

室内PM2.5实时监测解决方案



美国TSI公司
降凡
健康&安全产品经理
2015.3



UNDERSTANDING, ACCELERATED

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关于TSI



【TSI公司】

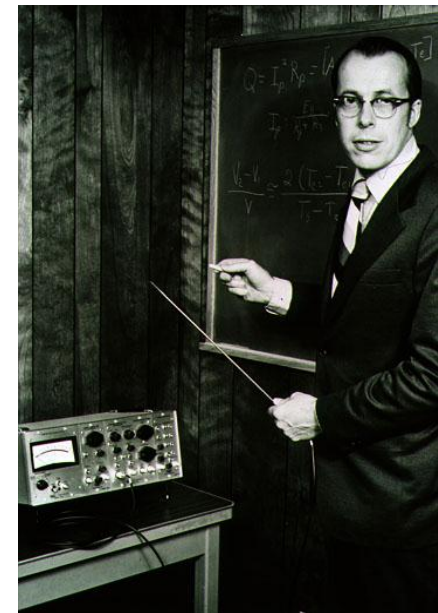


总部：明尼苏达州圣保罗市休维区

TSI's 创始人 –
Dr. Mike Fingerson

TSI成功的三大基石：

- ❖ 信任 (TRUST)
- ❖ 科学 (SCIENCE)
- ❖ 创新 (INNOVATION)



世界上第一台气溶胶分析仪（1967）

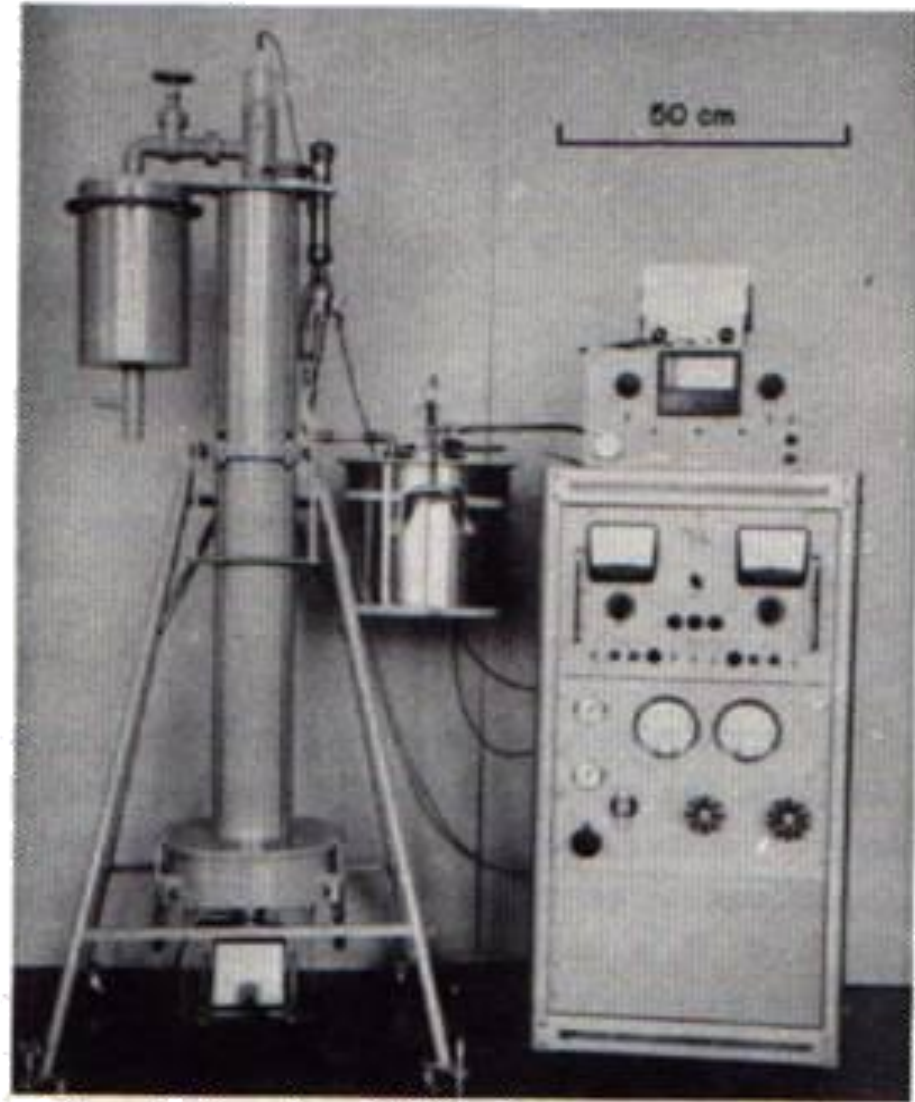
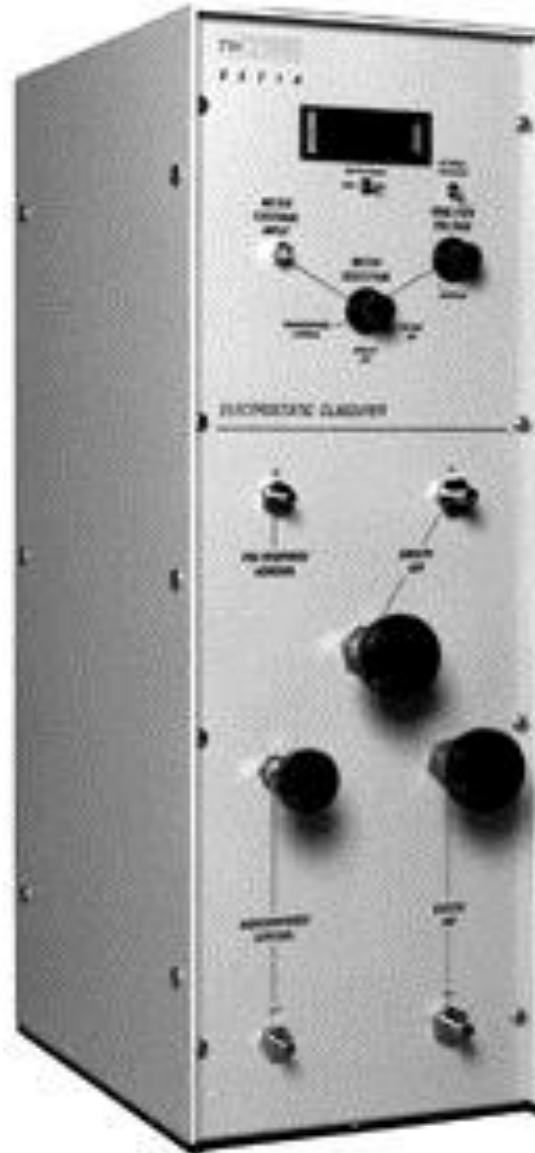


Figure 1. The University of Minnesota prototype electrical aerosol analyzer.

