2.0	
123	14-dm-2e-benzene	0.6			5.0	0.3	0.5	0.6	1.9	0.5	0.5	0.9	0.5		0.6	1.0	0.4
124	12-dm-4e-benzene	0.8	1.1	10.1		0.3	0.5	3.6	1.3	1.2	2.0	8.8		1.4	1.3	6.4	
125	13-dm-2e-benzene	1.9	6.8	5.9	4.3	0.5	0.5	0.8	2.7		7.9	0.6	2.8		0.9	1.2	2.3
126	n-undecane		1.1	1.1	2.4	2.0	3.6	4.1	1.2	3.0	1.7	3.5	2.1		4.7	4.5	1.3

ID	Compound Name	GM				JR				HD				PT			
		HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG
127	1245-ttm-benzene			0.7	1.8			0.5	0.6			0.6	1.6		0.9	1.0	1.2
128	2mb-benzene		0.8	0.3	4.5	0.3	0.1	0.3	1.8	0.8	0.6	1.0	4.4		1.1	0.8	2.4
129	tb-2m-benzene											0.7			0.8		
130	n-pentylbenzene	0.4				6.9	2.1			5.5	12.1	18.7	1.1	1.3	7.9		1.7
131	tb-35dm-benzene												1.5				4.0
132	tb-4e-benzene																
133	naphthalene	0.4	3.2	2.6	12.9	0.6	0.8	3.4	4.8	1.4	2.6	2.5	10.9		1.9	2.0	4.4
134	n-dodecane		1.2	1.4	3.1	0.5	1.2	1.3		1.2	0.8	1.1	3.1		2.5	2.7	
135	135-te-benzene			1.3													
136	124-te-benzene																
137	n-hexylbenzene		0.3														
138	n-tridecane		1.0	1.1											1.1		

**Table 28. Hydrocarbon compound concentrations for the Phase 2 hot soak tests (ng/L).**

ID	Compound Name	JE				SV				MH				SR			
		AMB	HSPT	HSH	HSG	HSAMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG
1	methane	1346	1528	1632	1451	1384	1536	1634	1428	1473	1438	1552	1515	1469	1700	1708	1471
2	ethylene	2.2	3.6	3.9	2.4		1.9	2.7	3.6	5.0	4.6	12.6	12.8	0.1	3.6	3.9	3.6
3	acetylene	1.4	1.6	1.5	1.8		1.7	1.9	2.2	3.8	2.8	7.8	8.1		2.4	2.2	1.8
4	ethane	5.4	15.9	18.1	6.5	10.3	6.6	7.9	6.7	6.9	4.3	6.2	10.7	4.7	28.6	30.4	9.5
5	propylene	0.5	1.0	0.7	1.0	1.4	0.7	1.4	1.8	2.1	1.9	5.3	5.7	0.8	0.8	1.3	1.9
6	propane	3.2	4.8	5.4	6.4	4.6	14.3	11.6	9.5	4.7	3.7	26.7	12.7	4.8	9.8	9.0	8.0
7	propyne			68.5				0.2	0.2		62.4	0.2		0.1			
8	isobutane	1.3	2.0	2.7	51.1		48.5	31.8	79.0	3.9	3.7	17.7	40.0	2.7	14.5	15.1	47.5
9	1-butene & isobutene	1.0	1.3	4.3	28.0	1.8			46.8	2.7	1.9	5.8	24.5	1.0	1.3	6.5	37.8
10	13-butadiene	0.1	0.2		1.0	0.4	0.6			0.5	0.5		1.8		0.2	0.9	
11	n-butane	3.4	4.0	7.4	149.1	8.9	7.2	17.6	230.6	8.6	12.0	60.2	123.5	4.5	5.9	26.8	143.4
12	t2-butene & 22-dm-propene	0.2	0.2	0.6	20.6	0.4	0.3	1.8	34.2	0.6	1.3	3.4	18.4	0.4	0.3	3.6	22.4
13	1-butyne																
14	c2-butene	0.2	0.2		14.2	0.3	0.2	1.2	31.5	0.3	0.7		12.5		0.1	2.3	20.0
15	3m1-butene				2.4				3.3		0.3	0.6	1.6		0.4	2.0	
16	2m-butane	1.6	2.1	3.7	112.1	3.1	101.5	98.0	131.3	4.7	10.4	21.5	70.4	2.1	3.7	8.7	77.7
17	1-pentene		1.0		9.6	0.3		0.4	8.5	0.1	0.5	0.7	5.1	0.2		1.0	4.7
18	2m1-butene	0.1	0.1	0.2	13.0	0.3	0.4	1.0	16.9	0.3	1.1	1.3	9.7		0.4	1.6	10.8
19	n-pentane	1.1	1.5	3.2	71.1	2.7	1.9	6.2	91.0	2.8	7.7	15.1	52.9	1.6	1.9	10.1	59.5
20	2m13-butadiene																
21	t2-pentene	0.1	0.4	0.6	16.4	0.3	0.5	1.6	23.6	0.3	1.6	3.0	13.7		0.2	2.9	16.8
22	c2-pentene		0.2	10.7	0.2		0.5	12.6	0.1	0.6	1.4	7.2			1.6	1.2	7.2
23	2m2-butene	0.1	0.3	0.2	19.8	0.5	1.7	0.4	13.0	0.3	2.2	0.2	19.2	0.4	0.9	4.5	6.0
24	22-dm-butane	0.1	0.2	0.4	8.9	0.5	0.3	0.8	9.6	0.6	1.5	2.3	6.6	0.2	0.2	1.0	5.4
25	cyclopentene		0.1	0.1	3.1			0.5	4.9	0.5	0.4	0.7	3.1		0.3	0.7	3.8
26	4m1&3m1-pentene		0.3		1.8		4.2	0.3	2.4		0.3	0.6	1.4			0.4	2.9
27	cyclopentane	0.2	0.2	1.1	12.7	0.4	0.4	1.4	15.9	0.6	1.6	3.0	9.9	0.3	0.5	1.9	11.1
28	23-dm-butane	0.2	0.2	0.6	12.2	0.5	0.3	0.9	13.2	0.6	2.5	3.4	9.4	0.3	0.3	1.3	8.4
29	2m-pentane & t-4m2-pentene	0.9	1.0	3.0	58.3	2.4	2.4	6.1	64.5	3.3	11.8	16.6	46.3	1.6	1.5	7.6	43.4
30	MTBE & c-4m2-pentene	0.2			2.9		4.0	1.8	3.2	0.2	0.7	1.1	3.1	0.3	0.6	0.8	3.4
31	3m-pentane	0.5	1.2	2.5	36.2	2.7	1.3	3.1	40.7	2.5	8.3	11.4	29.3	1.0	0.8	5.2	27.1
32	1-hexene & 2m1-pentene	0.7	0.6	1.9	2.5	0.4		3.3	8.2	1.4	2.6	2.5	6.5	1.0	1.4	5.0	9.1
33	n-hexane	0.6	1.0	2.7	37.1	1.4	1.8	3.6	43.8	1.8	9.5	11.9	30.6	1.0	0.9	5.2	30.7
34	t2-hexene		0.1	5.6		0.7	0.4	7.2	0.4	0.8	1.2	4.8			0.8	5.9	
35	2m2-pentene & 2e1-butene		2.4	3.5	4.7		3.7	4.3	5.3		0.5	0.6	3.4		4.3	5.3	2.8
36	c2-hexene		0.1	3.3			0.3	4.2		0.5	0.6	2.6		0.1	0.6	4.3	
37	c/t-3m2-pentene			1.4	6.4			0.4	7.8		0.9	0.6	4.5			0.7	1.5
38	22-dm-pentane		0.1	0.3	1.2		8.8	8.4	1.4	0.2	0.4	0.6	1.0			0.3	2.2
39	m-cyclopentane	0.3	0.7	1.8	43.4	0.9	1.8	4.3	49.6	1.1	7.1	9.8	33.5	0.6	0.6	5.3	34.7

ID	Compound Name	JE				SV				MH				SR			
		AMB	HSPT	HSH	HSG	HSAMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG
40	24-dm-pentane		0.3	0.3	5.8	0.3	0.4	1.0	5.4	0.3	1.4	1.6	3.9		0.5	1.0	4.3
41	223-dm-butane	0.1	0.3	0.5	0.9			0.8	0.9		0.6	1.9	0.6		0.5	0.7	4.9
42	1m-cyclopentene				5.0		1.1		0.6		0.6		0.4				
43	benzene	1.4	2.3	3.1	56.7	2.9	5.2	5.5	96.6	3.4	6.1	13.5	60.2	1.9	2.5	12.4	74.3
44	33-dm-pentane				2.1	0.2			2.7		0.8	0.7	2.3				
45	cyclohexane	0.2	0.3	0.6	9.8	1.2	0.3	0.8	10.5	2.8	3.6	3.4	8.7	1.0	0.2	1.2	7.7
46	2m-hexane	0.3	0.7	1.6	20.5	0.8	1.2	2.3	23.6	1.0	4.8	6.4	18.3	0.6	0.5	2.5	16.0
47	23-dm-pentane	0.1	0.3	0.6	6.5	0.4	0.5	0.8	7.2	0.4	1.8	2.3	5.8	0.2	0.2	0.8	5.1
48	11-dm-cyP				0.4	1.3			1.5		0.4	0.5	0.4				2.7
49	3m-hexane & cyclohexene	0.6	1.4	2.5	21.8	1.9	0.5	3.1	25.1	1.4	5.6	8.5	19.4	1.3	1.2	4.0	19.1
50	c-13-dm-cyP		0.2	2.4	4.7	0.2	0.4	0.6	5.6	0.2	1.7	1.9	3.9		0.2	0.9	5.3
51	t-13-dm-cyP & 3e-pentane	0.1	0.2		6.8	0.3	0.3	0.6	8.1	0.3	2.0	2.2	5.6		0.2	0.9	6.2
52	t-12-dm-cyP				1.2												
53	224-tm-pentane & 1-heptene	0.3	0.7	1.5	25.7	0.9	0.8	1.7	18.2	1.2	2.9	4.8	12.6	0.6	0.6	2.1	13.4
54	c3-heptene		0.2	0.2	2.2		0.4	0.3	2.8		0.5	0.4	1.4			0.4	3.7
55	n-heptane	0.3	1.3	2.5	19.6	0.7	1.1	2.0	23.0	0.7	5.1	6.4	15.7	0.6	0.5	2.4	15.8
56	t3-heptene				7.1			0.5	8.5		0.9		3.8		0.1	0.8	4.8
57	t2-heptene		0.9	1.1	2.3		0.2		3.0		0.3		1.5			0.3	3.2
58	c2-heptene		0.2	0.5	2.2	0.4	0.3	1.1	2.8		0.4		1.0				3.1
59	m-cyH & 22-dmC6	0.2	1.2	2.5	10.1	0.3	0.7	0.8	11.1	0.8	6.1	6.4	8.1	0.3	0.4	1.4	10.8
60	25-dm-C6 & e-cyP		0.3	0.3	3.7		0.5	0.3	3.2	0.2	0.5	0.9	2.1		0.3	0.9	2.5
61	24-dm-C6 & 223-tm-C5		0.4	0.8	7.8		0.7	0.9	7.7	0.4	1.8	2.4	5.2		0.2	0.9	5.9
62	ctc-124-tm-cyP																
63	ctc-123-tm-cyP		0.2	0.6	1.2				1.6		0.7	1.4	0.7				2.3
64	234-tm-pentane	0.1	0.4	0.6	7.6	0.3	1.0	1.1	6.5	0.4	1.4	1.9	2.9		0.3	1.1	4.7
65	toluene	2.0	8.7	21.0	269.5	6.2	18.4	28.4	343.8	8.1	13.1	34.3	189.6	4.5	8.1	35.0	256.3
66	2m-heptane	0.1	1.8	4.3	7.9	0.2	0.5	0.8	9.5	0.4	2.8	3.6	6.7	0.1	0.4	1.1	6.7
67	4m-heptane & 1m-cyhexene	0.2	0.6	1.4	4.4		0.4	0.4	5.4		1.0	1.3	3.2			0.6	7.2
68	3m-C7 & 3e-C6	0.1	1.8	4.4	10.4	0.5	0.8	1.1	12.7	0.2	2.9	3.3	8.5	0.1	0.6	1.8	11.1
69	cct-124-tm-cyP & c-13-dm-cyH		1.5	3.9	2.3				3.0		1.9	2.1	1.9			0.4	
70	t-14-dm-cyH	0.3	2.8	4.8	1.5	0.6	5.0	3.3	2.3	0.3	2.2	2.9	0.8	0.3	1.8	2.2	6.7
71	225-tm-C6				1.8		0.2		2.0		1.0	1.1	0.9				1.8
72	1-octene		1.2	2.3	0.8		0.1		1.0		1.3	1.6	1.9		0.3	1.0	2.7
73	1e-1m-cyP		0.4	0.3	1.1		0.3		0.5		0.3	0.4	0.5				2.7
74	n-octane & t-12-dm-cyH	0.3	5.9	11.6	8.7	0.6	1.3	1.5	10.5	0.7	4.1	4.4	6.1	0.6	1.3	2.0	8.8
75	t2-octene		0.6	0.7	1.3		0.7	0.6	2.0		0.4	0.4	0.6		0.8	0.7	4.0
76	ccc-123-tm-cyP																
77	?t-13-dm-cyH & c-14-dm-cyH	0.7	1.3	4.2		0.8	0.4	2.5		1.2	1.3	1.0		0.3	2.6	3.8	
78	c2-octene	0.4		0.7		4.7		0.9									6.6
79	ip-cyP	0.1	0.5	0.7				1.1		0.4	0.8	0.4					
80	c-12-dm-cyH	0.2	0.5	1.4		0.2		1.9		0.3	0.3	0.9					1.0
81	np-cyP	0.1	0.6	0.8		0.4		1.1	0.7	0.5	0.6	0.4		0.3		2.2	
82	25-dm-heptane	0.4	1.3	3.0		0.6	0.6	3.8		2.6	1.9			0.5	0.6	4.0	

ID	Compound Name	JE				SV				MH				SR			
		AMB	HSPT	HSH	HSG	HSAMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG
83	33-dm-heptane		0.2	0.4	0.6		0.4	0.2	0.8		1.2	1.0	0.3		0.2	0.9	
84	114-tm-cyH				1.0				1.3		0.6	0.4	0.3			1.0	
85	e-benzene	0.3	1.4	2.5	49.8	1.2	11.0	11.6	68.8	1.1	3.9	6.7	31.5	0.5	1.4	4.7	49.7
86	ctt-124-tm-cyH & 35-dm-C7		0.2	0.4	0.8		0.7	0.4	1.1		0.8	0.7	0.5		0.2	0.8	
87	m&p-xylene & 23-dm-heptane	1.2	4.6	7.9	160.4	3.9	40.3	44.4	221.1	4.0	12.9	22.5	99.6	1.9	5.0	15.8	149.9
88	34-dm-C7 & 4m-C8		0.2				0.4				1.2						
89	2m-octane	0.2	0.7	0.2	3.8	0.3	1.0	0.7	5.1	0.4	2.6	2.4	2.5	0.7	0.3	1.0	3.6
90	3m-octane & ctc-124-tm-cyH		0.3	0.4	1.8	1.8	0.5	2.3	1.4	2.3		1.1	0.6	0.5	0.5	0.5	3.7
91	styrene	0.5	1.8	3.0	70.1	1.8	15.0	15.8	93.6	1.9	5.1	10.0	40.6	1.0	2.5	6.4	61.4
93	1-nonene & 112-tm-cyH										1.3						
94	t3-nonene				0.9		0.4			1.2		0.8	0.7	0.4			1.2
95	c3-nonene & ib-cyP			0.3	0.5					0.9		0.5					1.3
96	n-nonane	0.2	0.4	0.6	2.6	0.4	2.0	1.7	3.6	0.4	4.9	4.3	2.2	0.2	0.7	0.8	2.5
97	t2-nonene				0.4				0.6		0.4						0.6
98	c2-nonene		0.2	0.5	0.6		0.9	0.5	1.3		1.5	1.3	0.6		0.3	0.5	0.9
99	ip-benzene		0.3	0.2	4.3		1.0	0.9	5.4		1.4	1.2	2.2		0.4	0.5	3.3
100	ip-cyH		0.1	0.1	0.8		0.7	0.6	1.5		1.6	1.2	0.7		0.3	0.3	0.6
101	nb-cyP		0.2	0.6	0.9		1.3	1.1	1.7	0.4	2.5	2.3	1.1		0.7	0.8	0.9
102	33 & 36- dm-octane	0.3	7.4	3.2	0.4	0.7	15.1	9.2	1.8	0.4	0.5	3.0	0.6		1.0	5.5	11.3
103	np-benzene	0.1	0.5	0.8	15.2	0.5	2.2	2.0	18.2	0.4	2.0	2.7	6.8	1.1	0.7	1.3	12.1
104	3e-toluene & 23-dm-octane	0.4	1.6	2.5	46.0	1.3	6.7	7.5	50.4	1.3	7.2	7.0	18.8	0.5	3.9	3.5	32.3
105	4e-toluene	0.3	1.5	1.1	20.4	0.6	3.7	2.6	23.5	0.5	2.0	3.2	8.6			1.7	15.3
106	135-tm-benzene & 2m-nonane		0.7	0.9	18.0	0.4	3.6	3.3	18.8	0.3	3.0	3.8	6.8	0.2	1.3	1.7	11.4
107	3e-octane			1.2			2.1	1.1	1.5		1.2	1.4			0.5		4.6
108	3m-nonane		0.2	0.4	0.8		1.0	0.9	1.5		0.9	0.9	0.7		0.7	0.7	0.9
109	2e-toluene	0.1	0.6	0.8	16.8	0.6	2.2	2.1	17.6	0.3	1.8	2.4	6.6		0.7	1.2	11.9
110	1-decene & ib-cyH	0.2	1.1	1.4	0.5	0.6	8.6	1.2	1.0	1.0	6.3	7.7			0.8	4.3	44.2
111	124-tm-benzene & tb-benzene	3.7	2.0	28.3	68.1	52.8	18.5	11.8	81.6	1.0	10.0	20.0	26.1	2.5	2.4	7.6	60.1
112	n-decane	0.2	2.1	2.6	1.3	0.4	3.4	0.5	2.3	0.3	0.5	0.4	1.4	0.3	4.7	4.1	2.1
113	ib-benzene				0.8		1.7		1.2	0.5	0.6	0.7	0.4		0.5		
114	sb-benzene			0.8	0.8		10.4	6.7	1.0		0.4	0.4		0.4			2.1
115	3-ip-toluene	1.8	2.4	5.6	4.4		2.7	2.6	3.4	0.3	4.4	3.0	4.7		2.4	2.4	25.1
116	4-ip-toluene & 123-tm-benzene	0.3	1.5	2.7	15.0	1.0	27.3	41.2	17.1		2.9	3.9	0.5	0.7	2.6	1.9	14.4
117	indan				0.4		2.1	2.1	0.7	0.7	2.5	1.2	3.0		1.2	2.3	
118	2-ip-toluene		9.4	23.2	9.2	0.3	3.8	3.2	12.3		1.6	1.8	0.7		1.9	1.3	2.2
119	3-np-toluene & 13de-benzene	0.4	1.3	1.3	3.0		6.2	4.1	8.1		0.5	0.7	2.5		0.4	0.3	0.7
120	4-np-tol/nb&13dm5e&14de-benz	1.2	0.6	10.9	0.4	3.0	1.7	1.1		2.0	3.1	2.0		0.6	1.5	1.4	2.6
121	12-de-benzene	0.8	1.3	1.3	0.6	5.5	5.2	3.7		1.1	0.5	0.8			0.6	0.7	14.0
122	2-np-toluene	0.1	1.3	2.0	2.7		5.2	5.5	4.9		2.0	1.9	0.5		1.6	1.1	2.2
123	14-dm-2e-benzene		1.1	1.7	3.6	0.3	2.1	1.7	3.9		0.5	1.0	1.1		0.4	0.8	2.9
124	12-dm-4e-benzene		0.6	1.2	6.8		3.4	4.3	3.0		1.2	1.7	0.4		0.8	0.8	2.9
125	13-dm-2e-benzene		0.4	2.1	0.7	0.3	3.6	4.9	2.2		1.7	1.5	0.3		1.2	0.9	3.6

ID	Compound Name	JE				SV				MH				SR			
		AMB	HSPT	HSH	HSG	HSAMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG
126	n-undecane	0.2	13.0	16.9	1.8	0.6	13.3	10.8	4.6		2.1	2.4	0.4		4.3	3.6	6.6
127	1245-ttm-benzene		0.9	1.6	1.5		6.6	5.3	6.4		0.5	0.8	0.4		0.5	0.8	
128	2mb-benzene		1.4	2.0	2.9	0.3	4.7	2.8	0.5		0.7	1.0			0.5	0.5	2.6
129	tb-2m-benzene		0.4	0.4	0.5	0.3	2.7	0.8	5.7		0.4	0.3	0.6		0.5		4.9
130	n-pentylbenzene	0.3	2.1	2.7	7.8		1.3	2.1	1.2		1.7	1.7			0.9	1.8	3.1
131	tb-35dm-benzene	0.3	0.5	0.8	0.8	2.9	2.3	1.1	1.9		0.4	1.1			0.2		8.0
132	tb-4e-benzene						3.6										
133	naphthalene		3.7	9.7	5.8			1.3			0.8	1.4			0.9		2.9
134	n-dodecane		1.9	3.0	1.5		7.8	2.4	10.0		1.0	1.1			1.6	0.7	1.1
135	135-te-benzene				0.3		0.4		3.7								7.3
136	124-te-benzene						0.8		0.4						0.6		
137	n-hexylbenzene				0.3				0.6			0.4					1.2
138	n-tridecane		0.3	0.7	0.8										0.6		1.2

**Table 29. Halocarbon compound concentrations for the Phase 1 cold start tests (ng/L).**

ID	Compound Name	GM				JR				HD			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
139	CFC-22												
140	CFC-12	3.2	4.0	3.9	3.8	2.9	6.4	5.8	3.7	3.3	4.3	4.3	3.4
141	chloromethane	1.7	1.8	1.9	2.8	1.6	1.4	1.7	1.9	2.0	1.7	2.2	4.2
142	CFC-114												
143	vinyl chloride												
144	bromomethane												
145	chloroethane												
146	CFC-11	1.4	3.5	5.5	1.4	1.3	1.9	1.8	1.1	1.5	1.6	1.9	1.3
147	bromoethane												
148	11-dichloroethene	3.0								1.0			
149	dichloromethane										18.1	21.4	
150	CFC-113	16.6	1.3	2.7	0.9	3.3	11.3	2.7	1.0	7.7	1.5	1.7	0.9
151	t-12-dichloroethene												
152	11-dichloroethane												
153	c-12-dichloroethene					2.1	4.0						
154	chloroform		5.6	16.1			3.9	2.6		0.8	1.9	2.4	
155	12-dichloroethane					14.3							
156	111-trichloroethane	7.5	5.1	8.6	0.9	1.5	6.4	4.0	1.5	2.6	2.7	3.1	0.9
157	carbon tetrachloride	1.0	1.1	1.2	1.0	1.0	1.0	0.9	0.9	1.4	1.0	1.0	0.9
158	12-dc-propane & dbm & bdcn	0.6	4.5	7.1	10.4		6.4	5.4	4.0	6.4	4.1	7.7	30.3
159	trichloroethene		3.3	3.2			0.5	0.5	0.5	0.5	0.5	0.5	
160	c-13-dichloropropene									1.3			0.9
161	t-13-dichloropropene												
162	112-trichloroethane			1.1			0.7		4.5	0.7	1.1	6.4	
163	dibromochloromethane												
164	bromotrichloromethane									0.5			
165	12-dibromoethane									0.4			
166	tetrachloroethene	0.1	0.3	0.6	0.4	0.2	2.1	2.8	0.4	0.8	3.3	3.4	0.2
167	chlorobenzene										2.9		
168	bromoform												
169	1122-ttC-ethane & 14-dC-butane												
170	13dichlorobenz/benzl-ch												
171	14-dichlorobenzene												
172	12-dichlorobenzene												
173	124-trichlorobenzene					3.5							
174	hexachloro-13-butadiene					2.3				0.6	0.4		

ID	Compound Name	PT				TR				MM			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
139	CFC-22	7.0	12.3	12.9									
140	CFC-12	4.0	6.3	4.3	3.5	3.5	3.9	3.7	3.6	2.9	4.0	3.8	4.2
141	chloromethane	1.8	1.6	2.6	1.8	1.8	1.6	2.0	1.8	2.2	1.7	2.3	2.3
142	CFC-114												
143	vinyl chloride												
144	bromomethane												
145	chloroethane												
146	CFC-11	3.3	5.9	4.5	1.3	1.6	1.5	2.0	1.4	1.2	5.0	4.8	1.4
147	bromoethane		0.8										
148	11-dichloroethene			6.8						18.6			
149	dichloromethane	17.2		3.8	16.2								
150	CFC-113	6.4	1.5	2.0	1.2	3.3	1.9	2.4	1.2	3.3	1.0	1.5	4.5
151	t-12-dichloroethene									41.3			
152	11-dichloroethane									2.8			
153	c-12-dichloroethene		0.6										
154	chloroform	0.8	0.9	0.9		0.9	0.6	1.2		0.3	2.4	4.8	
155	12-dichloroethane												
156	111-trichloroethane	6.8	7.3	16.2	0.9	1.8	1.1	3.4	1.0	21.7	5.4	6.1	1.0
157	carbon tetrachloride	1.0	1.0	1.0	1.0	1.5	1.0	1.0	0.9	0.8	0.8	0.9	0.9
158	12-dc-propane & dbm & bdcn	5.8	7.0	9.1	3.0	1.0	1.3	11.0	10.4		5.3	7.6	4.7
159	trichloroethene					0.7	0.2		0.1		0.7	1.3	
160	c-13-dichloropropene	0.7	6.2								0.6		
161	t-13-dichloropropene	0.9	1.9	2.6				1.7			0.4		
162	112-trichloroethane	2.2	9.7	3.4	1.5			1.6	5.3		0.4	1.9	4.0
163	dibromochloromethane												
164	bromotrichloromethane					0.9							
165	12-dibromoethane					0.4							
166	tetrachloroethene	0.5	0.5	0.7	0.1	0.8	0.1	0.6	1.2	0.2	10.4	11.3	0.1
167	chlorobenzene												
168	bromoform												
169	1122-ttC-ethane & 14-dC-butane												
170	13dichlorobenz/benzl-ch	4.8									6.0		
171	14-dichlorobenzene												
172	12-dichlorobenzene												
173	124-trichlorobenzene					1.8							
174	hexachloro-13-butadiene					1.3							

