

# **Response Planning for Extreme Air Pollution Events:**

## **Scenario-specific planning and responses to extreme air pollution events**

May 6-7, 2021

National Academies of Sciences, Engineering, and Medicine Standing Committee on Medical and Epidemiological Aspects of Air Pollution on U.S. Government Employees and their Families

# Triggers for action

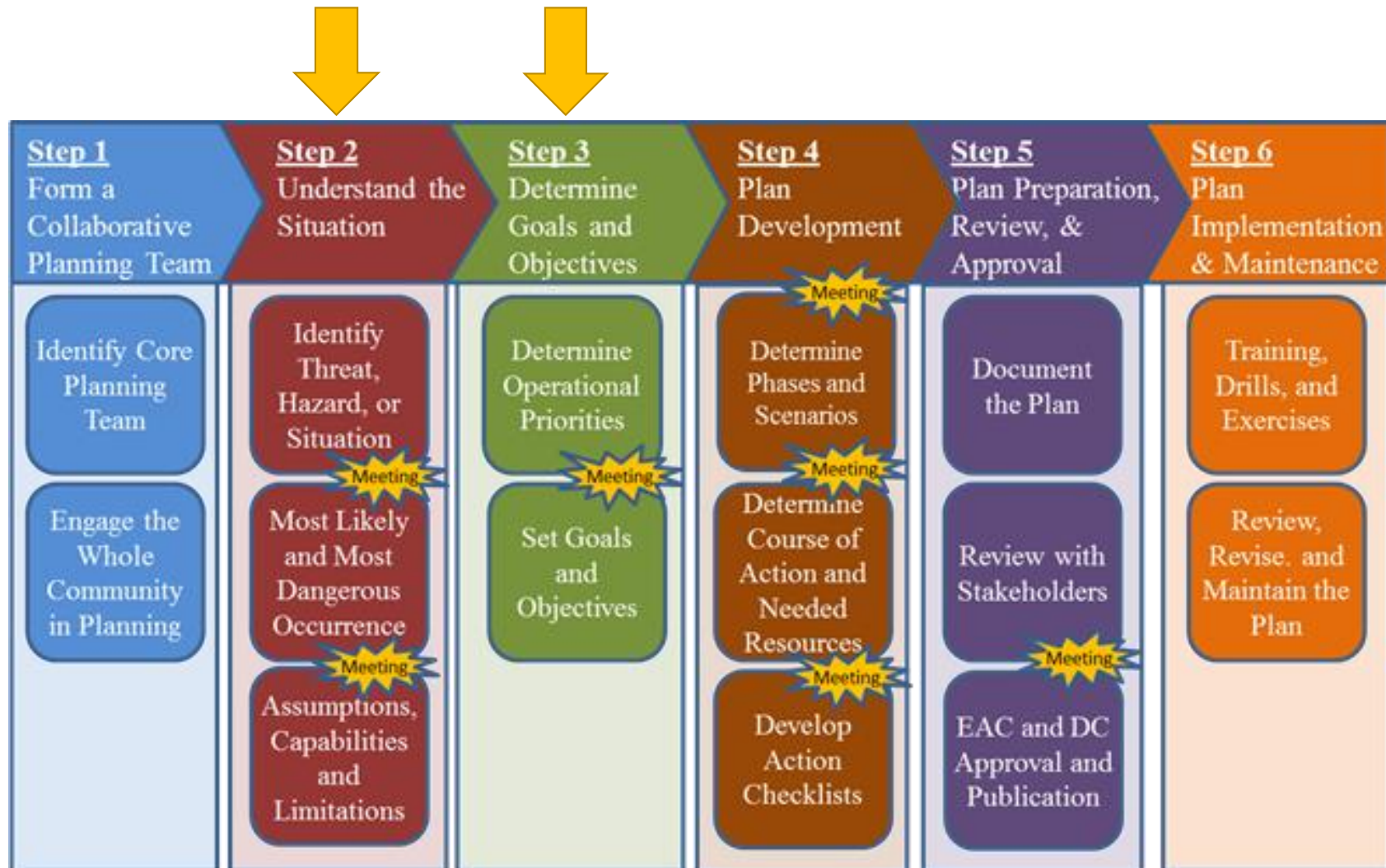
## Factors to consider

- Severity and persistence of high air pollution levels
- Forecasted air quality and weather
- Potential health risks
- Increase in health unit visits for respiratory, cardiovascular issues that cannot be managed locally
- Exposure mitigation measures at post and schools
- Imminent danger