世界上第一台气溶胶粒径分级器（1974）



世界上第一台凝聚核粒子计数器 (1979)



世界上第一台气溶胶粒径谱仪（1981）



1981 3100 Aerosol Particle Sizer



【TSI—颗粒物检测技术领导者】



【TSI与国内科研机构广泛合作】



- 2007年，与中国环境科学研究院共建“气溶胶测量联合实验室”。
- 2008年，与同济大学共建“同济大学-美国TSI公司发动机颗粒物测试实验室”。
- 2009年，与药物制剂国家工程研究中心共建“肺部给药实验室”。
- 2013年，与中国建筑科学研究院建筑环境与节能研究院共建“TSI-CABR建筑环境与节能检测技术联合实验室”。
- 2014年，与中科院地球环境研究所共同建立“中国科学院地球环境研究所—TSI公司气溶胶研究联合实验室”。



【产品优势——TSI校准维修中心】



中国建筑科学研究院
China Academy of Building Research



- TSI 与建研院在北京合作共建国家级重点实验室。
- 可对TSI通风类仪表、粉尘仪和激光尘埃粒子计数器进行校验。



CMA计量证书

CERTIFICATE OF CALIBRATION
TSI Incorporated, 581 Carleton Road, Shoreview, MN 55126 USA
TEL: 1-800-874-2811 1-651-498-2811 FAX: 1-651-498-3824 http://www.tsi.com

PARTICLE STANDARDS					ISO 21501-4 COUNT EFFICIENCY		
CHANNEL	PARTICLE SIZE	SIZE DENOVATION	LOT No.	EXPIRATION DATE	MEASUREMENT	ALLOWABLE RANGE	ACTUAL
1	0.488 µm	0.025 µm	34605	01-30-12	0.5 µm	50% ± 10	49%
2	0.707 µm	0.040 µm	32256	08-30-10	1.0 µm	100% ± 10	93%
3	0.924 µm	0.010 µm	34881	04-30-13			
4	3.005 µm	0.037 µm	34413	02-28-13			
5	5.2 µm	0.4 µm	36869	11-30-12			
6	10.0 µm	0.4 µm	36831	11-30-12			

Count Efficiency: During calibration, 0.5 µm count efficiency is set to 50% ± 10 by adjusting the signal threshold. Count efficiency is then checked at 1.0 µm and must be 100% ± 10 when compared to a Condensation Particle Counter.

Particle Standards: All particles are NIST traceable Polystyrene Latex spheres (PSL).

ISO 21501-4 CUTPOINT CALIBRATION					
CHANNEL	NOMINAL PARTICLE SIZE	GAIN STAGE	DIGITAL CUTPOINT	CUTPOINT RANGE	ACTUAL CUTPOINT ACCURACY
1	0.5 µm	A	269	40% - 60%	49%
2	0.7 µm	A	403	40% - 60%	32%
3	1.0 µm	A	830	40% - 60%	31%
4	3.0 µm	B	405	40% - 60%	31%
5	5.0 µm	B	1103	40% - 60%	32%
6	10.0 µm	B	2533	40% - 60%	32%

Capitol Calibration: The AeroTrak is challenged with aerosolized Particle Standards of the specified particle size. A minimum of 5000 particle counts are collected. The median digital height is determined from the distribution and divided to the channel output for the specified particle size. The capitol is verified by challenging the AeroTrak a second time with the same size Particle Standard. The sum of the counts in the channels below the Particle Standard's specified size, taken as a percentage of the total particles counted, must be within the Capitol Accuracy Range.

ISO 21501-4 Zero Count		ISO 21501-4 Flow Rate (L/min)		
Channel	Result	Nominal	Actual	Tolerance
1	PASSED	1.2	91.9	±5%

The Zero Count test is performed using a HEPA filter assembly. The instrument must count less than 1 particle per 5 minutes at a 95% confidence level in accordance with JIS P921 and ISO 21501-4.

The volumetric Flow Rate on the inlet is calibrated to 190.0 L/min ± 5% and is verified with a thermal flowmeter. The calibration ratio for this instrument is at least 3.1:1.

