

Supplementary Materials:

Cheng Chen ^{1,*}, Lingrui Wang ², Yanhong Qin ¹, Yunjiang Zhang ³, Shanshan Zheng ², Yifan Yang ², Shiguang Jin ³ and Xiaoxiao Yang ⁴

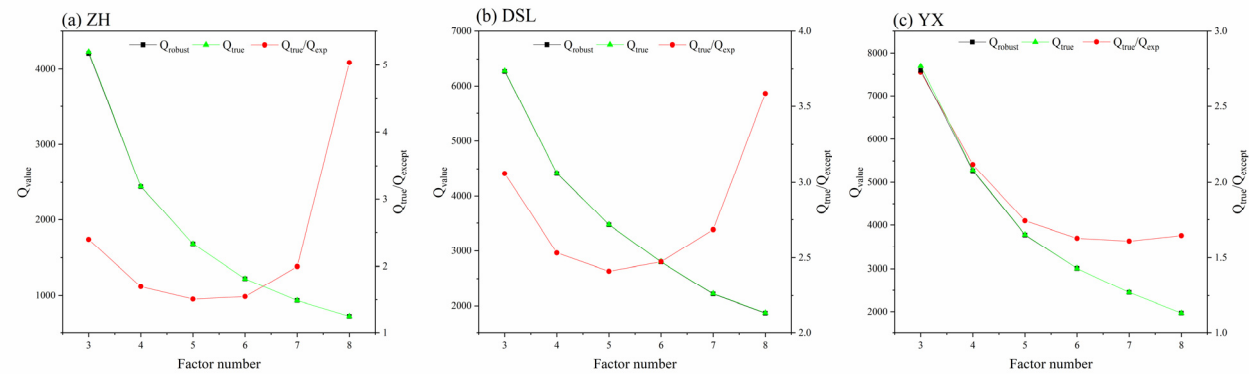
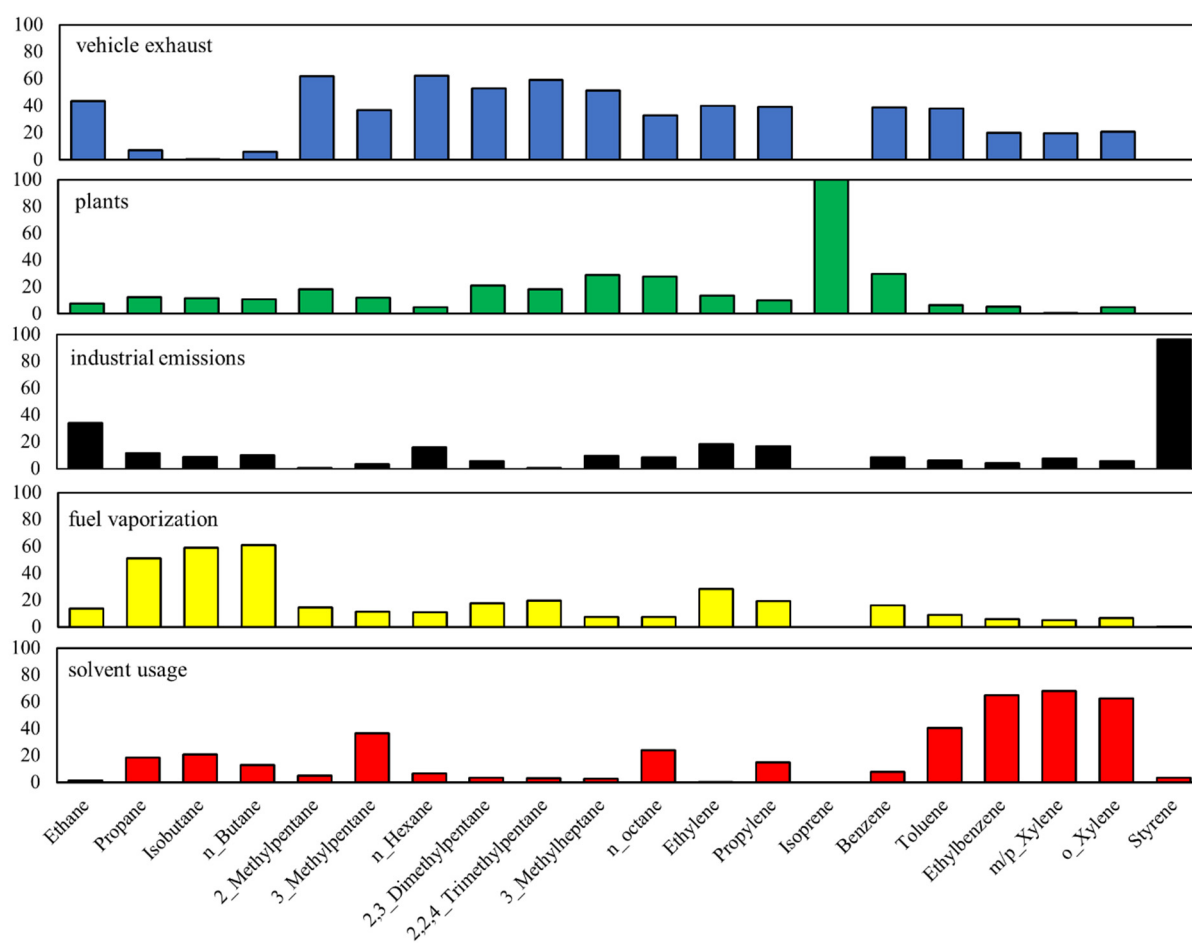


