Informal document **VIAQ-06-09**

Korea comments on working items

The 6th VIAQ meeting

Paris, October 26th

KATRI, The Republic of KOREA

(Korea Automobile Testing & Research Institute)

● Working Items

Working Item List **VIAQ-06-05**

1. Ambient mode (test temperature)

Ambient Mode (Soak Temperature)

◆ Ambient Mode (Test Temperature)

✓ Background

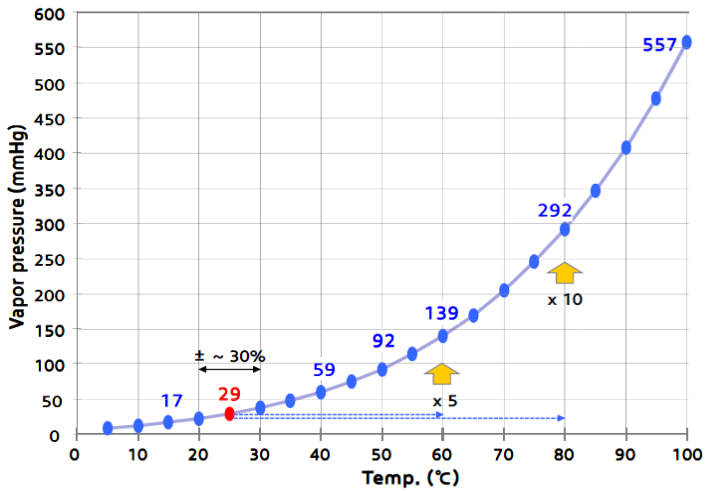
Å Interior air emissions from materials can vary depending on the temperature. Emission rates increase gradually as temperature rises. The soak temperature is an important factor because it directly affects the test results.

✓ Current Status

Å Ambient temperature is still being discussed (VIAQ-05-13).

● **Vapor pressure curve of Toluene : 20 → 25 ℃, Vp increases ~ 30 %**

Temp (℃)	Vp (mmHg)	Rel. Emission
5	9	
10	12	
15	17	
20	22	76
25	29	100
30	37	127
35	47	
40	59	
45	74	
50	92	
55	114	
60	139	479
65	169	583
70	204	
75	245	
80	292	1007
85	346	
90	408	
95	478	
100	557	



< VIAQ IWG VIAQ-04-08 >

Ambient Mode (Soak Temperature)

◆ Ambient Mode (Test Temperature)