ISO 21501-4 SIZE RESOLUTION		
ACTUAL	Size	LIMIT
0.2%	0.5 µm	15%

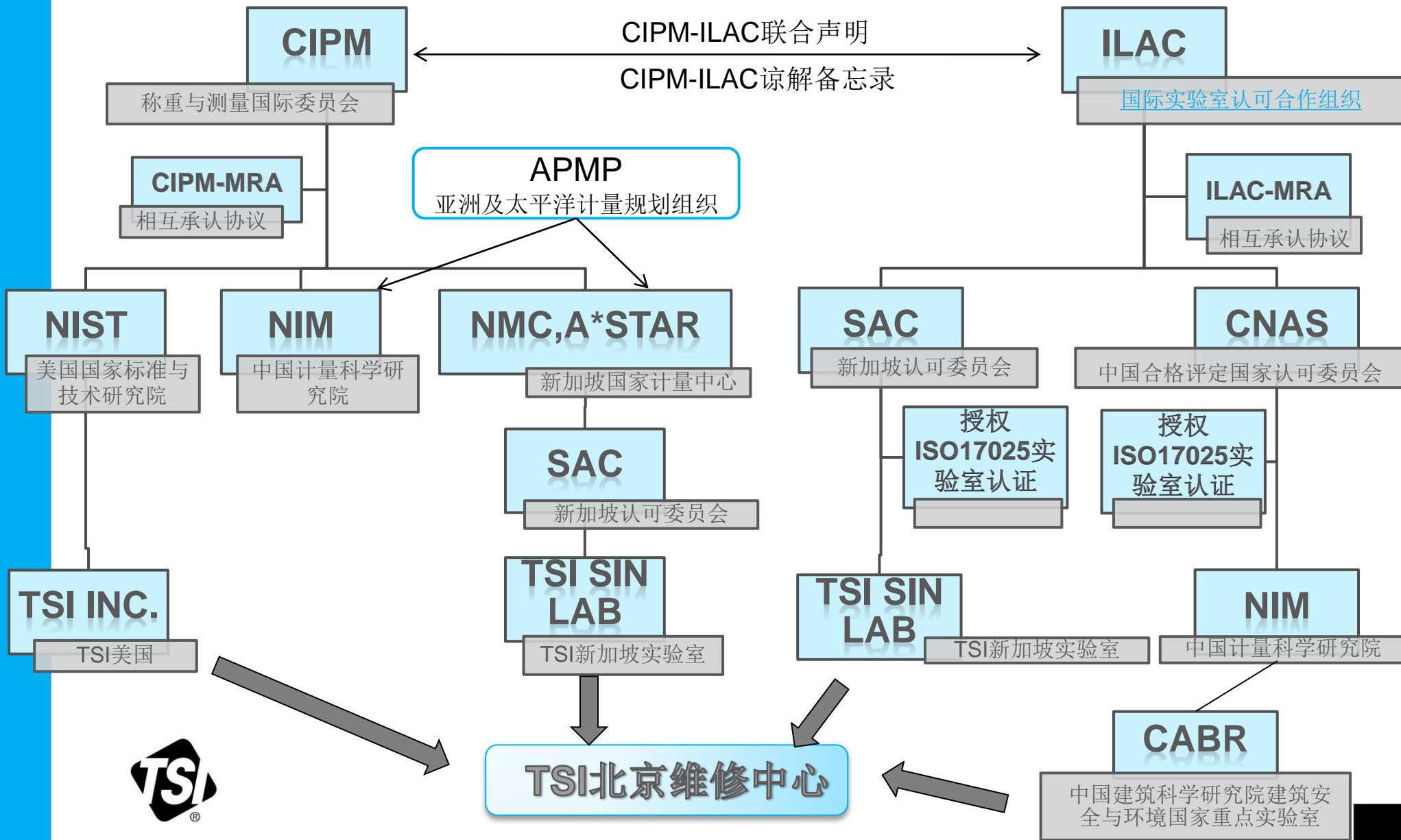
The Size Resolution test is performed in accordance with the test method specified in ISO 21501-4 Section 4.4. The instrument must have a size resolution less than 15% at the specified size.

Model 9500-01 SN 9500031002 August 13, 2010 Page 2 of 2

NIST可追溯 符合ISO
12103-1校准证书



【产品优势——量值溯源】



【产品优势——TSI校准维修中心】

“TSI-CABR建筑环境与节能检测技术联合实验室——粉尘仪校准实验室”是具备国际级水平的检验、检测和维修光散射粉尘仪的实验室。该实验室由美国TSI公司和中国建筑科学研究院建筑环境与节能研究院共同管理和运营。



