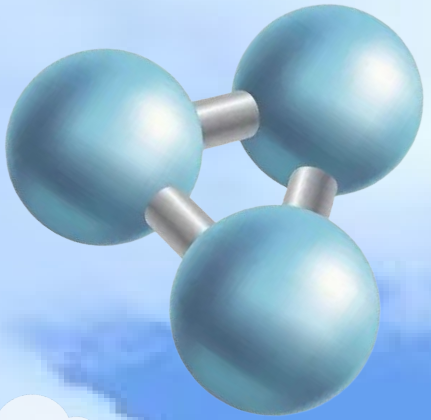
The Ozone Formation Precursors in the VOCs of Printing Enterprises



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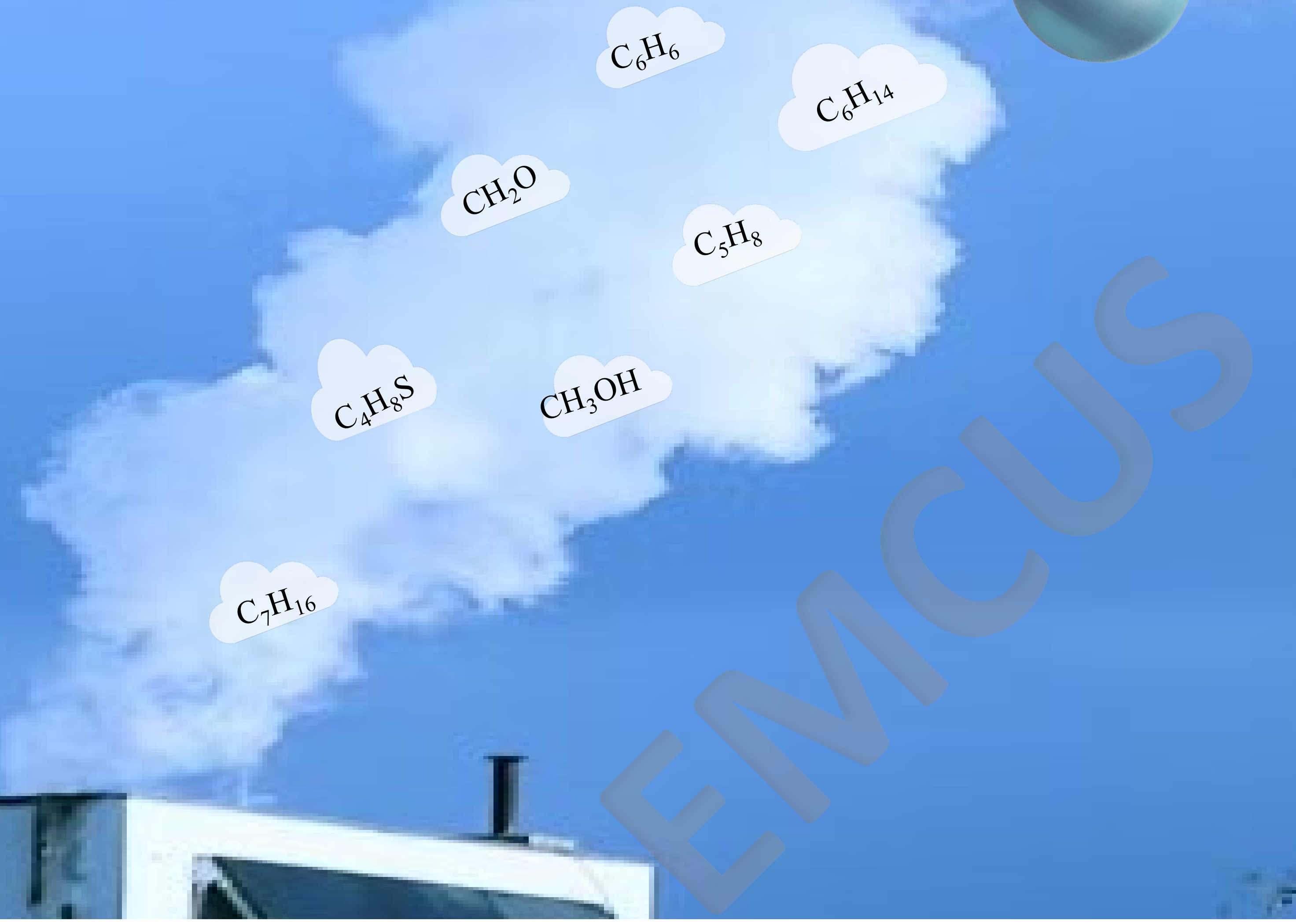
Weimin Zhang



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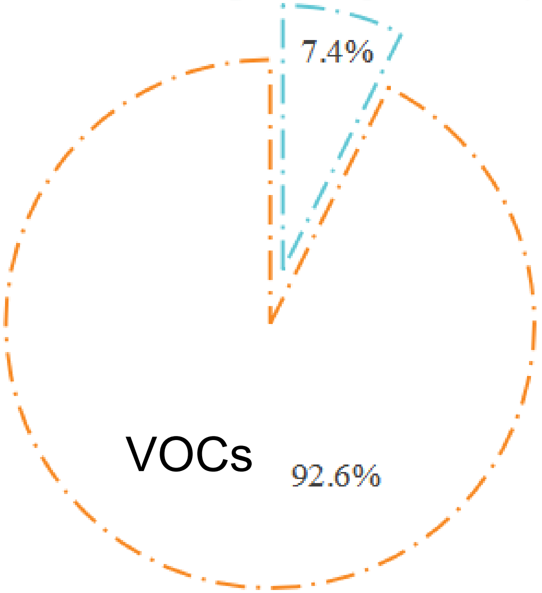
Background

Percentage of VOCs in the printing industry



The printing process uses raw and auxiliary materials such as ink, thinner, fountain solution, car wash, adhesive, varnish and so on.

印刷过程中会使用到油墨、稀释剂、润版液、洗车水、胶黏剂、光油等原辅材料。

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Introduction on Enterorise A

The temperature of the hot stamping process in the manufacture of gold foil 100-180 degrees Celsius