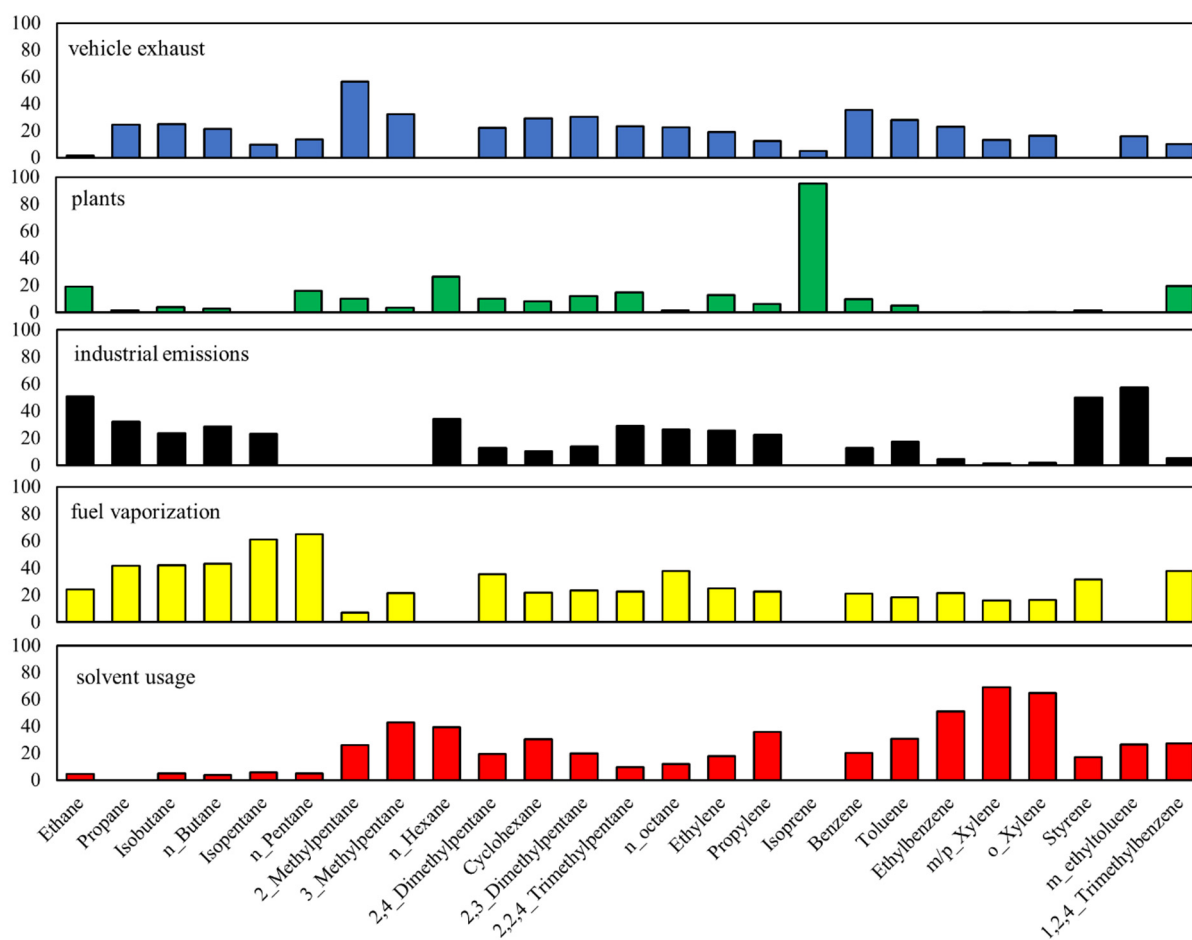
Figure S1. Q_{robust} , Q_{true} and $Q_{\text{true}}/Q_{\text{except}}$ plotted against the number of factors used in the positive matrix factorization (PMF) solution at the ZH, DSL and YX sites.