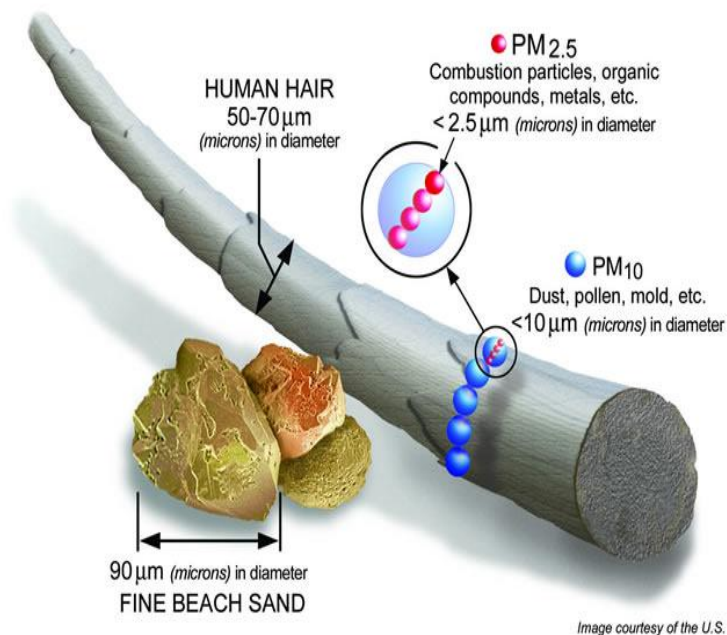
室内PM2.5 检测技术



【PM2.5?】

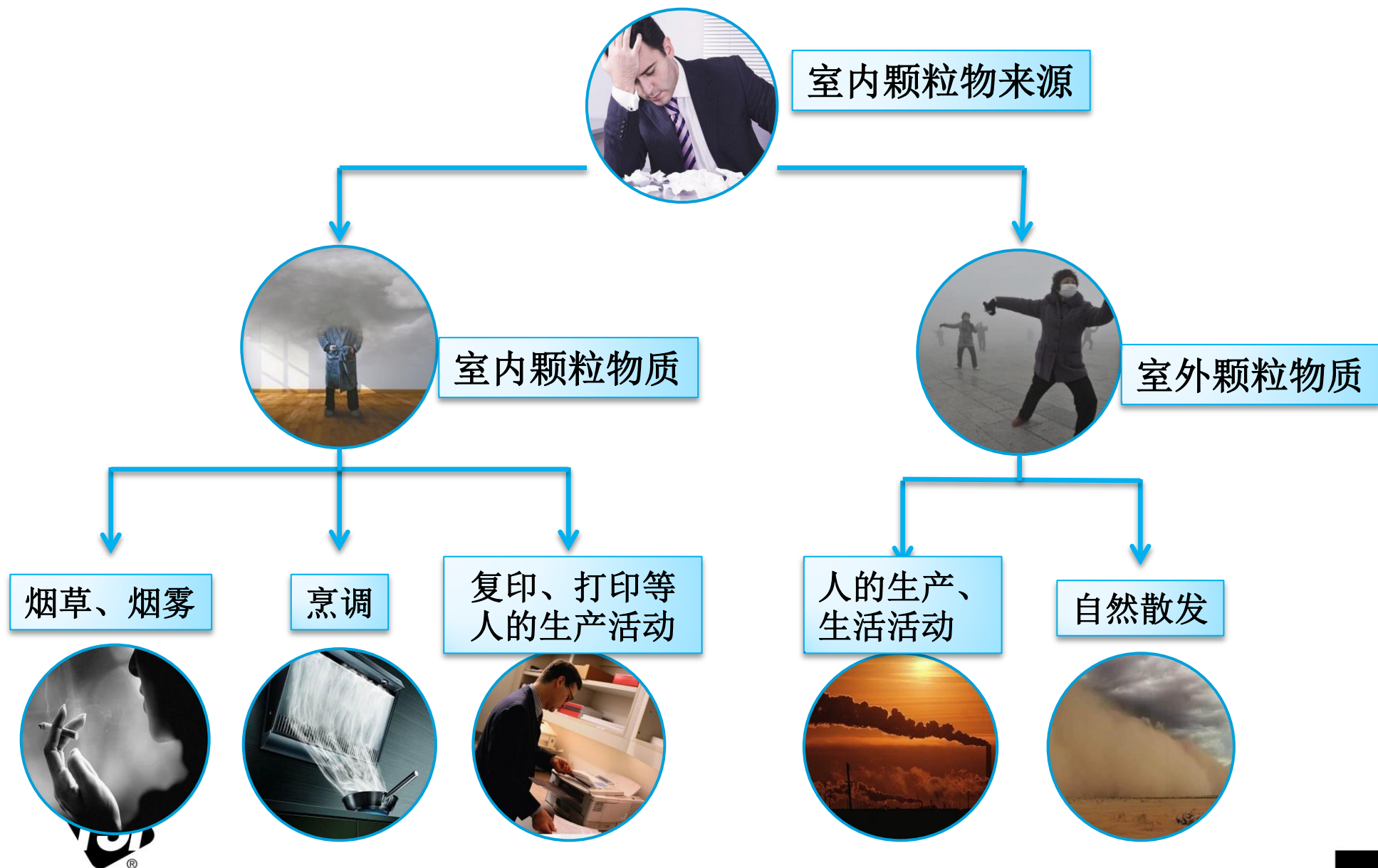
❖ **PM2.5**——细颗粒物，也叫可入肺颗粒物，是对空气中空气动力学直径小于或等于2.5微米的固体颗粒或液滴的总称。这些颗粒非常细小，人的肉眼无法看到，它们可以在空气中漂浮数天。

❖ 当每立方米空气中直径2.5 μm 以下的颗粒污染物的含量上升10 μg 时，长期肺癌死亡率就上升8%。



- ❑ 颗粒物越小，进入人体呼吸系统的部位就越深，甚至能够穿透肺泡进入人体血液循环影响心脏、大脑等重要器官，危害就越大。
- ❑ 颗粒物越小，其比表面积越大，表面吸附的有毒化学组分就越多。

【室内PM2.5污染源】



【国内室内PM2.5标准&检测方法】

GB/T18883-2002

《室内空气质量标准》

- （国家质量监督检验检疫总局、卫生部、国家环境保护总局联合发布）对PM10有规定，修订工作正在进行中，将增加PM2.5检测标准和限值。

GBT18204.2-2014

《公共场所卫生检验方法 第2部分：化学污染物》

- （中华人民共和国国家卫生和计划生育委员会与中国国家标准化管理委员会共同发布，于2014年12月01日实施）明确规定了光散射法作为PM10、PM2.5的检测方法。

JGJ/T309-2013

《建筑通风效果测试与评价标准》

- （中华人民共和国住房和城乡建设部批准于2014年02月01日实施）明确规定了新建建筑应进行通风效果模拟评价，此标准首次将PM2.5作为室内通风效果评价指标，建议日均值应小于75 $\mu\text{g}/\text{m}^3$ 。明确规定了光散射法作为PM2.5的检测方法。