金箔制造中的烫金工艺温度为:
100-180摄氏度

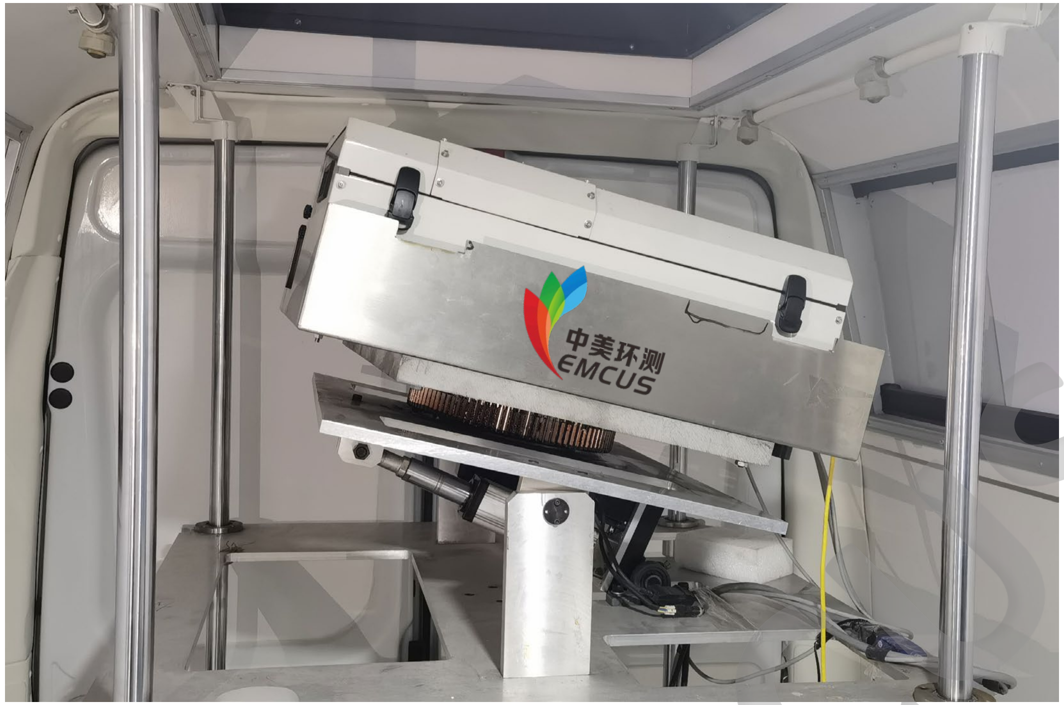
Introduction on Enterorise B

Beer labels, confectionery packaging, polyethylene-based materials

啤酒标签，糖果包装、聚乙烯类材料

Main Monitoring Equipment

All-Weather、 multi-angle、 more factors
全天候、多角度、多因子



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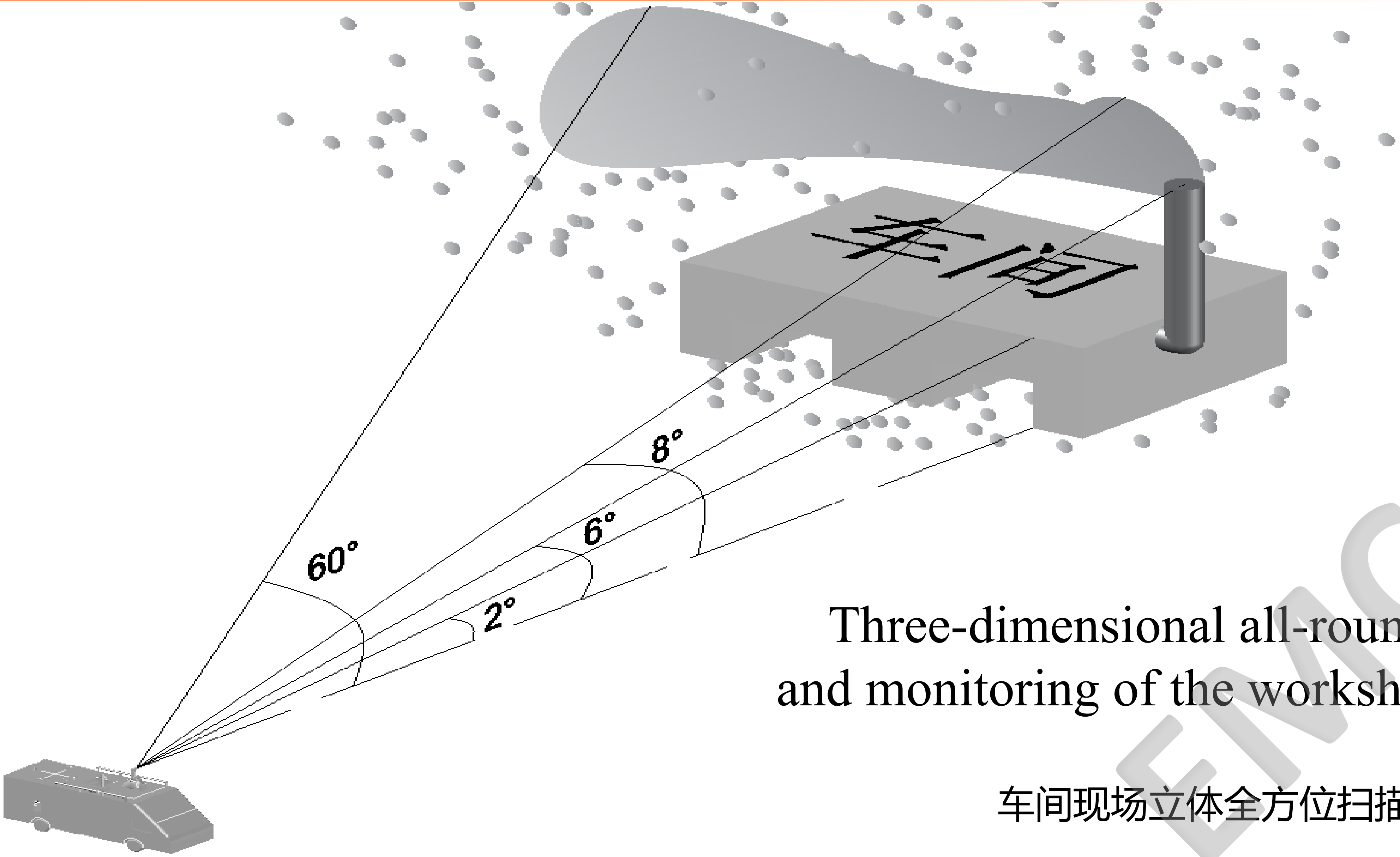
Monitoring Method to No.1 Chimney of Enterprise A

Monitoring diagram to No.1 Chimney of Enterprise A
A厂区内一号口监测图

- 4° 20min
  Sector station monitoring
  二十分钟
  扇形驻点监测

- 6° 23min
  Sector station monitoring
  二十三分钟
  扇形驻点监测

Monitoring Method



Three-dimensional all-round scanning and monitoring of the workshop site

车间现场立体全方位扫描监测

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Monitoring Method to No.2 Chimney of Enterprise A

- □8°　25 min
- 12°　20 min
- 15°　20 min

Changes in Weather Conditions, Temperature, and O_3 Concentration

Date	Weather	Tempreture	O_3（mg/m³）
23-6-19	Moderate Rain ~ Cloudy	23°C~27°C	0.05-0.07
23-6-25	Heavy rain ~ cloudy	23°C~25°C	0.14-0.18
23-6-27	Cloudy	22°C~32°C	0.07-0.11
23-6-28	Cloudy	25°C~34°C	0.07-0.16
23-12-27	Cloudy~Sunny	0°C~12°C	0.011-0.138
23-12-28	Foggy~Sunny~Cloudy	3°C~13°C	0.066-0.119
23-12-29	Foggy~Cloudy~Slightly Rainy	5°C~9°C	0.108-0.321
23-12-31	Sunny	-1°C~9°C	0.101-0.221

Ozone concentrations do not show a positive relationship with temperature; ozone concentrations are elevated during the winter months, and companies have a lot of thermal radiation in their production processes that contributes to ozone formation.

臭氧浓度与温度并没有呈现正比关系，在冬季臭氧浓度升高，企业在生产过程中有大量热辐射助长了臭氧的形成。

Ozone Precursors' Selection Conditions

- Alkane substance monitoring data>5mg/m3
  烷烃类物质监测数据 > 5mg/m^3
  such as: methane, 3-methylpentane, propane....
  如：甲烷、3-甲基戊烷、丙烷....
- Monitoring data of olefins > 0.5mg/m^3
  烯烃类物质监测数据 > 0.5mg/m^3
  such as: cis-2-butene, cyclopentene, n-butene....
  如：顺-2-丁烯、环戊烯、正丁烯....
- Aldehyde monitoring data >1mg/m^3
  醛类物质监测数据 >1mg/m^3
  such as: formaldehyde, acrolein....
  如：甲醛、丙烯醛....
- Benzene monitoring data >0.1mg/m^3
  苯类物质监测数据 >0.1mg/m^3
  such as: benzene, toluene....
  如：苯、甲苯....
- Monitoring data of alcohols and others >0.1mg/m^3
  醇类等物质监测数据 >0.1mg/m^3
  such as: methanol, n-propanol, isopropanol....
  如：甲醇、正丙醇、异丙醇....
- The main heat source substances in the production process
  生产过程中的主要热源物质
  such as: tetrahydrothiophene
  如：四氢噻吩
- Odor substances that contribute greatly to ozone >10mg/m^3
  对臭氧有较大贡献的异味物质 >10mg/m^3
  such as: methyl mercaptan, dimethylamine, benzyl alcohol
  如：甲硫醇 、二甲胺、苯甲醇
- The workshop temperature is >10°C, and the ambient temperature is >0°C
  车间温度 >10℃，环境温度 >0℃

Monitoring Data Comparison of Summer&Winter of Enterprise A

因子	Factors	Impact	MIR	in Plant	No. 1 Chimney	No. 2 Chimney	12:44-13:04
甲烷	methane	+	0.02	811.41	197.05	141.42	227.13
乙烷	Ethane		0.25	79.54	185.7	88.59	20.95
丙烷	Propane		0.48	95.56	28.64	44.52	37.38
异丁烷	Isobutane		1.21	42.27	19.85	29.54	17.54
正戊烷	n-Pentane		1.04	22.34	5.52	10.11	8.85
3-甲基戊烷	3-Methylpentane		1.5	80.77	21.74	24.66	21.08
正己烷	n-Hexane		0.98	82.86	26.6	18.70	43.12
环己烷	Cyclohexane		1.28	5.13	47.9	5.43	
正庚烷	n-Heptane		0.81	109.38	103.84	124.55	66.24
顺-2-丁烯	cis-2-butene		10	4.01	8.7	8.85	
反-2-丁烯	trans-2-Butene		10	0.75	0.3	0.69	0.41
环戊烯	Cyclopentene		7.7	19.29	16.36	26.42	10.97
二氧化氮	Nitrogen Dioxide			215.4	255.95	321.01	105.95
苯	Benzene	-	0.42	0.97	1.16	3.37	5.82
乙苯	ethylbenzene		2.7	2.01	1.22	0.88	0.48
甲醛	formaldehyde		7.2	23.92	99.62	61.86	24.63
正丙醇	n-Propanol		2.3	0.47	1.33	1.97	0.89
异丙醇	Isopropanol		0.54	0.82	0.47	0.45	0.51
臭氧	Ozone			4.91v	6.76	3.68	4.12