**Table 30. Halocarbon compound concentrations for the Phase 2 cold start tests (ng/L).**





**Table 31. Halocarbon compound concentrations for the Phase 1 hot soak tests (ng/L).**

**Table 32.** Halocarbon compound concentrations for the Phase 2 hot soak tests (ng/L).





**Table 33. Carbonyl compound concentrations for the Phase 1 cold start tests (ng/L).**

ID	Compound Name	GM				PT				JR			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
175	Formaldehyde	1.0	29.3	28.4	49.6		8.5	49.0	6.5	1.1	22.9	23.3	3.2
176	Acetaldehyde	1.3	16.3	17.0	44.6		7.1	15.5	6.5	2.3	14.9	17.6	8.6
177	2-3 butandione						0.5						
178	Acrolein												
179	Acetone	3.4	24.9	25.9	11.4	2.5	7.8	36.2	21.4	2.2	48.6	42.0	11.6
180	Propionaldehyde			1.7				2.8		0.3		2.2	
181	Methoxyacetone												
182	Crotonaldehyde							1.3					
183	Methyl Vinyl Ketone								4.6				
184	Methacrolein												
185	Methyl Ethyl Ketone	0.6	8.2	3.9	10.3	1.1		13.1		0.5		7.4	
186	Isobutyraldehyde	&		1.2						0.3			
187	Butyraldehyde				1.7	12.8		1.8				1.5	
188	Benzaldehyde												
189	Isovaleraldehyde							1.5				1.3	
190	Trimethylacetaldehyde & 3m2-Butanone			1.5									
191	Valeraldehyde			1.7				3.6				2.5	
192	Acetophenone												
193	o-Tolualdehyde												
194	m&p-Tolualdehyde							0.6					
195	Methyl isobutyl Ketone												
196	Pinacolone												
	Hexanaldehyde		12.9	7.3				16.4			10.0	12.6	

ID	Compound Name	HD				MM				TR			
		CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG	CSB	CSPT	CSH	CSG
175	Formaldehyde	0.9	13.1	13.2	28.1	2.9	31.4	40.4	10.2	1.5	7.6	14.3	12.9
176	Acetaldehyde	2.0	11.6	16.5	39.9	4.0	26.5	29.5	13.8	2.1	6.3	12.7	9.5
177	2-3 butandione			0.6				0.9					
178	Acrolein				2.9					0.2			
179	Acetone	3.8	28.9	34.1	19.5	1.1	29.6	36.0	15.1	3.4	26.2	58.5	15.0
180	Propionaldehyde			2.3	7.8			2.4		0.4		2.3	
181	Methoxyacetone												
182	Crotonaldehyde												
183	Methyl Vinyl Ketone												
184	Methacrolein												
185	Methyl Ethyl Ketone												
186	Isobutyraldehyde	&								1.0			
	Butyraldehyde										0.7		
187	Benzaldehyde											4.1	
188	Isovaleraldehyde												
189	Trimethylacetaldehyde		&										
	3m2-Butanone												
190	Valeraldehyde											1.8	
191	Acetophenone												
192	o-Tolualdehyde												
193	m&p-Tolualdehyde												
194	Methyl isobutyl Ketone												
195	Pinacolone												
196	Hexanaldehyde										6.4		

**Table 34. Carbonyl compound concentrations for the Phase 2 cold start tests (ng/L).**

ID	Compound Name	JE				SV				MH				SR			
		AMB	CSPT	CSH	CSG	CSAMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
175	Formaldehyde	0.2	19.3	15.3	6.9	0.4	24.3	26.4	11.1	1.9	8.5	7.8	4.8	0.8	19.4	22.1	10.6
176	Acetaldehyde	0.4	6.4	5.2	15.8	0.4	15.4	15.7	28.5	1.7	6.0	6.9	18.8	1.0	10.9	14.9	22.2
177	2-3 butandione																
178	Acrolein																
179	Acetone	0.8	31.4	13.7	4.3	0.7	57.4	50.5	20.1	0.2	2.5	24.3	0.6	0.1	43.6	0.7	5.7
180	Propionaldehyde			0.9	2.2			2.0		0.3		1.0	11.9	1.7	37.9	1.2	23.1
181	Methoxyacetone																
182	Crotonaldehyde																
183	Methyl Vinyl Ketone																
184	Methacrolein															0.5	
185	Methyl Ethyl Ketone																10.1
186	Isobutyraldehyde	&	0.1		0.9		0.2	9.8	10.4	4.4	0.1			0.6		1.9	
	Butyraldehyde																
187	Benzaldehyde			0.9		0.3	8.1	1.9	15.7	0.5	6.2	1.4	14.0			1.3	
188	Isovaleraldehyde																
189	Trimethylacetaldehyde & 3m2-Butanone			0.8				1.3		0.3				0.2		1.4	
190	Valeraldehyde			0.9				1.5									1.0
191	Acetophenone																
192	o-Tolualdehyde																
193	m&p-Tolualdehyde																
194	Methyl isobutyl Ketone													0.2			
195	Pinacolone																
196	Hexanaldehyde			2.3				4.4		0.2		1.4			3.1		

ID	Compound Name	JS				PB				GS				RW			
		AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
175	Formaldehyde	1.4	33.3	34.5	8.5	1.5	32.4	38.6	9.1	0.9	23.0	21.7	5.9	1.1	14.7	14.8	8.9
176	Acetaldehyde	2.1	14.3	15.0	9.6	1.9	15.8	21.2	15.4	1.1	62.6	34.8	14.8	0.8	10.4	13.7	21.7
177	2-3 butandione																
178	Acrolein	0.2		0.8		0.1		0.9			0.7			0.1		0.4	
179	Acetone	2.2	43.2	32.0	17.0	2.0	56.4	49.1	17.0	1.9	42.5	32.5	13.8	2.3	20.8	13.0	19.0
180	Propionaldehyde	0.3		1.8		0.3		2.9		0.2	3.4	1.5		0.2		1.3	
181	Methoxyacetone																
182	Crotonaldehyde																
183	Methyl Vinyl Ketone																
184	Methacrolein																
185	Methyl Ethyl Ketone	0.7		0.4		0.5		0.8		0.5	4.2	0.4		0.7		1.4	
186	Isobutyraldehyde	&		3.5		0.1	15.9	10.7				2.0				1.1	
	Butyraldehyde											1.9					
187	Benzaldehyde	0.1		1.0		0.2		1.4				1.1				0.7	
188	Isovaleraldehyde											0.6					
189	Trimethylacetaldehyde	& 3m2-	0.2		1.1		0.3		2.2		0.2		1.8		0.2		0.9
	Butanone											1.6					
190	Valeraldehyde			1.8		0.1		2.7								0.7	
191	Acetophenone																
192	o-Tolualdehyde																
193	m&p-Tolualdehyde	0.1		1.0													
194	Methyl isobutyl Ketone	0.2															
195	Pinacolone																
196	Hexanaldehyde	0.2		6.8		0.1	6.7	8.8			0.2	6.2	4.9		0.1		2.6

ID	Compound Name	KR				FA				HD			
		AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG	AMB	CSPT	CSH	CSG
175	Formaldehyde	0.7	46.3	43.0	13.8	0.2	18.3	21.2	8.6	0.5	21.1	20.8	35.5
176	Acetaldehyde	1.3	21.6	20.7	20.3	0.5	10.7	12.2	14.3	1.0	20.6	27.9	46.7
177	2-3 butandione			0.9								1.3	
178	Acrolein			1.4	6.0	0.1		0.8		0.1		1.7	12.4
179	Acetone	2.0	80.6	73.2	19.9	1.3	16.9	16.5	10.0	1.6	76.8	74.1	22.7
180	Propionaldehyde	0.1		2.9	3.6	0.1		1.1		0.1		3.1	8.7
181	Methoxyacetone												
182	Crotonaldehyde												
183	Methyl Vinyl Ketone												
184	Methacrolein							0.4			0.6		5.5
185	Methyl Ethyl Ketone	0.6	10.2	13.2		0.3		2.5	5.6	0.4	5.1	5.7	
186	Isobutyraldehyde	&						0.7				2.7	
	Butyraldehyde							1.0				1.7	
187	Benzaldehyde			2.1								1.2	
188	Isovaleraldehyde			0.6								6.6	
189	Trimethylacetaldehyde	& 3m2-		2.2					5.2	0.1	7.4		5.7
	Butanone			4.5				1.1				2.7	
190	Valeraldehyde												
191	Acetophenone												
192	o-Tolualdehyde												
193	m&p-Tolualdehyde												
194	Methyl isobutyl Ketone			0.9								1.3	
195	Pinacolone												
196	Hexanaldehyde		19.7	20.7			4.1			0.1	10.5	9.9	

**Table 35. Carbonyl compound concentrations for the Phase 1 hot soak tests (ng/L).**

ID	Compound Name	GM				PT				JR				HD			
		HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG	HSB	HSPT	HSH	HSG
175	Formaldehyde	0.8	23.7	24.4	7.8	1.1	27.9	51.5	12.8	1.0	18.2	16.6	3.4	1.7	9.2	11.3	8.6
176	Acetaldehyde	1.1	19.4	15.0	8.3	1.1	59.9	20.0	5.5	0.9	13.8	16.0	5.3	1.1	7.5	12.5	5.8
177	2-3 butandione									1.2							
178	Acrolein									3.6							1.2
179	Acetone	2.3	19.0	17.9	12.6	7.9	40.5	39.7	3.9	9.8	36.1	42.7	10.8	3.4	19.2	26.3	8.1
180	Propionaldehyde			1.8	1.6		11.5					1.3		0.2		2.3	1.0
181	Methoxyacetone																
182	Crotonaldehyde							1.0									
183	Methyl Vinyl Ketone																
184	Methacrolein																
185	Methyl Ethyl Ketone	0.5		5.9	2.2			8.1			0.8		0.3				
186	Isobutyraldehyde	&											2.9				7.6
187	Butyraldehyde												1.5				
188	Benzaldehyde			1.0									0.9				0.9
189	Isovaleraldehyde												0.5				
190	Trimethylacetaldehyde & 3m2-Butanone			1.1			5.5	1.7					1.3				2.2
191	Valeraldehyde												1.5				
192	Acetophenone																
193	o-Tolualdehyde																
194	m&p-Tolualdehyde																
195	Methyl isobutyl Ketone																
196	Pinacolone																
	Hexanaldehyde			2.5			7.6	0.7						0.9	1.9		1.0
				6.3	3.6		14.2	20.3	5.0				9.5	7.6	0.9	5.0	6.0

**Table 36. Carbonyl compound concentrations for the Phase 2 hot soak tests (ng/L).**

ID	Compound Name	JE				SV				MH				SR			
		AMB	HSPT	HSH	HSG	HSAMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG
175	Formaldehyde	0.2	24.4	24.7	2.5	1.3	30.5	31.3	3.9	1.9	9.4	7.5	2.3	0.8	19.6	21.4	3.5
176	Acetaldehyde	0.4	9.3	8.2	3.3	1.0	15.4	19.4	3.1	1.7	4.5	5.3	3.4	1.0	9.3	10.8	3.2
177	2-3 butandione																
178	Acrolein			0.7				0.7		0.2		0.4		0.1		0.6	
179	Acetone	0.8	29.8	20.5	7.0	2.7	51.7	44.4	5.8	2.5	19.2	12.2	7.3	1.7	48.5	40.8	9.3
180	Propionaldehyde			1.7						0.3		0.7		0.2		1.0	
181	Methoxyacetone																
182	Crotonaldehyde									0.1							
183	Methyl Vinyl Ketone																
184	Methacrolein			0.7				0.9		0.1							
185	Methyl Ethyl Ketone									0.6						1.4	
186	Isobutyraldehyde	&	0.1		1.5	1.2		11.8	12.1	0.1		1.1	1.3	0.6		1.3	1.4
	Butyraldehyde																
187	Benzaldehyde			0.9				1.7		0.5		1.4	1.4			1.0	
188	Isovaleraldehyde																
189	Trimethylacetaldehyde & 3m2-Butanone			1.4				1.5		0.3		0.7		0.2		1.4	
190	Valeraldehyde			1.2				1.8				0.6					1.4
191	Acetophenone																
192	o-Tolualdehyde																
193	m&p-Tolualdehyde									0.2							
194	Methyl isobutyl Ketone									0.2				0.2			
195	Pinacolone																
196	Hexanaldehyde			4.0				6.0		0.2		1.7				2.9	

ID	Compound Name	JS				PB				GS				RW			
		AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG
175	Formaldehyde	1.4	36.1	35.7	4.6	1.5	34.3	35.5	2.1	0.9	20.6	23.8	3.5	1.1	10.7	12.9	4.1
176	Acetaldehyde	2.1	14.1	17.3	6.0	1.9	14.7	15.2	2.2	1.1	17.2	21.5	5.0	0.8	6.8	8.2	4.5
177	2-3 butandione																
178	Acrolein	0.2		0.9		0.1		0.8				0.8		0.1		0.3	
179	Acetone	2.2	41.2	33.9	7.1	2.0	57.0	50.5	5.4	1.9	43.7	40.7	9.6	2.3	16.4	12.0	9.1
180	Propionaldehyde	0.3		2.4	1.4	0.3		2.3		0.2		1.9	1.0	0.2		1.1	0.9
181	Methoxyacetone																
182	Crotonaldehyde												0.5				
183	Methyl Vinyl Ketone																
184	Methacrolein							1.4					0.4				
185	Methyl Ethyl Ketone	0.7		3.2	1.3	0.5	10.0	10.2	1.3	0.5			2.6	1.7	0.7		1.4
186	Isobutyraldehyde	&		1.7		0.1							2.3				0.8
	Butyraldehyde																2.3
187	Benzaldehyde	0.1		1.0		0.2		1.8					2.0				
188	Isovaleraldehyde												0.8				
189	Trimethylacetaldehyde	& 3m2-		1.0	1.0	0.3		2.2		0.2		2.1		0.2		0.9	
	Butanone			1.7		0.1		2.3									
190	Valeraldehyde											2.0				0.7	
191	Acetophenone																
192	o-Tolualdehyde																
193	m&p-Tolualdehyde	0.1															
194	Methyl isobutyl Ketone	0.2		1.1						0.2		1.3		0.3			
195	Pinacolone																
196	Hexanaldehyde	0.2	6.7	7.2		0.1	8.4	8.6				5.7		0.1		2.2	1.2

ID	Compound Name	KR				FA				HD			
		AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG	AMB	HSPT	HSH	HSG
175	Formaldehyde	0.7	44.6	44.3	14.8	0.2	24.8	24.7	9.7	0.5	13.6	16.4	7.0
176	Acetaldehyde	1.3	19.0	22.6	7.8	0.5	11.0	12.7	6.7	1.0	10.6	17.9	9.8
177	2-3 butandione			0.9								0.8	
178	Acrolein			1.4		0.1		1.0		0.1		1.1	
179	Acetone	2.0	72.5	76.3	20.5	1.3	20.3	20.2	9.5	1.6	51.7	61.1	12.1
180	Propionaldehyde	0.1		3.0	1.6	0.1		1.3	1.6	0.1		2.9	2.1
181	Methoxyacetone												
182	Crotonaldehyde												
183	Methyl Vinyl Ketone												
184	Methacrolein												
185	Methyl Ethyl Ketone	0.6	8.6	12.0	4.2	0.3		4.0	1.6	0.4		6.7	2.5
186	Isobutyraldehyde	&											
	Butyraldehyde												
187	Benzaldehyde			2.2				1.2				2.0	
188	Isovaleraldehyde			0.8									
189	Trimethylacetaldehyde	& 3m2-		2.1				0.8		0.1		5.6	6.0
	Butanone			4.5				1.7				2.3	
190	Valeraldehyde												
191	Acetophenone												
192	o-Tolualdehyde												
193	m&p-Tolualdehyde												
194	Methyl isobutyl Ketone											1.3	2.7
195	Pinacolone												
196	Hexanaldehyde		20.6	21.6	3.4			4.7		0.1		7.9	2.3

**Table 37. Hydrocarbon compound concentrations for the Phase 2 additional samples (ng/L).**

ID	Compound Name	KR-IN18	KR-LR18	KR-KT18	FA-IN18	FA-FR18	FA-LR18	HD-IN18	HD-LR18	HD-FR18
43	benzene	13.6	10.7	6.1	5.5	5.9	5.7	25.1	18.7	13.0
44	33-dm-pentane	0.0	0.0	0.0	0.0	0.2	1.2	1.3	0.9	
45	cyclohexane	2.2	1.8	1.2	0.6	0.8	0.7	2.8	2.3	1.8
46	2m-hexane	4.2	3.3	1.7	2.1	2.2	2.2	9.0	7.0	5.3
47	23-dm-pentane	1.4	1.1	0.6	0.8	1.0	0.8	3.2	2.6	2.0
48	11-dm-cyP	0.3	0.3	0.2	0.0	0.0	0.0	0.4	0.5	0.3
49	3m-hexane & cyclohexene	5.7	1.3	1.2	3.6	3.4	2.7	10.8	9.2	6.6
50	c-13-dm-cyP	1.2	1.1	0.7	0.7	0.7	0.5	1.9	1.6	1.0
51	t-13-dm-cyP & 3e-pentane	1.4	1.2	0.6	0.8	0.8	0.6	2.7	2.1	1.5
52	t-12-dm-cyP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	224-tm-pentane & 1-heptene	3.1	2.9	1.7	2.6	2.9	2.7	6.4	5.2	3.7
54	c3-heptene	0.4	0.4	0.3	0.3	0.4	0.4	0.9	0.9	0.4
55	n-heptane	4.4	3.6	2.2	1.9	2.0	2.0	9.0	5.4	6.2
56	t3-heptene	1.2	0.9	0.4	0.7	0.7	0.7	2.9	0.0	1.4
57	t2-heptene	0.5	0.4	0.4	0.7	0.5	0.6	0.9	0.8	0.4
58	c2-heptene	1.4	3.8	1.9	0.6	0.4	0.2	1.0	1.7	1.4
59	m-cyH & 22-dmC6	2.5	2.3	1.6	0.8	0.8	1.0	4.0	3.2	2.8
60	25-dm-C6 & e-cyP	0.8	0.6	0.5	0.5	0.6	0.6	1.2	1.1	0.7
61	24-dm-C6 & 223-tm-C5	1.6	1.5	1.0	1.1	1.2	0.9	3.0	2.4	1.7
62	ctc-124-tm-cyP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63	ctc-123-tm-cyP	0.5	0.0	0.0	0.0	0.0	0.2	0.6	0.5	0.3
64	234-tm-pentane	1.5	2.1	0.8	1.3	2.1	1.4	3.0	2.5	1.4
65	toluene	47.3	42.4	31.3	17.4	18.8	19.7	68.9	59.1	53.4
66	2m-heptane	1.9	1.6	1.1	0.8	1.2	1.1	3.1	2.4	1.5
67	4m-heptane & 1m-cyhexene	1.3	1.1	0.6	0.3	2.3	0.5	1.5	1.7	0.7
68	3m-C7 & 3e-C6	2.5	2.3	1.4	1.2	1.7	1.2	3.6	2.9	1.9
69	cct-124-tm-cyP & c-13-dm-cyH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	t-14-dm-cyH	15.2	8.1	13.8	2.1	4.7	3.7	7.5	8.6	4.7
71	225-tm-C6	0.9	0.5	0.5	0.3	0.4	0.2	0.8	0.7	0.2
72	1-octene	1.1	1.7	1.0	0.7	1.2	0.6	1.1	1.3	0.3
73	1e-1m-cyP	0.8	1.1	0.3	0.0	0.4	0.0	0.2	0.3	0.1
74	n-octane & t-12-dm-cyH	3.7	3.8	3.2	2.7	3.7	2.7	3.3	3.2	2.4
75	t2-octene	1.4	1.7	1.3	0.4	0.9	0.6	0.0	0.0	0.0
76	ccc-123-tm-cyP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	?t-13-dm-cyH & c-14-dm-cyH	1.3	1.2	0.8	0.0	0.7	0.4	1.0	0.0	0.0
78	c2-octene	0.4	1.5	0.7	0.0	0.0	0.0	0.0	0.7	0.0
79	ip-cyP	0.6	0.0	0.0	0.0	0.8	0.0	0.3	0.0	0.0
80	c-12-dm-cyH	0.6	0.5	0.4	0.0	0.1	0.2	0.5	0.4	0.0
81	np-cyP	0.8	0.7	0.6	0.0	0.0	0.5	1.0	0.8	0.3
82	25-dm-heptane	2.0	2.3	4.0	0.0	0.2	0.0	1.3	1.0	0.7
83	33-dm-heptane	0.9	1.0	0.7	0.2	0.3	0.1	0.3	0.5	0.5
84	114-tm-cyH	0.0	0.4	0.3	0.0	0.6	0.0	1.0	0.5	0.0
85	e-benzene	10.4	9.7	7.2	3.0	5.4	3.1	17.3	13.5	11.5
86	ctt-124-tm-cyH & 35-dm-C7	0.6	0.6	1.1	0.3	3.2	0.1	1.3	1.1	0.7

ID	Compound Name	KR-IN18	KR-LR18	KR-KT18	FA-IN18	FA-FR18	FA-LR18	HD-IN18	HD-LR18	HD-FR18
87	m&p-xylene & 23-dm-heptane	33.3	29.1	24.4	9.6	10.2	8.6	52.5	40.5	36.2
88	34-dm-C7 & 4m-C8	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
89	2m-octane	1.4	1.2	1.1	1.0	1.3	0.0	2.2	1.1	0.9
90	3m-octane & ctc-124-tm-cyH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	styrene	1.9	1.6	4.1	0.4	2.0	0.6	2.0	1.8	1.4
92	o-xylene	14.0	12.2	9.9	4.0	4.2	3.6	21.6	16.9	13.6
93	1-nonene & 112-tm-cyH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
94	t3-nonene	0.9	0.7	0.7	0.0	0.0	0.0	0.6	0.5	0.4
95	c3-nonene & ib-cyP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
96	n-nonane	6.0	5.5	5.4	0.9	0.8	1.0	3.8	3.5	3.3
97	t2-nonene	0.5	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0
98	c2-nonene	2.5	2.2	2.2	0.4	0.5	0.3	0.0	0.0	0.9
99	ip-benzene	2.0	2.0	1.8	0.4	0.7	0.4	0.3	0.2	1.2
100	ip-cyH	2.7	2.5	2.4	0.4	0.5	0.4	1.3	1.0	0.9
101	nb-cyP	7.5	5.6	7.0	0.8	1.4	1.0	0.8	0.2	0.9
102	33 & 36- dm-octane	14.3	20.0	22.5	3.0	6.5	2.2	2.7	1.9	7.2
103	np-benzene	4.8	3.5	4.3	0.8	1.2	0.9	5.4	11.9	2.7
104	3e-toluene & 23-dm-octane	20.6	13.4	14.5	2.5	3.4	5.5	20.9	16.7	11.6
105	4e-toluene	1.5	1.2	1.4	1.0	1.2	0.0	6.2	4.6	3.9
106	135-tm-benzene & 2m-nonane	6.8	6.0	5.9	1.7	2.3	2.3	8.6	6.8	5.8
107	3e-octane	6.4	5.5	6.2	1.1	1.7	1.5	2.6	1.9	1.7
108	3m-nonane	4.6	4.1	4.5	0.5	0.9	0.8	1.6	1.2	1.2
109	2e-toluene	4.0	3.2	3.8	0.8	1.3	1.1	5.5	4.2	3.4
110	1-decene & ib-cyH	5.7	0.0	6.2	0.4	4.1	1.2	2.2	17.2	1.1
111	124-tm-benzene & tb-benzene	14.6	14.0	15.2	2.7	5.6	4.8	24.6	35.9	18.8
112	n-decane	31.0	29.8	31.1	4.2	5.4	5.7	10.1	9.6	9.0
113	ib-benzene	1.2	1.7	2.2	0.3	0.6	0.8	1.4	0.8	0.7
114	sb-benzene	9.2	6.9	8.8	0.0	3.2	0.0	0.6	0.5	0.0
115	3-ip-toluene	12.9	12.2	13.1	1.4	3.1	2.7	5.1	6.0	5.5
116	4-ip-toluene & 123-tm-benzene	53.7	32.8	49.5	2.4	3.8	12.7	12.2	11.9	7.9
117	indan	6.9	6.6	6.7	0.7	0.9	1.5	1.1	0.0	0.8
118	2-ip-toluene	7.5	6.9	8.4	0.8	1.3	1.9	7.2	5.0	3.6
119	3-np-toluene & 13de-benzene	9.1	8.4	9.7	1.1	1.5	0.9	1.7	1.6	1.3
120	4-np-tol/nb&13dm5e&14de-benz	6.6	6.3	7.1	1.1	1.1	2.2	5.5	5.3	3.9
121	12-de-benzene	6.7	6.6	7.6	0.7	1.0	1.5	3.1	3.8	2.2
122	2-np-toluene	9.3	8.9	9.9	0.8	1.1	1.8	3.9	3.7	3.3
123	14-dm-2e-benzene	2.7	2.5	3.4	0.9	0.1	0.8	1.9	1.6	1.4
124	12-dm-4e-benzene	4.9	4.1	5.6	0.4	0.9	1.9	4.8	4.5	3.3
125	13-dm-2e-benzene	10.9	9.0	11.1	1.0	1.3	2.0	7.0	4.7	4.2
126	n-undecane	31.9	32.1	37.7	4.8	6.9	7.9	16.2	15.9	14.7
127	1245-ttm-benzene	7.1	7.3	7.8	1.5	2.8	2.6	4.8	5.3	4.4
128	2mb-benzene	5.6	5.4	7.3	0.6	1.3	1.5	4.6	4.3	4.2
129	tb-2m-benzene	1.1	1.1	2.2	0.6	1.1	1.2	1.0	1.2	1.1
130	n-pentylbenzene	2.5	4.8	6.9	4.3	1.6	1.7	5.3	5.2	4.9