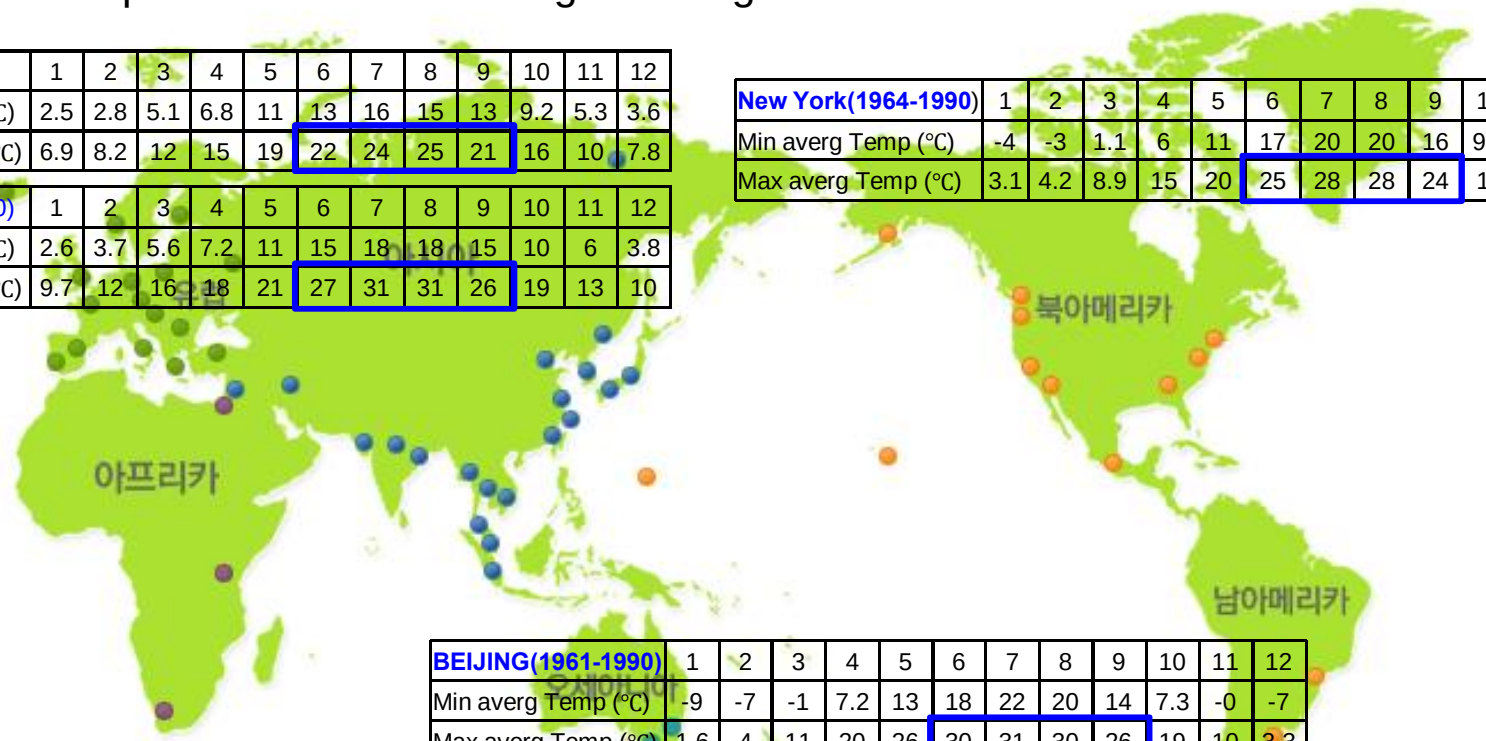
✓ **Worldwide Ambient Temperature**

Å Ambient temperature varies from region to region

Paris(1971-2000)	1	2	3	4	5	6	7	8	9	10	11	12
Min averg Temp (℃)	2.5	2.8	5.1	6.8	11	13	16	15	13	9.2	5.3	3.6
Max averg Temp (℃)	6.9	8.2	12	15	19	22	24	25	21	16	10	7.8

Madrid (1971-2000)	1	2	3	4	5	6	7	8	9	10	11	12
Min averg Temp (℃)	2.6	3.7	5.6	7.2	11	15	18	18	15	10	6	3.8
Max averg Temp (℃)	9.7	12	16	18	21	27	31	31	26	19	13	10

New York(1964-1990)	1	2	3	4	5	6	7	8	9	10	11	12
Min averg Temp (℃)	-4	-3	1.1	6	11	17	20	20	16	9.6	4.7	-1
Max averg Temp (℃)	3.1	4.2	8.9	15	20	25	28	28	24	18	12	5.9



BEIJING(1961-1990)	1	2	3	4	5	6	7	8	9	10	11	12
Min averg Temp (℃)	-9	-7	-1	7.2	13	18	22	20	14	7.3	-0	-7
Max averg Temp (℃)	1.6	4	11	20	26	30	31	30	26	19	10	3.3

SEOUL (1971-2000)	1	2	3	4	5	6	7	8	9	10	11	12
Min averg Temp (℃)	-6	-4	1.1	7.3	13	18	22	22	17	9.8	2.9	-3
Max averg Temp (℃)	1.6	4.1	10	18	23	27	29	30	26	20	12	4.2

*www.kma.go.kr (Korea Meteorological Administration)

Ambient Mode (Soak Temperature)

◆ Ambient Mode (Test Temperature)

✓ Thermal Comfort (ASHRAE Journal)