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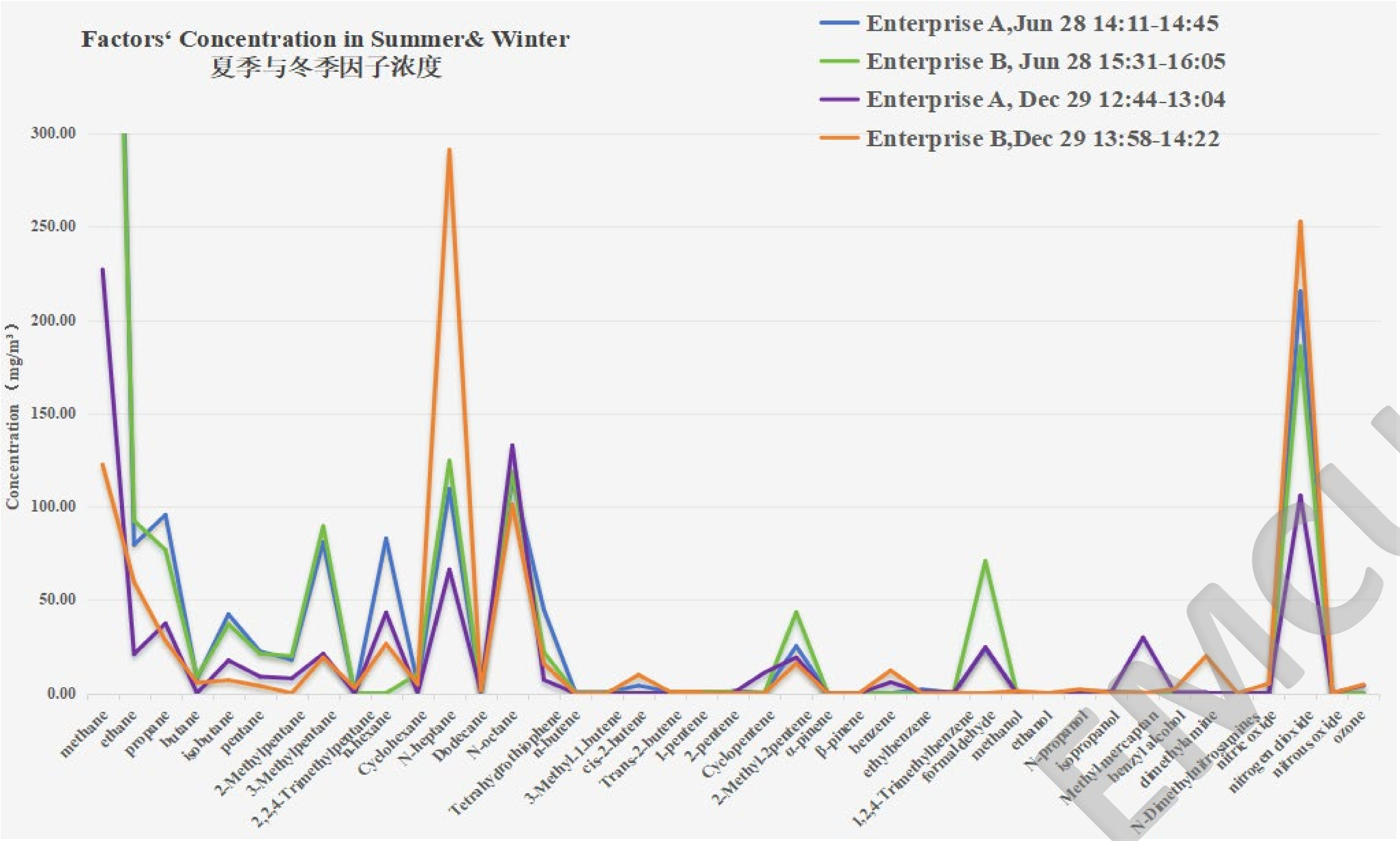
Monitoring Data Comparison of Summer&Winter of Enterprise B

因子	Factors	Impact	MIR	6-28	12-29 13:58-14:22
甲烷	methane	+	0.02	735.85	122.53
乙烷	Ethane		0.25	92.45	59.6
丙烷	Propane		0.48	76.73	28.02
丁烷	Butane		1.02	8.8	5.61
异丁烷	Isobutane		1.21	36.9	6.96
正戊烷	n-Pentane		1.04	21.19	3.84
3-甲基戊烷	3-Methylpentane		1.5	89.54	19.16
环己烷	Cyclohexane		1.28	10.23	4.76
正庚烷	n-Heptane		0.81	124.62	291.09
十二烷	Dodecane		0.38	1.93	1.46
正辛烷	n-Octane		0.6	118.51	101.23
四氢噻吩	Tetrahydrothiophene			22.04	15.9
反-2-丁烯	trans-2-Butene		10	0.7	0.68
二氧化氮	Nitrogen dioxide			185.87	5.17
甲醛	formaldehyde	-	7.2	70.71	67.63
正丙醇	n-Propanol		2.3	0.59	2.04
异丙醇	Isopropyl alcohol		0.54	0.25	0.36
臭氧	Ozone			7.66	4.62

Monitoring Data Comparison of Summer&Winter



OFP Value Comparison of Enterprise A

因子	Factors	Impact	MIR	Concentration	OFP	Concentration	OFP
甲烷	methane		0.02	811.41	16.2282	227.13	4.5426
乙烷	Ethane		0.25	79.54	19.885	20.95	5.2375
丙烷	Propane		0.48	95.56	45.8688	37.38	17.9424
异丁烷	Isobutane		1.21	42.27	51.1467	17.54	21.2234
正戊烷	n-Pentane		1.04	22.34	23.2336	8.85	9.204
3-甲基戊烷	3-Methylpentane		1.5	80.77	121.155	21.08	31.62
正己烷	n-Hexane	+	0.98	82.86	81.2028	43.12	42.2576
环己烷	Cyclohexane		1.28	5.13	6.5664		
正庚烷	n-Heptane		0.81	109.38	88.5978	66.24	53.6544
顺-2-丁烯	cis-2-butene		10	4.01	40.1		
反-2-丁烯	trans-2-Butene		10	0.75	7.5		
环戊烯	Cyclopentene		7.7			10.97	84.469
二氧化氮	Nitrogen Dioxide			215.4		105.95	
苯	Benzene		0.42			5.82	2.4444
乙苯	ethylbenzene		2.7	2.01	5.427	0.48	1.296
甲醛	formaldehyde	-	7.2	23.92	172.224	24.63	177.336
正丙醇	n-Propanol		2.3	0.47	1.081	0.89	2.047
异丙醇	Isopropanol		0.54	0.82	0.4428	0.51	0.2754
臭氧	Ozone			4.91	322.3095	4.12	86.7521

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OFP Value Comparison of Enterprise B

因子	Factor	Impact	MIR	Concentration	OFP	Concentration	OFP
甲烷	methane	+	0.02	735.85	14.717	122.53	2.4506
乙烷	Ethane		0.25	92.45	23.1125	59.6	14.9
丙烷	Propane		0.48	76.73	36.8304	28.02	13.4496
丁烷	Butane		1.02	8.8	8.976	5.61	5.7222
异丁烷	Isobutane		1.21	36.9	44.649	6.96	8.4216
正戊烷	n-Pentane		1.04	21.19	22.0376	3.84	3.9936
3-甲基戊烷	3-Methylpentane		1.5	89.54	134.31	19.16	28.74
环己烷	Cyclohexane		1.28	10.23	13.0944	4.76	6.0928
正庚烷	n-Heptane		0.81	124.62	100.9422	291.09	235.7829
十二烷	Dodecane		0.38	1.93	0.7334	1.46	0.5548
正辛烷	n-Octane		0.6	118.51	71.106	101.23	60.738
四氢噻吩	Tetrahydrothiophene			22.04		15.9	
反-2-丁烯	trans-2-Butene		10	0.7	7	0.68	6.8
二氧化氮	Nitrogen dioxide			185.87		5.17	
甲醛	formaldehyde	-	7.2	70.71	509.112	67.63	486.936
正丙醇	n-Propanol		2.3	0.59	1.357	2.04	4.692
异丙醇	Isopropyl alcohol		0.54	0.25	0.135	0.36	0.1944
臭氧	Ozone			7.66	-33.0955	4.62	-104.1763

The Ozone Influence Value of the Factors - Q

According to the ozone formation potential of each precursors of alkanes, the ozone influence value of a single precursor is defined as:
根据烷烃类前置因子的臭氧生成潜势，定义单个前置因子对臭氧影响值为：

In each polluted mass, the OFP values of the individual precursor of alkanes detected are divided by the sum of the OPF values of each precursor, multiplied by the concentration of ozone in the polluted mass.
每个污染云团中，检测到烷烃类中的单个前置因子的OFP值除于每个前置因子的OPF值总和，乘以污染云团中臭氧的浓度。

The formula is as follows:
公式如下：

$$Q = \frac{R_i * MIR}{\sum(R_{in} * MIR)} * R_{O_3}$$

R_i: Concentration of a single precursor
R_i为单个前置因子的浓度

R_{O_3}: Ozone Concentration
R_{O_3}为臭氧的浓度

R_{in}: （n=1,2,3,....）

Ozone Contribution of Different Kinds of Factors - K

In order to better illustrate the influence of different kinds of factors on ozone formation, the contribution of various factors to ozone is defined as:
为更好说明各种类因子对臭氧生成的影响，定义各种类因子对臭氧贡献度为：

The sum of the Q values of the various factors detected in each pollution cloud divided by the ratio of the ozone concentration in the pollution cloud.
每个污染云团中，检测到的各种类因子的Q值之和除于污染云团中臭氧的浓度的比值。

The formula is as follows:
公式如下：

$$K = \frac{\sum Q_n}{R_{O_3}}$$

Q_n The ozone contribution of each factor（n=1,2,3....)
为各因子的臭氧贡献值（n=1,2,3....)，

R_{O_3} Ozone Concentration
为臭氧浓度

The higher the K value is, the greater the contribution of the substance to the formation of ozone.