ID	Compound Name	KR-IN18	KR-LR18	KR-KT18	FA-IN18	FA-FR18	FA-LR18	HD-IN18	HD-LR18	HD-FR18
131	tb-35dm-benzene	1.0	1.0	1.4	0.0	0.0	0.5	1.5	1.4	2.7
132	tb-4e-benzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
133	naphthalene	1.2	1.6	2.6	0.0	0.7	0.9	3.1	3.4	2.3
134	n-dodecane	3.4	3.8	5.8	0.5	1.8	1.8	4.2	4.3	4.1
135	135-te-benzene	0.5	0.6	1.1	0.0	1.1	0.6	1.1	1.1	0.3
136	124-te-benzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137	n-hexylbenzene	0.0	0.5	0.4	0.0	0.7	0.5	0.3	0.7	0.0
138	n-tridecane	0.6	1.1	2.4	0.0	0.0	0.8	0.7	0.0	0.0

**Table 38. Halocarbon compound concentrations for the Phase 2 additional samples (ng/L).**

## Appendix 2

**Table 39.** Explanation of the conventions used in this document for hydrocarbon compound names.

Abbreviation	Full Name
t2-butene	trans-2-butene
c2-butene	cis-2-butene
2,2-dm-propane	2,2-dimethylpropane
3m1-butene	3-methyl-1-butene
1,1-dm-cyP	1,1-dimethylcyclopentane
e-cyP	ethylcyclopentane
4m-C7	4-methylheptane
3e-C6	3-ethylhexane
cct-1,3,5-tm-cyH	cis-cis-trans-1,3,5-trimethylcyclohexane
ip-	isopropyl-
np-	n-propyl
ib-	isobutyl-
sb-	sec-butyl
tb-	tert-butyl
1,2,4,5-ttm-benzene	1,2,4,5-tetramethylbenzene
1,3-de-benzene	1,3-diethylbenzene

## Appendix 3

**Table 40. Statistical summary of Phase 1 cold start data. Concentrations are in ng/L unless otherwise stated.**

		CSB				CSPT				CSH				CSG			
		Mean	St.Dev.	Max.	Min.												
	CO (ppmV)	0.52	0.27	0.97	0.18	0.38	0.23	0.72	0.13	6.24	12.89	32.52	0.35	80.20	93.18	255.90	14.31
	CO2 (ppmV)	431.94	56.86	545.79	392.18	856.23	204.87	1167.17	649.37	946.87	271.88	1398.40	581.61	742.51	274.23	1244.42	547.21
	SF6									6.30	5.07	14.07	0.37	192.81	74.57	310.25	86.49
ID																	
1	methane	1525.50	265.15	1939.97	1317.78	1739.69	459.99	2511.77	1252.14	1995.95	442.79	2752.18	1473.98	1922.04	570.92	3043.27	1477.62
2	ethylene	2.47	1.09	4.05	1.12	2.46	1.23	3.99	1.14	52.86	107.89	272.95	3.65	441.45	370.23	1047.27	128.70
3	acetylene	2.10	0.67	2.92	1.30	2.75	2.71	8.04	0.97	38.06	75.24	191.45	2.96	405.07	503.82	1380.61	70.32
4	ethane	1.74	0.75	2.50	0.79	0.29	0.14	0.54	0.16	0.45	0.25	0.69	47.97	74.00	160.72		
5	propylene	2.36	1.12	3.85	1.03	1.00	0.82	2.08		28.52	57.70	146.22	2.59	264.80	297.89	834.96	61.82
6	propane	3.69	1.56	6.41	2.21	15.66	21.61	59.23	4.30	14.45	13.88	42.25	4.82	12.81	8.41	28.12	4.28
7	propyne					0.04	0.10	0.25		2.35	5.61	13.81		31.98	38.89	107.82	7.67
8	isobutane	3.03	1.13	5.27	2.20	50.98	113.24	281.63		46.83	89.10	228.02		102.56	113.88	321.29	21.99
9	1-butene & isobutene	3.59	1.98	6.73	1.75	3.26	2.51	6.68		3.53	3.77	9.49		2.56	6.27	15.35	
10	13-butadiene	0.50	0.69	1.63		0.17	0.27	0.61		5.94	11.14	28.64	0.38	55.87	36.95	106.34	21.81
11	n-butane	7.49	2.49	10.39	4.03	12.49	7.67	25.72	5.61	34.26	52.77	141.63	9.52	282.63	312.71	886.20	59.69
12	t2-butene & 22-dm-propane	0.46	0.38	1.09		1.71	1.32	3.90	0.52	5.14	8.81	23.10	0.97	25.34	22.93	62.43	
13	1-butyne									0.16	0.39	0.95		3.49	3.33	7.46	0.45
14	c2-butene	0.70	1.01	2.70		0.67	0.69	1.79		1.66	2.28	6.01		32.90	35.82	101.68	8.44
15	3m1-butene									0.86	1.90	4.73		10.68	11.20	32.08	2.94
16	2m-butane	4.33	2.83	8.68	2.00	5.11	2.72	8.52	1.82	33.66	54.06	143.10	1.88	312.51	350.61	991.23	69.26
17	1-pentene	0.65	0.75	1.61		0.59	1.24	3.11		2.20	3.08	8.40	0.51	22.72	23.03	65.23	4.80
18	2m1-butene	0.18	0.29	0.68		0.54	0.41	1.18		4.22	7.57	19.64	0.55	41.86	43.91	126.32	10.74
19	n-pentane	2.06	1.64	4.17		3.98	1.97	7.07	2.00	19.11	31.83	83.94	4.09	188.98	213.46	602.71	41.47
20	2m13-butadiene	0.92	1.60	3.91													
21	t2-pentene	0.23	0.28	0.66		0.91	0.66	1.80		4.08	6.64	17.54	0.72	38.50	42.04	119.93	9.26
22	c2-pentene	0.12	0.19	0.38		0.87	1.50	3.85		2.37	4.89	12.33		22.01	24.16	68.85	5.49
23	2m2-butene	0.24	0.29	0.73		5.28	12.31	30.39		9.09	10.91	23.38	0.38	55.63	65.21	180.24	
24	22-dm-butane	0.35	0.48	1.16		0.65	0.74	2.04		4.36	7.12	18.79	0.54	41.01	46.26	130.77	9.43
25	cyclopentene	0.29	0.59	1.46		0.41	0.26	0.85	0.16	1.27	2.00	5.34	0.32	12.53	13.24	37.89	3.48
26	4m1&3m1-pentene									0.67	1.27	3.18		3.80	3.23	9.14	
27	cyclopentane	0.50	0.39	1.04		0.98	0.71	2.39	0.51	3.90	6.21	16.54	0.74	36.03	40.03	113.59	8.46
28	23-dm-butane	0.65	0.56	1.65	0.22	1.04	1.28	3.58	0.25	5.50	8.81	23.19	0.59	52.62	59.85	168.95	12.07
29	2m-pentane & t-4m2-pentene	3.82	3.44	10.44	1.33	5.90	7.93	21.97	1.39	26.48	37.99	101.41	4.38	235.89	270.79	764.94	60.36
30	MTBE & c-4m2-pentene	0.18	0.32	0.80		0.22	0.26	0.64		1.04	1.68	4.33		8.67	8.09	24.33	3.26
31	3m-pentane	2.32	3.12	8.58	0.37	4.74	7.35	19.64	0.77	18.63	25.60	67.43	2.66	154.27	179.04	503.86	35.37
32	1-hexene & 2m1-pentene					2.09	2.16	4.90		5.05	4.69	13.71		20.15	28.58	77.90	4.32
33	n-hexane	2.51	3.95	10.55	0.63	6.15	10.46	27.45	0.99	18.68	24.06	59.76	2.14	140.50	166.22	466.16	31.67
34	t2-hexene	0.04	0.11	0.26		0.17	0.30	0.74		1.63	2.86	7.44		18.70	20.75	59.49	6.27

		CSB				CSPT				CSH				CSG			
		Mean	St.Dev.	Max.	Min.	Mean	St.Dev.	Max.	Min.	Mean	St.Dev.	Max.	Min.	Mean	St.Dev.	Max.	Min.
35	2m2-pentene & 2e1-butene	0.15	0.37	0.90		1.48	2.16	5.77		2.80	2.25	5.55		18.14	22.99	63.32	2.29
36	c2-hexene	0.36	0.45	1.10		0.17	0.21	0.49		1.06	1.61	4.32		10.73	13.12	36.68	2.22
37	c/t-3m2-pentene	0.06	0.14	0.35		0.48	0.65	1.75		1.99	3.35	8.77		20.40	23.35	66.02	4.50
38	22-dm-pentane	0.19	0.48	1.17	0.23	0.50	1.23	3.02		1.49	2.06	4.37		8.33	9.89	27.68	1.79
39	m-cyclopentane	1.37	1.71	4.76	0.90	2.92	3.24	9.40	0.90	16.99	28.29	74.31	2.41	173.95	206.86	579.02	38.16
40	24-dm-pentane	0.38	0.83	2.07		1.24	1.40	3.81		4.10	4.19	12.02	1.37	29.25	33.71	95.05	6.72
41	223-dm-butane	0.32	0.38	0.89		0.20	0.28	0.71		0.62	0.61	1.71	0.09	6.66	5.54	16.70	1.00
42	1m-cyclopentene	0.08	0.19	0.45		0.04	0.09	0.23		1.09	2.18	5.51		13.33	22.00	57.45	
43	benzene	2.57	1.24	4.84	1.43	6.78	4.34	14.20	2.53	28.87	51.02	132.87	5.55	346.33	413.84	1156.77	77.06
44	33-dm-pentane	0.22	0.54	1.32		0.64	1.35	3.38		1.79	2.61	5.64		12.45	14.95	41.83	2.86
45	cyclohexane	0.26	0.19	0.57		0.59	0.31	1.17	0.29	3.76	6.37	16.73	0.59	38.04	45.87	128.13	8.15
46	2m-hexane	1.94	3.54	9.15	0.21	5.35	9.56	24.76	0.44	15.63	20.69	49.99	1.28	125.50	142.75	404.90	25.10
47	23-dm-pentane	0.73	1.35	3.48		2.07	3.57	9.24		5.56	7.21	16.99	0.43	31.32	49.10	126.62	
48	11-dm-cyP					0.10	0.25	0.60		0.70	1.38	3.46		7.18	8.31	23.41	1.55
49	3m-hexane & cyclohexene	2.50	4.60	11.83		7.15	11.94	31.41	1.05	18.61	23.36	55.00	2.24	130.27	158.11	441.57	28.10
50	c-13-dm-cyP	0.43	0.30	0.85		0.51	0.45	1.36		2.52	4.03	10.70	0.60	24.62	29.79	83.26	5.15
51	t-13-dm-cyP & 3e-pentane	0.21	0.27	0.68		0.29	0.33	0.67		3.35	6.40	16.38		37.98	45.58	127.56	7.94
52	t-12-dm-cyP	0.36	0.71	1.79		0.81	1.84	4.57		0.97	2.39	5.85					
53	224-tm-pentane & 1-heptene	0.77	0.29	1.30	0.48	1.39	1.25	3.63	0.24	8.78	15.91	41.18	1.07	94.28	113.52	317.51	19.42
54	c3-heptene	0.03	0.07	0.17		0.33	0.67	1.67		0.72	1.50	3.76		8.05	9.70	27.06	1.75
55	n-heptane	1.70	3.00	7.83	0.28	5.23	8.60	22.66	0.65	13.68	17.27	41.51	1.11	104.68	125.33	351.82	20.82
56	t3-heptene	0.08	0.20	0.48		0.18	0.29	0.68		2.61	4.81	12.35		27.73	36.22	97.85	
57	t2-heptene	0.25	0.60	1.48		0.12	0.20	0.49		1.15	1.46	3.77		8.99	10.66	29.94	1.71
58	c2-heptene	1.63	2.24	5.41		1.03	1.48	3.91		1.61	1.49	4.12		8.31	8.72	24.99	1.62
59	m-cyH & 22-dmC6	0.20	0.26	0.65		0.66	0.51	1.38	0.08	5.32	9.20	24.05	0.62	55.61	67.29	187.81	11.43
60	25-dm-C6 & e-cyP	0.13	0.21	0.48		0.36	0.39	0.86		1.92	3.25	8.52		19.87	25.73	69.85	1.12
61	24-dm-C6 & 223-tm-C5	0.27	0.41	1.02		0.52	0.86	2.02		3.87	6.72	17.43		42.58	50.46	142.18	8.45
62	ctc-124-tm-cyP					0.02	0.04	0.11						0.28	0.56	1.40	
63	ctc-123-tm-cyP					0.16	0.26	0.61		1.08	1.54	3.36		7.70	9.19	25.75	1.57
64	234-tm-pentane	0.39	0.25	0.75		0.68	0.50	1.67	0.28	3.22	4.59	12.44	0.54	28.66	34.77	97.20	5.64
65	toluene	5.47	5.26	16.04	1.93	24.50	21.51	65.22	7.96	72.05	120.57	317.64	12.96	854.80	1030.04	2879.49	190.04
66	2m-heptane	0.28	0.40	1.08		0.65	0.53	1.32		4.98	9.05	23.39	0.30	64.88	75.21	211.00	12.27
67	4m-heptane & 1m-cyhexene	0.07	0.17	0.41		0.32	0.25	0.70		2.33	4.45	11.38		26.26	37.99	100.54	
68	3m-C7 & 3e-C6	0.47	0.58	1.62		0.80	0.87	1.95		6.97	11.94	31.22	0.74	82.33	102.72	284.54	12.89
69	cct-124-tm-cyP & c-13-dm-cyH					0.18	0.44	1.07		1.15	2.69	6.63		16.41	20.36	56.56	3.16
70	t-14-dm-cyH	1.60	3.00	7.69		5.04	2.94	9.82	1.32	6.17	2.22	9.63	3.07	5.69	5.82	17.15	1.77
71	225-tm-C6	0.09	0.23	0.56		0.39	0.67	1.73		1.16	1.51	3.98		9.25	11.31	31.55	1.92
72	1-octene	0.12	0.20	0.46		0.38	0.45	1.06		2.49	3.09	6.86		14.07	19.64	52.34	1.06
73	1e-1m-cyP					0.37	0.53	1.24		1.64	2.34	5.36		6.44	10.83	28.41	
74	n-octane & t-12-dm-cyH	0.61	0.83	2.26		1.47	1.32	3.87	0.51	7.70	8.60	20.72	1.05	58.33	72.67	201.82	11.69
75	t2-octene					0.36	0.35	0.81		2.13	2.83	7.32		6.96	8.52	23.75	1.38
76	ccc-123-tm-cyP																
77	??t-13-dm-cyH & c-14-dm-cyH	0.11	0.26	0.64		1.35	0.98	2.74	0.42	10.23	19.75	50.42	0.64	12.21	15.67	43.28	2.31

		CSB				CSPT				CSH				CSG			
		Mean	St.Dev.	Max.	Min.	Mean	St.Dev.	Max.	Min.	Mean	St.Dev.	Max.	Min.	Mean	St.Dev.	Max.	Min.
78	c2-octene					0.09	0.21	0.52		1.69	3.43	8.57		1.91	3.73	9.45	
79	ip-cyP	0.64	0.76	2.11		0.17	0.43	1.04		0.67	1.17	2.84		4.59	5.29	14.20	
80	c-12-dm-cyH					0.31	0.48	1.24		0.93	1.95	4.90		11.15	15.24	41.04	1.88
81	np-cyP	0.16	0.40	0.99		0.12	0.23	0.56		0.54	0.74	1.82		4.35	5.66	15.44	
82	25-dm-heptane	0.12	0.29	0.70		0.38	0.52	1.32		2.07	3.47	9.08		24.43	30.35	84.28	4.85
83	33-dm-heptane	0.26	0.58	1.43		0.13	0.17	0.38		0.57	0.79	2.11		4.45	6.02	16.25	
84	114-tm-cyH	0.79	0.94	2.52		0.02	0.06	0.14		0.53	0.94	2.32		5.80	7.67	20.78	
85	e-benzene	0.50	0.70	1.88		4.83	3.86	11.39	1.56	14.43	22.18	59.33	2.69	201.93	241.10	674.73	44.46
86	ctt-124-tm-cyH & 35-dm-C7	1.01	1.98	5.01		1.07	1.95	5.02		0.53	0.53	1.34		3.29	4.26	11.69	0.44
87	m&p-xylene & 23-dm-heptane	4.31	5.02	14.44	1.33	14.92	10.21	28.44	4.34	44.03	68.71	183.42	8.44	668.01	805.44	2251.80	144.71
88	34-dm-C7 & 4m-C8					0.11	0.26	0.65		0.38	0.60	1.31		1.92	3.86	9.64	
89	2m-octane	0.48	0.33	0.82		0.63	0.26	0.97	0.25	4.83	5.78	14.00	0.88	29.97	38.43	106.05	5.23
90	3m-octane & ctc-124-tm-cyH	0.65	1.13	2.88		0.33	0.82	2.01		0.50	0.88	2.17		4.71	6.58	17.51	
91	styrene	0.36	0.60	1.41		1.30	0.31	1.78	0.88	3.51	3.62	10.67	1.29	49.93	54.89	156.74	13.35
92	o-xylene	2.38	2.38	6.73	0.26	6.55	4.45	12.76	1.74	18.43	27.65	74.51	4.19	275.67	327.90	919.63	63.31
93	1-nonene & 112-tm-cyH					0.19	0.47	1.14									
94	t3-nonene					0.27	0.23	0.57		0.74	0.73	1.70		5.15	6.25	17.44	1.18
95	c3-nonene & ib-cyP					1.69	1.42	3.05		3.96	3.29	8.76	0.83	20.92	26.76	74.01	4.26
96	n-nonane	0.64	0.76	2.11		0.04	0.11	0.26		0.12	0.29	0.70		2.63	3.20	8.91	0.61
97	t2-nonene					0.16	0.40	0.99		1.36	1.44	3.80		5.53	6.87	19.11	1.40
98	c2-nonene					0.07	0.18	0.45		1.44	1.93	5.21		18.67	22.40	62.60	4.01
99	ip-benzene					0.12	0.29	0.70		1.17	1.17	2.73		6.95	8.57	23.81	1.45
100	ip-cyH					0.26	0.58	1.43		2.49	2.47	6.50		7.78	8.88	25.19	1.69
101	nb-cyP					0.79	0.94	2.52		19.47	21.23	59.73		3.62	2.27	6.54	1.22
102	33 & 36- dm-octane					0.50	0.70	1.88		13.42	12.89	35.14	2.88	165.87	180.75	511.90	37.69
103	3e-toluene & 23-dm-octane					6.27	3.71	12.22	2.34	5.83	4.19	12.60	0.79	5.63	5.61	15.49	
104	4e-toluene					0.75	1.20	3.16		2.84	1.79	4.97		4.79	5.58	15.72	0.97
105	135-tm-benzene & 2m-nonane					0.33	0.81	1.98		1.31	0.98	2.26		0.84	0.79	1.78	
106	3e-octane					0.15	0.37	0.90		0.85	0.62	1.62		1.39	1.44	3.45	
107	3m-nonane					0.41	0.56	1.51		1.71	1.19	3.80	0.54	3.24	4.21	11.76	
108	2e-toluene					2.27	5.15	12.77		2.26	1.15	3.25		4.60	3.98	11.33	1.55
109	1-decene & ib-cyH					7.73	16.36	41.09	0.34	16.31	12.80	41.05	5.11	26.54	18.57	48.38	4.18
110	124-tm-benzene & tb-benzene					1.22	1.72	4.72	0.36	6.27	4.15	11.07	0.74	7.89	7.86	21.85	
111	n-decane					0.31	0.25	0.57		0.91	0.76	2.12		1.21	0.97	2.51	
112	ib-benzene					2.84	2.39	7.17	0.77	0.24	0.43	1.06		0.46	0.82	2.03	
113	sb-benzene					0.78	1.24	3.14		1.71	2.61	6.95		30.63	39.89	104.34	
114	3-ip-toluene					1.71	2.61	6.95		1.20	2.17	5.58		3.18	3.03	9.05	0.74
115	4-ip-toluene & 123-tm-benzene					0.27	0.66	1.62		0.94	0.34	1.37		0.39	1.40	0.99	
116	indan					0.10	0.25	0.62		1.48	1.09	3.26		3.21	2.65	7.69	0.78
117	2-ip-toluene					0.10	0.25	0.61		1.69	2.56	6.95		1.91	2.76	77.28	6.06
118	3-np-toluene & 13de-benzene					2.84	2.39	7.17	0.77	5.26	2.05	8.60	2.63	7.13	5.79	18.43	3.75
119	4-np-tol/nb&13dm5e&14de-benz					0.78	1.24	3.14		6.21	5.76	16.63	0.78	5.38	4.52	13.96	1.17
120						0.27	0.66	1.62		5.57	9.90	25.66		37.22	38.49	110.37	8.68

		CSB				CSPT				CSH				CSG			
		Mean	St.Dev.	Max.	Min.	Mean	St.Dev.	Max.	Min.	Mean	St.Dev.	Max.	Min.	Mean	St.Dev.	Max.	Min.
121	12-de-benzene	0.16	0.38	0.93		0.91	0.51	1.44		1.41	1.36	4.19	0.66	3.09	4.15	10.93	
122	2-np-toluene	0.17	0.42	1.02		1.16	0.38	1.61	0.55	1.53	0.91	3.05	0.54	8.79	9.53	26.94	1.99
123	14-dm-2e-benzene	0.49	1.00	2.51		0.63	0.40	1.23	0.30	1.64	1.94	5.36	0.25	13.45	13.72	39.28	3.10
124	12-dm-4e-benzene	0.37	0.57	1.22		1.12	0.98	2.80		1.65	1.48	4.01		22.13	22.44	64.36	5.01
125	13-dm-2e-benzene	0.89	1.07	2.86		1.74	1.34	3.39		1.88	1.31	4.16	0.60	4.89	4.11	12.37	1.78
126	n-undecane	1.05	1.99	5.08		4.79	3.02	7.52	0.68	5.80	4.80	14.46	1.36	5.83	5.53	16.01	1.39
127	1245-ttm-benzene	0.25	0.45	1.12		0.77	0.52	1.56		1.01	0.92	2.66		4.99	5.12	14.37	0.84
128	2mb-benzene	0.56	0.78	1.99		1.03	0.57	1.55		1.62	0.73	2.70	0.92	9.50	9.12	26.29	2.09
129	tb-2m-benzene	0.15	0.36	0.88		0.28	0.18	0.54		0.82	1.01	2.73		2.34	2.04	6.16	0.65
130	n-pentylbenzene	2.36	4.34	11.15		5.11	7.76	19.94		1.53	1.43	3.91		10.87	14.43	39.98	2.47
131	tb-35dm-benzene	0.26	0.42	0.96		0.33	0.57	1.37		0.09	0.22	0.53		1.92	2.09	5.91	
132	tb-4e-benzene																
133	naphthalene	1.05	1.44	3.11		2.61	1.00	3.88	0.81	2.25	1.04	3.76	1.02	22.66	18.89	56.65	6.55
134	n-dodecane	0.36	0.65	1.61		1.62	0.63	2.40	0.64	1.64	0.54	2.22	0.84	5.93	5.28	15.18	1.32
135	135-te-benzene													0.73	0.57	1.53	
136	124-te-benzene					0.02	0.06	0.14						0.69	0.84	1.92	
137	n-hexylbenzene	0.06	0.15	0.37		0.03	0.08	0.19						0.96	1.31	3.12	
138	n-tridecane	0.20	0.30	0.62		1.17	0.99	2.98		0.46	0.74	1.73		0.89	0.51	1.48	
139	CFC-22																
140	CFC-12	3.30	0.40	3.98	2.89	2.06	5.03	12.33		2.15	5.26	12.89		3.68	0.28	4.19	3.39
141	chloromethane	1.85	0.21	2.19	1.61	4.81	1.20	6.41	3.86	4.30	0.77	5.78	3.74	2.48	0.93	4.23	1.82
142	CFC-114					1.65	0.14	1.82	1.44	2.13	0.32	2.63	1.73				
143	vinyl chloride																
144	bromomethane																
145	chloroethane																
146	CFC-11	1.72	0.78	3.27	1.19	3.24	1.88	5.93	1.50	3.42	1.67	5.48	1.82	1.32	0.09	1.38	1.15
147	bromoethane					0.13	0.33	0.80									
148	11-dichloroethene	3.78	7.37	18.62		1.13				1.13	2.77	6.79					
149	dichloromethane	2.87	7.03	17.23		3.01	7.38	18.07		4.20	8.57	21.43		2.70	6.62	16.20	
150	CFC-113	6.78	5.15	16.56	3.31	3.09	4.04	11.33	1.03	2.17	0.50	2.74	1.55	1.62	1.43	4.53	0.93
151	t-12-dichloroethene																
152	11-dichloroethane	6.89	16.88	41.34		0.10	0.25	0.61						0.36	0.88	2.15	
153	c-12-dichloroethene	1.13	1.79	3.99		2.54	1.91	5.60	0.57	4.67	5.78	16.14	0.90				
154	chloroform	0.46	0.40	0.87													
155	12-dichloroethane	2.38	5.83	14.29													
156	111-trichloroethane	6.98	7.67	21.73	1.52	4.66	2.32	7.27	1.12	6.89	4.99	16.16	3.10	1.01	0.23	1.47	0.88
157	carbon tetrachloride	1.12	0.27	1.55	0.85	0.99	0.09	1.10	0.84	0.99	0.13	1.22	0.86	0.93	0.05	0.98	0.86
158	12-dc-propane & dbm & bdcn	2.31	2.96	6.39		4.74	2.03	6.97	1.25	7.99	1.89	10.95	5.39	10.46	10.22	30.26	3.00
159	trichloroethene	0.20	0.31	0.65		0.93	1.15	3.26	0.22	0.92	1.23	3.24		0.10	0.19	0.48	
160	c-13-dichloropropene	0.12	0.30	0.74		1.13	2.50	6.22		0.15	0.36	0.88					
161	t-13-dichloropropene	0.37	0.59	1.31		0.39	0.78	1.95		0.71	1.14	2.58					
162	112-trichloroethane	0.48	0.89	2.20		1.98	3.83	9.75		2.41	2.24	6.39		2.54	2.34	5.27	



