Air Pollution Episode Plans
大气污染极端事件应对计划

Nanjing, China 2013 March 19
南京，2013年3月19日

Chris James

The Regulatory Assistance Project

China
European Union
United States

www.raponline.org

Presentation Overview
概述

- **What is a pollution episode?**
- **Why develop episode plans?**
- **1950s USA episodes**
- **Episode plan contents**
- **Lessons learned from USA**
- **Actions taken to date by China**
- **Recommendations for China to consider**

- 什么是大气污染极端事件？
- 为什么要制定极端事件应对计划？
- 20世纪50年代美国的极端事件
- 极端事件应对计划的内容
- 美国的经验
- 中国目前已经采取的行动
- 对中国的建议

Key Messages
关键信息

- **Measures implemented during pollution episodes *supplement but do not supplant* control measures already in effect or being planned**
- **Air agencies develop plans, determine what extra measures are required and when/how they will be implemented**
- **Industry and business are responsible for acting to reduce pollution**

- 在污染极端事件时期所采取的措施可以对目前已经生效或者正在计划中的控制措施起到补充作用，但不能将其取代。

- 大气污染防治机构制定计划，决定需要哪些辅助措施，何时以及如何实施这些措施。

- 工商业实体负责将计划付诸于行动减少污染。

What is a Pollution Episode?
什么是污染极端事件？

- Air pollution episodes are short-term periods when pollutant concentrations rise to dangerous and hazardous levels. Episodes typically last for a few days, though some can last longer.
- Features that create conditions favorable for pollution episodes are:
  - Stagnant atmospheric conditions (many hours of calm or light winds)
  - Geography (an urban area located in a bowl or surrounded by hills and mountains)
  - Large numbers of industrial sources and/or vehicles in a concentrated area

- 空气污染极端事件是指短时期内污染浓度上升到危险程度。极端事件一般持续几天，有时会更久。
- 以下特征为污染极端事件发生提供了前提条件：

  –静止的大气（几小时平稳或者微风的状态）

  –地形（城市处于盆地或者被山地环绕）

  –大量工业污染源以及/或者机动车聚集在同一地区

Why Develop Episode Plans?
为什么要制定极端事件应对计划

- **Save lives, reduce health effects, and reduce duration and geographic coverage of dangerous pollution levels**
- **Current pace of economic growth overwhelming rate of environmental improvement**
- **Existing control measures in place, but not yet fully effective**
- **Important education tool for the public and businesses: they're part of the solution**

- 救助生灵，减少对人体的影响，减少危险污染级别停留的时间和覆盖度。
- 目前经济增长的速度远超过环境改善的进程。
- 已有一些控制措施，但是并不是完全有效。
- 需要对公众和企业进行宣传教育，因为他们是解决方案的一个关键组成部分。

Episode Plan Contents
极端事件应对计划内容

- A typical episode plan contains four key elements:
- Trigger levels or stages for each pollutant based on ambient data, analysis of local and regional meteorology and photochemistry;
- Requirements for each stage that escalate with higher pollutant levels
- Actions that correlate to what sources and pollutants contribute to emissions
- Requirements for large industrial sources to submit episode plans, and to have such plans reviewed and approved by an air quality agency

- 典型的极端事件应对计划包括四个主要元素：
- 基于空气环境数据、地区和区域气候和光化学分析得出的每个污染物的触发级别或者阶段；
- 每个污染阶段上升到更高污染级别所需要的条件；
- 对应污染源和污染物排放的减排行动；
- 要求大型工业源提交极端事件应对计划，大气污染防治机构对计划进行审核和批准。

Episode Plan Contents (cont)
极端事件应对计划内容（续）

- **Plans put into effect based on peak concentrations observed at one or more monitors**
- **All major industrial facilities and businesses required to submit plans to air agency**

- 应对计划的实施基于一个或多个监测点观察到的污染浓度峰值。
- 所有主要工业设施和商业企业都要求向大气污染防控机构提交极端事件应对计划。

Episode Plan Contents (cont)
极端事件应对计划内容（续）

- **Three stages, actions escalate in proportion to severity of pollution**
- **Stage 1: notice to public, schools, hospitals. Voluntary actions**
- **Stage 2: some mandatory actions plus cessation of outdoor sports activities**
- **Stage 3: driving bans, suspension of industrial activities, cessation of indoor and outdoor sports**

- 三个阶段措施，根据污染严重的情况依次增加行动：

- 第一阶段：对公众、学校和医院的预警，开展自愿行动。

- 第二阶段：采取一部分强制性行动，同时禁止户外活动。

- 第三阶段：发布禁令、暂停工业生产、禁止室内和室外活动。

1950s USA Episodes
20世纪50年代美国的极端事件

HERE'S RUNDOWN ON SMOG ALERTS IN LOS ANGELES

Here is a table showing the history of Los Angeles smog alerts.