K数值越大，说明该种类物质对臭氧的生成贡献度越大。

Comparison of OFP Value, Q Value and Ozone Contribution Value of Enterprise A

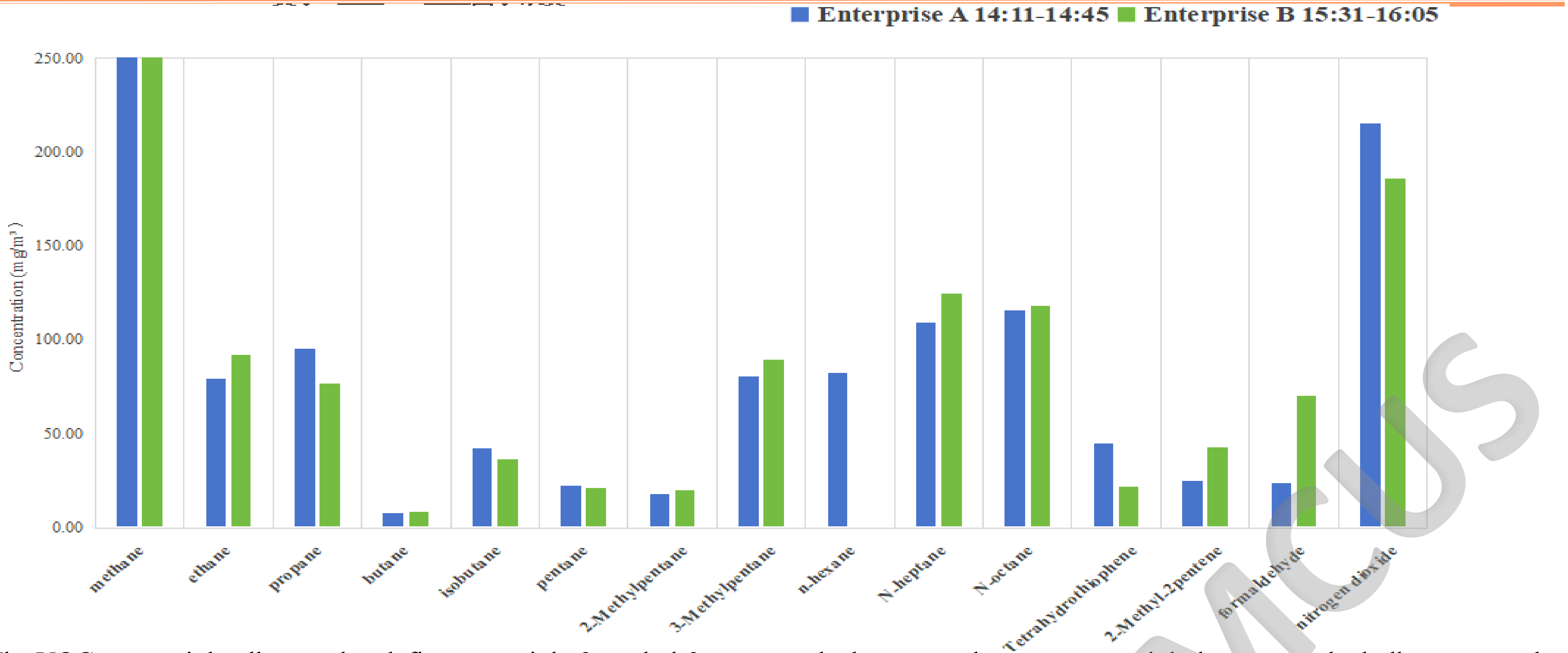
因子	Factors	Impact	MIR	OFP	Q	K	OFP	Q	K
甲烷	methane	+	0.02	16.2282	0.0238	0.0031	4.5426	0.0100	0.0058
乙烷	Ethane		0.25	19.885	0.0292	0.0038	5.2375	0.0115	0.0071
丙烷	Propane		0.48	45.8688	0.0674	0.0088	17.9424	0.0396	0.0164
异丁烷	Isobutane		1.21	51.1467	0.0751	0.0098	21.2234	0.0468	0.0182
正戊烷	n-Pentane		1.04	23.2336	0.0341	0.0045	9.204	0.0203	0.0083
3-甲基戊烷	3-Methylpentane		1.5	121.155	0.1780	0.0232	31.62	0.0697	0.0432
正己烷	n-Hexane		0.98	81.2028	0.1193	0.0156	42.2576	0.0932	0.0290
正庚烷	n-Heptane		0.81	88.5978	0.1302	0.0170	53.6544	0.1183	0.0316
环戊烯	Cyclopentene		7.7				84.469	0.1862	0.0027
乙苯	ethylbenzene	-	2.7	5.427	0.0080	0.0010	1.296	0.0029	
甲醛	formaldehyde		7.2	172.224	0.2530	0.0330	177.336	0.3910	0.0019
正丙醇	n-Propanol		2.3	1.081	0.0016	0.0002	2.047	0.0045	0.0614
异丙醇	Isopropanol		0.54	0.4428	0.0007	0.0001	0.2754	0.0006	0.0004

3-Methylpentane，n-Heptane， formaldehyde have the highest ozone formation contribtion value.

Comparison of OFP Value, Q Value and Ozone Contribution Value of Enterprise B

因子	Factor	Impact	MIR	夏季OFP	Q	K	冬季OFP	Q	K
甲烷	methane	+	0.02	14.717	0.0149	0.0019	2.4506	0.0041	0.0009
乙烷	Ethane		0.25	23.1125	0.0234	0.0031	14.9	0.0252	0.0055
丙烷	Propane		0.48	36.8304	0.0373	0.0049	13.4496	0.0227	0.0049
丁烷	Butane		1.02	8.976	0.0091	0.0012	5.7222	0.097	0.0210
异丁烷	Isobutane		1.21	44.649	0.0452	0.0059	8.4216	0.0142	0.0031
正戊烷	n-Pentane		1.04	22.0376	0.0223	0.0029	3.9936	0.0067	0.0015
3-甲基戊烷	3-Methylpentane		1.5	134.31	0.1359	0.0177	28.74	0.0486	0.0105
环己烷	Cyclohexane		1.28	13.0944	0.0133	0.0017	6.0928	0.0103	0.0022
正庚烷	n-Heptane		0.81	100.9422	0.1022	0.0133	235.7829	0.3984	0.0862
十二烷	Dodecane		0.38	0.7334	0.0007	0.0001	0.5548	0.0009	0.0002
正辛烷	n-Octane		0.6	71.106	0.0720	0.0094	60.738	0.1026	0.0222
反-2-丁烯	trans-2-Butene		10	7	0.0071	0.0009	6.8	0.0115	0.0025
甲醛	formaldehyde	-	7.2	509.112	0.5152	0.0673	486.936	0.1143	0.0247
正丙醇	n-Propanol		2.3	1.357	0.0014	0.0002	4.692	0.0079	0.0017
异丙醇	Isopropyl alcohol		0.54	0.135	0.0001	0.0000	0.1944	0.0003	0.0001

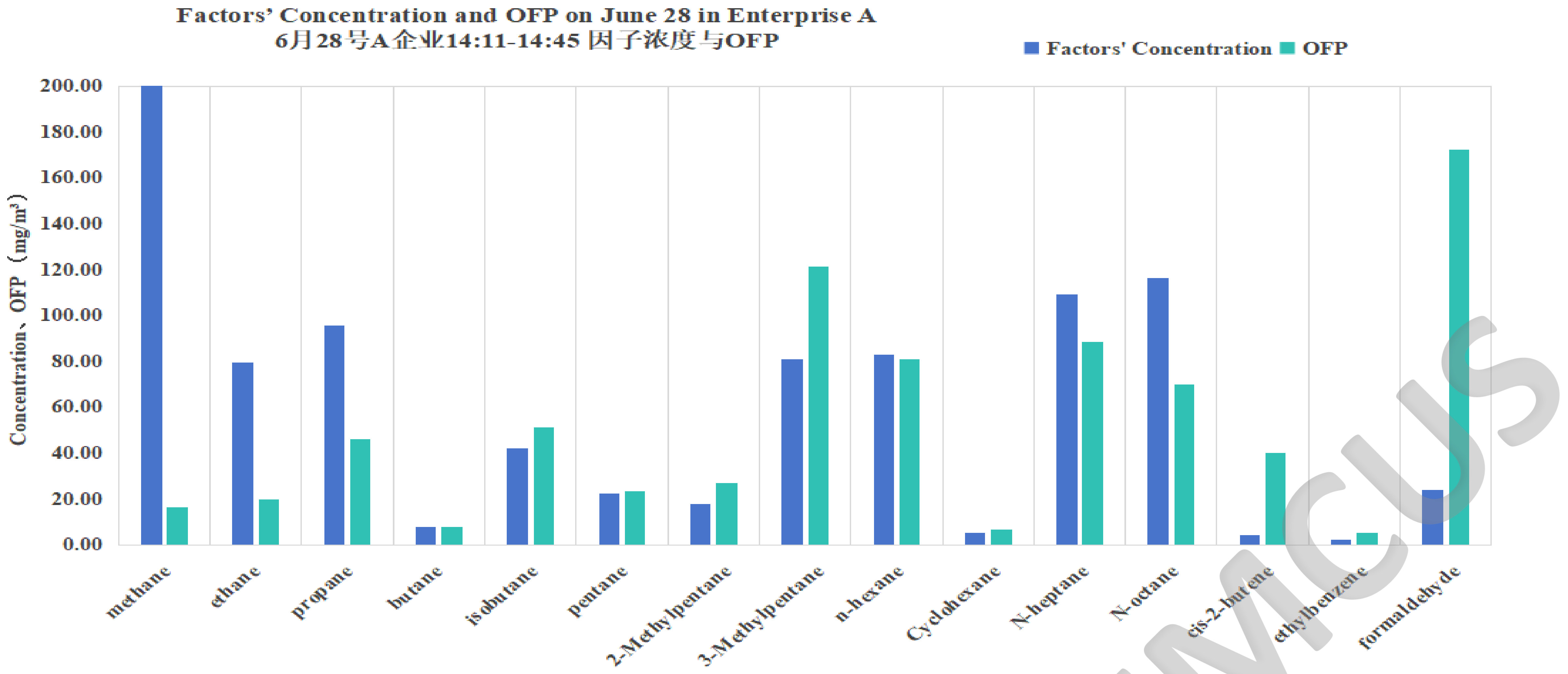
On June 28, the Precursers of Ozone for Enterprise A & B



The VOCs are mainly alkanes, the olefins are mainly 2-methyl-2-pentene, the benzene substances are mainly benzene and ethylbenzene, and the ketoaldehydes are mainly formaldehyde. Among the odor substances, dimethylamine and n-propanol are the main substances. Among the flammable and explosive substances, n-octane is the main one.