**Table 41. Statistical summary of Phase 2 cold start data. Concentrations are in ng/L unless otherwise stated.**

		AMB (CS)				CSPT				CSH				CSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
	CO (ppmV)	0.63	0.43	1.83	0.21	0.46	0.27	1.11	0.19	5.80	4.57	16.39	2.15	115.89	45.09	174.76	25.02
	CO2 (ppmV)	401.22	17.89	431.00	381.14	776.11	161.22	1033.82	551.15	840.02	211.01	1276.75	608.13	797.58	158.11	1009.63	536.26
ID																	
1	methane	1378.01	90.56	1502.34	1261.34	1546.63	191.36	1976.92	1336.32	1652.18	209.22	1951.13	1362.03	2206.70	418.44	3137.05	1633.97
2	ethylene	0.99	1.77	5.00		3.84	1.52	6.17	1.08	36.44	29.15	99.96		852.43	320.29	1157.57	245.83
3	acetylene	1.15	1.43	3.83		2.57	1.21	4.25	0.67	27.63	24.02	85.00		579.47	227.88	896.62	153.79
4	ethane	5.88	2.85	12.29		10.70	6.03	22.77	2.72	15.69	10.80	40.62		83.99	35.80	128.94	23.47
5	propylene	1.38	0.63	2.20	0.54	1.68	0.91	3.11	0.54	18.28	13.30	47.57	6.54	402.30	176.36	639.13	92.40
6	propane	3.89	1.34	5.79	1.50	21.78	25.70	80.13	2.89	35.20	54.08	175.89	3.68	16.49	4.06	22.46	7.79
7	propyne	4.37	14.38	47.72		7.41	24.48	81.24		1.44	1.86	6.05		122.34	202.12	705.46	9.80
8	isobutane	2.10	1.26	3.90		23.03	36.89	123.48		86.47	246.71	829.61		109.84	59.00	198.24	
9	1-butene & isobutene	1.72	0.74	2.76	0.71	2.62	1.66	5.24		12.64	8.10	29.45	4.52	209.83	80.49	302.15	59.73
10	13-butadiene	0.24	0.21	0.55		0.31	0.20	0.68		5.66	4.27	15.17	1.97	97.52	50.48	166.47	33.22
11	n-butane	6.95	3.95	15.42	2.38	75.45	114.25	310.59	5.72	84.21	95.10	285.41	9.31	462.56	190.08	751.21	112.13
12	t2-butene & 22-dm-propane	0.38	0.18	0.68	0.13	2.00	1.62	6.15	0.33	4.55	3.06	11.20	1.35	64.95	35.53	114.93	
13	1-butyne													2.20	1.58	5.21	
14	c2-butene	0.19	0.16	0.58		1.02	1.23	4.27		3.98	3.97	14.64	0.89	50.73	19.97	75.62	14.61
15	3m1-butene	0.06	0.20	0.65		0.25	0.23	0.82		0.87	0.69	2.38		16.18	6.07	23.80	4.37
16	2m-butane	3.56	1.99	6.95	0.92	16.39	19.13	65.88		74.76	87.60	265.65	6.08	462.94	165.82	701.41	111.64
17	1-pentene	0.18	0.19	0.58		0.88	0.87	2.79		2.59	1.68	5.42	0.72	34.88	13.39	57.82	10.91
18	2m1-butene	0.18	0.13	0.33		1.26	1.34	5.01	0.41	2.97	1.59	6.37	1.32	42.46	16.19	63.53	13.14
19	n-pentane	2.04	0.93	3.58	0.79	10.90	10.79	35.55	1.91	22.17	16.43	54.80	6.19	303.25	110.83	430.95	69.99
20	2m13-butadiene																
21	t2-pentene	0.23	0.20	0.59		1.91	1.75	6.68	0.38	3.87	2.89	9.45		61.66	22.95	90.34	16.47
22	c2-pentene	0.06	0.11	0.33		1.15	1.03	3.70	0.15	2.32	1.86	5.14	0.50	35.01	13.07	51.06	8.73
23	2m2-butene	0.49	0.43	1.69	0.09	2.25	1.80	5.78	0.16	3.73	2.43	7.76	0.84	91.94	42.79	159.14	23.96
24	22-dm-butane	0.29	0.16	0.60		0.88	0.59	2.27	0.31	3.67	2.87	10.82	1.24	57.38	24.27	93.69	14.87
25	cyclopentene	0.22	0.22	0.54		0.48	0.53	1.93	0.07	1.31	0.97	3.38	0.37	20.86	8.53	35.86	5.13
26	4m1&3m1-pentene					0.28	0.22	0.60		0.73	0.48	1.81	0.24	15.20	6.79	23.54	3.37
27	cyclopentane	0.48	0.16	0.65	0.23	1.42	1.02	4.01	0.28	3.60	2.36	8.69	1.24	55.12	20.02	82.01	13.02
28	23-dm-butane	0.38	0.22	0.72		1.37	1.16	4.49	0.34	4.71	3.50	12.82	1.48	76.83	29.76	124.91	21.67
29	2m-pentane & t4m2-pentene	1.93	0.95	3.50	0.72	7.91	6.65	26.23	2.16	23.07	16.13	58.17	7.22	360.07	135.68	553.62	95.28
30	MTBE & c4m2-pentene	0.17	0.15	0.36		0.68	0.60	1.82		1.33	0.84	2.99	0.36	6.89	7.71	19.96	0.59
31	3m-pentane	1.09	0.63	2.51	0.38	4.88	2.86	10.74	1.51	14.54	9.80	38.13	5.24	230.96	89.47	362.30	62.54
32	1-hexene & 2m1-pentene	1.45	1.17	3.83		2.86	2.63	10.15		4.44	3.30	11.37		25.56	13.21	46.66	1.52
33	n-hexane	1.12	0.46	1.81	0.49	6.16	3.54	11.97	1.79	14.64	8.95	36.24	4.69	211.71	82.17	328.95	56.07
34	t2-hexene	0.08	0.14	0.38		0.58	0.47	1.85	0.16	1.60	1.17	4.35	0.54	27.14	10.30	42.76	8.47
35	2m2-pentene & 2e1-butene					2.50	2.36	7.82	0.21	4.69	2.92	11.17	1.71	28.63	11.83	43.75	8.53
36	c2-hexene					0.35	0.25	1.01	0.11	0.98	0.62	2.56	0.46	14.84	5.59	23.24	4.87
37	c/t-3m2-pentene	0.09	0.30	0.98		0.84	0.86	2.71		1.85	1.41	5.44	0.73	21.54	19.24	51.05	1.37

		AMB (CS)				CSPT				CSH				CSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
38	22-dm-pentane	0.03	0.08	0.21		0.89	2.16	7.37		1.37	1.90	6.87	0.30	12.46	4.97	20.07	3.62
39	m-cyclopentane	0.70	0.32	1.16	0.29	3.96	1.93	6.98	1.05	13.88	10.91	42.31	4.71	235.99	120.09	411.82	59.59
40	24-dm-pentane	0.14	0.14	0.30		0.97	0.56	2.00	0.41	2.97	1.76	7.27	1.16	41.40	16.54	67.79	13.08
41	223-dm-butane	0.20	0.21	0.57		1.13	0.88	3.34	0.32	1.54	0.80	3.27	0.47	3.95	1.84	7.55	0.51
42	1m-cyclopentene	0.04	0.13	0.44		0.04	0.09	0.27		0.25	0.34	0.91		10.58	13.03	37.76	0.86
43	benzene	2.29	0.83	3.56	1.08	7.09	3.95	16.76	2.02	24.35	19.34	72.79	7.97	464.01	218.57	749.27	125.86
44	33-dm-pentane	0.03	0.09	0.31		0.25	0.42	1.33		1.40	0.99	3.83	0.33	18.70	7.34	29.44	5.83
45	cyclohexane	0.79	0.72	2.75	0.16	1.42	0.97	3.27	0.37	3.71	2.82	11.15	1.00	52.15	26.42	91.17	13.82
46	2m-hexane	0.64	0.29	1.06	0.23	2.87	1.41	5.74	1.15	9.92	7.41	28.88	2.88	171.24	74.52	281.04	48.88
47	23-dm-pentane	0.29	0.13	0.45		1.03	0.53	2.07	0.43	3.43	2.55	9.90	0.70	55.64	22.59	88.99	16.68
48	11-dm-cyP	0.04	0.14	0.45		0.29	0.18	0.57		0.83	0.84	3.00		9.43	4.80	16.62	2.61
49	3m-hexane & cyclohexene	1.21	0.51	1.99	0.36	3.95	1.84	7.78	1.79	10.63	8.51	32.43	3.01	187.55	80.84	305.40	53.88
50	c-13-dm-cyP	0.11	0.18	0.52		0.91	0.55	1.83	0.30	2.44	1.85	7.21	0.73	34.88	15.92	57.94	10.10
51	t-13-dm-cyP & 3e-pentane	0.20	0.17	0.41		1.05	0.56	1.92	0.39	3.29	2.53	9.98	1.04	51.75	23.66	86.67	15.46
52	t-12-dm-cyP	0.04	0.13	0.42													
53	224-tm-pentane & 1-heptene	0.93	0.38	1.62	0.34	2.34	1.22	4.45	0.77	7.92	5.83	22.92	2.73	129.35	58.79	214.14	38.92
54	c3-heptene					0.27	0.28	0.80		0.80	0.74	2.54		11.98	4.70	19.25	4.05
55	n-heptane	0.55	0.23	0.84	0.15	3.47	1.89	6.62	0.89	9.09	6.36	25.61	3.15	143.30	66.07	239.45	41.70
56	t3-heptene					0.53	0.62	2.08		2.36	2.14	7.57		41.23	17.09	69.42	13.39
57	t2-heptene					0.38	0.31	0.91		0.94	0.66	2.60	0.36	12.59	5.06	20.21	4.16
58	c2-heptene	0.07	0.12	0.30		0.62	0.77	2.36		1.36	0.88	3.08	0.17	13.00	4.93	21.29	4.52
59	m-cyH & 22-dmC6	0.37	0.20	0.84	0.09	2.44	1.98	6.35	0.53	5.66	3.73	14.86	1.73	76.97	37.57	130.78	21.08
60	25-dm-C6 & e-cyP	0.08	0.12	0.24		0.46	0.29	0.99	0.18	1.61	1.42	5.09	0.22	27.72	12.94	45.98	7.81
61	24-dm-C6 & 223-tm-C5	0.15	0.16	0.40		1.11	0.78	2.50	0.25	3.37	2.94	10.86	0.35	56.63	26.95	94.54	15.68
62	ctc-124-tm-cyP					0.02	0.06	0.20						0.52	0.58	1.49	
63	ctc-123-tm-cyP	0.05	0.16	0.54		0.45	0.64	2.20		0.83	0.82	2.87		10.31	4.54	16.91	3.40
64	234-tm-pentane	0.33	0.16	0.59		1.01	0.66	2.62	0.34	2.72	1.96	7.78	0.72	41.57	15.75	65.66	14.73
65	toluene	4.93	2.05	8.10	2.05	27.51	14.39	61.11	8.57	60.33	38.13	157.60	21.52	1038.53	594.82	1803.22	162.99
66	2m-heptane	0.23	0.13	0.45		1.38	0.86	3.28	0.59	4.47	3.75	14.38	1.39	80.97	40.21	136.70	20.38
67	4m-heptane & 1m-cyhexene	0.14	0.25	0.74		0.71	0.41	1.62	0.26	2.28	1.98	6.92	0.64	38.70	18.54	65.45	10.46
68	3m-C7 & 3e-C6	0.36	0.45	1.64	0.11	1.90	1.10	4.51	0.77	5.94	5.07	19.03	1.85	108.53	54.15	183.38	27.16
69	cct-124-tm-cyP & c-13-dm-cyH					0.23	0.67	2.25		0.87	1.63	5.27		22.40	10.52	37.13	6.61
70	t-14-dm-cyH	0.36	0.29	0.93		4.81	3.91	13.80	0.43	5.31	3.63	12.17	1.77	7.14	3.00	10.91	2.30
71	225-tm-C6					0.39	0.38	1.06		0.88	0.89	3.20	0.18	11.85	5.58	19.80	3.57
72	1-octene	0.25	0.26	0.84		0.90	0.68	2.41	0.25	1.92	1.66	5.64	0.59	23.88	10.67	39.63	7.65
73	1e-1m-cyP	0.12	0.30	0.97		0.50	0.65	1.94		0.67	0.90	2.62		8.48	5.94	18.00	1.28
74	n-octane & t-12-dm-cyH	0.75	0.58	1.97	0.25	3.04	1.44	5.35	1.07	5.25	3.42	14.43	2.48	75.89	38.42	128.39	17.85
75	t2-octene	0.24	0.57	1.74		0.96	1.00	3.84		1.05	0.86	2.50		9.58	4.44	15.43	0.55
76	ccc-123-tm-cyP																
77	?t-13-dm-cyH & c-14-dm-cyH	0.08	0.27	0.88		1.11	0.88	3.20		1.20	1.08	3.52		17.32	8.17	30.42	5.15
78	c2-octene					0.44	0.77	2.26		0.25	0.67	2.19		2.29	2.39	7.23	
79	ip-cyP	0.10	0.34	1.13		0.32	0.48	1.24		0.33	0.71	2.32		6.85	3.81	13.85	1.72
80	c-12-dm-cyH					0.33	0.31	1.12		1.17	1.05	3.57	0.17	15.83	8.19	26.71	1.25

		AMB (CS)				CSPT				CSH				CSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
81	np-cyP	0.06	0.20	0.66		0.36	0.31	1.06		0.53	0.49	1.60		6.33	2.58	9.75	2.01
82	25-dm-heptane	0.09	0.31	1.02		0.79	1.00	3.41		2.13	1.76	6.78	0.61	31.94	15.60	53.28	7.98
83	33-dm-heptane					0.40	0.42	1.33		0.77	0.59	2.30	0.17	6.18	2.89	10.01	1.82
84	114-tm-cyH					0.24	0.28	0.69		0.49	0.68	2.21		8.46	3.34	13.25	2.66
85	e-benzene	0.80	0.31	1.26	0.34	6.19	3.83	15.18	1.29	12.98	8.03	33.54	3.85	263.91	125.47	416.31	63.97
86	ctt-124-tm-cyH & 35-dm-C7					0.45	0.39	1.15		0.59	0.40	1.42		4.80	2.01	7.52	1.47
87	m&p-xylene & 23-dm-heptane	2.59	1.09	4.44	1.16	20.57	11.82	44.96	3.99	41.61	24.03	101.86	13.15	880.86	416.69	1406.85	213.59
88	34-dm-C7 & 4m-C8													1.14	2.57	7.32	
89	2m-octane	0.71	0.46	1.75	0.17	1.14	0.71	2.76	0.50	3.16	2.82	10.34	0.46	39.10	19.99	65.63	8.56
90	3m-octane & ctc-124-tm-cyH	0.26	0.28	0.74		1.93	1.56	5.98	0.18	3.28	3.02	9.99	0.47	5.09	1.96	7.77	1.85
91	styrene	0.14	0.20	0.48										51.20	26.53	94.57	16.77
92	o-xylene	1.28	0.46	2.07	0.54	8.64	4.93	18.59	1.60	17.33	10.10	42.62	4.93	365.88	171.41	578.40	89.72
93	1-nonene & 112-tm-cyH	0.03	0.11	0.36													
94	t3-nonene					0.37	0.38	1.09		0.56	0.53	1.55		7.04	2.91	11.11	2.19
95	c3-nonene & ib-cyP					0.09	0.31	1.03						5.31	2.23	8.05	1.45
96	n-nonane	0.36	0.21	0.94	0.16	3.58	3.64	10.93	0.34	4.21	3.46	10.96	0.63	25.49	12.61	41.96	5.81
97	t2-nonene					0.15	0.23	0.54		0.15	0.25	0.61		3.55	1.39	5.40	1.09
98	c2-nonene					0.71	0.69	1.82		1.06	0.88	2.45		7.78	3.09	11.79	2.40
99	ip-benzene					0.77	0.60	1.77	0.22	1.58	0.94	3.77	0.48	24.81	12.06	39.52	5.64
100	ip-cyH					1.04	0.83	2.46	0.18	1.35	0.94	2.70	0.34	9.45	4.23	15.02	2.64
101	nb-cyP	0.08	0.14	0.41		2.88	3.58	10.97	0.27	3.05	2.91	7.80	0.50	12.01	5.03	17.37	3.74
102	33 & 36- dm-octane	0.38	0.52	1.77		7.27	6.10	21.51	1.09	7.82	5.94	23.74	2.61	4.44	3.81	13.54	0.46
103	np-benzene	0.21	0.33	1.07		4.92	6.83	21.90	0.50	4.18	2.53	8.22	1.08	65.00	32.95	107.86	13.18
104	3e-toluene & 23-dm-octane	0.74	0.44	1.58	0.31	8.64	5.59	15.61	1.72	14.88	8.04	27.37	3.83	217.92	105.96	354.48	46.70
105	4e-toluene	0.28	0.17	0.52		1.71	2.12	7.04		3.12	3.04	9.73		91.83	44.68	151.18	19.39
106	135-tm-benzene & 2m-nonane	0.18	0.19	0.49		3.84	3.78	11.49		6.72	4.05	12.98	1.46	90.96	44.20	145.44	18.48
107	3e-octane					1.87	2.12	6.97		2.15	2.38	6.44		3.74	1.98	6.98	0.96
108	3m-nonane					1.78	1.85	5.66	0.18	1.89	1.49	4.55	0.28	11.78	5.99	19.46	2.39
109	2e-toluene	0.21	0.15	0.44		2.28	1.78	6.44	0.52	3.86	1.92	7.59	1.16	74.99	36.41	121.79	15.91
110	1-decene & ib-cyH	0.38	0.49	1.20		5.61	8.02	22.05		3.69	5.17	15.66		11.26	7.40	26.92	3.65
111	124-tm-benzene & tb-benzene	1.51	1.26	3.65		18.87	17.19	51.87	1.56	18.02	10.51	34.77	3.88	308.29	152.63	496.71	57.44
112	n-decane	0.30	0.17	0.61		11.43	14.13	36.47	0.35	11.88	12.77	32.99	1.53	12.42	4.60	17.81	4.02
113	ib-benzene	0.05	0.15	0.50		0.81	0.95	3.03		0.81	1.00	2.96		5.51	2.39	8.76	1.54
114	sb-benzene	0.03	0.12	0.38		2.13	3.25	9.19		2.29	3.49	8.18		4.11	2.51	7.46	
115	3-ip-toluene	0.36	0.54	1.79		5.24	4.41	11.53		5.04	3.21	12.46	1.45	17.38	25.96	94.46	2.35
116	4-ip-toluene & 123-tm-benzene	0.40	0.40	1.13		15.49	22.43	68.87	1.18	15.55	19.59	64.75	2.07	54.59	33.31	102.11	4.61
117	indan	0.08	0.22	0.74		7.75	10.65	30.95		4.43	5.49	16.13		9.60	15.91	56.99	1.26
118	2-ip-toluene					3.67	4.10	14.28	0.52	13.87	30.25	102.72	0.49	34.16	21.69	67.25	1.75
119	3-np-toluene & 13de-benzene	0.04	0.13	0.43		2.99	3.79	11.03	0.20	3.44	3.73	9.50	0.44	27.06	21.67	82.69	4.59
120	4-np-tol/nb&13dm5e&14de-benz	0.17	0.32	0.94		2.64	1.97	6.48	0.47	3.36	1.75	6.47	0.50	23.98	33.11	89.88	1.00
121	12-de-benzene	0.13	0.34	1.12		2.95	3.84	12.71	0.16	3.00	3.77	11.98	0.40	11.42	9.00	32.75	2.71
122	2-np-toluene	0.29	0.62	2.02		2.67	2.69	8.11	0.27	4.02	4.10	13.53	0.61	16.50	9.83	33.41	1.21
123	14-dm-2e-benzene	0.13	0.28	0.82		1.38	1.19	3.81	0.22	1.55	1.10	3.48	0.26	13.08	8.05	32.25	4.50



		AMB (CS)				CSPT				CSH				CSG				
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	
166	tetrachloroethene													1.27	4.22	13.99		
167	chlorobenzene	0.11	0.24	0.67		0.30	0.71	2.33										
168	bromoform																	
169	1122-ttC-ethane & 14-dC-butane																	
170	13dichlorobenz/benzl-ch																	
171	14-dichlorobenzene																	
172	12-dichlorobenzene																	
173	124-trichlorobenzene																	
174	hexachloro-13-butadiene																	
175	Formaldehyde	0.87	0.57	1.93	0.16	23.68	10.32	46.25	8.46	24.20	10.68	43.04	7.82	11.26	8.43	35.55	4.83	
176	Acetaldehyde	1.10	0.60	2.08	0.36	17.70	15.74	62.65	5.97	17.13	8.67	34.82	5.24	20.73	9.98	46.68	9.57	
177	2-3 butandione									0.21	0.47	1.33						
178	Acrolein	0.08	0.08	0.23						0.79	0.46	1.72		3.23	4.21	12.43		
179	Acetone	1.74	0.59	2.55	0.74	44.89	21.38	80.58	16.86	36.76	22.87	74.12	11.92	17.77	3.87	23.15	10.02	
180	Propionaldehyde	0.16	0.11	0.33		0.31	1.03	3.41		1.79	0.84	3.15	0.86	1.33	2.74	8.74		
181	Methoxyacetone																	
182	Crotonaldehyde																	
183	Methyl Vinyl Ketone																	
184	Methacrolein	0.01	0.03	0.09						0.44	0.33	0.96		0.50	1.66	5.50		
185	Methyl Ethyl Ketone	0.44	0.26	0.71		3.22	5.37	15.94		3.55	4.56	13.20		1.42	3.32	10.07		
186	Isobutyraldehyde	&	0.05	0.08	0.18		0.89	2.95	9.79		1.77	3.00	10.37		0.40	1.32	4.38	
187	Butyraldehyde																	
188	Benzaldehyde	0.10	0.17	0.51		1.29	2.91	8.08		1.30	0.44	2.11	0.70	2.70	6.02	15.71		
189	Isovaleraldehyde									0.21	0.40	1.17						
190	Trimethylacetaldehyde & 3m2-Butanone	0.15	0.11	0.28		0.68	2.24	7.44		1.66	1.81	6.62		0.99	2.21	5.72		
191	Valeraldehyde									1.67	1.23	4.49						
192	Acetophenone	0.01	0.03	0.12														
193	o-Tolualdehyde																	
194	m&p-Tolualdehyde	0.02	0.06	0.16														
195	Methyl isobutyl Ketone	0.10	0.12	0.25														
196	Pinacolone																	
	Hexanaldehyde	0.07	0.08	0.16		3.91	6.41	19.66		6.27	5.49	20.72	1.40					

## Appendix 4

**Table 42. Statistical summary of Phase 1 hot soak data. Concentrations are in ng/L unless otherwise stated.**

		HSB				HSPT				HSH				HSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
	CO (ppmV)	0.32	0.09	0.43	0.24	0.46	0.27	0.82	0.21	0.58	0.21	0.73	0.27	0.63	0.24	0.93	0.37
	CO2 (ppmV)	523.27	144.33	714.91	407.85	718.17	123.23	833.00	566.71	762.36	80.18	876.12	687.64	489.61	52.60	538.52	421.62
	SF6									11.42	10.86	27.13	2.74	938.33	235.70	1283.90	782.90
ID																	
1	methane	1531.77	134.53	1678.18	1380.85	1703.84	393.06	2221.21	1345.06	1759.04	270.94	2105.05	1528.69	1435.15	69.60	1500.19	1339.88
2	ethylene	3.59	2.53	6.94	0.90	3.62	1.26	5.36	2.45	4.35	1.68	6.55	2.75	4.92	2.96	8.36	1.72
3	acetylene	2.76	1.62	4.30	1.01	4.72	4.20	11.02	2.51	3.58	2.41	7.01	1.74	3.89	2.32	6.69	1.24
4	ethane	1.92	1.70	4.34	0.73	0.26	0.09	0.37	0.15	0.40	0.13	0.58	0.29	0.61	0.10	0.70	0.49
5	propylene	5.86	5.81	14.45	1.99	1.41	0.45	2.05	1.02	3.15	1.77	4.77	1.37	2.61	1.49	4.48	1.24
6	propane	6.19	4.15	11.04	2.41	4.66	1.69	6.46	2.43	10.10	2.60	12.00	6.26	12.24	2.49	15.34	10.01
7	propyne																
8	isobutane	9.22	13.96	29.49		2.46	2.99	6.06		24.52	20.72	55.21	11.32	108.29	41.54	157.28	55.66
9	1-butene & isobutene	3.56	3.63	8.41		1.00	0.54	1.59	0.28	8.69	7.50	19.74	3.07	9.38	18.77	37.53	
10	13-butadiene	0.62	0.93	1.98		0.31	0.11	0.48	0.24	0.65	0.33	1.03	0.30	1.87	0.56	2.34	1.05
11	n-butane	16.71	13.64	32.71	3.52	10.08	4.54	15.62	5.89	51.02	43.51	114.22	15.13	353.50	128.88	496.04	184.59
12	t2-butene & 22-dm-propane	0.89	1.19	2.64		0.17	0.34	0.69		4.31	7.29	15.15		54.87	20.83	79.88	29.29
13	1-butyne																
14	c2-butene	0.66	0.74	1.71		0.32	0.39	0.78		4.07	4.29	10.46	1.23	38.18	14.47	55.43	20.16
15	3m1-butene									0.48	0.68	1.45		5.07	1.87	7.07	2.56
16	2m-butane	7.51	5.52	15.09	2.06	4.54	0.53	5.21	3.99	23.98	24.27	59.75	7.02	211.34	74.87	292.92	111.38
17	1-pentene	0.73	0.85	1.54		0.53	0.46	0.98		1.52	1.78	4.07		17.03	9.03	29.32	7.56
18	2m1-butene	0.52	0.35	0.75		0.54	0.41	0.99		3.26	3.40	8.26	1.05	28.43	10.82	40.48	14.17
19	n-pentane	3.16	4.69	9.93		3.08	2.15	6.17	1.58	17.53	17.36	42.50	5.52	150.73	56.36	214.48	77.13
20	2m13-butadiene	0.96	1.23	2.56													
21	t2-pentene	0.73	1.02	2.22		0.59	0.58	1.20		4.25	5.10	11.55		35.91	25.37	59.59	
22	c2-pentene	0.10	0.21	0.41		0.24	0.28	0.48		3.78	2.28	6.09	1.39	22.07	8.33	31.53	11.28
23	2m2-butene	2.21	2.39	5.79	0.85	1.45	1.59	3.52		6.75	7.44	16.30		57.99	21.14	82.91	31.50
24	22-dm-butane	0.57	0.54	1.25		0.41	0.53	1.11		2.18	2.18	5.34	0.57	15.35	6.10	21.86	7.16
25	cyclopentene	0.37	0.27	0.64		0.14	0.16	0.32		1.57	0.92	2.44	0.67	8.97	3.56	13.07	4.48
26	4m1&3m1-pentene									0.29	0.57	1.14		3.82	1.46	5.50	1.93
27	cyclopentane	0.84	0.64	1.78	0.38	0.66	0.30	1.04	0.32	3.43	2.64	7.23	1.46	27.47	10.44	39.49	14.05
28	23-dm-butane	0.77	0.61	1.65	0.29	0.54	0.48	1.11		2.62	2.70	6.53	0.76	21.57	8.38	30.17	10.08
29	2m-pentane & t-4m2-pentene	4.55	2.60	8.05	1.78	4.27	1.32	6.08	3.24	14.45	12.54	32.90	5.86	110.71	41.75	154.02	53.63
30	MTBE & c-4m2-pentene	0.34	0.43	0.89		0.09	0.17	0.35		1.07	1.09	2.49		6.09	2.11	8.55	3.41
31	3m-pentane	2.29	2.19	5.46	0.57	1.78	1.29	3.52	0.49	8.51	7.45	19.53	3.43	69.19	26.73	96.31	32.31
32	1-hexene & 2m1-pentene	1.27	2.54	5.07		1.53	2.94	5.94		5.98	4.08	8.94		15.73	3.46	20.00	11.58
33	n-hexane	2.06	1.72	4.53	0.60	1.62	0.68	2.51	1.01	8.94	9.33	22.64	2.96	77.64	28.56	106.85	38.40
34	t2-hexene	0.20	0.28	0.59		0.16	0.19	0.37		1.76	1.30	3.40	0.42	12.53	4.65	17.60	6.33