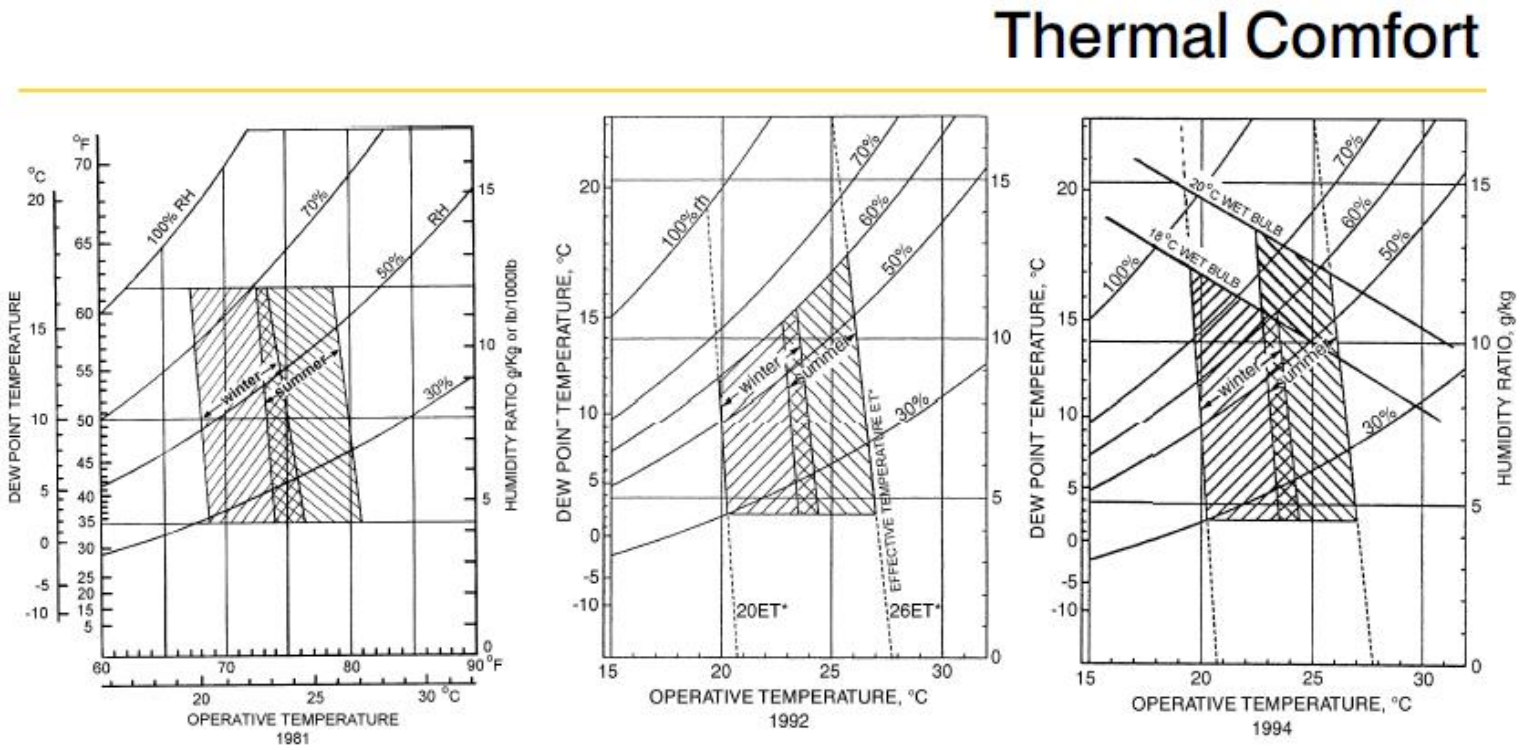


Figure 1: Acceptable ranges of operative temperature and humidity for people in typical summer and winter clothing during light and primarily sedentary activity (≤1.2 met). The ranges are based on a 10% dissatisfaction criterion.[11]

* ASHRAE Journal, August 2000 ï Guidelines For Comfort by Bjarne W. Olessen, Ph.D.

Ambient Mode (Soak Temperature)

◆ Ambient Mode (Test Temperature)

✓ **Standard reference conditions for temperature and pressure**

* 40 CFR 50.3 - Reference conditions(all measurement of air quality): 25.0 ℃, 760 mmHg

Title 40: Protection of Environment
PART 50—NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS

§50.3 Reference conditions.

All measurements of air quality that are expressed as mass per unit volume (e.g., micrograms per cubic meter) other than for particulate matter ($PM_{2.5}$) standards contained in §§50.7, 50.13, and 50.18, and lead standards contained in §50.16 shall be corrected to a reference temperature of 25 (deg) C and a reference pressure of 760 millimeters of mercury (1,013.2 millibars). Measurements of $PM_{2.5}$ for purposes of comparison to the standards contained in §§50.7, 50.13, and 50.18, and of lead for purposes of comparison to the standards contained in §50.16 shall be reported based on actual ambient air volume measured at the actual ambient temperature and pressure at the monitoring site during the measurement period.