VOCs以烷烃类为主，其它物质中烯烃类主要是2-甲基-2-戊烯，苯类物质主要是苯和乙苯，酮醛类主要是甲醛。异味物质中二甲胺、正丙醇是主要物质。易燃易爆物质中以正辛烷为主。

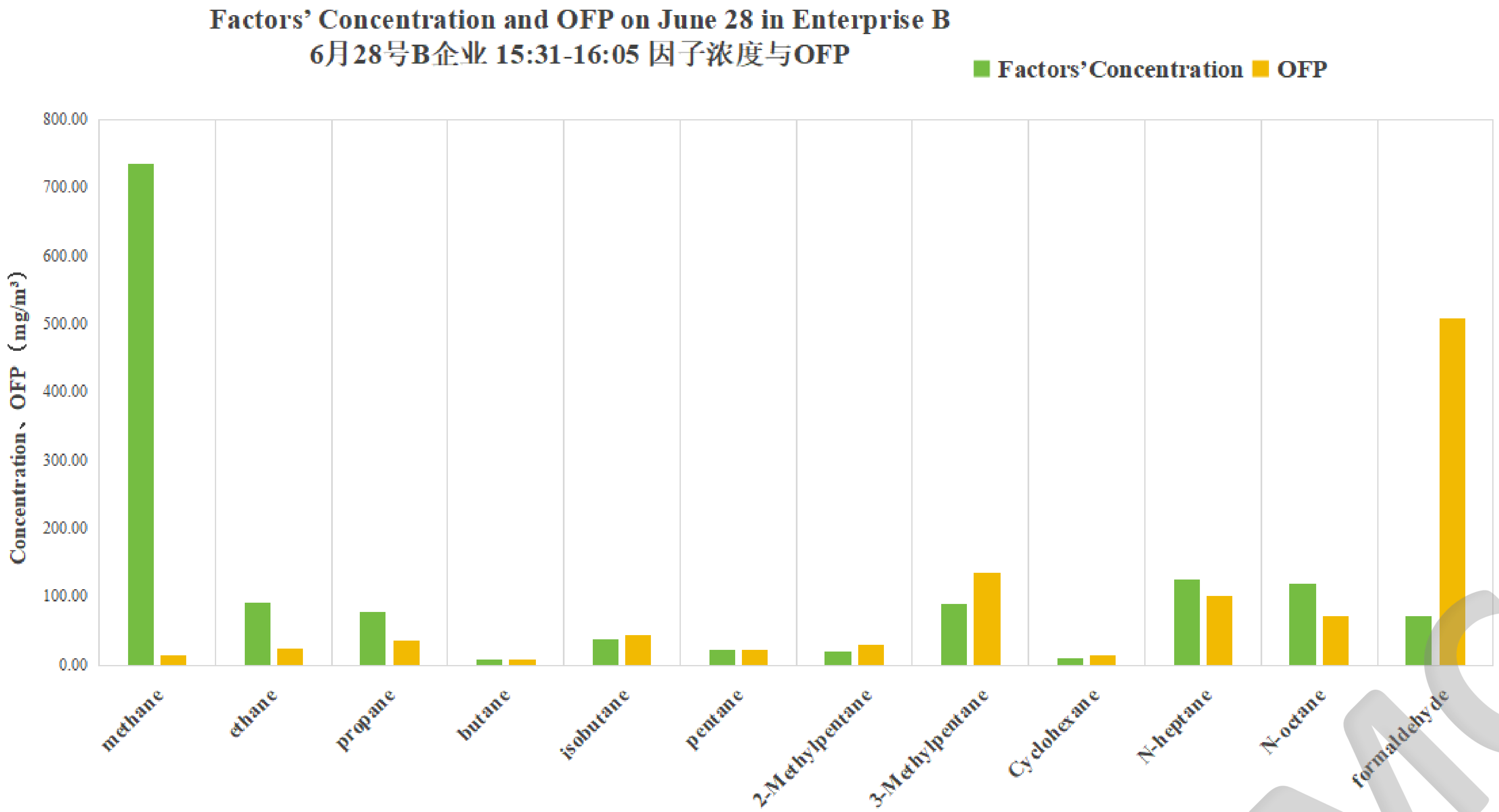
Factors' Concentration and OFP on June 28 in Enterprise A



The main contributing factors in Enterprise A in summer are n-heptane, 3-methylpentane, n-octane, and cis-2-butene. It is followed by isobutane, n-hexane, and 2-methylpentane.

夏季A企业中起主要贡献的因子是正庚烷、3-甲基戊烷、正辛烷、顺-2-丁烯。其次为异丁烷、正己烷、2-甲基戊烷。

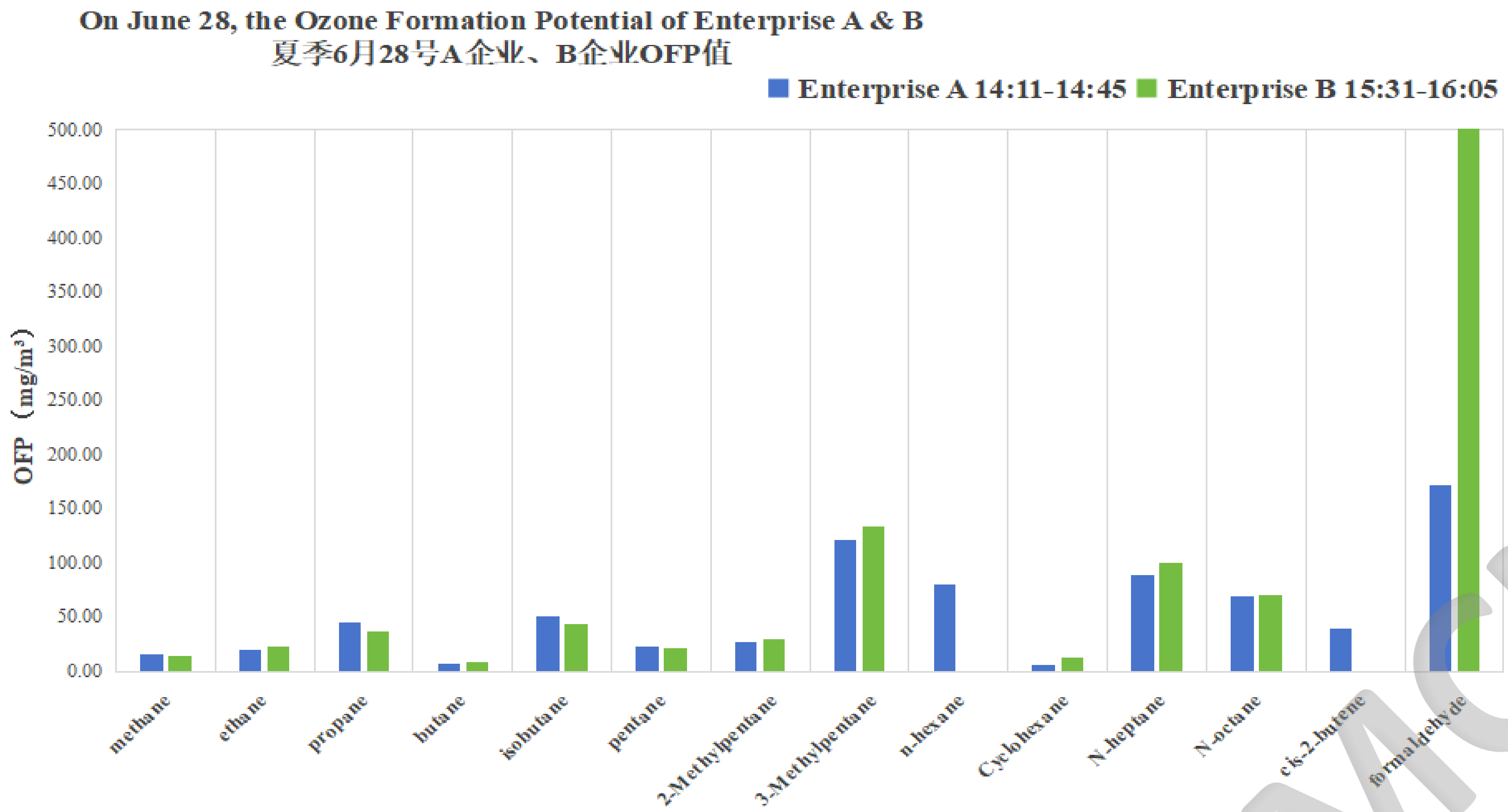
Factors' Concentration and OFP on June 28 in Enterprise B



The main contributing factors in summer printing Enterprise B are 3-methylpentane, n-heptane, and n-octane. It is followed by isobutane, n-hexane, and 2-methylpentane.