Table S1. Control measures during different control phases in Shanghai and Yixing.		
City	Control phases	Control measurement
Shanghai	Phase 1-3	The company shutdown or curtail 255 oil refinery, petrochemical, steel and other industries;
		Reduce 30% of coal-fired boilers and other combustion facilities;
		Stop 101 large construction activities;
		Ban single-hull ferry boats and non-road machinery operations;
		Restrict driving of high emitter (i.e., yellowlabel) vehicles to downtown;
Yixing	Phase 1-2	Extend public transport services and encourage flexible working schedules.
		Reduce more than 25% of sulfur dioxide, nitrogen oxides, dust and VOCs.
	Phase 3	Stop petrochemical industries and key VOCs emission companies; Close some gas stations.

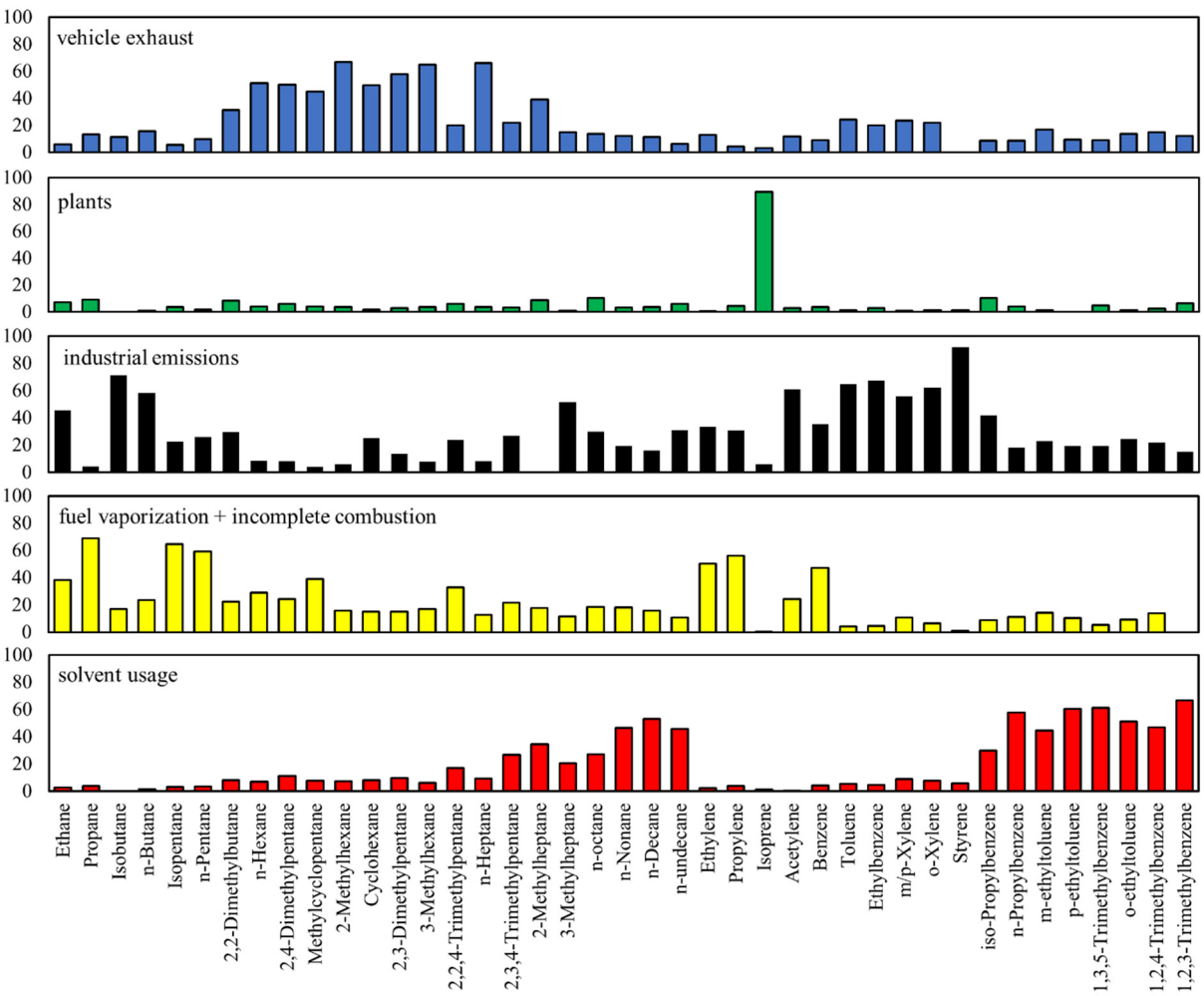
(a) ZH: in control



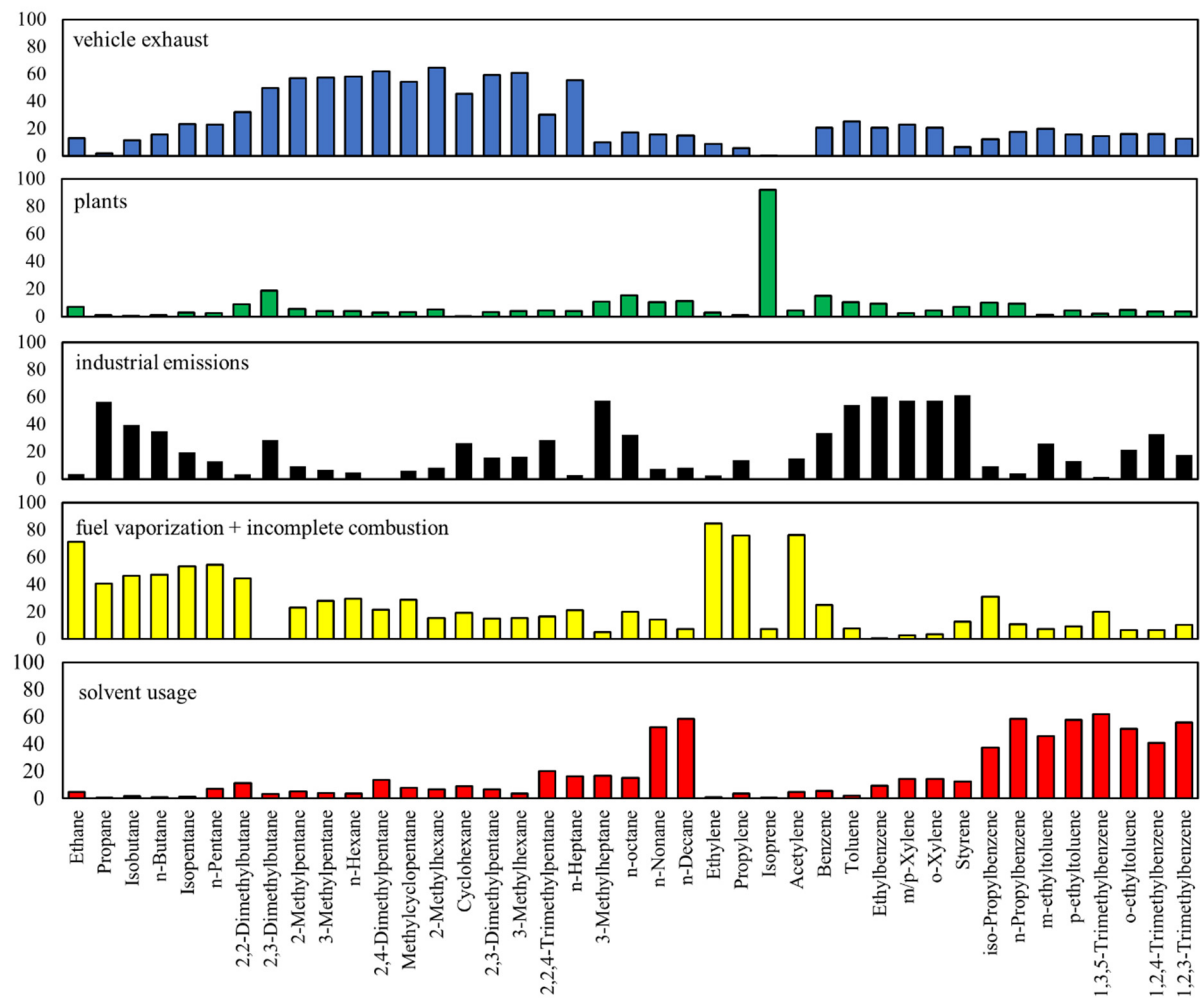
(b) ZH: deregulation



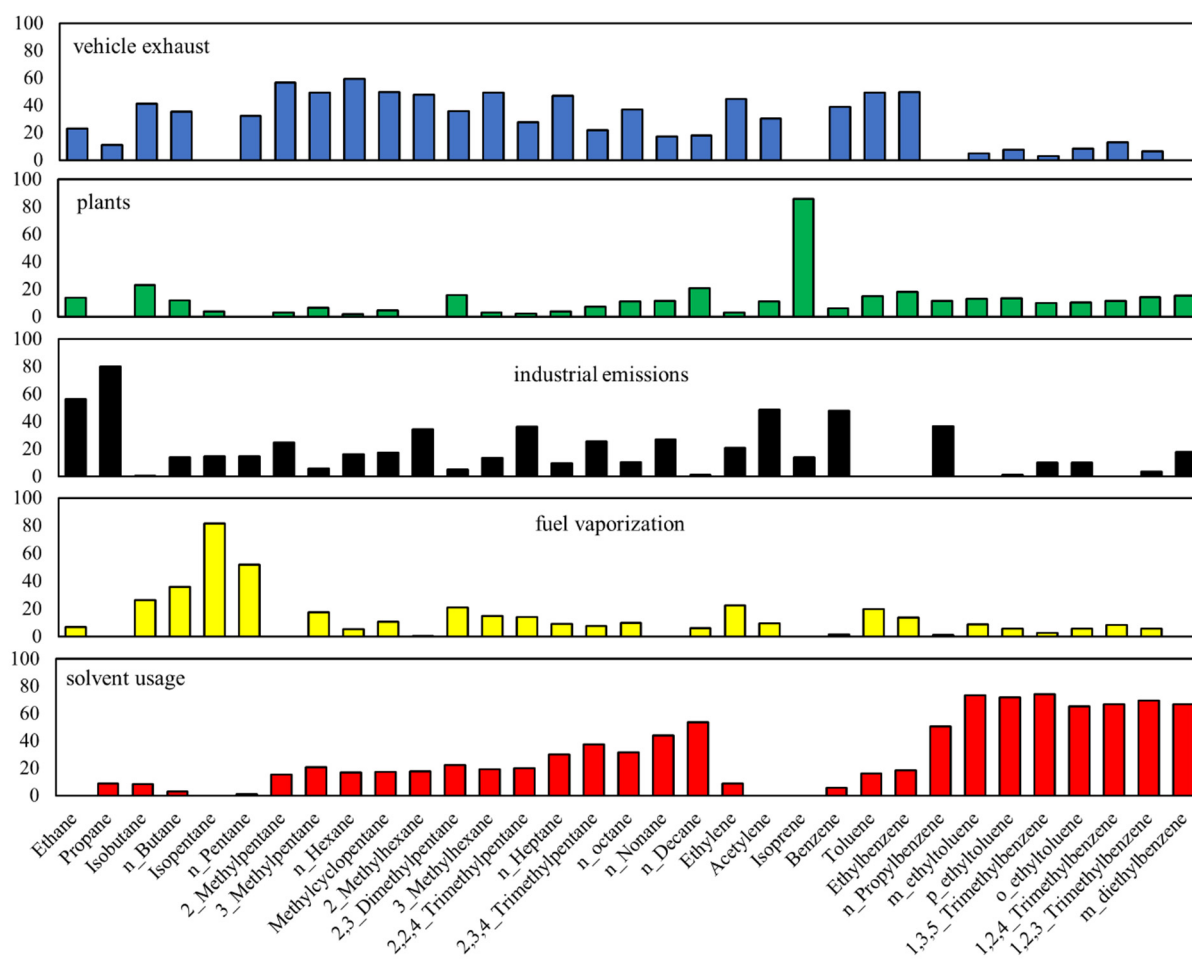
(c) DSL: in control



(d) DSL: deregulation



(e) YX: in control



(f) YX: deregulation

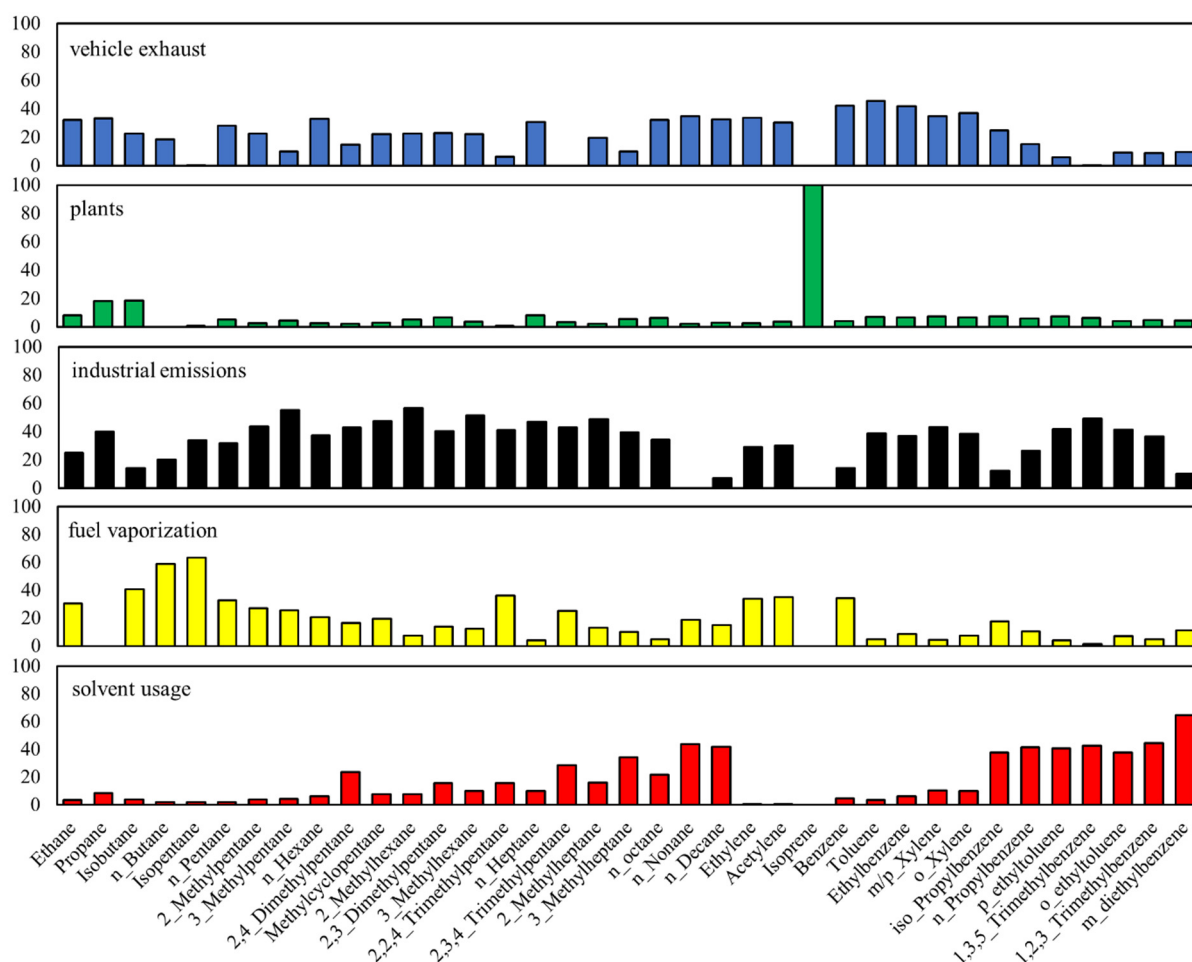


Figure S2. Factor profile resolved by PMF at the ZH, DSL and YX sites during different periods of the G20 summit.

The sampling and analysis methods

At the YX site, VOCs observe the TH-300B rapid online continuous automatic monitoring system for atmospheric volatile organic compounds developed by Wuhan Tianhong for real-time continuous