[78 FR 3277, Jan. 15, 2013]

* IUPAC (SATP, Standard Ambient Temperature and Pressure): 25.0 ℃

Standard reference conditions in current use

Temperature	Absolute pressure	Relative humidity	Publishing or establishing entity
°C	kPa	%	
0	100.000		IUPAC (STP)[1]
0	101.325		NIST,[7] ISO 10780,[8] formerly IUPAC[1]
15	101.325	0[2][9]	ICAO's ISA,[9] ISO 13443,[2] EEA,[10] EGIA[11]
20	101.325		EPA,[12] NIST.[13] This is also called NTP, Normal Temperature and Pressure.[14]
22	101.325	20-80	American Association of Physicists in Medicine[15]
25	100.000		IUPAC (SATP)[1]
25	101.325		EPA[16]

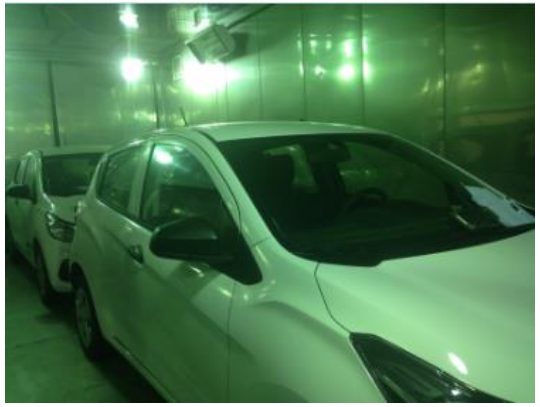
< Standard conditions for temperature and pressure from Wikipedia>

Ambient Mode (Soak Temperature)

◆ Ambient Mode (Test Temperature)

✓ **Soak temperature test between 23 ℃ and 25 ℃ in Ambient mode**

* Test Purpose : Temperature comparison 23 ℃ with 25 ℃
* Test car : 2 vehicles - same model and production date, 3 June 2016
* Test place : Environmental test chamber
* Sample : 2 samples taken
* Door open time : 30 min
* Door closed time : 16 hours



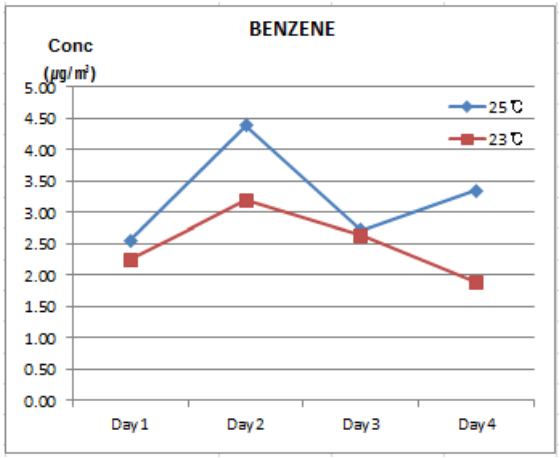
< Test Schedule >

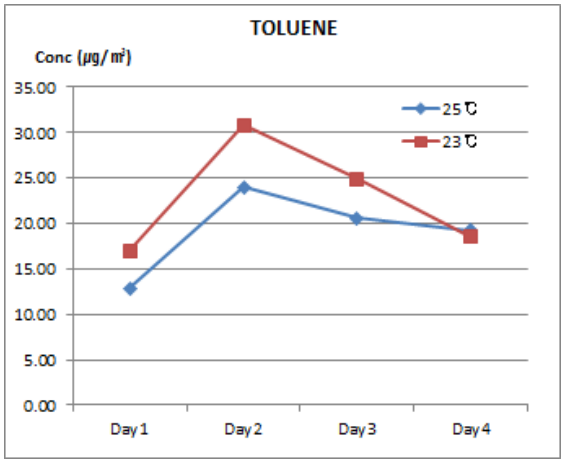
Test DATE	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23	6/24
Weekday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
Date from the production date	+13	+14	+15	+16	+17	+18	+19	+20	+21
Test temperature	23 ℃	25 ℃	-	23 ℃	25 ℃	23 ℃	25 ℃	23 ℃	25 ℃
Test Day(23 ℃)	Day1(23)	-	-	Day2(23)	-	Day3(23)	-	Day4(23)	-
Test Day(25 ℃)	-	Day1(25)	-	-	Day2(25)	-	Day3(25)	-	Day4(25)
Test vehicle A	Sample2	Sample2	-	Sample2	Sample2	Sample2	Sample2	Sample2	Sample2
Test vehicle B	Sample2	Sample2	-	Sample2	Sample2	Sample2	Sample2	Sample2	Sample2