【TSI PM2.5监测仪产品】

PM2.5/PM10监测产品



8530/8533



8530EP/
8533EP



8532/8534



AM510



AIRASSURE



本质安全
防爆型

8535



8537



DUSTTRAK
系列

DUSTTRAK II
AEROSOL MONITOR

DUSTTRAK DRX
AEROSOL MONITOR

New



TSI新一代室内 PM2.5在线监测仪



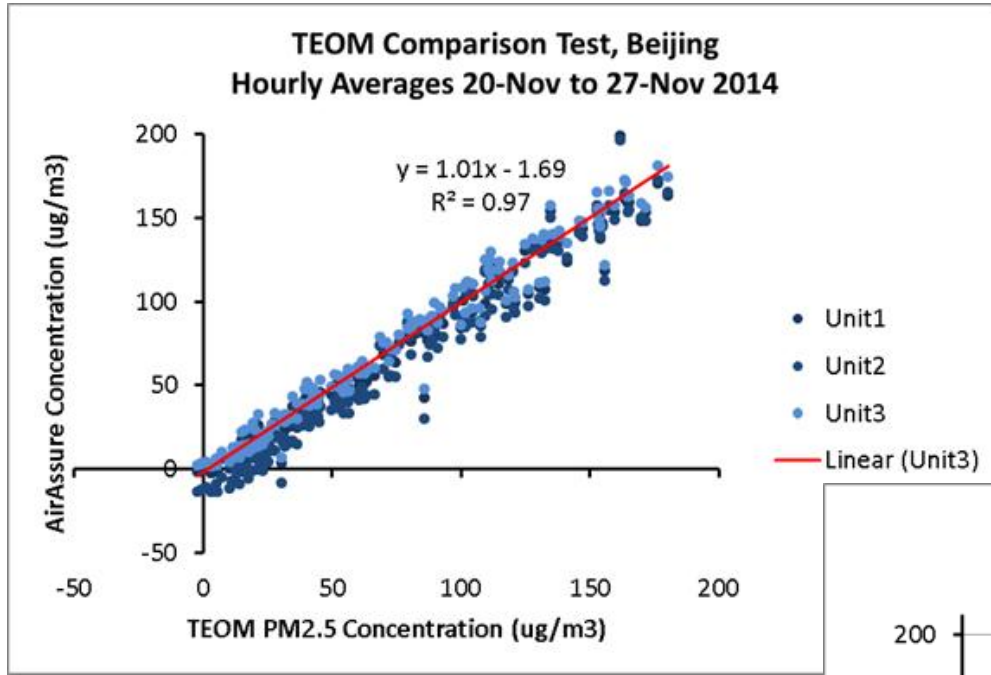
室内PM2.5实时监测解决方案

AirAssure

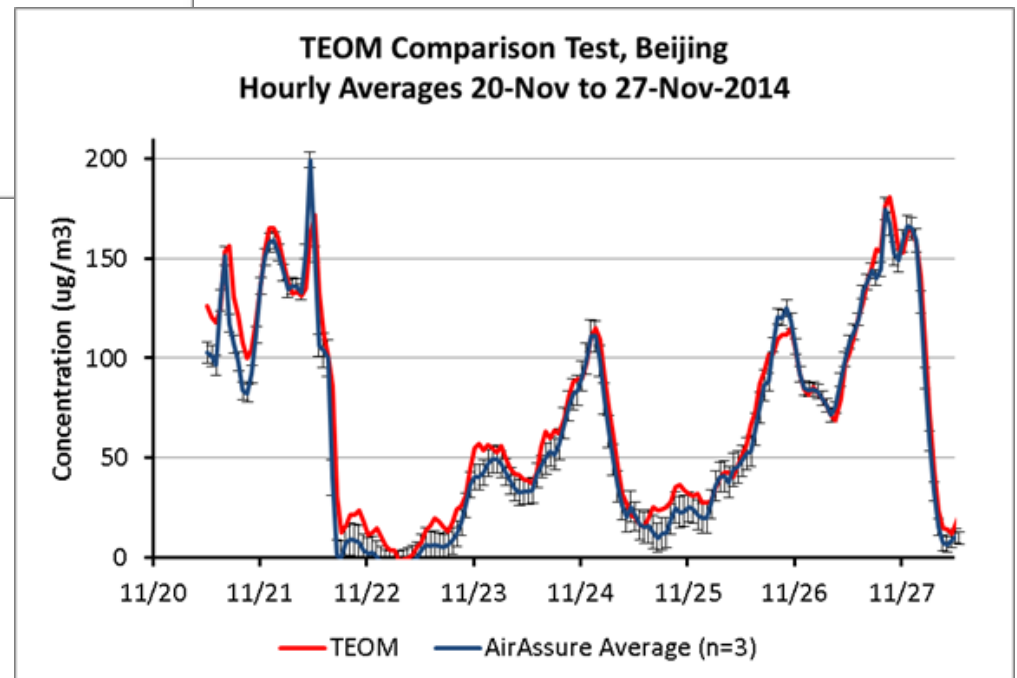
❖ 与中国商业地产现状高度匹配的“室内PM2.5实时监测解决方案”



【专业标准级检测精度】



❖ 与美国联邦和中国国家标准认可的PM2.5自动检测方法（**TEOM微量振荡天平法**） & **DustTrak** 的长期比对实验，采用TSI专利拟合算法，保证了测量结果的高度一致。



【内置PM2.5空气质量指数分级】



World Health Organization

□ 室内空气质量标准

❖ PM2.5 接触限值:

✓ 25 ug/m³ – 24小时均值

✓ 10 μg/m³ – 年均值

❖ 《环境空气质量指数 (AQI) 技术规定》 (HJ633-2012) 空气质量指数及对应的污染物项目浓度限值中PM2.5分级和表示颜色标准。



【BAS 无缝接入楼宇 自控系统】

PCs Outside LAN



IT Router/
Firewall

Server with
Web App



Location	PM 2.5	IP Address	Latitude
Machine Shop	10	192.168.200.1	1.52
Executive Suite	10	192.168.200.2	1.52
Lab 1	15	192.168.200.3	1.52
Lab 2	5	192.168.200.4	1.52
Lab 3	40	192.168.200.5	1.52
Lab 4	No Data	192.168.200.6	No Data
HVAC Lab	5	192.168.200.7	1.52

Machine Shop	192.168.200.1	1.52
	192.168.200.1	1.52
PM 2.5		10

Local Area Network (LAN)

Ethernet TCP/IP



24V AC/DC
4-20 mA

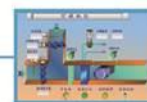
Local PCs



中控室



新风系统



空调系统



大屏显示系统



AIRASSURE™ 室内PM2.5在线监测仪

【 Web App 】

On PC

On Mobile Device



TSI UNDERSTANDING, ACCELERATED

PM Web

Instruments

Instruments

Instrument	Reading
Floor 1	13
Floor 2	11
Lobby	52
SW Lab	21
Executive Suite	6

192.168.1.22:80

TSI UNDERSTANDING, ACCELERATED LOGIN

PM Web

Instruments

Instruments

Instrument	Reading
11	0
13	0

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192.168.1.22:80

TSI UNDERSTANDING, ACCELERATED LOGIN

PM Web

Instruments

Serial: 11

Instrument Location	IP Address
Accounting office east	192.168.1.40

Details

Reading	Correction Factor	Reading Date
0	1.000	Dec 8, 2014 9:...
0	1.000	Dec 8, 2014 9:...
0	1.000	Dec 8, 2014 9:...
0	1.000	Dec 8, 2014 9:...
0	1.000	Dec 8, 2014 9:...
45	1.000	Dec 8, 2014 9:...
45	1.000	Dec 8, 2014 9:...
45	1.000	Dec 8, 2014 9:...