夏季印刷B企业中起主要贡献的因子是3-甲基戊烷、正庚烷、正辛烷。其次为异丁烷、正己烷、2-甲基戊烷。

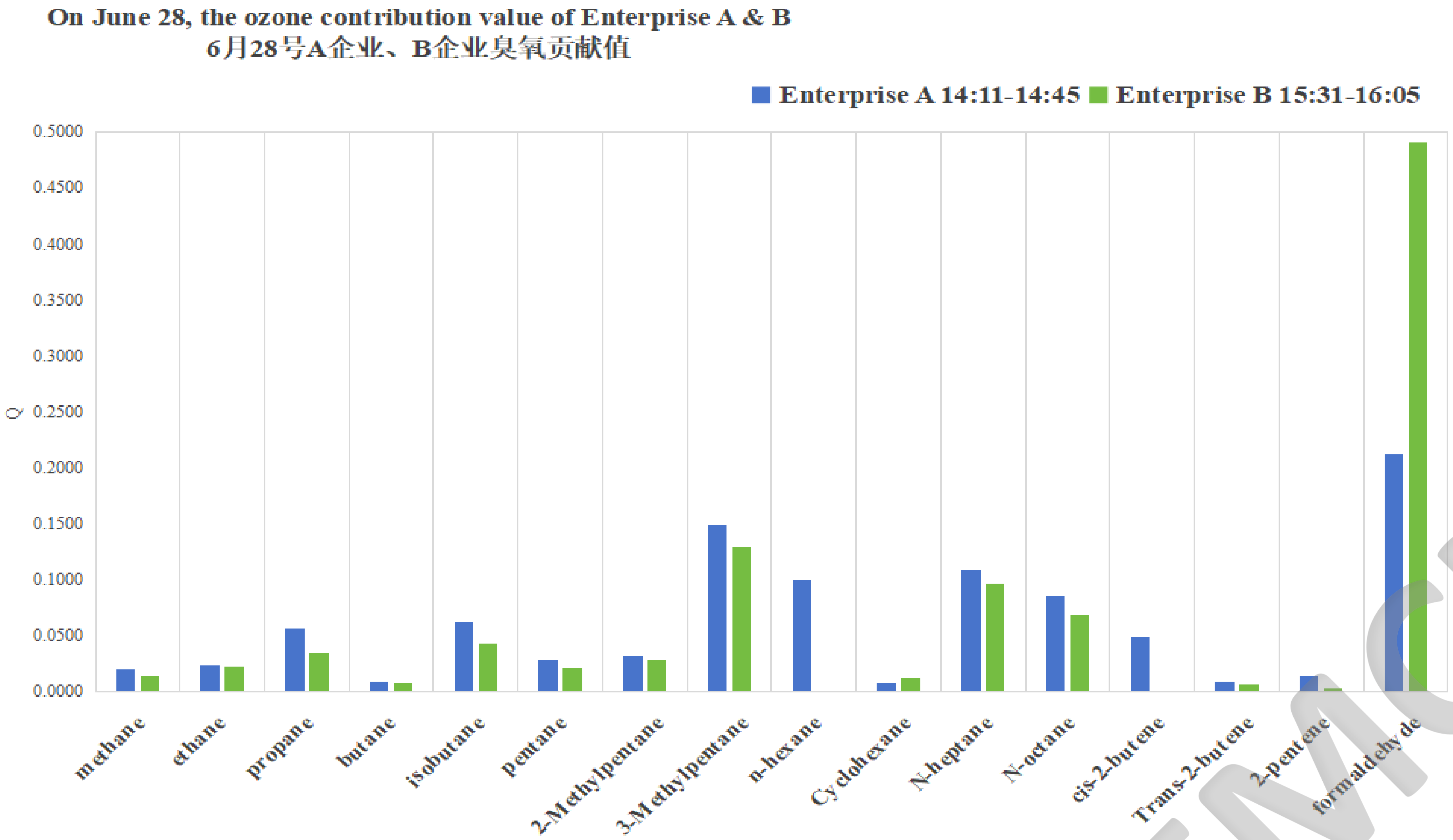
On June 28, the Ozone Formation Potential of Enterprise A & B



Among the VOCs emitted by the two printing enterprises,cyclopentene, 3-methylpentane, n-heptane, n-octane and cis-2-butene had higher OFP values, and formaldehyde had the highest OFP value. These factors have a significant impact on ozone production.

两家印刷企业中排放的VOCs中环戊烯、3-甲基戊烷、正庚烷、正辛烷、顺-2-丁烯的OFP值较高，甲醛的OFP值最高。这几种因子对臭氧生成有较大影响。

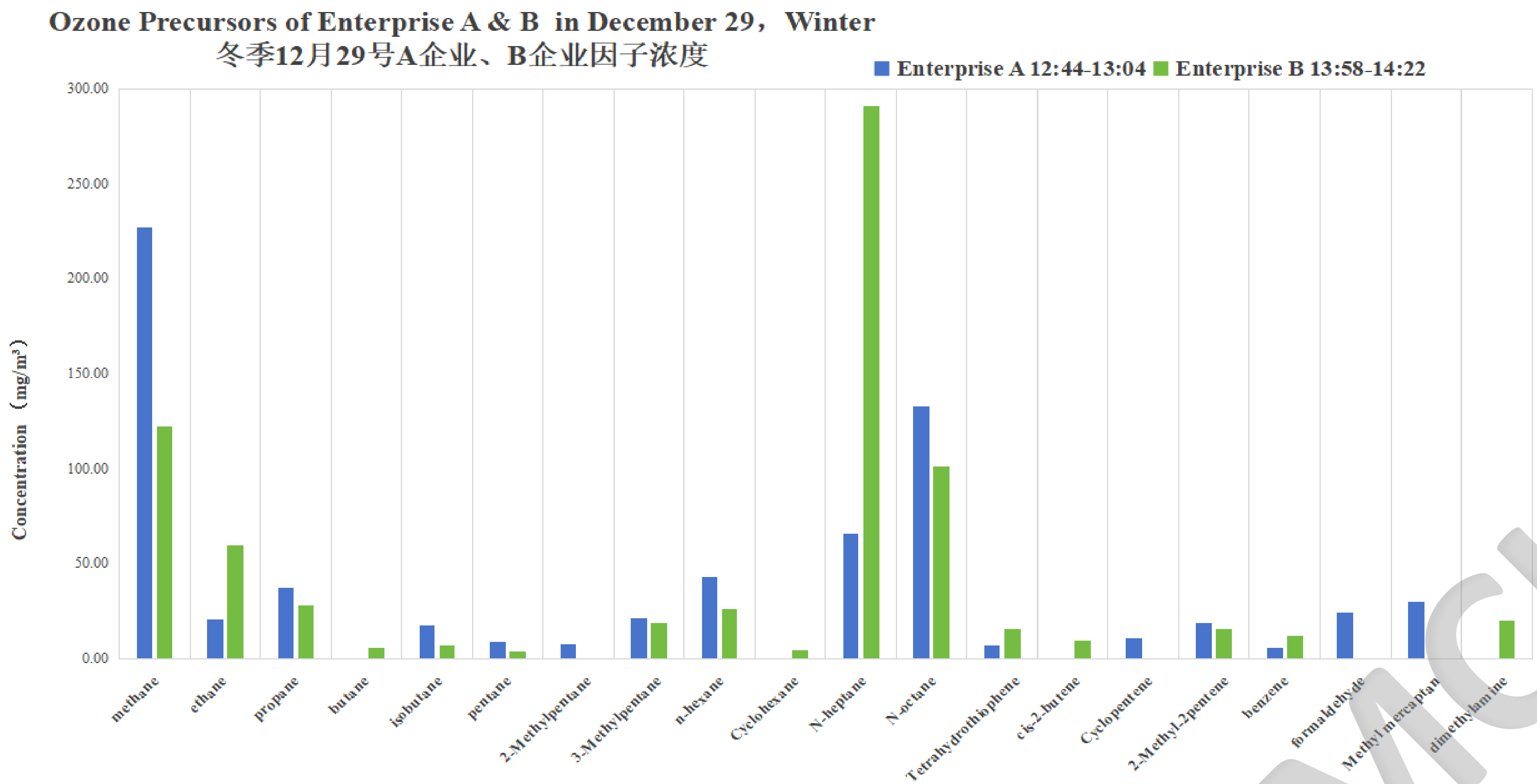
On June 28, the Ozone Contribution Value of Enterprise A & B



From the ozone contribution values of the two companies, it can be seen that 3-methylpentane, n-hexane, n-heptane, n-octane, cis-2-butene are the main ozone contributing factors in summer.

从两个企业的臭氧贡献值中可以看出：3-甲基戊烷、正己烷、正庚烷、正辛烷、顺-2-丁烯为夏季的主要的臭氧贡献因子。

Ozone Precursors of Enterprise A & B in December 29, Winter



In winter, VOCs are still dominated by alkanes, olefins are mainly 2-methyl-2-pentene and cyclopentene, benzene are mainly benzene and ethylbenzene, and ketoaldehydes are mainly formaldehyde. Methyl mercaptan is the main substance among the odorous substances.