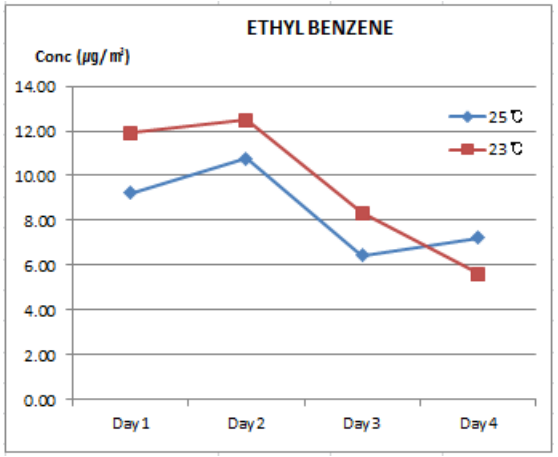
Ambient Mode (Soak Temperature)

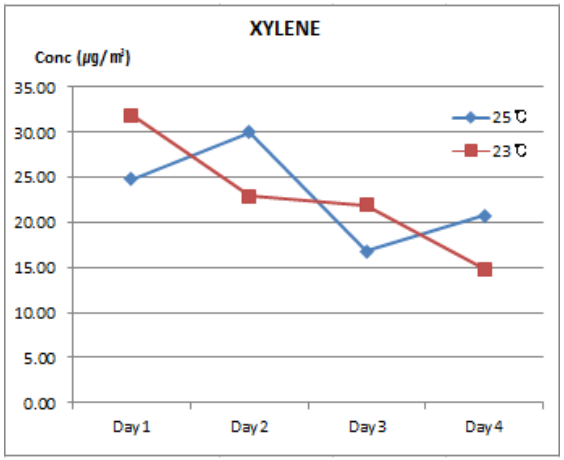
◆ Ambient Mode (Test Temperature) : 23 ℃ vs 25 ℃

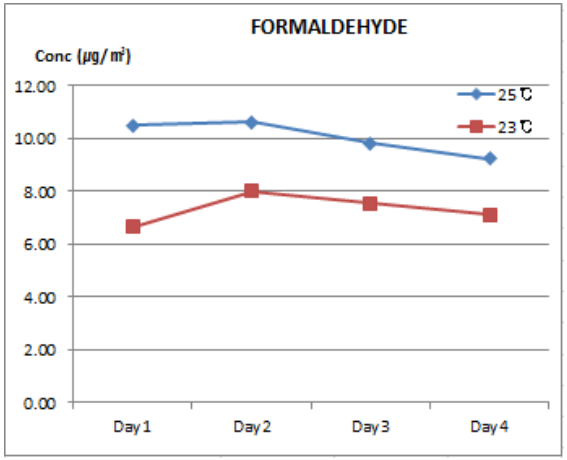
✓ **Test results – Test car A : No significant difference in substance levels.**

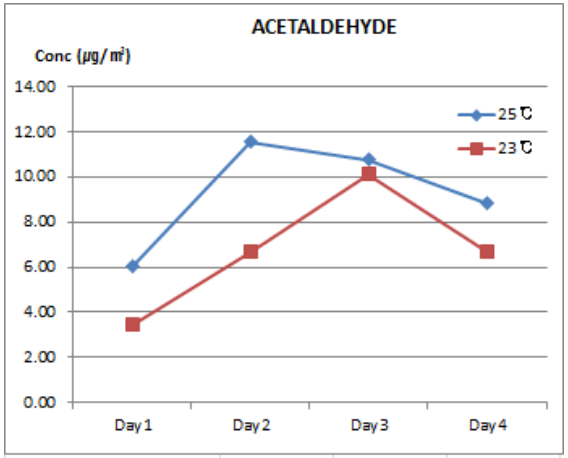












Ambient Mode (Soak Temperature)