## Potential triggers

- Several consecutive days of Hazardous AQI
- Inadequate measures to maintain indoor air quality in offices, homes, schools and lack of clean air shelters
- Increase in medical or psychologic symptoms in post community and people in susceptible groups that cannot be adequately addressed locally
- Active fires in post location
- Local government issued a State of Emergency

# Triggers in a response plan



# Framework for determining response

01

Assess threats,  
risks, impacts

02

Assess post and  
host country's  
capabilities and  
limitations

03

Determine  
mitigation  
measures

04

Define metrics to  
determine  
change in  
situation and risk

# Potential management actions

- Nothing
- Engage DOS air pollution experts
- Communications to staff, families, at-risk populations, broader U.S. citizenry
- Notice to limit time outdoors, run/make room air cleaners at home
- Emphasize asthma management plans
- Request/obtain room air cleaners, request indoor air monitoring equipment
- Monitor indoor air quality
- Telework (considerations for locally employed staff)
- Shuttle service for staff
- Cancel off-site meetings
- Implement liberal leave
- Reduce outdoor workshifts, offer N95 respirators to staff who work outdoors
- Recommend schools cancel outdoor activity or cancel school
- Offer N95 respirators to post community – staff and families
- Close specific sections at post, close post
- Shift staff to better indoor air quality areas
- Leave office buildings open for longer
- Leave post

# Risk communication tools

- Air quality alerts
- Air quality and actions to take infographic
- Health risks infographic
- MGT notice
- Respiratory protection guidance
- Room air cleaner guidance
- Town hall
- Understanding the U.S. Air Quality Index infographic

## Sample Air Quality Alert Email over 500 AQI:

Embassy Colleagues and Community Members:

The Air Quality Index (AQI) has exceeded 500.

According to the Environmental Protection Agency (EPA) recommendations, AQI levels above 500 are considered "beyond index." The EPA recommends that, at AQI levels above 500, everyone should avoid all physical activities outdoors. Individuals with heart or lung disease, older adults, and children are at the greatest risk.

What you should do:

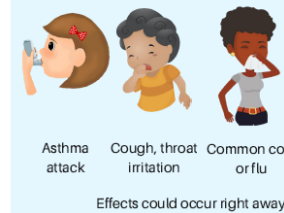
- **Remain indoors** and keep all windows and doors closed tightly.
- **Run your room air cleaners** continuously - on the highest setting where the noise is acceptable.
- **Overnight in occupied bedrooms**, run room air cleaners with the door closed while you sleep.
- **If room air cleaners appear to be malfunctioning or need replacement air filters**, contact: \_\_\_\_\_
- **Create clean air rooms** by moving room air cleaners into select rooms, and close off the other rooms. If you have an indoor air quality monitor that measures PM2.5, try to keep PM2.5 from exceeding 35 µg/m3. Remain in this "clean air shelter".
- **Limit any indoor activity that may increase indoor air pollution** such as vacuuming, burning candles, smoking, etc.
- When it is necessary for you to go outside, do so only for short periods, and **consider wearing a well-fitting respirator** with N-95 or higher certification. Avoid all outdoor strenuous physical activities. Review mask guidance [here](#).
- **Keep all vents to outdoors closed and exhaust fans off, except when essential.** Close doors to closets and unused rooms.
- If leaks are apparent, **place barriers**, even a [rolled up](#) towel, to reduce air infiltration.
- **Monitor air quality data** before planning any outdoor activity. The website is [\[link\]](#)
- **If you are experiencing health symptoms** contact the health unit

## Health Risks of Air Pollution

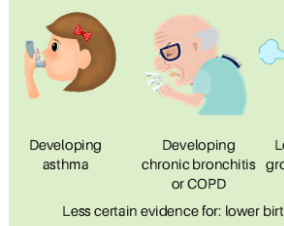
### IMPORTANT POINTS TO KEEP IN MIND

- Higher air pollution over both days and years is linked to many different health problems.
- No safe level of air pollution is identified in the science.
- The amount of risk cannot be determined.
- Scientific studies give the average increase in risk.
- This graphic describes the type and range of health risks at higher risk.