		HSB				HSPT				HSH				HSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
35	2m2-pentene & 2e1-butene	0.39	0.47	1.07		0.68	0.79	1.45		1.70	1.76	3.90		9.25	3.38	13.14	4.90
36	c2-hexene	0.18	0.22	0.44		0.10	0.20	0.39		0.86	0.90	2.11		6.99	2.45	9.73	3.77
37	c/t-3m2-pentene	0.24	0.33	0.70		0.13	0.15	0.27		1.37	1.36	3.33	0.44	13.01	5.14	18.86	6.33
38	22-dm-pentane									0.34	0.28	0.69		1.94	0.79	2.59	0.81
39	m-cyclopentane	2.26	2.12	5.37	0.59	1.50	1.03	3.00	0.71	9.18	8.64	21.60	3.17	85.50	33.28	122.87	42.40
40	24-dm-pentane	0.40	0.35	0.79		1.17	0.88	2.40	0.43	1.76	0.98	3.19	1.11	9.94	3.94	13.70	4.54
41	223-dm-butane	0.10	0.14	0.29		0.31	0.30	0.72		0.53	0.40	0.93	0.03	0.77	0.38	1.14	0.32
42	1m-cyclopentene	0.20	0.29	0.61		0.44	0.88	1.77		1.05	1.41	2.99		12.07	4.87	16.84	5.69
43	benzene	4.59	3.96	10.41	1.55	3.13	2.31	5.28		18.03	17.29	43.51	7.00	167.99	61.70	238.53	88.08
44	33-dm-pentane	0.11	0.21	0.43		0.06	0.12	0.24		0.53	0.67	1.37		4.50	1.51	6.04	2.43
45	cyclohexane	0.61	0.33	0.92	0.21	0.46	0.19	0.67	0.29	2.05	1.73	4.57	0.82	17.72	7.08	25.50	8.44
46	2m-hexane	1.32	1.14	2.96	0.34	1.03	0.71	1.56		4.91	4.68	11.78	1.86	39.47	14.83	54.05	18.79
47	23-dm-pentane	0.50	0.50	1.19		0.45	0.30	0.63		1.52	1.90	4.26		11.59	4.49	15.36	5.12
48	11-dm-cyP					0.21	0.42	0.83		0.28	0.32	0.59		2.14	0.87	3.10	1.02
49	3m-hexane & cyclohexene	1.75	1.48	3.71	0.22	2.90	1.51	5.11	1.76	6.58	4.47	13.23	3.57	42.12	15.43	57.43	20.66
50	c-13-dm-cyP	0.39	0.29	0.62		0.31	0.24	0.56		1.00	1.04	2.41		8.72	3.38	12.30	4.23
51	t-13-dm-cyP & 3e-pentane	0.56	0.22	0.85	0.34	0.32	0.23	0.53		1.45	1.53	3.57		13.02	4.89	18.16	6.45
52	t-12-dm-cyP					0.28	0.56	1.12									
53	224-tm-pentane & 1-heptene	1.40	1.06	2.92	0.55	0.81	0.61	1.42		4.37	2.98	8.18	1.42	22.74	8.64	30.49	10.36
54	c3-heptene	0.10	0.20	0.39		0.06	0.12	0.24		0.58	0.67	1.27		4.30	1.63	5.97	2.07
55	n-heptane	1.28	1.09	2.83	0.31	1.35	0.36	1.69	0.85	4.92	4.46	11.46	2.07	38.30	14.14	52.70	18.82
56	t3-heptene	0.16	0.33	0.66						1.36	1.39	3.28		13.97	5.63	20.39	6.66
57	t2-heptene									0.61	0.73	1.45		4.46	1.75	6.34	2.13
58	c2-heptene	0.68	0.80	1.52		0.51	0.45	1.06		1.16	1.30	3.01		4.19	1.76	6.36	2.05
59	m-cyH & 22-dmC6	0.64	0.50	1.15		0.65	0.27	0.94	0.31	2.27	1.90	5.04	0.82	17.44	6.58	24.34	8.69
60	25-dm-C6 & e-cyP	0.45	0.30	0.86	0.17	1.29	1.91	4.15	0.21	0.50	0.34	0.70		4.12	1.54	5.36	1.88
61	24-dm-C6 & 223-tm-C5	0.37	0.51	1.09		0.25	0.30	0.57		1.05	0.96	1.96		11.19	4.26	15.53	5.40
62	ctc-124-tm-cyP									0.27	0.53	1.07					
63	ctc-123-tm-cyP									0.12	0.25	0.50		2.35	0.94	3.06	0.99
64	234-tm-pentane	0.79	0.62	1.66	0.34	0.67	0.31	1.07	0.32	2.04	1.17	3.14	0.97	9.06	3.68	12.73	4.35
65	toluene	37.22	61.52	129.34	2.56	17.37	11.54	32.04	4.52	64.41	71.07	170.16	20.87	580.94	201.43	795.56	308.90
66	2m-heptane	0.49	0.57	1.31		0.37	0.29	0.70		1.59	1.65	4.03	0.41	14.32	5.33	19.49	6.90
67	4m-heptane & 1m-cyhexene	0.20	0.29	0.62		0.07	0.14	0.28		0.65	0.99	2.09		8.27	3.20	11.57	3.90
68	3m-C7 & 3e-C6	0.60	0.73	1.65		0.73	0.38	1.28	0.45	2.88	1.65	5.13	1.21	19.07	7.12	25.84	9.04
69	cct-124-tm-cyP & c-13-dm-cyH	0.08	0.17	0.34		0.06	0.12	0.23		0.29	0.58	1.15		3.96	1.67	5.43	1.59
70	t-14-dm-cyH	1.66	1.44	3.12	0.15	5.31	3.56	10.49	2.45	5.24	1.87	6.51	2.54	2.77	1.28	4.47	1.41
71	225-tm-C6	0.04	0.07	0.15		0.32	0.65	1.30		0.58	0.83	1.75		2.08	1.06	2.85	0.53
72	1-octene	0.08	0.16	0.32		0.44	0.38	0.94		0.54	0.64	1.28		2.11	1.34	4.11	1.34
73	1e-1m-cyP					0.16	0.19	0.38		0.30	0.35	0.62		3.20	2.20	5.56	0.51
74	n-octane & t-12-dm-cyH	0.74	0.53	1.50	0.27	1.30	1.17	3.06	0.65	2.72	1.65	4.25	1.18	15.85	6.31	20.80	6.81
75	t2-octene	0.37	0.66	1.36		0.20	0.27	0.56		0.42	0.40	0.97		3.43	3.17	7.96	0.67
76	ccc-123-tm-cyP					0.04	0.08	0.15									
77	??t-13-dm-cyH & c-14-dm-cyH	0.19	0.39	0.78		0.64	0.23	0.97	0.45	1.10	0.90	2.36	0.33	10.19	13.55	30.38	1.26

		HSB				HSPT				HSH				HSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
78	c2-octene					0.12	0.24	0.48		0.18	0.37	0.74		1.77	3.55	7.09	
79	ip-cyP	0.19	0.37	0.74						0.34	0.68	1.36		0.74	0.51	1.17	
80	c-12-dm-cyH					0.10	0.21	0.41		0.13	0.25	0.51		1.27	0.72	1.95	0.56
81	np-cyP					0.47	0.36	0.87		0.56	0.73	1.52		1.57	0.59	2.42	1.07
82	25-dm-heptane	0.18	0.36	0.73						0.87	0.67	1.63		4.69	1.41	6.01	2.69
83	33-dm-heptane									0.12	0.23	0.47		0.19	0.38	0.76	
84	114-tm-cyH									0.38	0.75	1.51		1.60	1.23	2.76	
85	e-benzene	3.48	4.37	10.04	1.15	3.03	1.99	5.08	1.17	10.77	10.89	26.75	3.37	102.18	35.21	136.74	53.01
86	ctt-124-tm-cyH & 35-dm-C7					0.37	0.27	0.63		0.81	0.37	1.34	0.53	1.07	0.72	1.52	
87	m&p-xylene & 23-dm-heptane	10.70	14.17	31.82	1.79	10.36	6.61	17.29	3.51	31.94	30.16	75.63	11.79	316.11	109.36	425.50	164.40
88	34-dm-C7 & 4m-C8																
89	2m-octane	0.64	0.32	0.97	0.24	0.82	0.54	1.55	0.39	2.69	2.54	6.45	1.08	5.62	1.70	6.84	3.20
90	3m-octane & ctc-124-tm-cyH	0.29	0.34	0.62		0.85	0.86	2.04		0.13	0.27	0.54		1.95	0.77	3.07	1.29
91	styrene	1.01	0.89	2.04		0.92	0.46	1.59	0.58	3.01	2.33	6.47	1.44	3.17	1.25	4.51	1.59
92	o-xylene	4.62	6.36	14.09	0.45	4.87	3.16	8.47	1.55	14.06	12.40	31.95	5.40	130.49	45.32	175.82	67.65
93	1-nonene & 112-tm-cyH																
94	t3-nonene	0.10	0.20	0.40		0.32	0.37	0.66		0.15	0.31	0.62		1.24	1.07	2.59	
95	c3-nonene & ib-cyP													0.51	0.60	1.13	
96	n-nonane	1.21	1.24	2.49		1.78	0.98	3.02	0.63	2.48	1.43	3.92	1.08	3.99	1.13	4.94	2.36
97	t2-nonene									0.31	0.62	1.24		0.19	0.37	0.75	
98	c2-nonene	0.09	0.17	0.34		0.44	0.36	0.83		1.09	0.52	1.81	0.55	1.08	0.30	1.45	0.76
99	ip-benzene	0.35	0.42	0.84		0.52	0.40	0.95		1.08	0.69	2.08	0.57	6.10	2.03	8.09	3.27
100	ip-cyH	0.40	0.36	0.83		0.45	0.31	0.68		0.85	0.35	1.36	0.55	1.17	0.34	1.43	0.68
101	nb-cyP	0.79	0.81	1.74		1.07	0.61	1.55	0.24	1.55	0.83	2.77	1.03	1.40	0.40	1.84	0.88
102	33 & 36- dm-octane	2.35	1.74	4.82	0.78	2.00	2.88	6.20		4.26	5.02	9.76		2.65	1.63	3.86	0.31
103	np-benzene	0.80	0.96	2.17		1.18	0.63	1.73	0.56	2.53	2.28	5.78	0.72	20.59	7.11	27.59	10.67
104	3e-toluene & 23-dm-octane	2.70	3.19	7.36	0.40	4.62	3.30	8.49	0.69	7.45	6.80	15.31		57.97	20.49	78.43	29.59
105	4e-toluene	2.77	1.12	4.10	1.58	5.47	5.66	13.93	2.03	9.69	4.93	14.54	3.85	29.54	11.78	43.63	14.82
106	135-tm-benzene & 2m-nonane	1.40	1.85	3.89		2.05	1.42	3.03		3.43	3.21	7.75		20.13	7.44	27.29	9.83
107	3e-octane					0.78	0.59	1.26		0.36	0.71	1.43					
108	3m-nonane	0.45	0.39	0.90		0.56	0.38	0.86		0.67	0.56	1.31		1.34	0.50	1.67	0.61
109	2e-toluene	0.82	0.96	2.22		1.23	0.62	1.88	0.65	2.68	1.87	5.37	1.05	19.23	6.77	25.68	9.71
110	1-decene & ib-cyH	0.59	0.17	0.74	0.36	4.26	6.49	13.99	0.67	3.16	3.88	8.65		0.52	0.68	1.44	
111	124-tm-benzene & tb-benzene	20.31	30.20	64.94	0.49	5.55	4.22	9.37	1.33	38.73	39.66	97.30	9.87	83.05	28.02	109.78	44.28
112	n-decane	1.55	1.31	2.99	0.34	3.15	1.66	5.01	1.00	4.82	3.46	8.03		2.10	0.50	2.42	1.35
113	ib-benzene					0.27	0.21	0.49		0.66	1.04	2.18		1.15	0.82	1.87	
114	sb-benzene									1.97	3.95	7.89		1.26	0.34	1.73	0.92
115	3-ip-toluene	2.66	1.16	4.40	1.95	7.51	4.49	12.61	1.87	8.41	8.42	21.01	3.71	4.95	2.27	7.71	2.30
116	4-ip-toluene & 123-tm-benzene	2.77	4.20	9.04	0.44	4.07	2.39	7.34	2.29	4.40	2.09	6.76	2.24	16.56	6.18	22.95	8.35
117	indan	0.16	0.33	0.66		0.75	0.09	0.88	0.68	1.23	1.53	3.46		0.27	0.32	0.61	
118	2-ip-toluene	1.16	1.24	2.82		5.59	5.53	12.83		3.13	2.66	6.29		8.83	5.63	14.02	1.55
119	3-np-toluene & 13de-benzene	0.16	0.32	0.65		0.90	0.14	1.10	0.81	0.84	0.48	1.39	0.23	2.48	1.24	3.57	0.74
120	4-np-tol/nb&13dm5e&14de-benz	0.78	1.12	2.37		1.41	0.80	2.17	0.45	3.10	2.49	6.56	0.67	11.70	3.54	15.13	7.37

		HSB				HSPT				HSH				HSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
121	12-de-benzene	0.19	0.27	0.58		0.93	0.55	1.73	0.54	1.31	2.21	4.60		0.34	0.67	1.35	
122	2-np-toluene	0.29	0.45	0.96		0.86	0.36	1.22	0.50	0.87	0.36	1.29	0.55	2.30	0.71	2.92	1.44
123	14-dm-2e-benzene	0.19	0.24	0.49		0.54	0.07	0.63	0.48	0.61	0.44	1.00		1.94	2.14	4.96	0.37
124	12-dm-4e-benzene	0.32	0.65	1.29		0.91	0.46	1.40	0.35	1.19	0.62	1.96	0.45	7.25	2.86	10.13	3.63
125	13-dm-2e-benzene	0.61	0.89	1.89		4.05	3.87	7.94	0.51	2.13	2.54	5.91	0.56	3.04	0.89	4.32	2.30
126	n-undecane	1.25	1.50	3.01		2.80	1.65	4.69	1.14	3.30	1.53	4.53	1.09	1.73	0.59	2.38	1.17
127	1245-ttm-benzene					0.22	0.44	0.88		0.70	0.19	0.98	0.55	1.30	0.55	1.83	0.57
128	2mb-benzene	0.26	0.38	0.80		0.66	0.42	1.11	0.10	0.60	0.35	0.98	0.27	3.25	1.39	4.49	1.76
129	tb-2m-benzene					0.21	0.42	0.85		0.17	0.34	0.69					
130	n-pentylbenzene	5.30	8.97	18.68		0.69	0.84	1.71		1.70	2.59	5.48		7.71	3.33	12.08	4.03
131	tb-35dm-benzene												0.38	0.75	1.50		
132	tb-4e-benzene																
133	naphthalene	0.61	0.59	1.41		2.11	1.00	3.16	0.82	2.64	0.56	3.39	2.04	8.23	4.30	12.85	4.38
134	n-dodecane	0.42	0.55	1.16		1.44	0.75	2.53	0.85	1.64	0.70	2.67	1.14	1.55	1.80		
135	135-te-benzene									0.34	0.67	1.34					
136	124-te-benzene																
137	n-hexylbenzene					0.08	0.16	0.32									
138	n-tridecane	0.17	0.35	0.69		0.66	0.49	1.07		0.27	0.53	1.07					
139	CFC-22																
140	CFC-12	4.86	4.13	9.67		7.96	8.61	20.87	3.37	8.36	2.86	10.84	5.22	34.94	15.29	52.34	15.31
141	chloromethane	1.88	0.22	2.17	1.68	1.67	0.19	1.88	1.49	1.79	0.21	2.02	1.61	1.84	0.22	2.03	1.53
142	CFC-114																
143	vinyl chloride																
144	bromomethane																
145	chloroethane																
146	CFC-11	0.85	1.03	2.06		5.07	2.79	8.12	1.91	3.17	2.43	5.61		1.80	0.86	3.09	1.29
147	bromoethane																
148	11-dichloroethene									2.10	4.20	8.40					
149	dichloromethane					3.40	2.31	4.95		5.28	10.55	21.10					
150	CFC-113	4.02	4.45	10.35		3.16	3.35	8.18	1.46	2.01	1.40	3.24		2.92	0.24	3.22	2.65
151	t-12-dichloroethene	0.71	1.42	2.84													
152	11-dichloroethane																
153	c-12-dichloroethene	0.57	1.13	2.26		2.56	1.96	5.19	0.44	3.62	1.35	4.62	1.64	0.91	0.84	1.69	
154	chloroform	0.95	0.80	1.84													
155	12-dichloroethane	0.20	0.40	0.79													
156	111-trichloroethane	2.56	2.21	5.26		5.38	3.24	9.59	1.77	8.71	5.25	15.83	4.69	1.79	1.16	3.50	1.05
157	carbon tetrachloride	1.08	0.21	1.37	0.87	1.01	0.05	1.08	0.95	1.12	0.06	1.19	1.04	1.04	0.06	1.10	0.98
158	12-dc-propane & dbm & bdcn	3.24	2.00	5.26	0.53	5.71	5.62	12.11		10.68	2.31	13.06	8.16	6.60	1.87	9.01	5.00
159	trichloroethene	0.23	0.27	0.46		1.44	2.09	4.57	0.18	0.88	1.22	2.68		0.36	0.47	0.98	
160	c-13-dichloropropene	0.19	0.38	0.77													
161	t-13-dichloropropene	0.76	1.06	2.24		0.65	0.44	1.00		2.02	1.80	4.03		1.37	2.75	5.49	
162	112-trichloroethane									0.73	0.96	2.02		4.25	2.99	6.76	

		HSB				HSPT				HSH				HSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
163	dibromochloromethane																
164	bromotrichloromethane																
165	12-dibromoethane																
166	tetrachloroethene	3.20	5.72	11.76		0.91	0.67	1.83	0.31	1.43	1.00	2.57	0.31	0.45	0.30	0.76	0.10
167	chlorobenzene																
168	bromoform																
169	1122-ttC-ethane & 14-dC-butane																
170	13dichlorobenz/benzl-ch	1.71	3.42	6.83		0.80	1.60	3.19		8.95	11.55	24.22					
171	14-dichlorobenzene																
172	12-dichlorobenzene																
173	124-trichlorobenzene																
174	hexachloro-13-butadiene																
175	Formaldehyde	1.13	0.38	1.67	0.77	19.76	8.10	27.93	9.16	25.98	17.87	51.54	11.34	8.13	3.83	12.77	3.42
176	Acetaldehyde	1.24	0.28	1.65	1.09	25.14	23.71	59.95	7.46	15.87	3.13	20.03	12.52	6.23	1.36	8.25	5.35
177	2-3 butandione																
178	Acrolein																
179	Acetone	4.30	2.45	7.87	2.31	28.70	11.24	40.49	19.03	31.66	11.61	42.71	17.93	7.87	5.55	12.58	
180	Propionaldehyde	0.05	0.10	0.21		2.87	5.74	11.48		2.32	1.14	3.92	1.31	3.12	4.53	9.84	
181	Methoxyacetone																
182	Crotonaldehyde																
183	Methyl Vinyl Ketone																
184	Methacrolein																
185	Methyl Ethyl Ketone																
186	Isobutyraldehyde	&	0.47	0.35	0.84												
187	Butyraldehyde																
188	Benzaldehyde																
189	Isovaleraldehyde																
190	Trimethylacetaldehyde & 3m2-Butanone					1.37	2.74	5.47		1.16	0.48	1.87	0.87				
191	Valeraldehyde					1.68	3.35	6.70		2.41	1.45	4.58	1.51				
192	Acetophenone																
193	o-Tolualdehyde																
194	m&p-Tolualdehyde																
195	Methyl isobutyl Ketone					1.91	3.82	7.65		0.66	0.46	1.03		1.10	1.28	2.46	
196	Pinacolone																
	Hexanaldehyde					7.18	6.08	14.18		10.06	6.89	20.34	6.01	2.37	2.31	5.00	

**Table 43. Statistical summary of Phase 2 hot soak data. Concentrations are in ng/L unless otherwise stated.**

		AMB (HS)				HSPT				HSH				HSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
	CO (ppmV)	0.64	0.43	1.83	0.21	0.46	0.20	0.80	0.15	0.66	0.45	1.90	0.24	0.69	0.45	1.53	0.27
	CO2 (ppmV)	400.46	17.25	431.00	381.14	747.26	108.81	897.48	560.72	834.16	156.86	1163.07	559.29	469.63	41.52	560.35	425.56
ID																	
1	methane	1374.05	89.12	1502.34	1261.34	1490.25	131.25	1700.23	1327.95	1548.75	122.22	1721.58	1367.62	1448.98	50.02	1521.59	1351.96
2	ethylene	0.68	1.58	5.00		3.55	1.68	7.37	1.53	4.56	2.87	12.65	2.38	3.37	3.67	12.85	
3	acetylene	0.90	1.36	3.83		2.25	0.83	4.09	1.27	2.56	1.81	7.76	1.38	2.03	2.31	8.09	
4	ethane	6.30	3.14	12.29		9.93	7.28	28.59	3.89	12.10	7.53	30.35	5.29	5.94	3.58	10.70	
5	propylene	1.37	0.63	2.20	0.54	1.40	0.72	2.66	0.66	1.92	1.41	5.28		3.17	2.62	8.61	0.97
6	propane	4.00	1.35	5.79	1.50	10.68	9.43	35.71	2.52	12.56	8.34	29.02	3.70	10.54	4.60	21.55	6.38
7	propyne	4.36	14.38	47.72		0.03	0.07	0.20		23.82	44.13	130.88		0.05	0.09	0.25	
8	isobutane	1.80	1.34	3.90		22.12	23.59	74.27		23.80	21.12	65.64		74.67	40.94	174.29	39.99
9	1-butene & isobutene	1.71	0.74	2.76	0.71	1.32	1.00	3.63		5.11	3.82	14.23		41.14	17.72	83.57	24.49
10	13-butadiene	0.25	0.22	0.55		0.33	0.29	0.78		0.43	0.44	1.16		1.18	0.89	3.20	
11	n-butane	7.09	3.99	15.42	2.38	11.99	12.72	48.80	4.00	46.31	46.30	167.82	7.39	334.81	316.70	1012.12	123.51
12	t2-butene & 22-dm-propane	0.39	0.18	0.68	0.13	0.47	0.33	1.28	0.14	3.77	3.08	11.47	0.60	34.53	20.81	83.31	18.35
13	1-butyne																
14	c2-butene	0.20	0.16	0.58		0.29	0.19	0.71	0.07	2.45	3.05	8.76		16.71	13.87	49.18	
15	3m1-butene	0.06	0.20	0.65		0.04	0.09	0.27		0.47	0.52	1.85		4.04	3.29	11.29	1.63
16	2m-butane	3.53	1.99	6.95	0.92	24.95	37.35	101.48	1.27	51.44	58.17	178.96	3.71	159.97	120.71	437.12	70.43
17	1-pentene	0.15	0.14	0.41		0.27	0.31	0.95		1.49	1.57	5.84		11.95	11.19	34.74	0.81
18	2m1-butene	0.18	0.13	0.33		0.44	0.43	1.21		2.41	2.70	9.90	0.24	21.45	20.33	64.30	3.74
19	n-pentane	2.09	0.95	3.58	0.79	4.82	4.86	18.26	1.47	17.25	16.86	58.20	3.22	127.56	109.14	362.52	52.92
20	2m13-butadiene																
21	t2-pentene	0.24	0.20	0.59		0.44	0.48	1.56		3.29	4.28	15.65		34.06	30.39	100.41	13.75
22	c2-pentene	0.08	0.12	0.33		0.33	0.48	1.61		1.72	1.98	7.35	0.17	19.06	16.81	57.35	6.96
23	2m2-butene	0.51	0.43	1.69	0.09	1.45	1.02	3.32	0.30	4.16	5.62	19.17	0.15	41.06	39.64	123.16	5.97
24	22-dm-butane	0.30	0.17	0.60		0.50	0.46	1.47		1.42	1.17	4.52	0.36	10.73	7.09	29.69	5.43
25	cyclopentene	0.19	0.23	0.54		0.20	0.16	0.43		1.06	1.43	5.21	0.13	9.32	10.33	30.17	3.07
26	4m1&3m1-pentene					0.57	1.23	4.22		0.53	0.40	1.34		3.09	2.39	8.27	1.28
27	cyclopentane	0.47	0.16	0.65	0.23	0.58	0.37	1.55	0.23	2.80	2.21	9.04	1.06	20.75	15.89	55.71	9.87
28	23-dm-butane	0.39	0.22	0.72		0.91	0.82	2.52	0.20	2.27	2.09	8.07	0.56	15.79	11.32	42.62	8.00
29	2m-pentane & t4m2-pentene	1.99	0.96	3.50	0.72	5.02	4.30	12.38	0.87	12.83	11.66	45.80	3.03	82.96	61.82	223.45	41.44
30	MTBE & c4m2-pentene	0.15	0.15	0.36		0.57	1.19	4.05		0.84	0.82	2.63		4.66	3.23	11.85	2.51
31	3m-pentane	1.26	0.78	2.66	0.38	3.19	2.55	8.32	0.68	8.07	5.41	21.95	2.51	49.91	35.65	133.30	25.14
32	1-hexene & 2m1-pentene	1.26	1.16	3.83		3.46	3.60	11.36		4.51	2.23	8.95	1.85	11.50	9.42	32.13	2.46
33	n-hexane	1.14	0.47	1.81	0.49	3.96	3.37	9.48	0.62	9.56	6.30	25.04	2.66	56.17	41.72	150.20	28.08
34	t2-hexene	0.08	0.14	0.38		0.26	0.28	0.78		1.04	0.99	3.77	0.14	9.60	7.53	26.23	4.55
35	2m2-pentene & 2e1-butene					2.08	2.47	7.74		3.12	2.54	8.82		9.63	9.66	35.21	2.76
36	c2-hexene					0.34	0.48	1.35		0.69	0.60	2.40	0.14	5.50	4.12	14.50	2.49
37	c/t-3m2-pentene	0.09	0.30	0.98		0.39	0.74	2.48		1.47	1.07	3.61	0.41	7.12	5.85	22.38	0.42
38	22-dm-pentane	0.03	0.08	0.21		0.95	2.61	8.81		1.12	2.43	8.41		1.66	1.12	3.96	0.69