◆ Ambient Mode (Test Temperature) : 23 ℃ vs 25 ℃

✓ **Test results analysis for Formaldehyde – ANOVA: Single factor : Statically Difference**

Test Vehicle A

Formaldehyde	25℃	23℃
Day1	10.49	6.6561067
Day2	10.64	8.0091417
Day3	9.83	7.5586533
Day4	9.24	7.140905

Formaldehyde	23℃	25℃
AVG	10.05	7.34
STD	0.648	0.578

Formaldehyc	25℃	23℃
Sample1	11.50114	7.23768
Sample2	9.4825567	6.0745333
Sample3	10.675383	7.80555
Sample4	10.61199	8.2127333
Sample5	9.7975533	8.01561
Sample6	9.8568967	7.1016967
Sample7	8.8796833	7.309
Sample8	9.5947033	6.97281

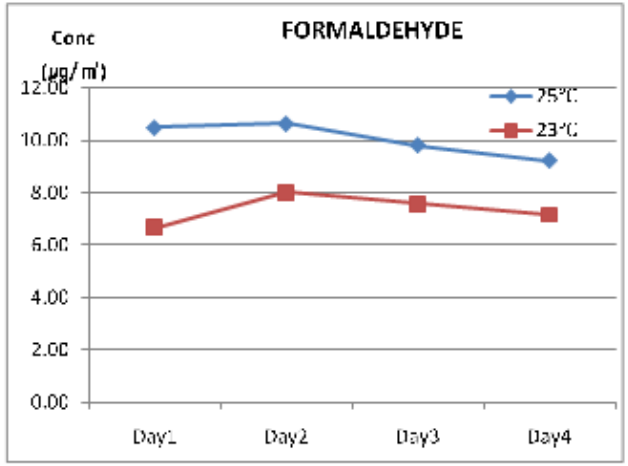
Anova: Single factor

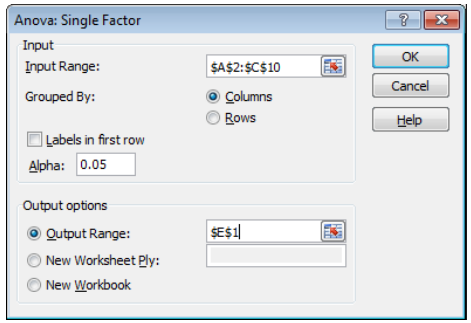
SUMMARY

Groups	*Count*	*Sum*	*Mean*	*Variance*
25℃	4	40.19995	10.04999	0.419326
23℃	4	29.36481	7.341202	0.334301

ANOVA

Sources	*SS*	*df*	*MS*	*F*	*P-value*
Between Gr	14.67505	1	14.67505	38.94514	0.000784
Within Grou	2.2608802	6	0.376813		
Total	16.935931	7			





Anova: Single factor

SUMMARY

Groups	*Count*	*Sum*	*Mean*	*Variance*
25℃	8	80.39991	10.04999	0.687527
23℃	8	58.72961	7.341202	0.462756

ANOVA

Sources	*SS*	*df*	*MS*	*F*	*P-value*
Between Gr	29.350101	1	29.3501	51.03109	4.98E-06
Within Grou	8.0519815	14	0.575142		
Total	37.402082	15			

Ambient Mode (Soak Temperature)

◆ Ambient Mode (Test Temperature) : 23 ℃ vs 25 ℃

✓ **Test results analysis for Xylene – ANOVA: Single factor : No statically difference**

Test Vehicle A

XYLENE	25°C	23°C
Day1	24.80	31.915
Day2	29.99	22.965
Day3	16.81	21.95
Day4	20.75	14.87

XYLENE	25°C	23°C
AVG	23.09	22.93
STD	5.641	6.992

XYLENE	25°C	23°C
Sample1	25.37	32.25
Sample2	24.23	31.58
Sample3	31.4	22.05
Sample4	28.58	23.88
Sample5	16.79	21.51
Sample6	16.83	22.39
Sample7	21.11	15.52
Sample8	20.38	14.22