monitoring. The sampling frequency is 1 h, and the detection limit range is $0.008 \times 10^{-9} \sim 0.05 \times 10^{-9}$. The detection limits of each species are shown in Table 2. Equipped with a high-precision mass flow control device, the accuracy is up to 1%, and the sampling flow rate is 60 ml/min to ensure the high repeatability of VOCs capture. The TH-300B monitoring system specifically includes a carrier gas system, an electronic refrigeration ultra-low temperature pre-concentration sampling system, a GC-FID/MS (gas chromatography-flame ionization detector/mass spectrometer detector) analysis system, and a recording system. During monitoring, the ambient air sample is collected by the sampling system and then enters the concentration system. Under low temperature conditions, the C2-C4 hydrocarbons in the atmosphere are captured by the 20m×0.32×3.0μm PLOT AL203 capillary column. The carrier gas is high-purity nitrogen (purity greater than 99.999%), and the carrier gas flow rate is 1.3ml/min; other VOCs are trapped by the empty column of deactivated quartz capillary; then, it is quickly heated and analyzed to make the compounds enter the analysis system. After being separated by the gas chromatographic column, the hydrocarbons of C2-C4 are detected by the FID detector at a temperature of 200°C. The flow rate of fuel gas (hydrogen) is 50ml/min, the flow rate of supporting gas (air) is 400ml/min, and the flow rate of compensation gas (nitrogen) is 20ml/min. Other VOCs are detected by MS detectors. The GC-MS column is a

60m×0.25×1.4μm DB-624 capillary column for the analysis of C5-C12 hydrocarbons, halogenated hydrocarbons and oxygen-containing VOCs. The carrier gas is high-purity helium (purity greater than 99.999%), and the carrier gas flow rate is 1.3ml/min. The whole process is automatically completed by the control software, and it is also equipped with an automatic back blow and automatic calibration system. The system can detect 98 VOCs (hydrocarbons, halogenated hydrocarbons, oxygenated volatile organic compounds) in one sampling.