		AMB (HS)				HSPT				HSH				HSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
39	m-cyclopentane	0.71	0.32	1.16	0.29	2.27	1.89	7.15	0.61	6.89	3.79	15.51	1.83	52.58	30.91	134.85	32.17
40	24-dm-pentane	0.15	0.14	0.30		0.77	0.42	1.38	0.23	1.36	0.74	2.99	0.35	7.17	5.06	18.62	3.77
41	223-dm-butane	0.15	0.19	0.57		0.97	0.86	3.06		1.39	0.84	3.07	0.31	1.40	1.24	4.91	0.56
42	1m-cyclopentene	0.04	0.13	0.44		0.17	0.36	1.12		0.14	0.30	0.95		2.54	6.45	21.47	
43	benzene	2.33	0.84	3.56	1.08	3.65	1.45	6.15	1.83	11.68	7.54	30.82	3.08	103.30	60.85	256.61	56.75
44	33-dm-pentane	0.05	0.11	0.31		0.12	0.25	0.78		0.15	0.27	0.70		2.90	2.09	7.23	
45	cyclohexane	0.85	0.72	2.75	0.16	1.00	1.14	3.58	0.24	1.92	1.09	3.62	0.60	11.50	6.63	28.83	6.52
46	2m-hexane	0.65	0.30	1.06	0.23	1.95	1.42	4.81	0.41	4.27	2.50	10.53	1.56	27.16	17.82	69.61	14.44
47	23-dm-pentane	0.30	0.14	0.45		0.78	0.49	1.79	0.20	1.50	0.84	3.54	0.55	8.16	5.37	20.58	4.09
48	11-dm-cyP	0.04	0.14	0.45		0.14	0.20	0.52		0.37	0.24	0.74		1.58	0.82	3.23	0.70
49	3m-hexane & cyclohexene	1.28	0.55	1.99	0.36	2.67	1.69	5.59	0.48	5.74	2.79	12.33	2.52	29.24	18.76	73.72	15.62
50	c-13-dm-cyP	0.13	0.17	0.52		0.58	0.50	1.69	0.10	1.40	0.62	2.43	0.55	6.19	3.60	14.96	3.31
51	t-13-dm-cyP & 3e-pentane	0.20	0.17	0.41		0.68	0.59	1.99	0.17	1.41	0.88	3.37		8.84	5.70	22.63	4.20
52	t-12-dm-cyP	0.04	0.13	0.42						0.11	0.36	1.21					
53	224-tm-pentane & 1-heptene	0.95	0.38	1.62	0.34	1.85	1.50	5.32	0.56	3.46	1.65	7.04	1.48	19.65	11.62	47.48	10.01
54	c3-heptene					0.18	0.17	0.46		0.53	0.31	1.30	0.19	3.28	2.11	7.80	1.44
55	n-heptane	0.56	0.23	0.84	0.15	2.33	1.68	5.07	0.34	4.58	2.44	10.35	2.00	25.59	16.00	64.34	14.49
56	t3-heptene					0.18	0.32	0.94		0.92	1.06	3.76		10.10	7.62	27.00	3.76
57	t2-heptene					0.25	0.32	0.88		0.51	0.51	1.37		3.44	2.28	8.42	1.54
58	c2-heptene	0.11	0.16	0.44		0.23	0.22	0.68		0.80	0.70	2.12		3.24	2.25	7.88	1.00
59	m-cyH & 22-dmC6	0.37	0.20	0.84	0.09	1.89	1.83	6.12	0.24	3.03	1.84	6.38	0.81	12.11	6.90	29.83	6.80
60	25-dm-C6 & e-cyP	0.06	0.11	0.24		0.40	0.18	0.72	0.07	0.64	0.31	1.28	0.29	3.17	1.68	7.24	1.69
61	24-dm-C6 & 223-tm-C5	0.14	0.17	0.40		0.76	0.55	1.84	0.04	1.47	0.97	3.86	0.77	8.08	4.59	19.64	4.44
62	ctc-124-tm-cyP																
63	ctc-123-tm-cyP	0.05	0.16	0.54		0.25	0.30	0.90		0.49	0.46	1.43		1.66	0.95	3.60	0.75
64	234-tm-pentane	0.34	0.16	0.59		0.95	0.72	2.68	0.30	1.35	0.72	3.14	0.62	7.45	5.24	18.91	2.90
65	toluene	5.00	2.08	8.10	2.05	17.62	8.40	29.49	6.20	39.47	16.31	80.63	21.03	321.87	162.70	762.11	189.64
66	2m-heptane	0.22	0.13	0.45		0.98	0.73	2.78	0.25	1.92	1.34	4.34	0.51	9.59	5.29	23.24	5.80
67	4m-heptane & 1m-cyhexene	0.14	0.25	0.74		0.58	0.60	2.22		0.94	0.50	2.04	0.45	5.93	3.38	14.09	3.17
68	3m-C7 & 3e-C6	0.38	0.45	1.64	0.11	1.19	0.73	2.91	0.49	2.47	1.24	4.57	0.84	12.83	7.03	30.96	7.20
69	cct-124-tm-cyP & c-13-dm-cyH					0.49	0.84	1.97		1.82	2.66	7.44		2.61	1.78	6.66	
70	t-14-dm-cyH	0.39	0.30	0.93		4.42	3.53	13.66	0.14	4.06	3.26	11.33		2.78	2.06	6.70	0.76
71	225-tm-C6					0.32	0.30	1.04		0.48	0.63	2.05		1.68	0.96	3.70	0.37
72	1-octene	0.23	0.27	0.84		0.80	0.90	3.24		0.96	0.72	2.31		2.50	2.17	7.24	0.68
73	1e-1m-cyP	0.12	0.30	0.97		0.69	1.29	4.30		0.75	1.31	4.56		1.83	1.53	5.38	0.29
74	n-octane & t-12-dm-cyH	0.76	0.57	1.97	0.25	3.12	2.74	9.93	0.61	5.41	5.51	19.83	1.47	10.32	5.58	24.64	5.75
75	t2-octene	0.24	0.57	1.74		2.64	4.41	12.31	0.26	0.86	0.65	2.21		2.07	1.37	4.14	0.52
76	ccc-123-tm-cyP					0.43	1.44	4.76									
77	?t-13-dm-cyH & c-14-dm-cyH	0.08	0.27	0.88		0.53	0.42	1.20		1.05	0.75	2.55		2.74	1.55	5.66	0.79
78	c2-octene					1.21	2.51	7.54		0.71	1.12	3.27		1.43	1.82	6.63	
79	ip-cyP	0.10	0.34	1.13		0.32	0.73	2.44		0.36	0.49	1.51		0.66	0.59	1.69	
80	c-12-dm-cyH					0.32	0.23	0.83		0.39	0.38	1.23		1.16	0.30	1.90	0.93
81	np-cyP	0.06	0.20	0.66		0.22	0.17	0.49		0.38	0.40	1.21		1.19	0.71	2.27	0.44

		AMB (HS)				HSPT				HSH				HSG			
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
82	25-dm-heptane	0.09	0.31	1.02		0.62	0.53	1.56		1.06	0.80	2.58		3.61	1.99	8.60	1.93
83	33-dm-heptane					0.33	0.36	1.18		0.49	0.35	1.01		0.66	0.41	1.49	
84	114-tm-cyH					0.25	0.30	0.96		0.23	0.31	0.85		1.44	1.28	4.10	0.32
85	e-benzene	0.84	0.33	1.26	0.34	4.62	3.28	11.04	1.31	8.53	4.93	20.77	2.51	70.99	45.32	181.04	31.50
86	ctt-124-tm-cyH & 35-dm-C7					0.53	0.27	0.81		0.58	0.50	1.43		0.99	0.52	2.32	0.53
87	m&p-xylene & 23-dm-heptane	2.71	1.16	4.44	1.16	15.70	11.84	40.27	4.62	27.84	15.45	60.85	7.87	224.42	145.34	579.50	99.65
88	34-dm-C7 & 4m-C8																
89	2m-octane	0.66	0.48	1.75	0.17	1.11	0.79	2.60	0.30	1.52	0.85	2.86	0.21	4.42	2.29	10.28	2.48
90	3m-octane & ctc-124-tm-cyH	0.23	0.29	0.74						0.06	0.15	0.50					
91	styrene	0.19	0.22	0.52		1.36	0.63	2.26	0.42	1.23	0.67	2.27	0.43	2.85	2.99	8.80	0.39
92	o-xylene	1.33	0.49	2.07	0.54	6.65	4.57	15.01	1.84	11.04	6.13	25.14	2.97	93.30	60.89	242.79	40.58
93	1-nonene & 112-tm-cyH	0.03	0.11	0.36		0.31	0.71	2.11		0.16	0.52	1.73					
94	t3-nonene					0.44	0.47	1.38		0.50	0.49	1.29		1.04	0.82	2.76	
95	c3-nonene & ib-cyP					0.03	0.10	0.34		0.07	0.18	0.54		0.62	0.63	1.73	
96	n-nonane	0.37	0.21	0.94	0.16	4.08	4.97	16.83	0.39	4.20	4.39	13.50	0.56	3.27	1.54	7.16	2.25
97	t2-nonene					0.21	0.33	0.96		0.23	0.38	1.16		0.42	0.42	1.17	
98	c2-nonene					0.88	0.73	2.11		1.08	0.89	2.70		1.00	0.57	2.16	0.56
99	ip-benzene					1.06	0.92	3.24	0.20	0.90	0.72	2.43	0.24	4.71	2.81	11.83	2.23
100	ip-cyH					1.24	1.38	4.75	0.13	1.05	0.87	2.75	0.15	1.11	0.61	2.51	0.61
101	nb-cyP	0.08	0.14	0.41		3.67	4.22	13.67	0.20	2.58	2.64	7.95	0.30	1.45	0.65	2.84	0.91
102	33 & 36- dm-octane	0.40	0.53	1.77		4.39	5.02	15.12	0.46	4.77	3.76	11.35	0.10	2.70	3.23	11.32	0.38
103	np-benzene	0.23	0.34	1.07		2.70	2.35	8.29	0.43	4.82	5.20	16.95	0.80	15.93	9.50	40.00	6.84
104	3e-toluene & 23-dm-octane	0.80	0.47	1.58	0.31	9.91	8.14	26.53	1.24	11.52	7.88	23.73	2.55	46.22	28.78	115.63	18.83
105	4e-toluene	0.30	0.19	0.58		1.96	1.55	4.96		3.15	2.69	8.69		21.22	12.96	52.73	8.57
106	135-tm-benzene & 2m-nonane	0.21	0.19	0.49		4.87	5.45	18.63	0.72	4.42	4.32	13.20		16.95	10.68	42.49	6.80
107	3e-octane					2.59	3.45	11.59		2.06	2.09	6.02		0.73	1.46	4.62	
108	3m-nonane					1.83	2.23	7.24		1.87	1.88	5.62	0.26	1.20	0.64	2.64	0.43
109	2e-toluene	0.24	0.19	0.56		2.36	2.01	6.66	0.51	2.83	1.76	6.01	0.79	16.05	10.08	40.74	6.57
110	1-decene & ib-cyH	0.43	0.48	1.20		3.72	3.10	8.59		4.46	5.20	18.53	0.36	4.77	13.10	44.19	
111	124-tm-benzene & tb-benzene	6.25	15.48	52.77		13.41	12.57	38.01	1.69	21.94	11.94	40.39	5.90	73.40	48.72	193.11	26.08
112	n-decane	0.32	0.17	0.61		10.86	17.24	56.43	0.49	12.50	15.71	45.94	0.43	2.80	1.55	6.55	1.32
113	ib-benzene	0.05	0.15	0.50		1.62	2.34	8.18		1.38	1.81	6.27		1.02	0.72	2.71	
114	sb-benzene	0.03	0.12	0.38		2.31	3.72	10.43		2.64	3.15	7.78		0.95	0.68	2.19	
115	3-ip-toluene	0.28	0.53	1.79		4.43	3.46	11.69		5.03	3.52	12.24	1.30	5.07	6.86	25.12	1.20
116	4-ip-toluene & 123-tm-benzene	0.49	0.42	1.13		14.22	17.52	59.78	1.52	27.01	50.63	175.60	1.93	14.67	9.74	36.63	0.53
117	indan	0.07	0.22	0.74		3.85	3.86	11.89		2.73	2.91	8.14		0.62	0.86	3.03	
118	2-ip-toluene	0.03	0.09	0.29		4.86	4.61	15.54	0.15	5.30	6.39	23.25	0.78	9.61	7.26	26.09	0.74
119	3-np-toluene & 13de-benzene	0.04	0.13	0.43		2.70	2.96	7.79	0.41	3.44	3.47	9.35	0.35	2.83	2.22	8.08	
120	4-np-tol/nb&13dm5e&14de-benz	0.22	0.33	0.94		3.82	4.28	14.46	0.20	3.43	3.39	12.01	0.24	6.83	5.65	17.91	1.08
121	12-de-benzene	0.19	0.37	1.12		3.23	3.61	11.38	0.24	3.03	2.59	7.00		5.35	8.30	26.98	
122	2-np-toluene	0.22	0.60	2.02		3.88	4.28	15.30	0.42	4.07	4.08	13.34	0.50	2.39	1.54	5.03	
123	14-dm-2e-benzene	0.15	0.28	0.82		1.71	1.65	5.94		1.92	1.40	5.19	0.53	3.11	1.75	6.29	1.10
124	12-dm-4e-benzene	0.04	0.14	0.46		2.98	3.23	11.48	0.33	3.44	3.71	13.27	0.41	3.96	3.70	13.18	0.29

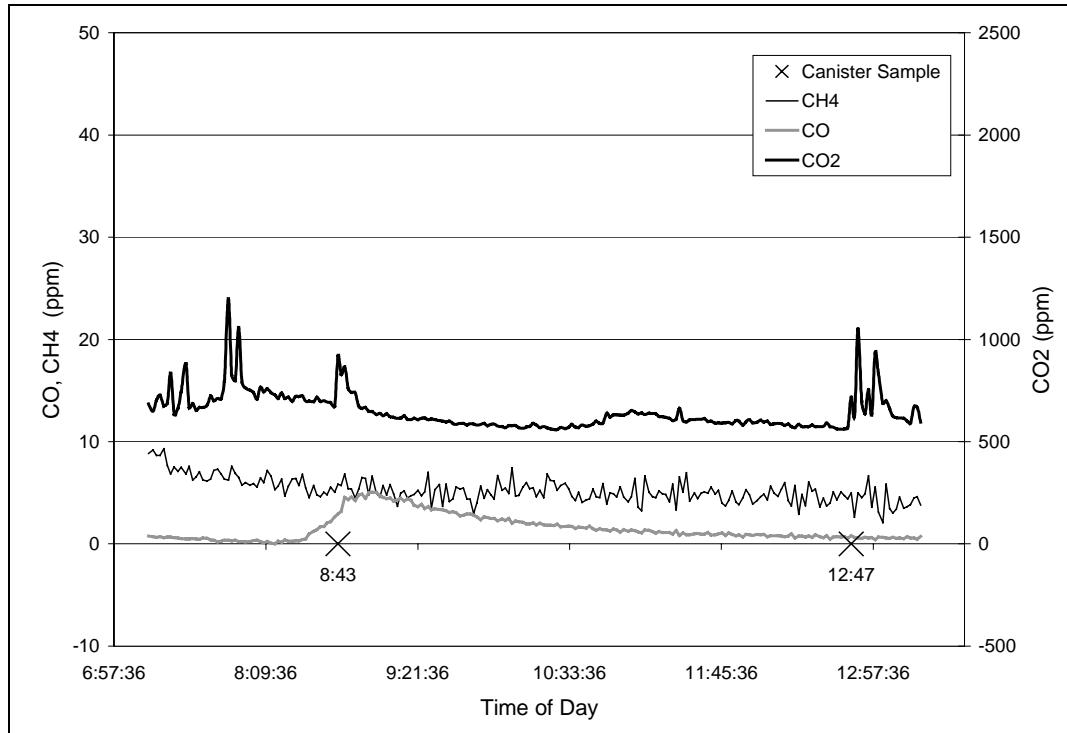


		AMB (HS)				HSPT				HSH				HSG				
		Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	
167	chlorobenzene	0.11	0.24	0.67		0.41	0.79	2.62		0.20	0.66	2.18						
168	bromoform																	
169	1122-ttC-ethane & 14-dC-butane																	
170	13dichlorobenz/benzl-ch																	
171	14-dichlorobenzene																	
172	12-dichlorobenzene																	
173	124-trichlorobenzene																	
174	hexachloro-13-butadiene																	
175	Formaldehyde	0.95	0.55	1.93	0.16	24.41	11.18	44.62	9.35	25.30	10.84	44.29	7.53	5.27	3.87	14.81	2.08	
176	Acetaldehyde	1.16	0.55	2.08	0.36	11.99	4.48	19.03	4.50	14.47	5.83	22.57	5.31	5.00	2.35	9.80	2.20	
177	2-3 butandione									0.15	0.34	0.92						
178	Acrolein	0.08	0.08	0.23						0.80	0.30	1.39	0.34					
179	Acetone	1.92	0.56	2.75	0.79	41.09	17.81	72.48	16.43	37.51	20.48	76.26	11.98	9.33	4.19	20.50	5.40	
180	Propionaldehyde	0.16	0.11	0.33						1.66	0.94	3.03		0.78	0.81	2.06		
181	Methoxyacetone																	
182	Crotonaldehyde	0.01	0.03	0.08						0.04	0.14	0.46						
183	Methyl Vinyl Ketone																	
184	Methacrolein	0.01	0.03	0.09						0.31	0.48	1.39						
185	Methyl Ethyl Ketone	0.44	0.26	0.71		1.69	3.77	10.01		3.77	4.17	12.02		1.35	1.33	4.16		
186	Isobutyraldehyde	&	0.04	0.06	0.15		1.07	3.54	11.75		1.88	3.47	12.06		0.35	0.60	1.36	
	Butyraldehyde																	
187	Benzaldehyde	0.07	0.16	0.51						1.37	0.64	2.16		0.13	0.43	1.44		
188	Isovaleraldehyde									0.15	0.32	0.85						
189	Trimethylacetaldehyde	& 3m2-	0.15	0.11	0.28					1.79	1.36	5.57	0.66	0.63	1.79	5.97		
	Butanone																	
190	Valeraldehyde	0.01	0.03	0.12						1.83	1.06	4.52	0.55					
191	Acetophenone																	
192	o-Tolualdehyde																	
193	m&p-Tolualdehyde	0.02	0.06	0.16						0.34	0.58	1.33		0.49	1.09	2.69		
194	Methyl isobutyl Ketone	0.10	0.12	0.25														
195	Pinacolone																	
196	Hexanaldehyde	0.07	0.08	0.16		3.24	6.52	20.64		6.59	5.48	21.62	1.68	0.64	1.19	3.41		

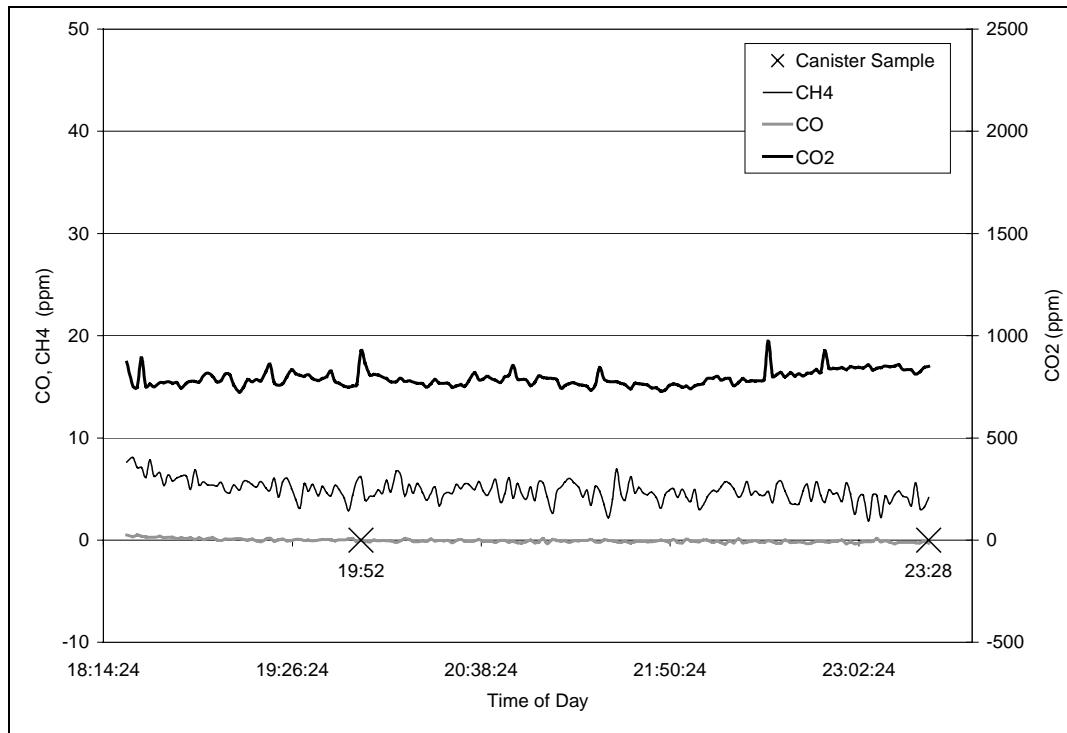
## Appendix 5

Concentration data collected using Innova monitor.