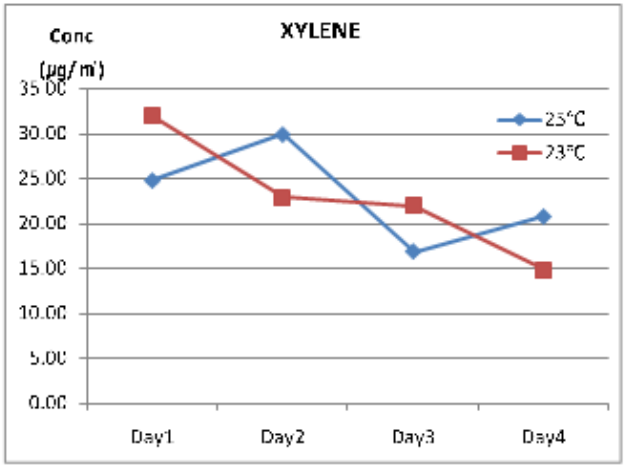
Anova: Single factor

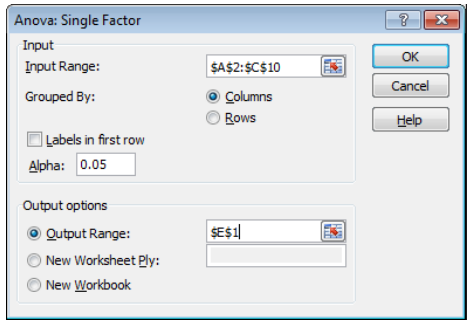
SUMMARY

Groups	*Count*	*Sum*	*Mean*	*Variance*
25°C	4	92.345	23.08625	31.82382
23°C	4	91.7	22.925	48.88512

ANOVA

Sources	*SS*	*df*	*MS*	*F*	*P-value*
Between Gr	0.0520031	1	0.052003	0.001289	0.972528
Within Grou	242.12682	6	40.35447		
Total	242.17882	7			





Anova: Single factor

SUMMARY

Groups	*Count*	*Sum*	*Mean*	*Variance*
25°C	8	184.69	23.08625	27.9766
23°C	8	183.4	22.925	42.34883

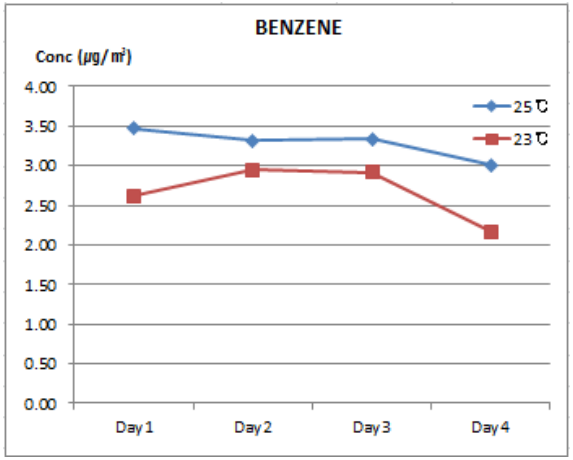
ANOVA

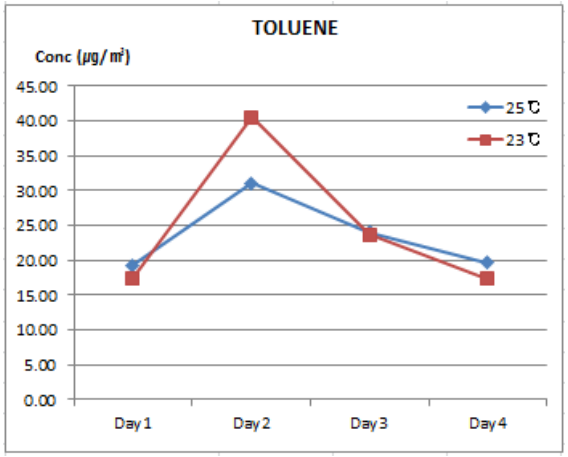
Sources	*SS*	*df*	*MS*	*F*	*P-value*
Between Gr	0.1040063	1	0.104006	0.002958	0.957396
Within Grou	492.27799	14	35.16271		
Total	492.38199	15			