1955

Date	Ozone Count	Duration	Peak Location
Aug. 1	.57	25 min.	Pasadena
Aug. 26	.64	2 hr. 19 min.	Vernon
Aug. 27	.58	1 hr. 35 min.	Pasadena
Aug. 29	.60	1 hr. 28 min.	Pasadena
Aug. 30	.52	1 hr. 8 min.	Vernon
Sept. 6	.56	3 hr. 44 min.	Vernon
Sept. 13	.90	3 hr. 9 min.	Vernon & Downtown
Sept. 14	.64	2 hr. 40 min.	Downtown
Sept. 20	.54	1 hr. 48 min.	Downtown
Sept. 30	.65	1 hr. 20 min.	Pasadena
Oct. 1	.63	51 min.	Pasadena
Oct. 7	.55	1 hr. 19 min.	Downtown
Oct. 29	.63	2 hr. 44 min.	Vernon
Nov. 3	.57	1 hr. 35 min.	Downtown
Nov. 28	.52	25 min.	Pasadena

1956

Date	Ozone Count	Duration	Peak Location
Jun. 11	.52	2 hr. 30 min.	Vernon
Jun. 12	.70	1 hr. 22 min.	Vernon
July 6	.50	1 hr. 50 min.	Downtown
Aug. 22	.60	2 hr. 32 min.	Rivera
Aug. 23	.60	2 hr. 33 min.	El Monte
Sept. 18	.50	52 min.	Burbank
Sept. 24	.50	35 min.	Downtown
Sept. 26	.55	2 hr. 53 min.	Downtown
Sept. 27	.55	1 hr. 15 min.	Vernon
Sept. 28	.70	3 hr. 35 min.	Vernon

Lessons Learned from USA Episode Plans
从美国极端事件应对计划中得到的经验

- **Early public notification is critical, as is cooperation with other agencies and businesses**
- **Enforce and strengthen existing regulations**
- **Adjust pollution levels for each stage when ambient standards are revised**

- 早期对公众的预警十分重要，因为公众参与与其他机构和企业的活动互相促进。

- 加强现有空气污染监管措施的力度。

- 当空气环境标准修改之后应该及时调整每一阶段的污染级别。

Pollution Severity Differences Between USA and China
中国和美国污染严重性对比

- **USA: smaller affected geographic area, Pacific Ocean upwind, ozone**
- **China: regional scale, land mass and concentrated sources upwind, ozone and PM$_{2.5}$**