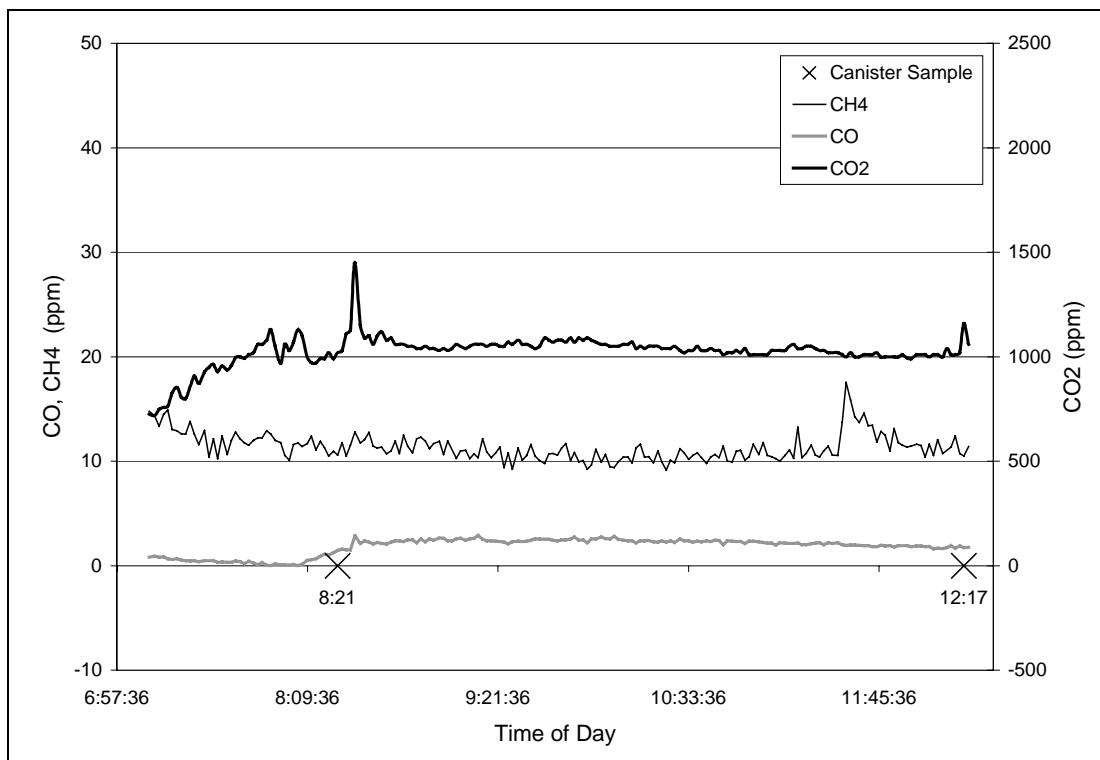
**Figure 30. Real-time concentrations for JE cold start test.**



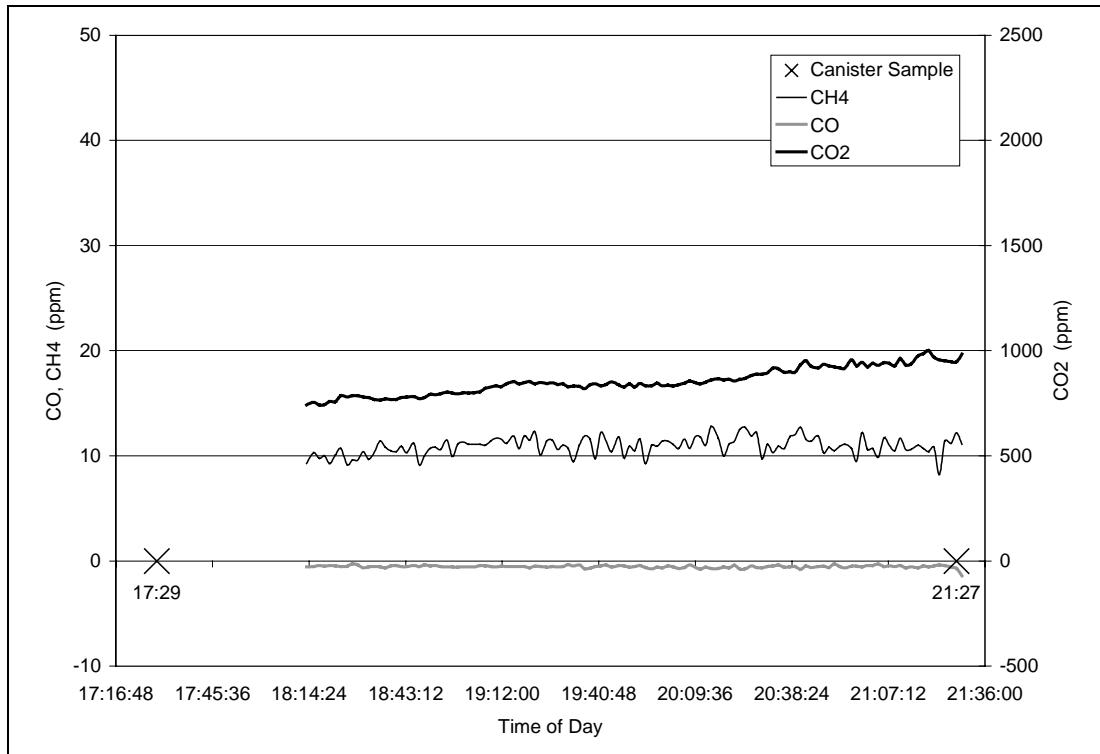
**Figure 31. Real-time concentrations for JE hot soak test.**



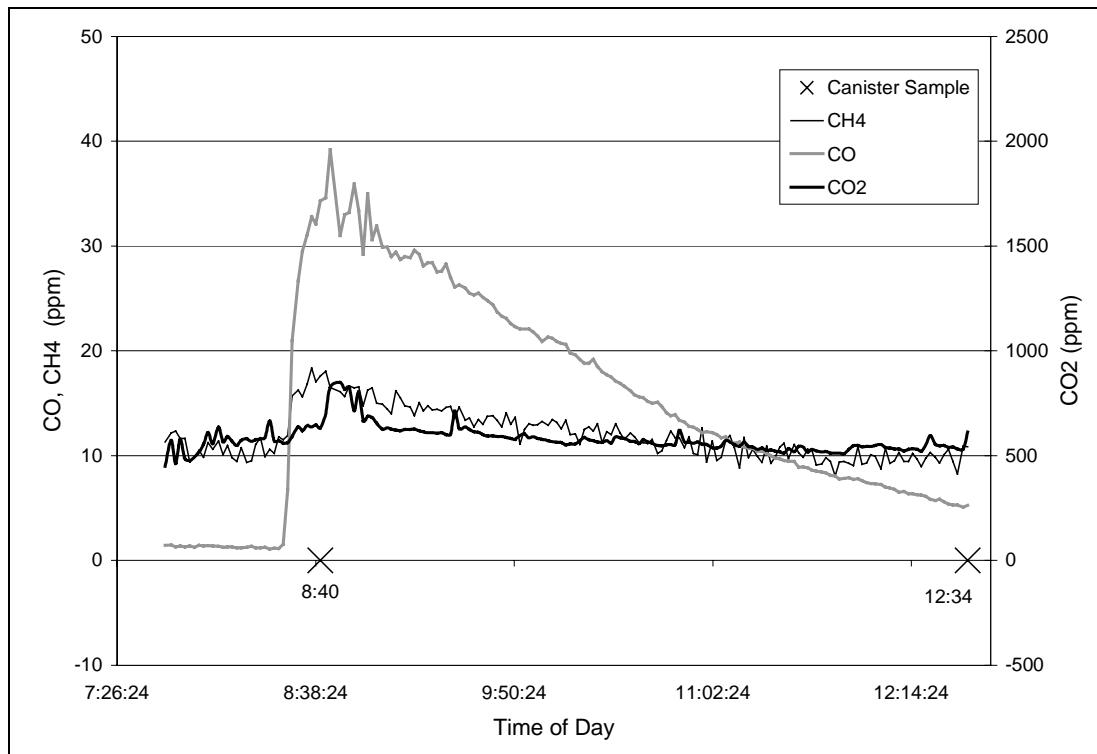
**Figure 32. Real-time concentrations for SV cold start test.**



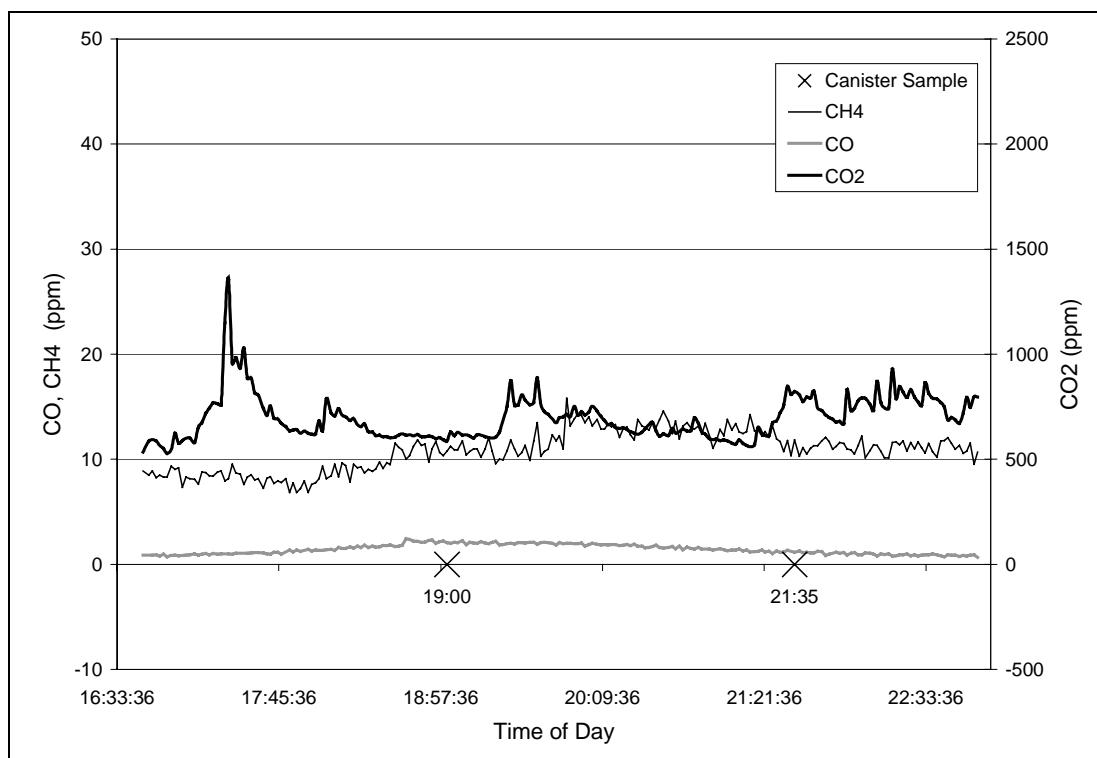
**Figure 33. Real-time concentrations for SV hot soak test.**



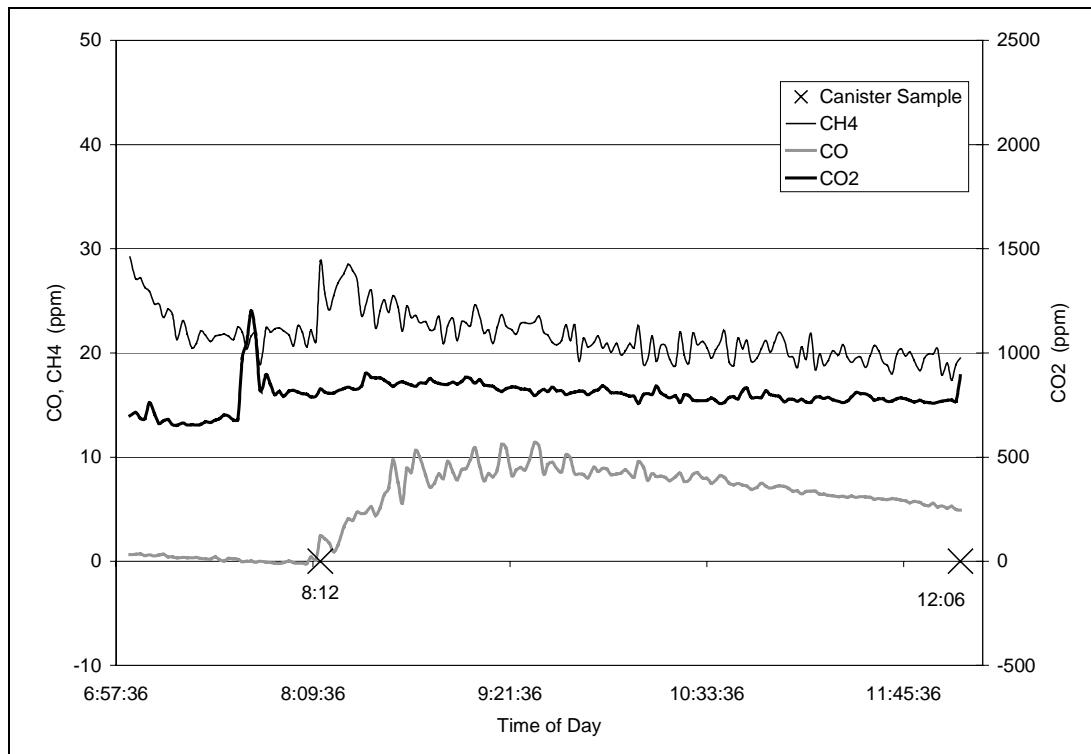
**Figure 34. Real-time concentrations for MH cold start test.**



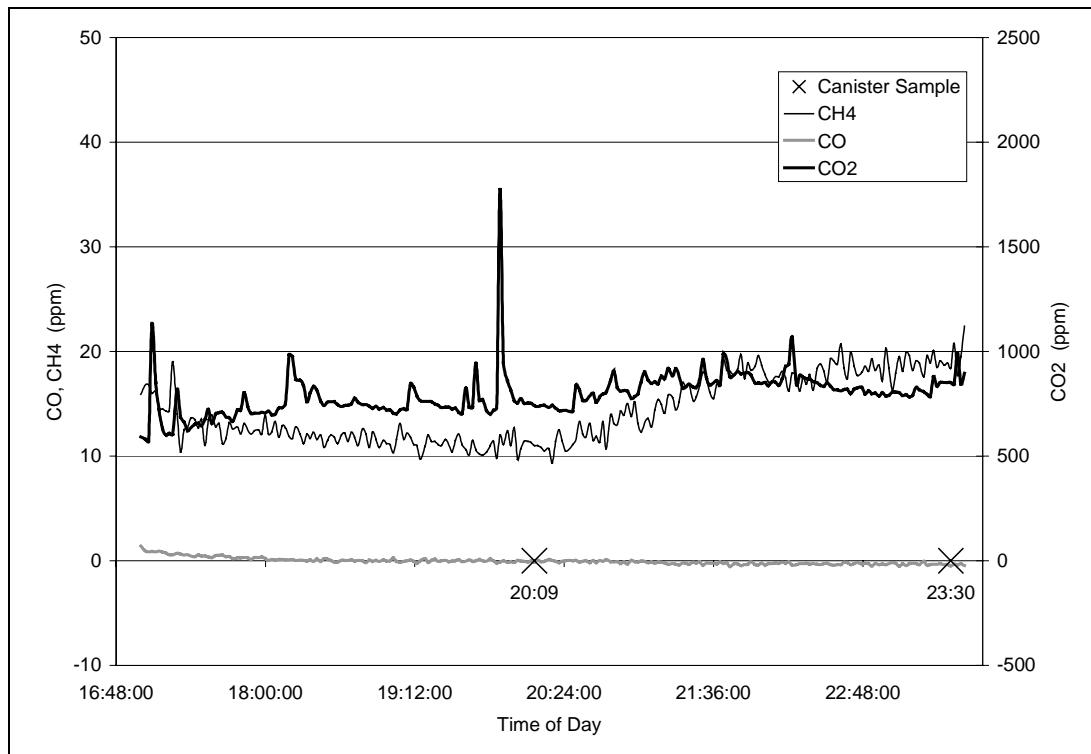
**Figure 35. Real-time concentrations for MH hot soak test.**



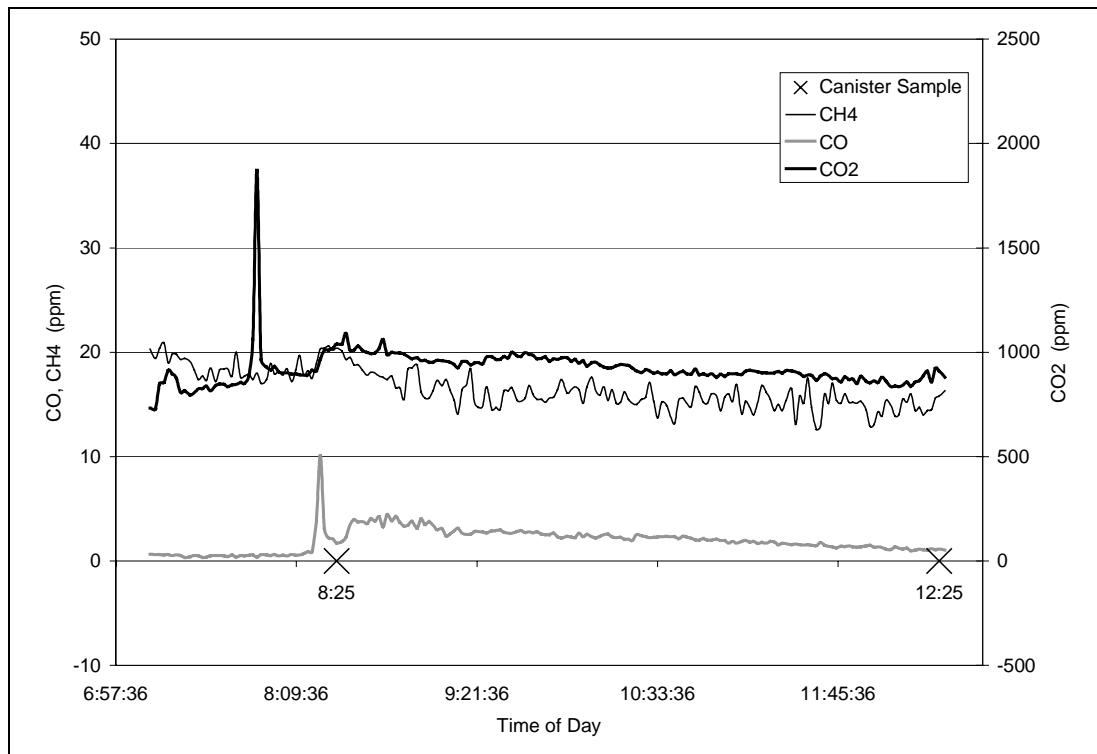
**Figure 36. Real-time concentrations for SR cold start test.**



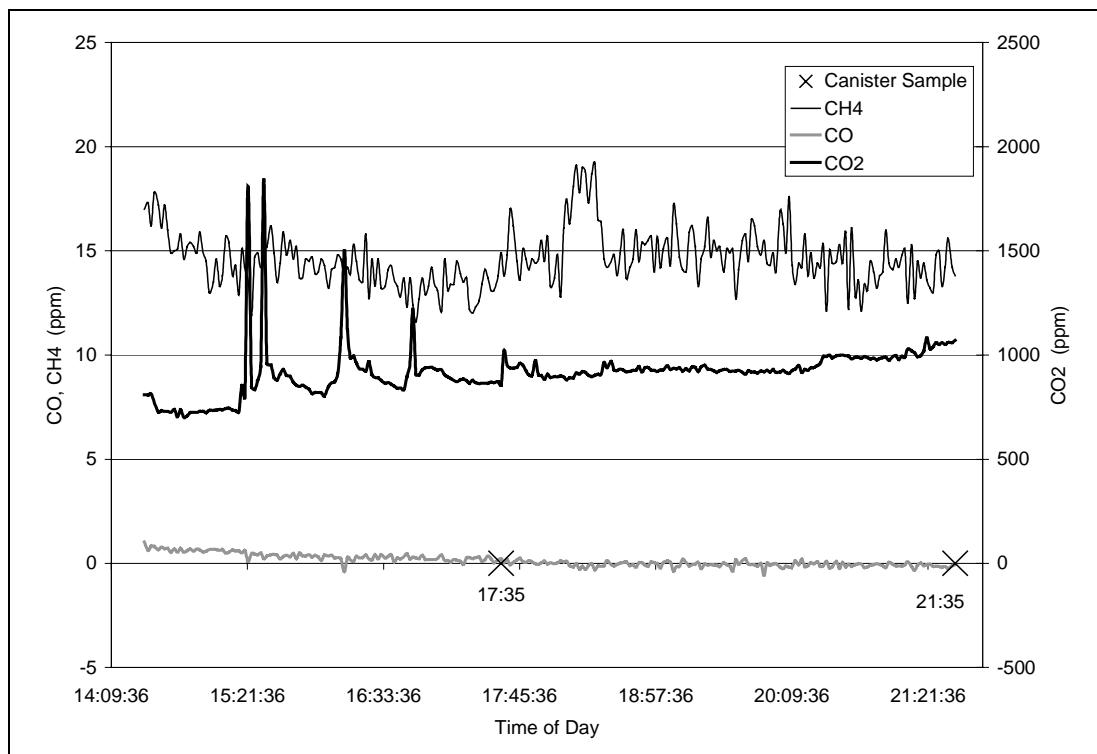
**Figure 37. Real-time concentrations for SR hot soak test.**



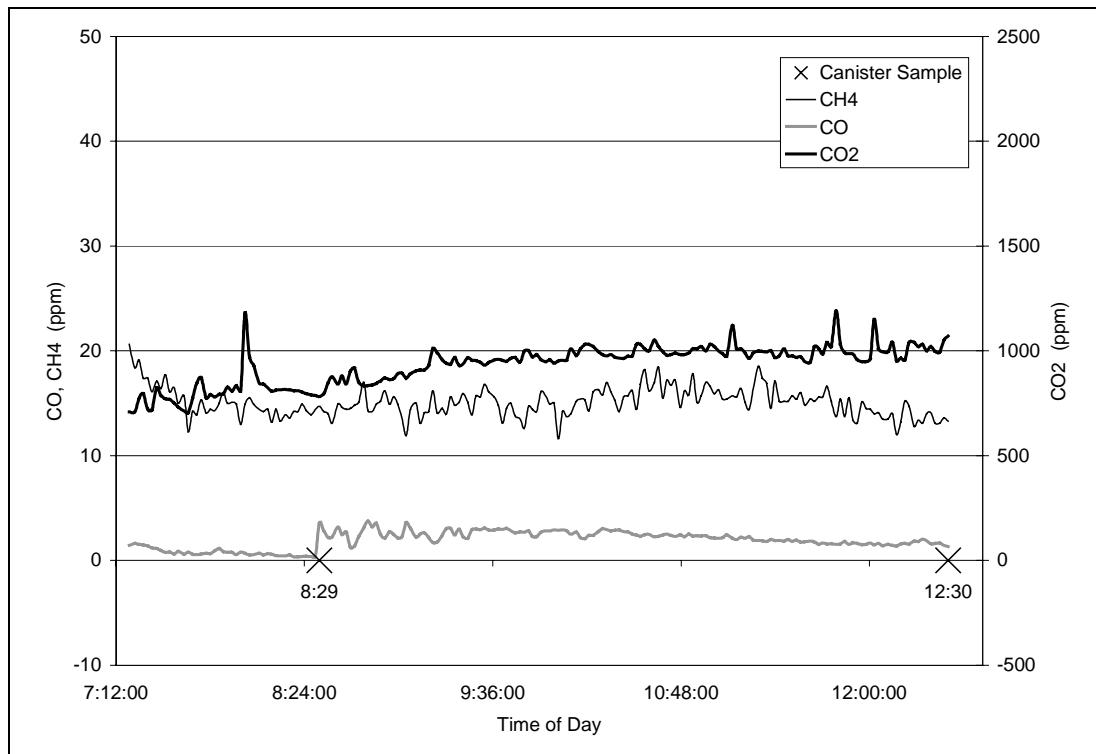
**Figure 38. Real-time concentrations for JS cold start test.**



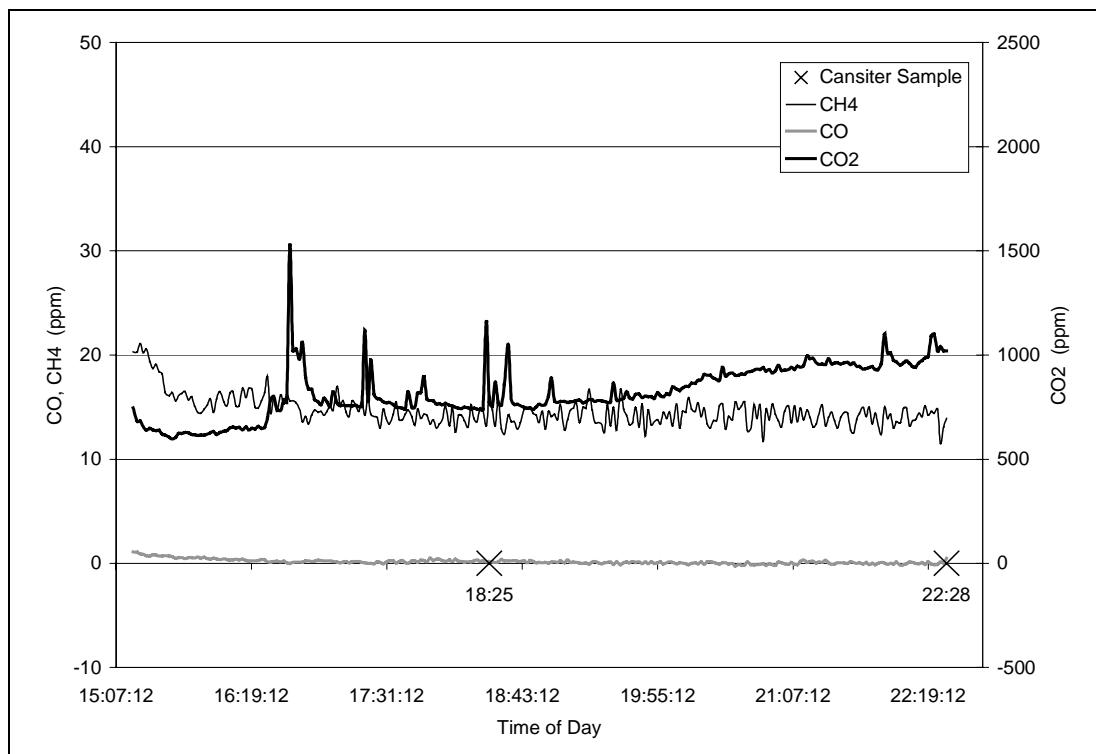
**Figure 39. Real-time concentrations for JS hot soak test.**