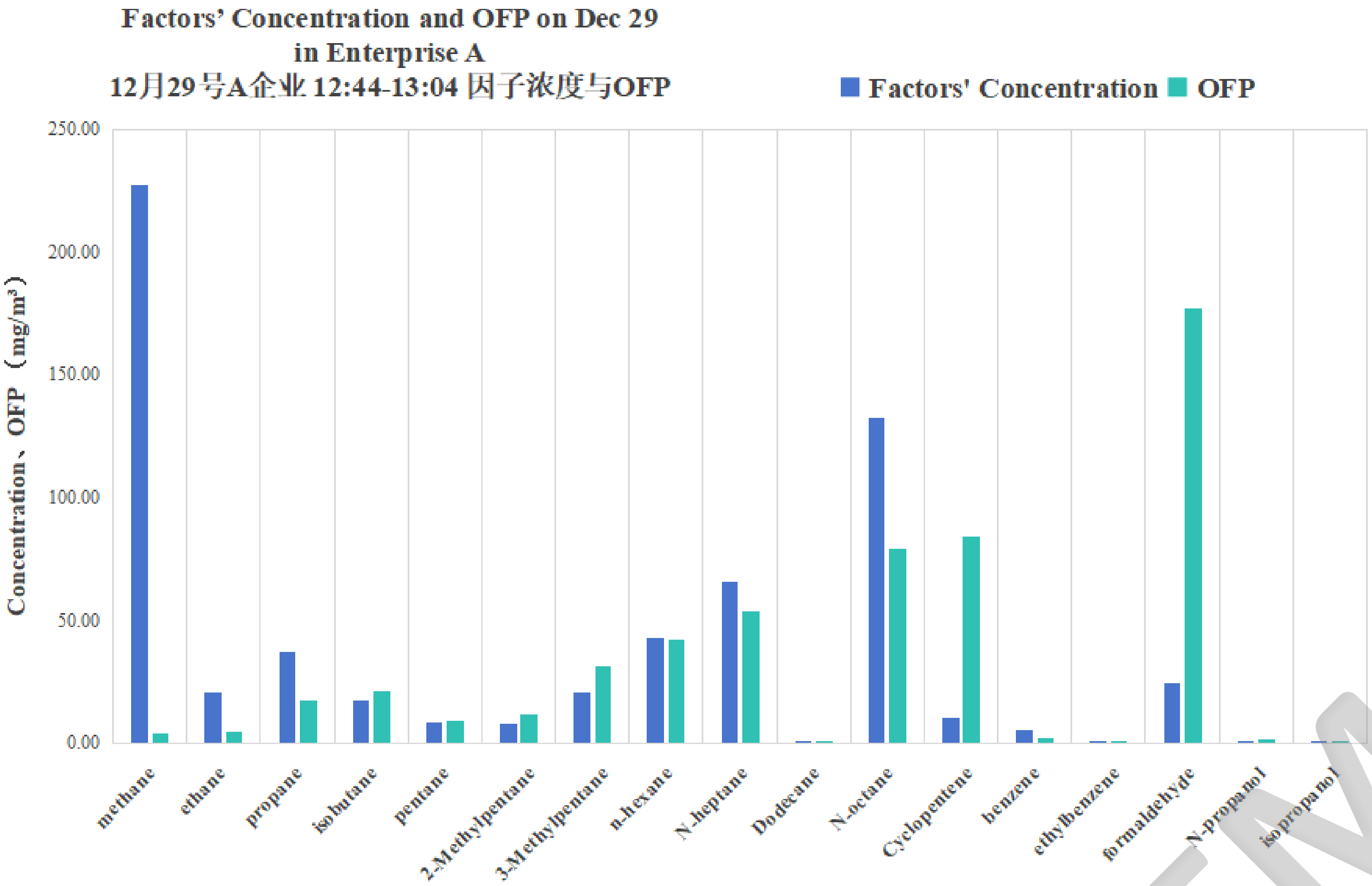
在冬季VOCs依然以烷烃类为主，其它物质中烯烃类主要是2-甲基-2-戊烯、环戊烯，苯类物质主要是苯和乙苯，酮醛类主要是甲醛。异味物质中甲硫醇是主要物质。

The Substances that Have Contribution to Ozone Formation

Flammable substances such as n-octane, tetrahydrothiophene etc. contribute the formation of ozone.

正辛烷、四氢噻吩等易燃物质助长了臭氧的形成。

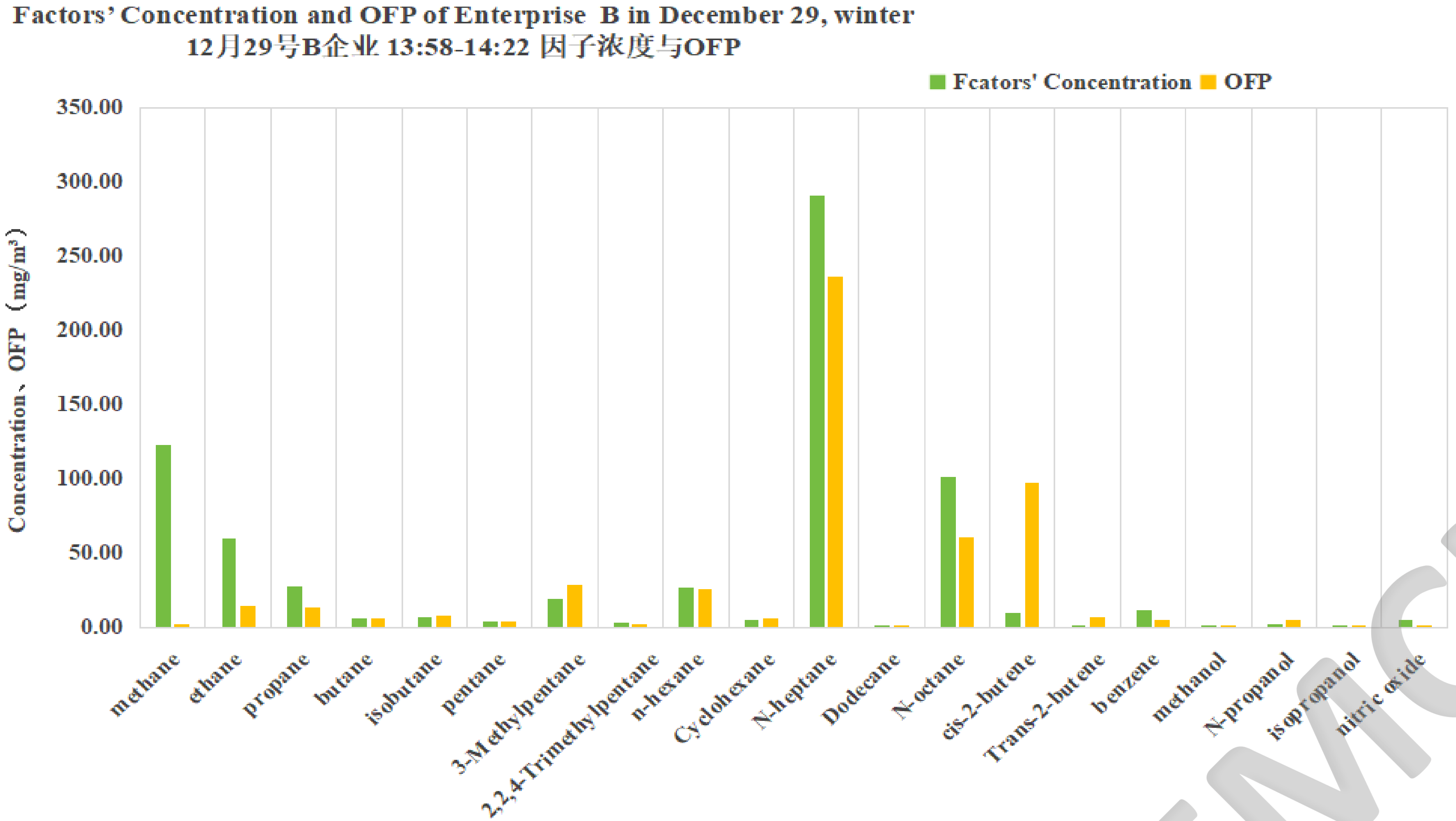
Factors' Concentration and OFP on Dec 29 in Enterprise A



The main contributing factors in winter printing Enterprise A are cyclopentene, n-heptane, n-octane, followed by 3-methylpentane, n-hexane, etc.