192.168.1.22:80

TSI UNDERSTANDING, ACCELERATED 登录

PM Web

颗粒物网页

仪器

序列: 11 状态: 激活

仪器位置	网络地址	校正系数
Accounting office east	192.168.1.40	1.000

详情

读取	校正系数	读取数据
0	1.000	2014-12-8 21:28:56
0	1.000	2014-12-8 21:28:26
0	1.000	2014-12-8 21:27:55
0	1.000	2014-12-8 21:27:24
0	1.000	2014-12-8 21:26:54
0	1.000	2014-12-8 21:26:23
0	1.000	2014-12-8 21:25:52
0	1.000	2014-12-8 21:25:22
0	1.000	2014-12-8 21:24:51

【AirAssure功能亮点】



1

快速测量室内PM2.5浓度

2

简单的挂壁式安装

3

模拟端口和以太网端口输出

4

直观快速获取空气质量指数

5

自动调零功能

6

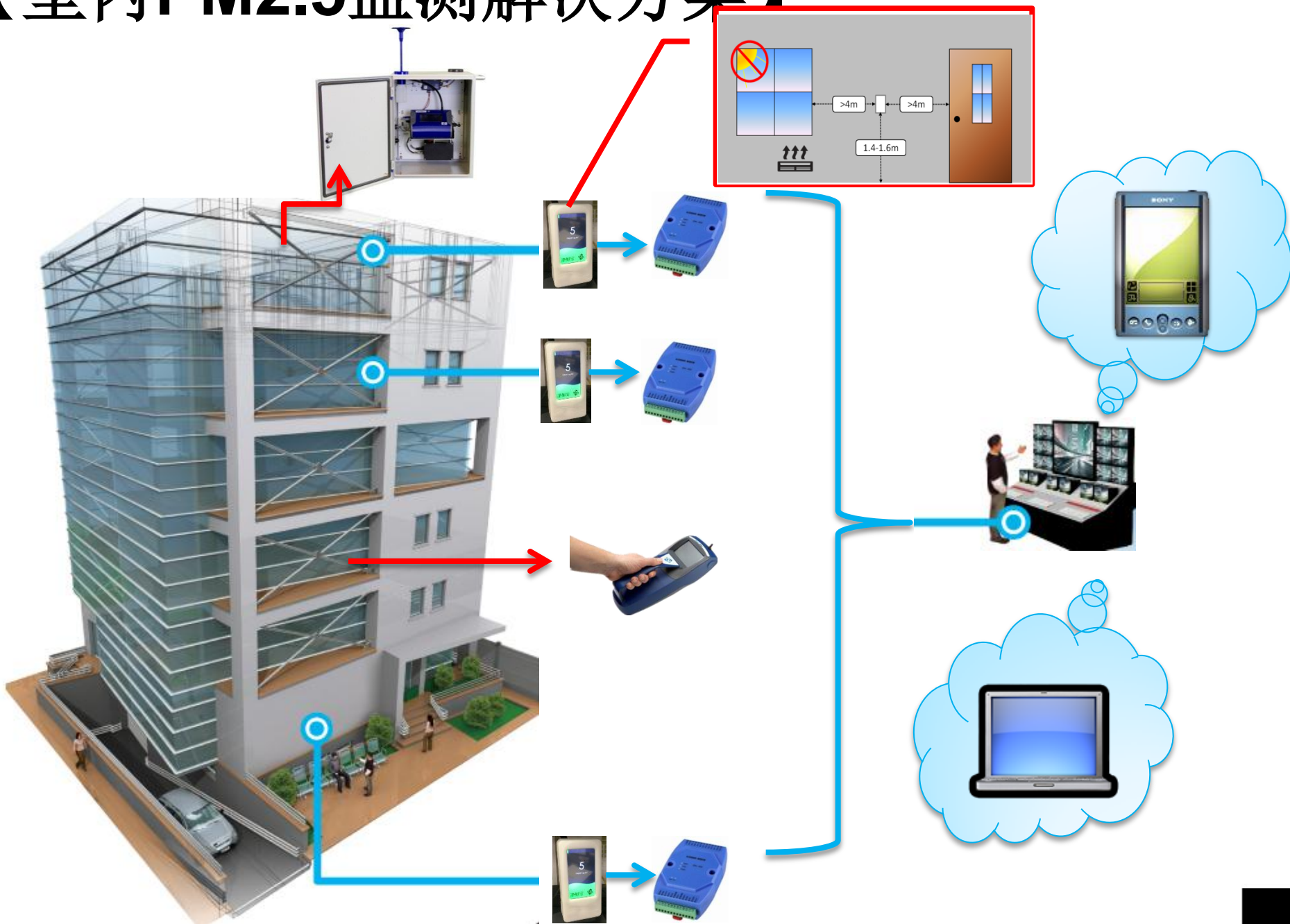
支持现场使用维护

7

NIST可溯源校准认证



【室内PM2.5监测解决方案】



TSI颗粒物现场检测技术应用实例



【边界监测- 纽约：新Meadowlands 体育场工地】

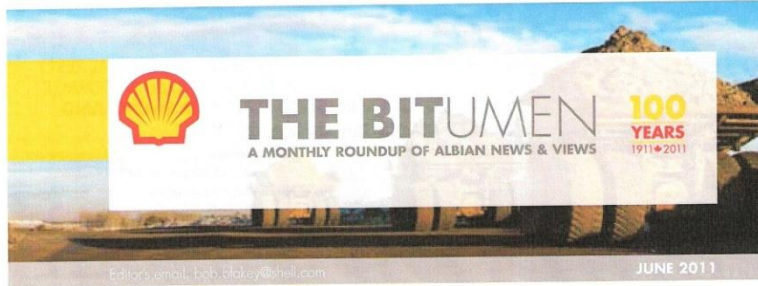


【室外连续监测应用】



The University of Sydney

【火灾污染监测应用】



SMOKE RESPONSE: HIGH PRAISE FOR EVERYONE

It began as a haze on the horizon, drifting down from what would become one of the largest fires Alberta has ever seen.

Conditions at MRM mine were such that by Saturday evening May 21, response team members, led by AIT on-call leader Mario Levesque, decided to meet with more than a hundred MRM mine shift workers face to face.

Despite the dense smoke, the top-of-mind questions were crystal clear: How safe is it to work in these conditions? Is there a way to monitor air quality where we're actually working? What are you doing to protect our health and safety?

"Safety of workers was and continues to be our top priority," says Adrian Gnyra, HSSE Manager. "A comprehensive response plan was put in place to ensure everyone's safety so operations could continue."