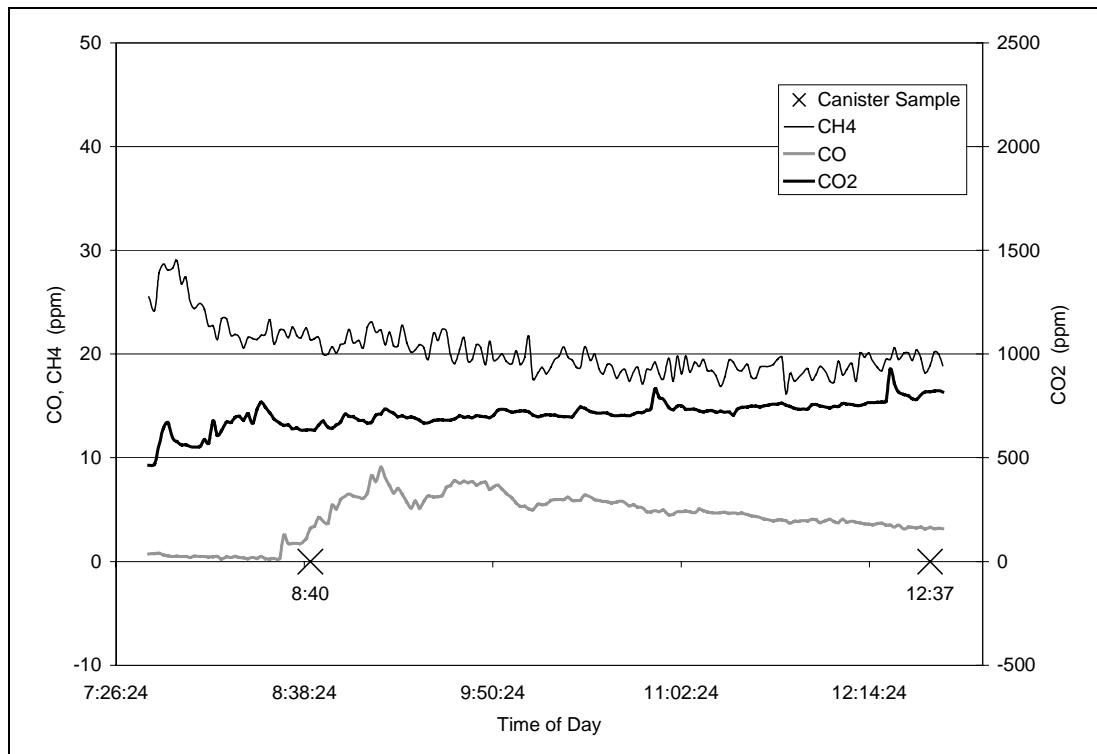
**Figure 40. Real-time concentrations for PB cold start test.**



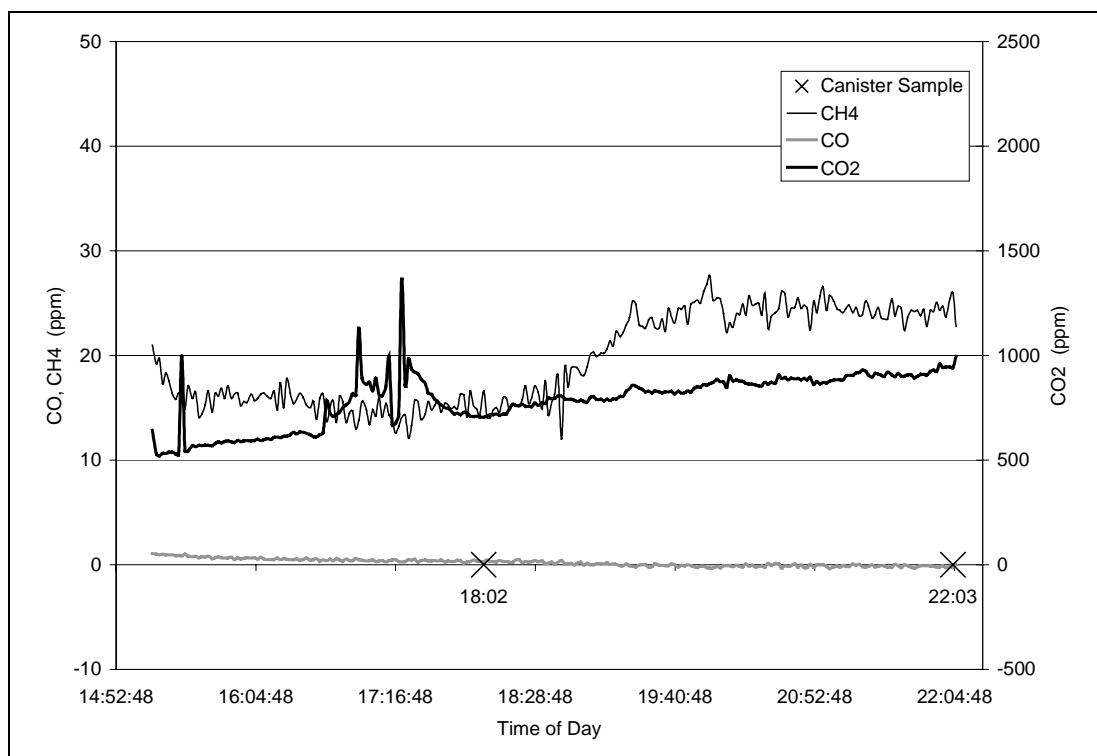
**Figure 41. Real-time concentrations for PB hot soak test.**



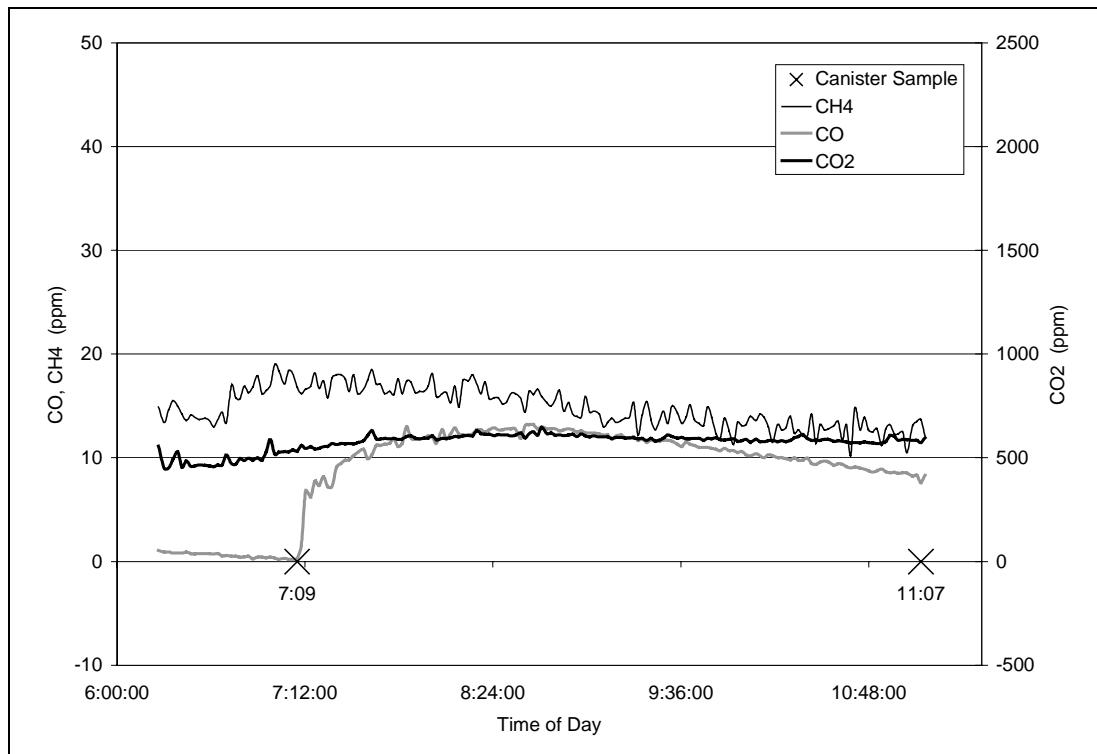
**Figure 42. Real-time concentrations for GS cold start test.**



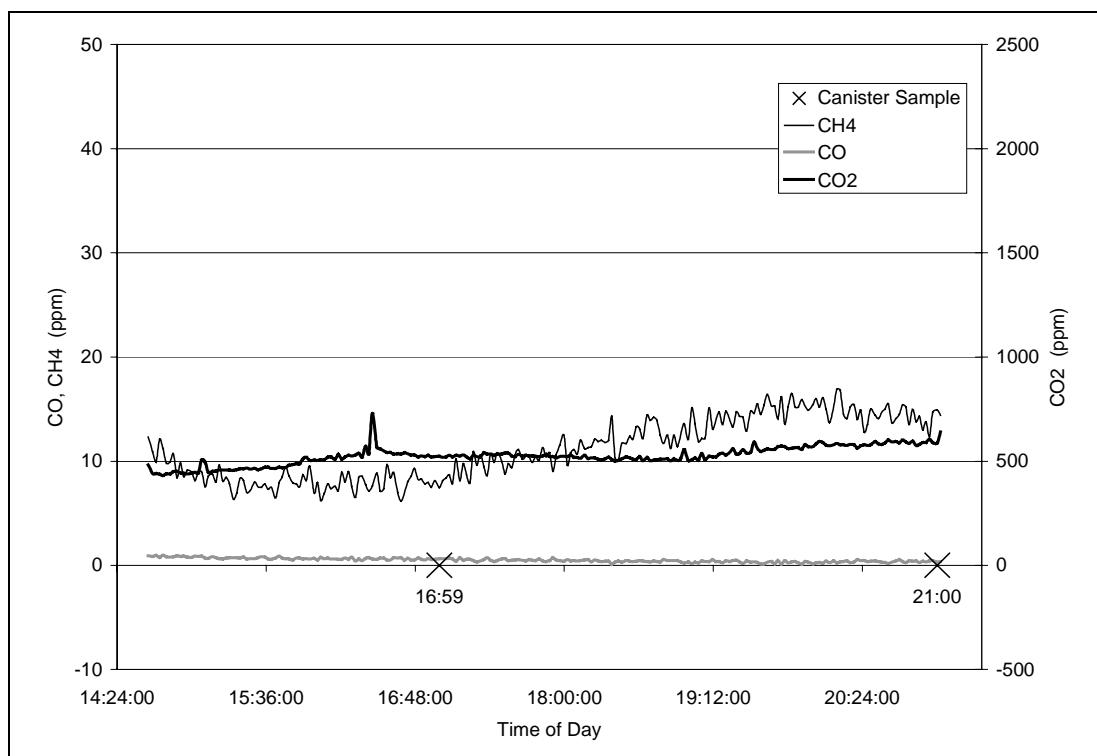
**Figure 43. Real-time concentrations for GS hot soak test.**



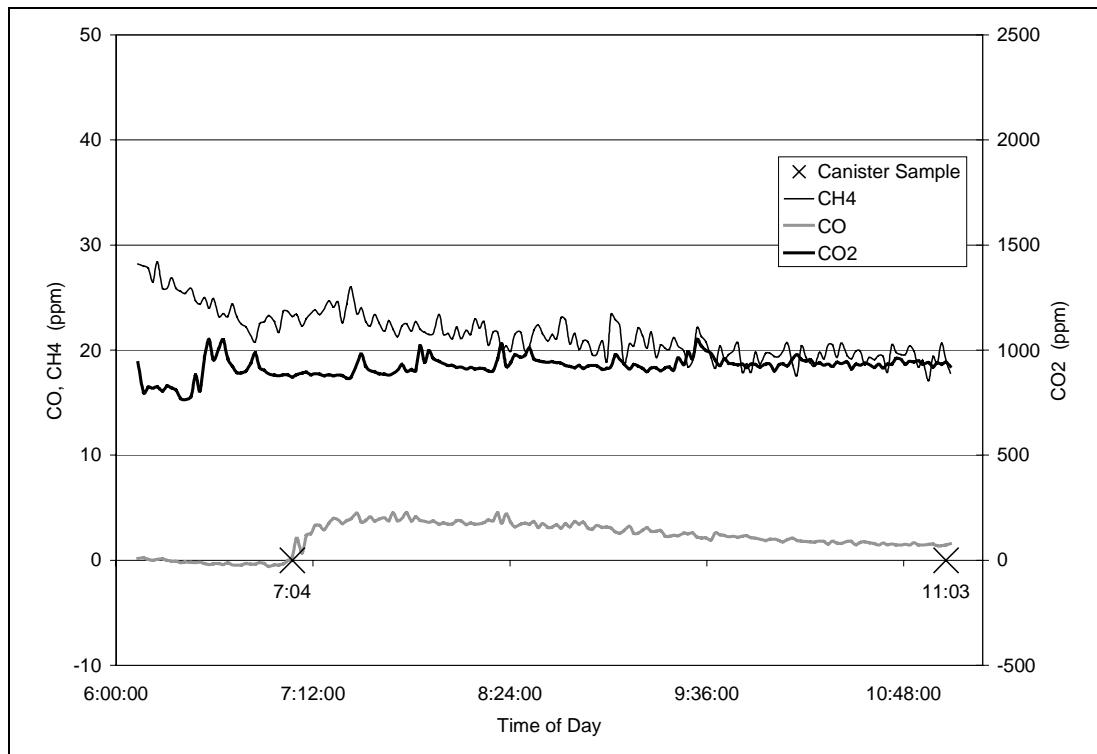
**Figure 44.** Real-time concentrations for RW cold start test.



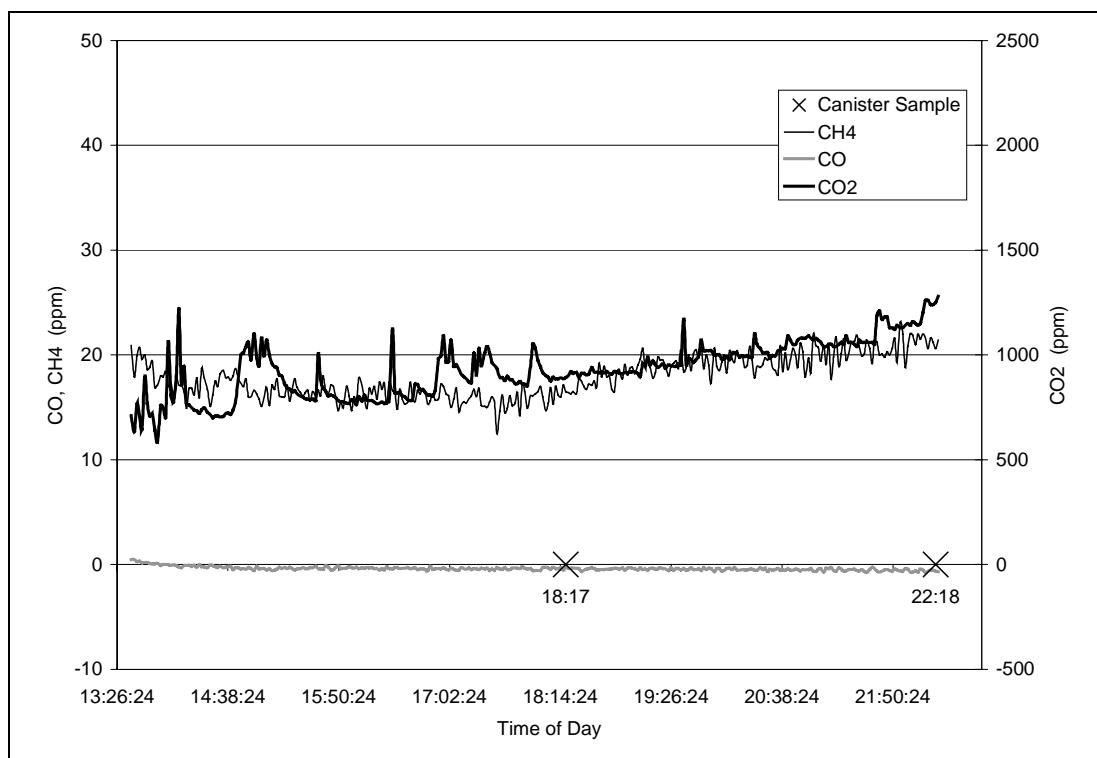
**Figure 45.** Real-time concentrations for RW hot soak test.



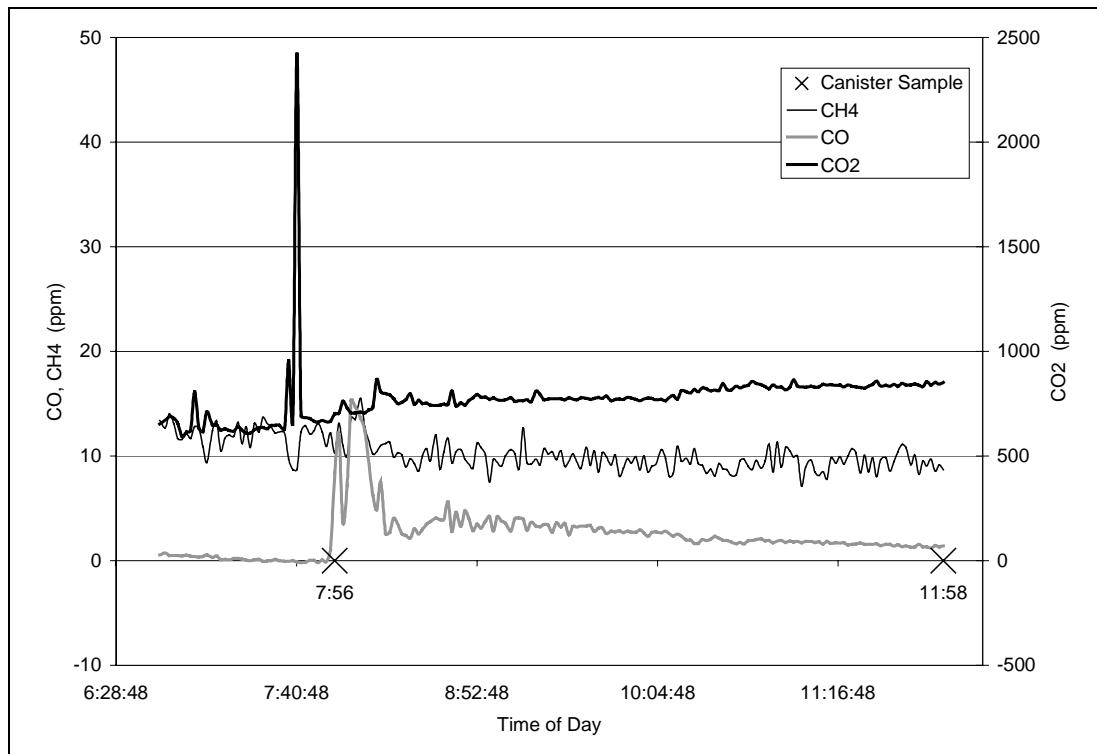
**Figure 46. Real-time concentrations for KR cold start test.**



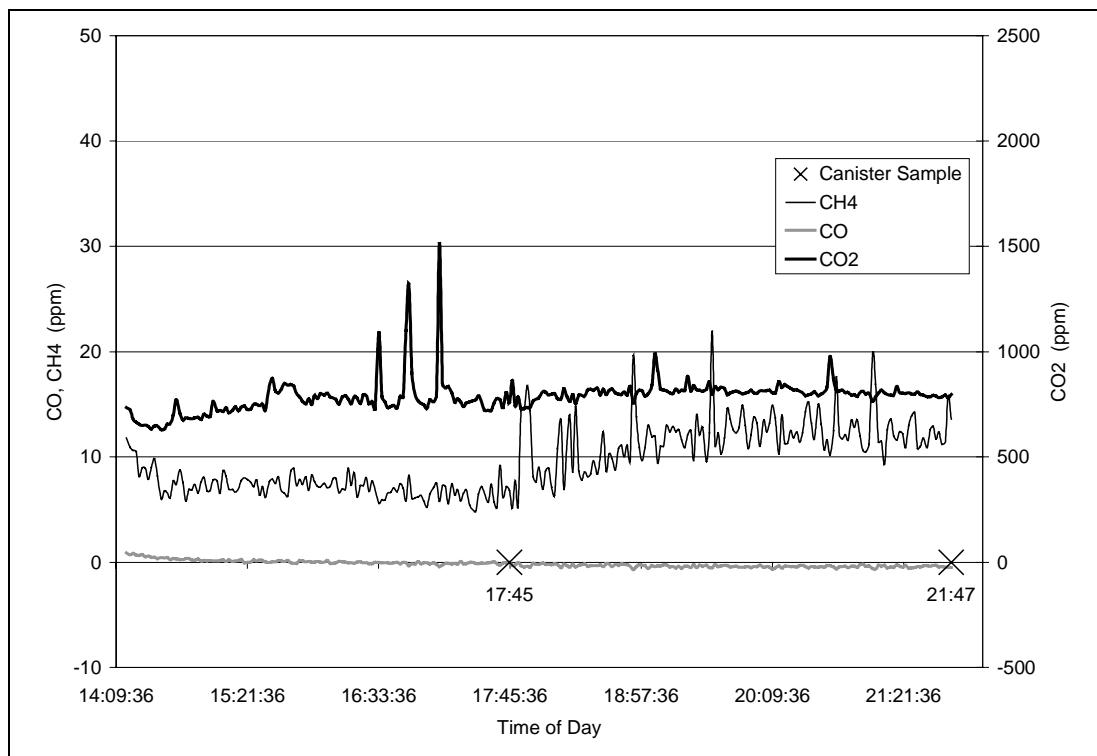
**Figure 47. Real-time concentrations for KR hot soak test.**



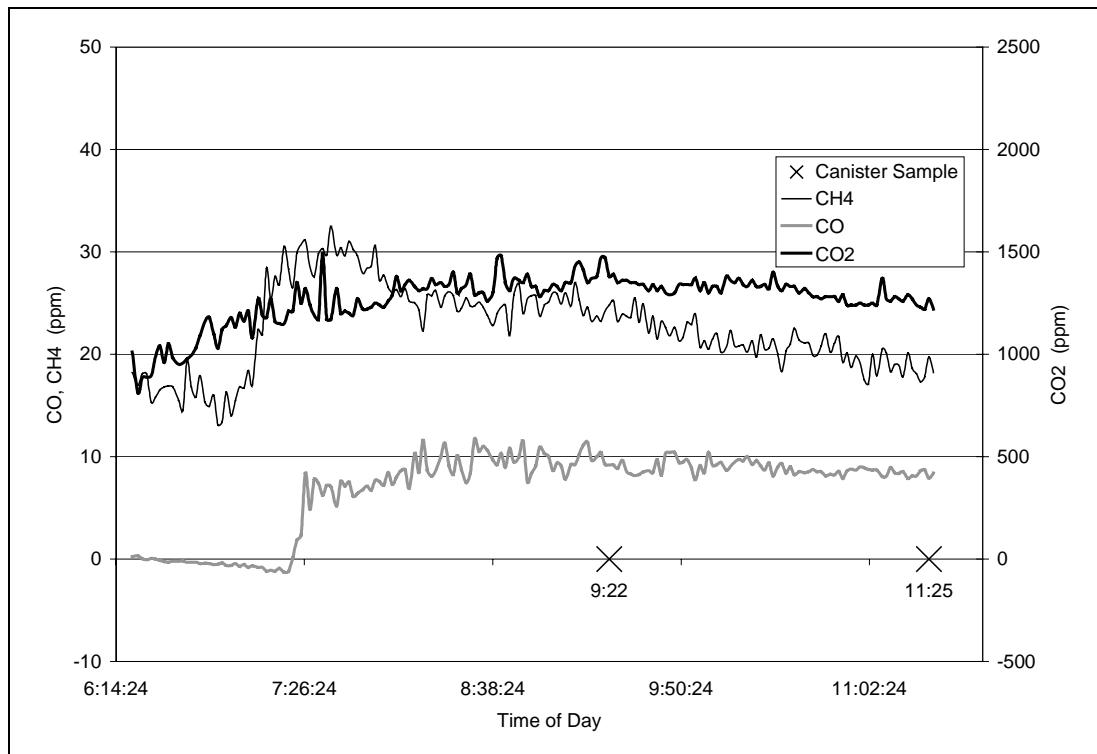
**Figure 48. Real-time concentrations for FA cold start test.**



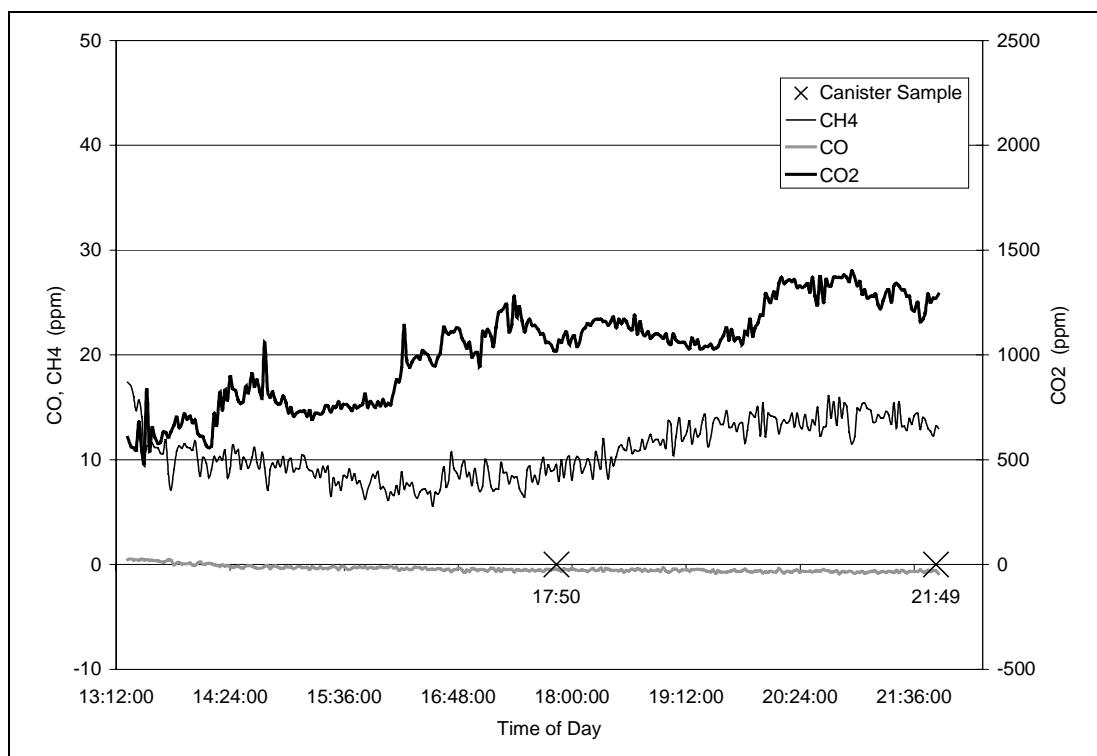
**Figure 49. Real-time concentrations for FA hot soak test.**



**Figure 50. Real-time concentrations for HD cold start test.**



**Figure 51. Real-time concentrations for HD hot soak test.**



## **Appendix 6**

Product information on the real-time analysers used in Phase 2 of this study.

The product information included for the Innova analyser is for their new model, Model 1312. The model used in this study, Model 1302, operates on the same principle. The major difference between the two models is the enhanced computer interface of the newer model.