### SHORT-TERM EXPOSURE: DAYS



### LONG-TERM EXPOSURE: YEARS



Learn more about specific pollutants and their health impacts: <http://cas.state.gov/airquality/health-impacts-of-air-pollution>  
<https://www.epa.gov/ozone-pollution/basic-information>  
<https://www.epa.gov/pm-pollution/health-and-environmental-effects>

### Why It is useful

- Describes
- Higher AQI
- Describes
- Gives advice

### How U.S. embassies & consulates report the U.S. AQI

- Posts report the U.S. Environmental Protection Agency's (EPA) NowCast AQI to describe recent air quality.
- The NowCast AQI is based on fine particles (PM2.5) or ozone levels averaged up to several hours.
- Pollutant levels are converted to index value and put into a color-coded category: Good to Hazardous.
- Good and Moderate means air pollution is below the standards EPA has set to protect human health.
- Good AQI poses low health risk.
- Hazardous AQI poses high risk for everyone.
- All posts report a NowCast AQI for PM2.5.
- Posts that measure ozone report separate NowCast AQI for ozone.
- EPA also has a daily AQI based on daily levels of 5 pollutants: PM2.5, ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide. The highest value is reported.

### TIPS

Good AQI does not mean zero risk of health effects. Hazardous AQI does not mean health effects will absolutely occur.

The AQI should not be used for low-cost sensor readings in areas with less than 1 hour.

The AQI of multiple pollutants should not be added together.

There are many reasons why an air quality index reported by a country government differs from the U.S. AQI.

Learn More: AQI: <https://www.airnow.gov/index.htm>  
particle pollution: <https://www.airnow.gov/particle-pollution>  
air pollution: <https://www.epa.gov/pm-pollution>  
<http://cas.state.gov/airquality/health-impacts>

Learn More: Asthma action plan: <https://www.epa.gov/asthma/asthma-action-plan>. Current and historical air quality data from AirNow: [https://airnow.gov/index.cfm?action=airnow/global\\_summary](https://airnow.gov/index.cfm?action=airnow/global_summary).

## Understanding the U.S. Air Quality Index

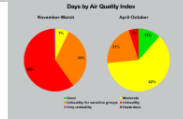
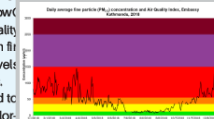
### KEY FACTS ABOUT THE U.S. AQI

## Air Quality in Kathmandu and Actions to Take

### BE READY FOR THE WORST AIR QUALITY SEASON

#### November to April for fine particles (PM2.5)

- Most days have Air Quality Index (AQI) of Unhealthy.
- Good AQI days are unlikely.

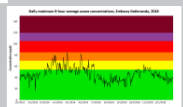


#### Get ready in fall

- Understand the U.S. AQI and messaging: see other side. Ask your questions to the health unit or [AirPollution@state.gov](mailto:AirPollution@state.gov).
- Find indoor places for exercise and play.
- People with asthma: have enough medicine ready. Discuss a management plan with your medical provider.
- If you use a respirator or mask, be sure it fits properly & is in good condition. Order a new filter or mask if needed.

#### Ozone rarely drives the AQI

- On most days, AQI is worse for PM2.5 than ozone.
- A small number of days had ozone AQI Unhealthy for Sensitive Groups.



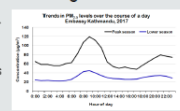
#### Watch ozone AQI April to June in afternoon

- People with asthma & people who exercise outdoors: there may be a rare afternoon for shorter, less intense outdoor activity.
- People with asthma: keep your medicine with you.

### TAKE ACTIONS FOR AIR QUALITY CHANGES DURING THE DAY

#### Protect yourself mornings and late evening

- Avoid outdoor exercise in the morning.
- If you wear a respirator or mask, focus on the morning commute.
- Run room air cleaners & keep windows closed at home to lower exposure to higher air pollution levels at night.