冬季印刷A企业中起主要贡献的因子是环戊烯、正庚烷、正辛烷，其次为3-甲基戊烷、正己烷等。

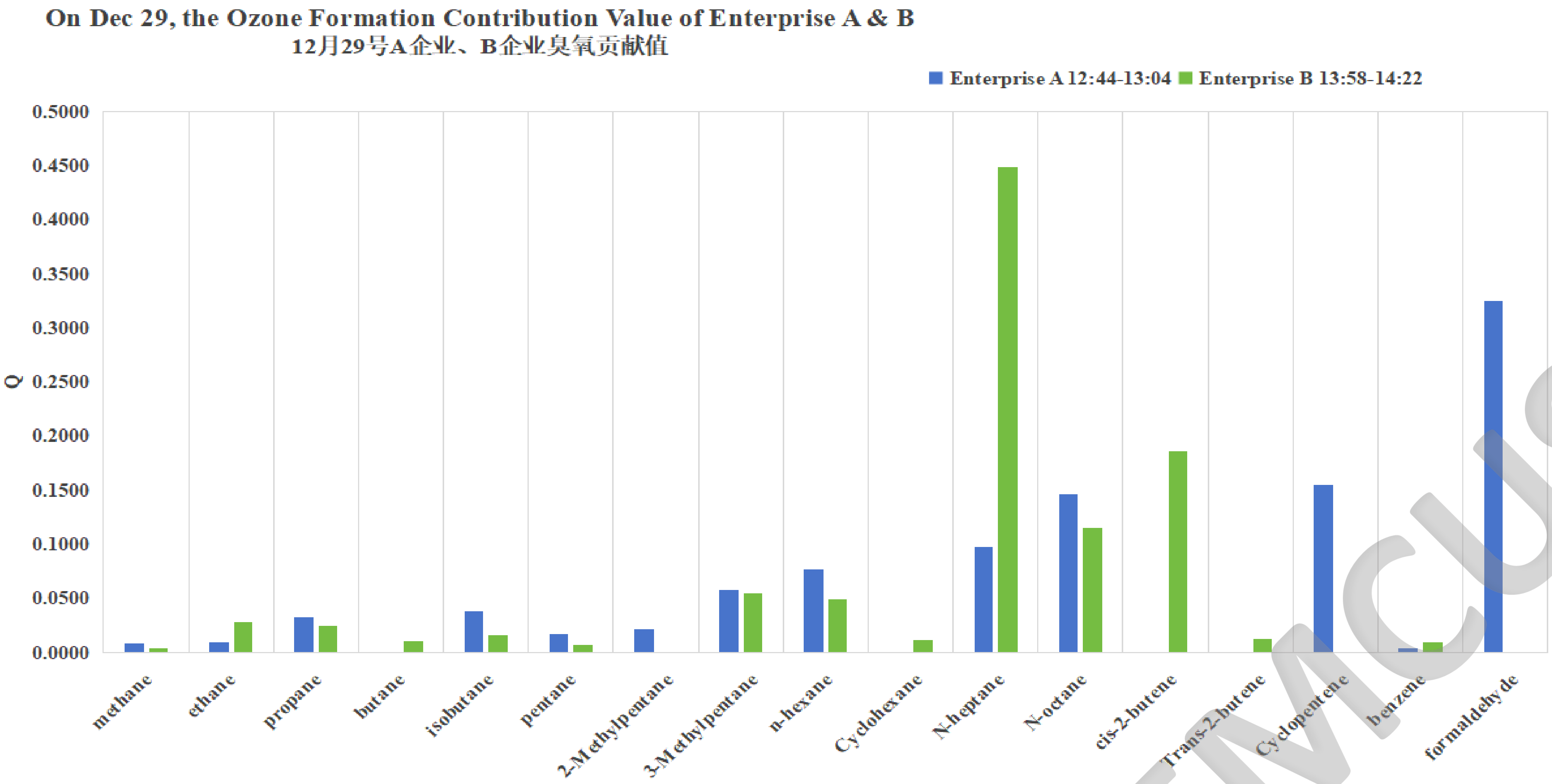
Factors' Concentration and OFP of Enterprise B in December 29, Winter



The main contributing factors in winter printing Enterprise B are n-heptane, cis-2-butene, n-octane, followed by 3-methylpentane, n-hexane, etc.

冬季印刷B企业中起主要贡献的因子是正庚烷、顺-2-丁烯、正辛烷，其次为3-甲基戊烷、正己烷等。

On December 29, the Ozone Formation Contribution Value—Q of Enterprise A & B



It can be seen from the ozone contribution values of the two enterprises:n-heptane, cis-2-butene, cyclopentene, n-octane, and 3-methylpentane are the main ozone contribution factors in winter.

从两个企业的臭氧贡献值中可以看出：正庚烷、顺-2-丁烯、环戊烯、正辛烷、3-甲基戊烷为冬季的主要的臭氧贡献因子。

Conclusion

1. There is no proportional relationship between ozone formation and ambient temperature, and the temperature difference between summer and winter does not affect the ozone formation in printing enterprises.
企业的臭氧生成与环境温度没有正比例增长关系，夏季与冬季的温度差异并不会影响印刷企业周围臭氧的生成.

2. The combustion of a large amount of natural gas used in the production heating process of printing enterprises and the process of incomplete combustion produce a large amount of thermal radiation, which helps and promotes the formation of ozone in printing enterprises. The representative substance is **tetrahydrothiophene**. And odorous substance such as: methanol, ethanol, n-propanol, isopropanol, n-butanol, methyl mercaptan, dimethylamine, dimethylnitrosamine, etc

印刷企业生产加热过程中使用的大量天然气的燃烧和不完全燃烧的过程中产生大量的热辐射，帮助和助长了印刷企业臭氧的生成。代表性物质为四氢噻吩。以及异味物质和易燃物质如： 甲醇、乙醇、正丙醇、异丙醇、正丁醇、甲硫醇、二甲胺、二甲基亚硝胺等

3. The main factors that contribute ozone formation in summer is:
夏季对臭氧生成主要贡献的因子顺序是:
cyclopentene, n-heptane, 3-methylpentane, n-octane, cis-2-butene. Then followed by isobutane, n-hexane, 2-methylpentane, etc.
环戊烯、正庚烷、3-甲基戊烷、正辛烷、顺-2-丁烯。其次为异丁烷、正己烷、2-甲基戊烷等。

The main factors that contribute ozone formation in winter is:
冬季对臭氧生成主要贡献的因子顺序是:
cyclopentene, n-heptane, n-octane, n-butene, n-hexane. followed by 3-methylpentane, 2-pentene, cis-2-butene, etc.
环戊烯、正庚烷、正辛烷、正丁烯、正己烷。其次为3-甲基戊烷、2-戊烯、顺-2-丁烯等。

Conclusion

4. The factors have positive impact to ozone formation in printing enterprises
印刷行业中对臭氧形成起到正影响的物质是:

Alkanes: n-heptane, 3-methylpentane, n-octane, isobutane, n-hexane, 2-methylpentane;
烷烃类物质:　正庚烷、3-甲基戊烷、正辛烷、异丁烷、正己烷、2-甲基戊烷;

Olefins: 2-methyl-2-pentene, cyclopentene, cis-2-butene, n-butene, etc
烯烃类物质：　2-甲基-2-戊烯、环戊烯、顺-2-丁烯、正丁烯等

NOx in organics: nitrogen oxide, nitrogen dioxide
无机物中的氮氧化物：一氧化氮、二氧化氮

5. The factors have negative impact to ozone formation in printing enterprises
印刷行业中对臭氧形成起到负影响的物质是:

Aldehydes: formaldehyde, acetaldehyde,etc
醛类物质: 甲醛、乙醛等

Benzene substances: ethylbenzene, benzene, toluene, paraxylene, m-xylene, o-xylene, etc
苯类物质 ： 乙苯，苯、甲苯、对二甲苯、间二甲苯、邻二甲苯等

Expectation

1. There is quite a difference between the MIR activity value and the existing MIR value in the airspace emitted by the company's production， and needs to be re-studied or tested on the MIR. value on the ozone formation precursors within 10-100m airspaces, such as methane.

在企业生产排放的空域中MIR活性值与现有的MIR值存在着较大的差异，需要对在10-100m空域中臭氧形成的前置物质的MIR值重新进行研究或测试，如甲烷。

2. A large amount of natural gas is used in the printing industry, and the main additive in natural gas is tetrahydrothiophene, which has been monitored many times and contributes to ozone f rmation, etc.

印刷行业中使用大量的天然气，天然气中的主要添加剂为四氢噻吩，被多次监测到，助长了臭氧的形成，需要研究和定义四氢噻吩的MIR值。

3. The precursors to ozone formation are varied in different industries, and the detection and research methods of the ozone formation precursors in printing enterprises can be mapped to other industries.

不同行业的臭氧形成的前置因子是不同的，对于印刷企业中臭氧形成的前置因子的检测及研究方法可应用到其它行业。

4. The relationship between positive impact substances and negative impact substance on ozone formation need a further research.

臭氧生成的正影响物质和负影响物质之间的关系需要进一步研究。

Expectation

5. Human cognition of the ozone formation is still very superficial, and the monitoring methods at different heights are extremely limited, so it is necessary for China and USA counterparts to work together to solve the generation conditions and ozone precursors in different industries, and solve the problem of rising ozone substances that human beings are facing.

人类对臭氧的形成的认知还很肤浅，在不同高度的监测手段极 其有限，需要中美两国同行联手面对，解决在不同行业臭氧的生成条件及前置因子，解决人类正在面临的臭氧物质不断升高难题。

6. Human-being need use low altitude monitoring technology（low altitude UAV) to carry out long-time on-site hovering monitoring towards ozone’ s concentration change situationin a specific area’s airspace, thus to research the rule from zone formation to ozone disperation.

人类需要借助于低空监测技术（如低空无人机）对10-200m的特定区域的空域臭氧变化进行长时间定点悬停监测。研究臭氧从形成到消失的变化规律。

We would like to have further communication and exchanges on the air quality monitoring with all experts and participators.

Welcome to Suzhou China and have a real-site visit to EMCUS!

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