"We worked as quickly as we could to set specific exposure limits for particulates based on the advice from our own doctors and nurses, Alberta Occupational Health and Safety and other operators," said Colin Ashton, Plant Production Manager.

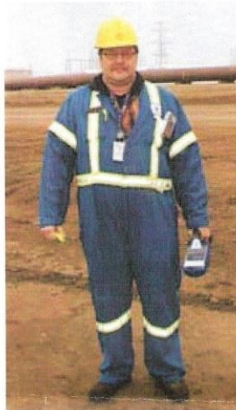
Six air-monitoring instruments were quickly put to work, consistently taking samples

outdoors, indoors and in truck cabs in specific locations around site. This will continue as long as smoke persists.

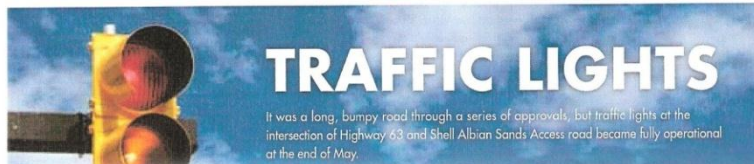
"We used these readings to make hourly decisions on the safety of the air quality. When readings were high, workers were brought inside to safe areas and operations were temporarily halted," says Ashton.

The ongoing response has relied on the hard work and collaboration of many teams, including Environment, Emergency Response, and Health and Safety, to name just a few. But most of all, hats off to the perseverance of everyone on site.

"I have high praise for everyone involved because of your consistent professionalism and skill in dealing with conditions that are unprecedented at Albian," said General Manager, Christian Houle. Read more...



Darryl Mackoway, labourer - MWAP, uses an air quality monitor to take readings at Jackpine.



TRAFFIC LIGHTS

It was a long, bumpy road through a series of approvals, but traffic lights at the intersection of Highway 63 and Shell Albian Sands Access road became fully operational at the end of May.

SHELL OIL SANDS
ALBERTA, 加拿大森林火灾:
DustTrakDUSTTRAK
用来测量对于周边空气质量的影响

【太空中的TSI颗粒物检测仪DustTrak和纳米颗粒物检测仪 P-Trak! 】



- 在美国宇航局的航天飞机和国际空间站（ISS）中，DUSTTRAK和P-Trak用于测量人员的工作和生活空间的空气质量并作为烟火探测器已超过10年。



【 BP石油泄漏污染监测- 墨西哥湾】



- 追踪烟气
- 保护消防人员和参与清除工作的船员健康
- 为EPA提供颗粒物的质量浓度报告

【“欧洲清洁空气计划” (CLEAN AIR FOR EUROPE)】



UFIPOLNET

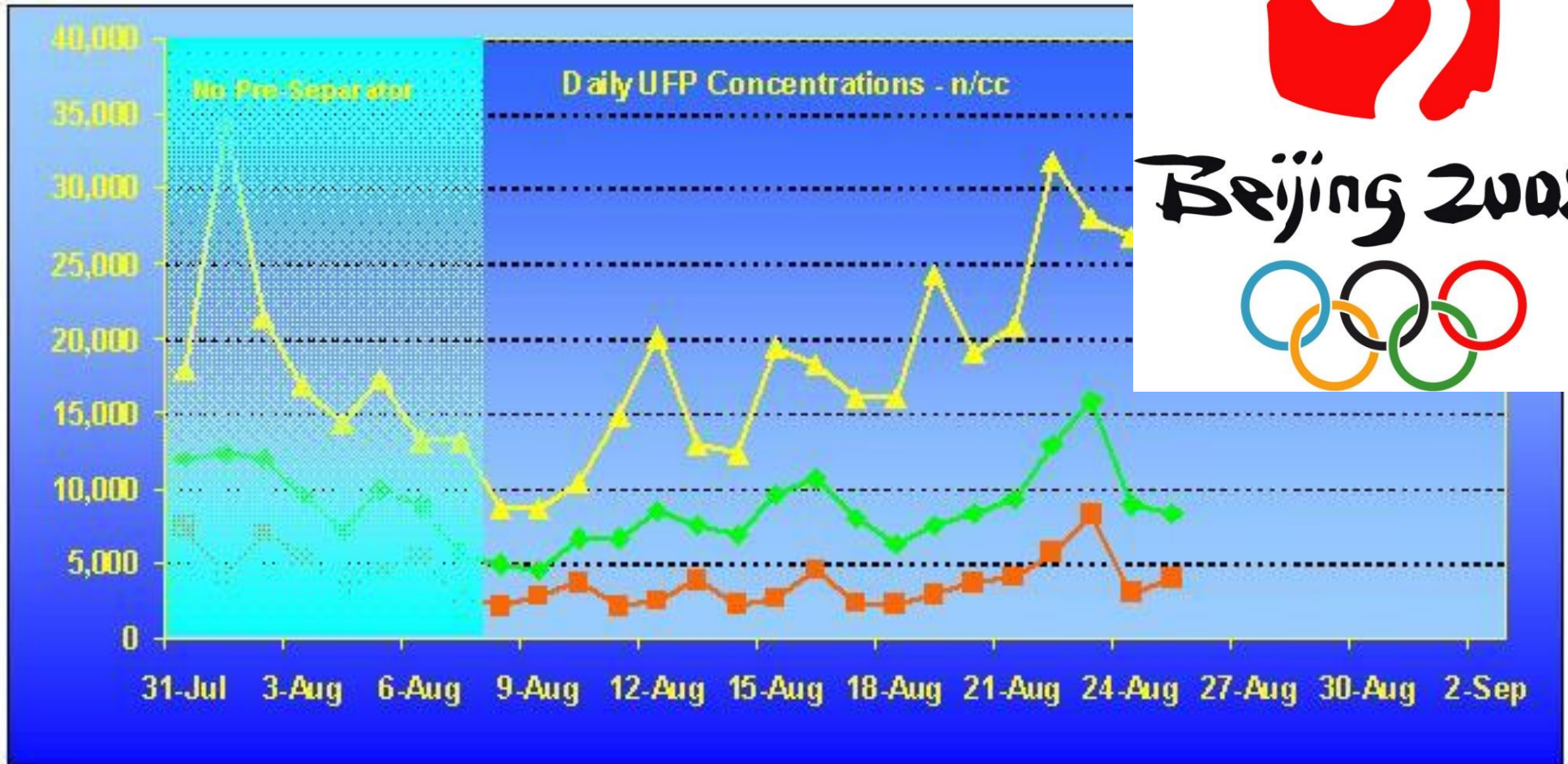
ultrafine particle size distributions
in air pollution monitoring networks