- 美国：小部分地区受到影响，太平洋处于上风区域，臭氧

- 中国：区域级别极端污染事件，大部分地区，集中污染源处于上风区域，臭氧以及细颗粒物。

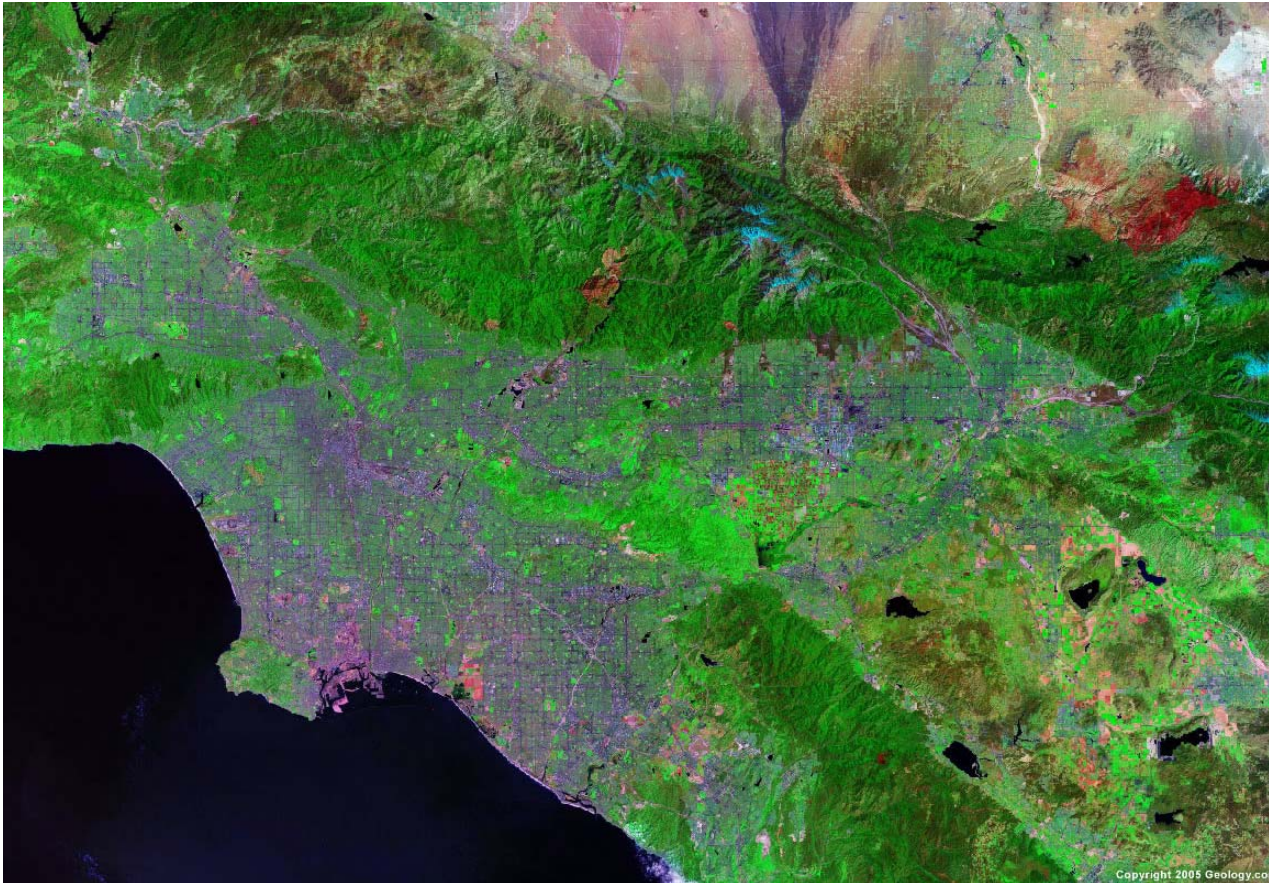# Beijing/Shanghai January 2013
北京/上海 2013年1月

Prevailing wind patterns for Beijing/Shanghai are from land mass to west

北京/上海主导风向是从集中地块到西部地区

Prevailing Wind Patterns for Los Angeles Are from Pacific Ocean
主导风向是从太平洋到洛杉矶

Copyright 2005 Geology.com

Evolution of USA and EU Pollution Episodes
美国和欧洲污染极端事件的演变

- **Today: emphasis on ozone and PM$_{2.5}$**
- **Warning to sensitive populations before pollution levels increase**
- **Air agencies coordinate with transport, media outlets (weather segment of news)**
- **Stronger correlation between global warming and pollution episodes**

- 今天：重点强调臭氧和细颗粒物。

- 在污染级别升高之前警告敏感人群。

- 空气污染防治机构与交通、媒体（新闻天气预报）等部门的互相合作。

- 全球变暖和污染物极端事件有更加紧密的相关性。

Recent US Episodes
最近美国的极端事件

- **Heat waves (2011, 2012): increased ozone concentrations, drought ➔ low river flow, power plants idled in Texas, midwest. Concerns about electricity reliability**
- **Drought caused wildfires, increased PM in West, Southwest 2011, 2012**
- **2013 is expected to be another serious wildfire year in the US West and Southwest**