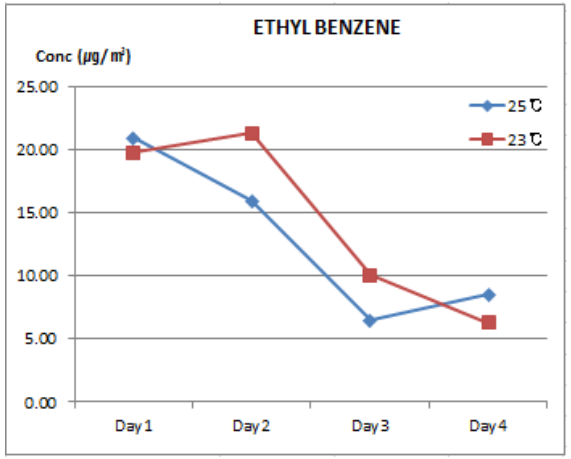
Ambient Mode (Soak Temperature)

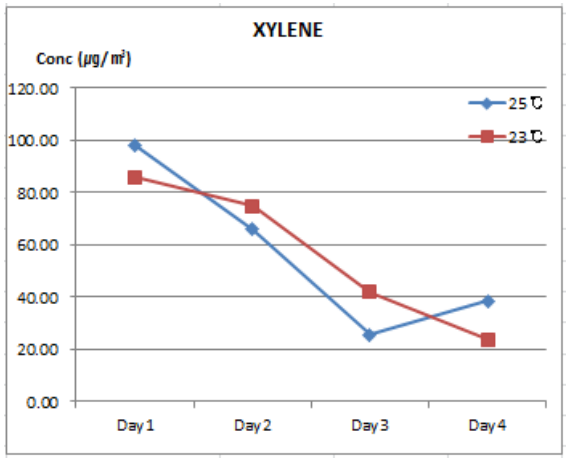
◆ Ambient Mode (Test Temperature) : 23 ℃ vs 25 ℃

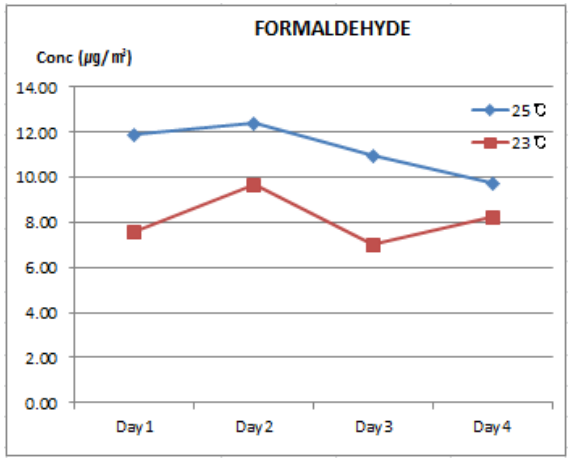
✓ **Test results – Test car B : No significant difference in substance levels.**

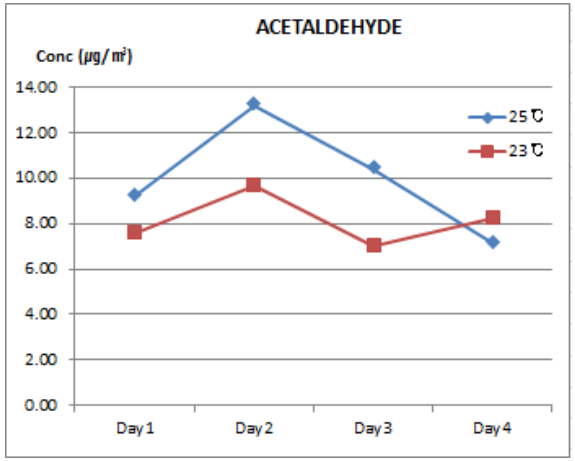












Ambient Mode (Soak Temperature)

◆ Conclusion

✓ **Consideration**

Å We considered the temperature most commonly used by people in buildings, homes and vehicles. The temperature range is 20℃ ~ 30℃.

Å No significant difference in test results between 23 ℃ vs 25 ℃.

Å 25℃ was already used as a standard reference temperature in many fields.

Å 25℃ for the test temperature as a harmonized level taking into account standard ambient conditions and existing standards.

✓ **Possible option** : Prefer option 1

Å Option 1: *25* ℃

Å Option 2: *23* ℃