【北京奥运观测数据】

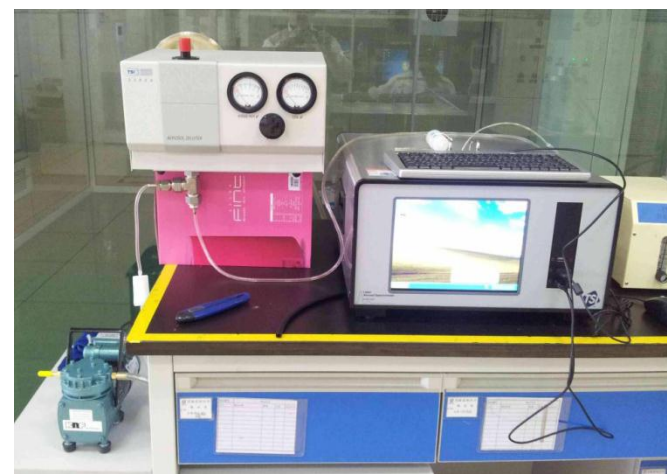


Beijing 2008

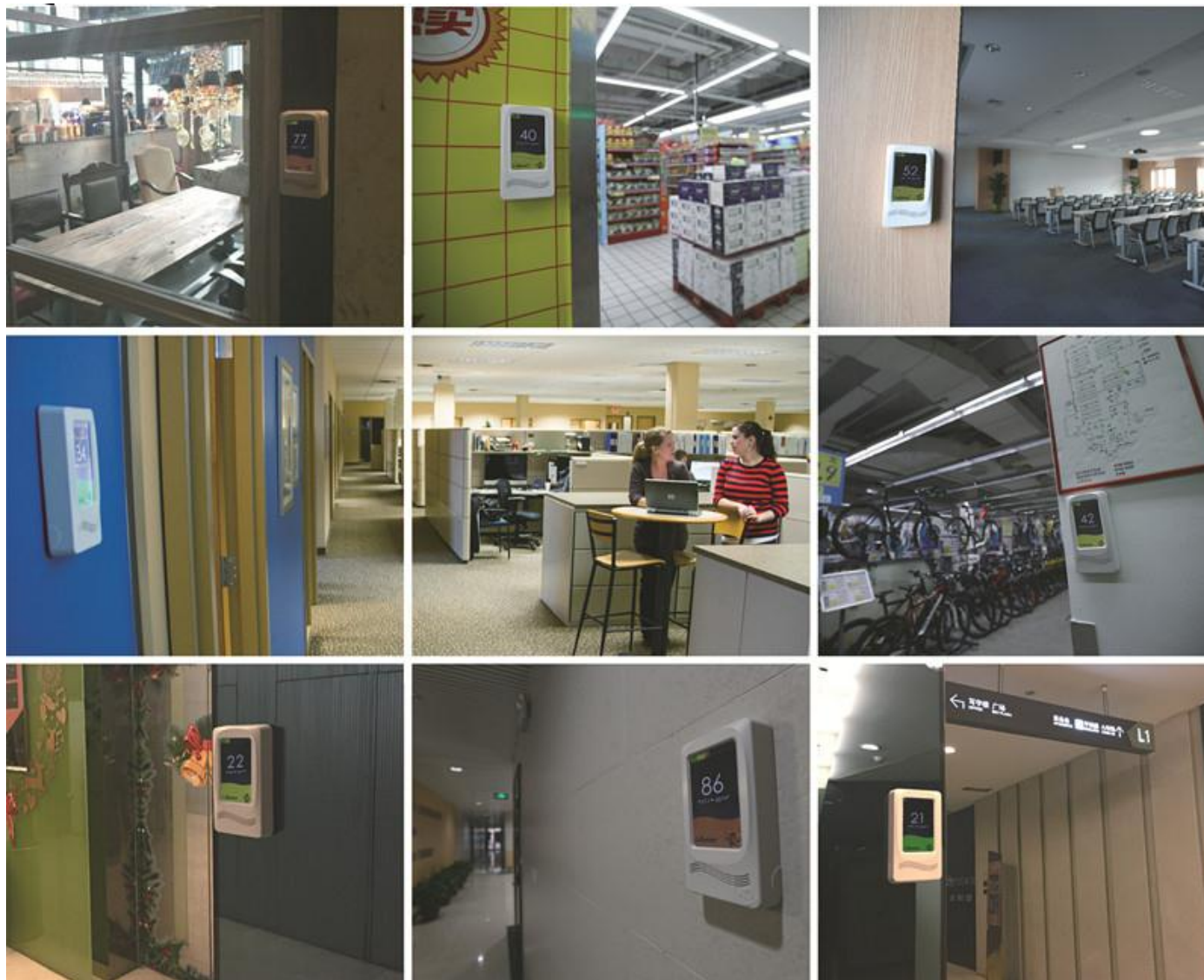


【净化器CADR & 过滤器一次通过净化效率检测】

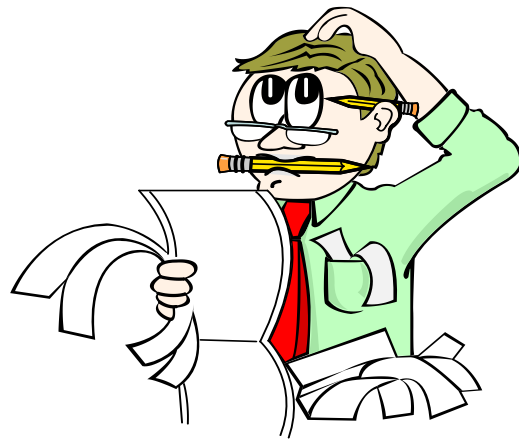
CADR (洁净空气输出比率) 测试——使用测试专用密封箱



【专业的室内PM2.5监控卫士】



问题&解答？





For More Information...

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