- 热潮（2011，2012）：大气中臭氧浓度增高，干旱

  ➔ 河流水量减少，德克萨斯州的火电厂闲置，引起对供电可靠性的担心。
- 干旱引起的火灾，使得西部地区颗粒物增加，同样**2011,2012**发生在西南部地区。
- 认为在美国西部和西南部地区**2013**还会有严重的火灾。

Actions Taken To Date By China
中国目前采取的行动

- **Beijing EPB: Plan issued Oct. 2012.**
  - **Real-time reporting of data**
  - **Cessation of industrial activities and driving**
- **Put into effect Jan. 2013**
- **Any information on its success? What metrics were used to assess ?**
- **74 cities now reporting PM2.5 data in real-time**

- 北京环保局：**2012**年**10**月发布的污染极端事件应对计划：

-实时报告数据

-禁止工业生产和驾驶

- **2013**年**1**月起正式施行

- 有没有显示计划成功的消息？用什么基准来测量**?**

- **74**个城市已经实时汇报细颗粒物**PM2.5**排放数据。

Actions Taken By China (cont)
中国采取的行动（续）

- **Episode plans also adopted by Chongqing, Chengdu**
- **These plans also emphasize communications, data transparency**
- **Actions implemented focus on: stopping construction, dust suppression**

- 重庆、成都也采取了相应的应急计划。

- 这些计划也强调了宣传和数据透明的重要性。

- 实施的措施主要有：暂停建筑，抑制扬尘。

US and China AQI Scores for PM10 and PM2.5 Concentrations
美国和中国PM10和PM2.5的空气质量指数

AQI Score	Description	PM10 (US) µg/m3 24 hr	PM10 (CHINA) µg/m3 24 hr	PM2.5 (US) µg/m3 24 hr	PM2.5 (CHINA) µg/m3 24 hr
0-50	Excellent	0	0	0	0
51-100	Good	50	50	15	35
101-150	Slightly Polluted	150	150	40	75
151-200	Lightly Polluted	250	250	65	115
201-300	Moderately Polluted	350	350	150	150
>300	Heavily Polluted	420	420	250	250

US and China AQI Scores for SO2, Ozone and NO2 Concentrations
美国和中国SO2,臭氧和NO2的空气质量指数

AQI Score	Description	SO$_2$ (US) µg/m3 24 hr	SO$_2$ (CHINA) µg/m3 24 hr	O$_3$ (US) µg/m3 8-hr	O$_3$ (CHINA) µg/m3 8-hr	NO$_2$ (US) µg/m3 24 hr	NO$_2$ (CHINA) µg/m3 24 hr
0-50	Excellent	0	0	0	0	(2)	0
51-100	Good	9.1	50	13	100	(2)	40
101-150	Slightly Polluted	38	150	17	160	(2)	80
151-200	Lightly Polluted	59	475	20	215	(2)	180
201-300	Moderately Polluted	80	800	24	265	122	280
>300	Heavily Polluted	158	1,600	(1)	800	235	565

Beijing Episode January 2013
北京2013年1月空气污染极端事件

Recommendations for China
对中国的建议

- **Strengthen existing air pollution control programs**:
  - Beijing Olympics: each day 210 tons PM_{10} were removed
  - This level is benchmark from which control strategies should be developed
  - Consider how the EIA could be used. Add actions for enterprises to take during episodes
- **Measures implemented during episode are in addition to existing controls**
- **Regional extent of pollution requires coordination between several agencies**
- **Use individual monitors to assess efficacy of episode measures**

- 加强现有大气污染控制措施：

–北京奥林匹克：每天减少210吨PM10。

–应该根据这一基准来制定大气污染控制策略。

–考虑如何利用环境影响评价，增加企业在极端污染事件时需要采取的行动。

- 在极端事件时采取的措施应该是对现有控制措施的补充。

- 区域污染要求各部门之间的协调合作。

- 利用单个监测点数据来评估极端事件措施的有效性。

Questions and Discussion
问题和讨论

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

Christopher James
Email: cjames@raponline.org
Mobile: 617-861-7684 (Pacific Time)

The Regulatory Assistance Project

Beijing, China • Berlin, Germany • Brussels, Belgium • **Montpelier, Vermont USA** • New Delhi, India
50 State Street, Suite 3 • Montpelier, VT 05602 • *phone:* +1 802-223-8199 • *fax:* +1 802-223-8172

www.raponline.org