#### Many afternoons and early evenings ok to be outside

- Sit outside, go for a walk, run errands with children & friends.
- Avoid intense outdoor activity.
- Avoid spending all your time inside.
- Briefly open windows at home.

### MAKE DECISIONS ON AIR QUALITY IN REAL TIME

#### Take action: check AQI on AirNow or Embassy website, phone apps

- Children, older adults, people with lung or heart disease: avoid all physical activity outdoors. Run room air cleaners at home.
- Everyone else: avoid long, intense outdoor activity. Run room air cleaners.
- It's ok to be outside. Run room air cleaners at home.
- Children, older adults, people with lung or heart disease: keep activity short & low intensity. Move indoors if you have symptoms.
- Everyone else: reduce time & intensity of activity.

Learn More: Asthma action plan: <https://www.epa.gov/asthma/asthma-action-plan>. Current and historical air quality data from AirNow: [https://airnow.gov/index.cfm?action=airnow/global\\_summary](https://airnow.gov/index.cfm?action=airnow/global_summary).

# Tips for breakout sessions

Use your moderator for help

Use slides on management actions and risk communication tools to help answer questions

We are not looking for a specific, correct answer

Goal is to work through the process of evaluating an event, forming a decision, understanding the resources available

# **Weather and fuel combustion**

Case study: Beijing Airpocalypse, January 2013

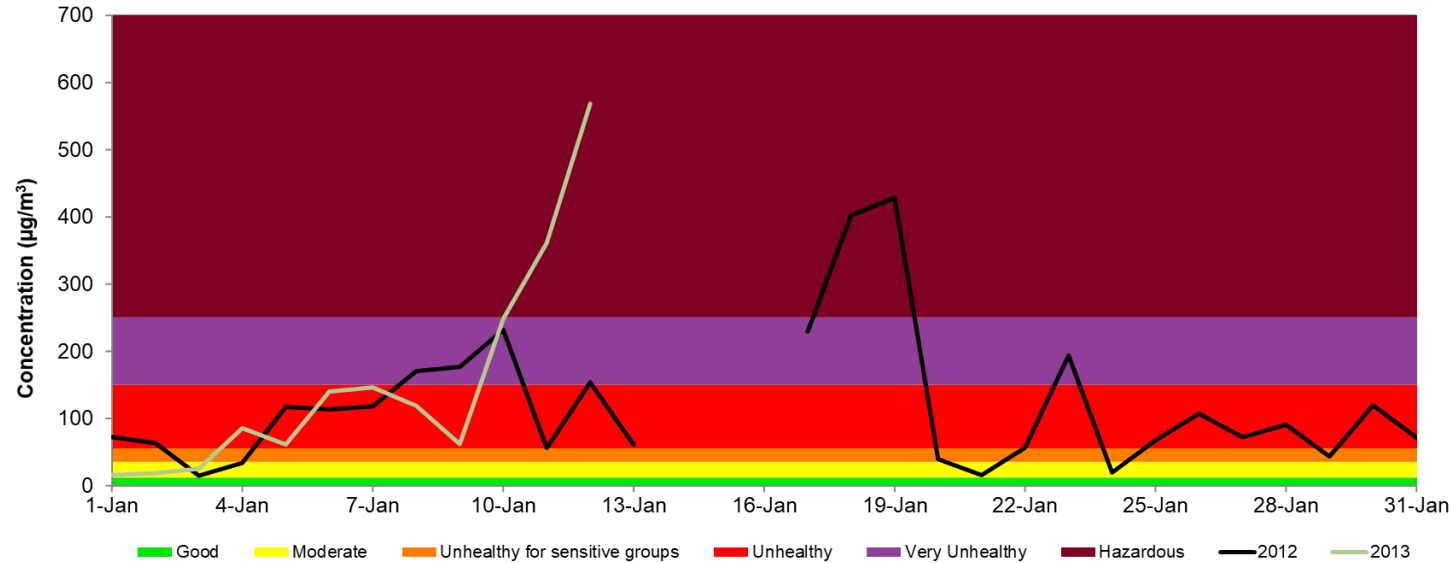


# Breakout session I

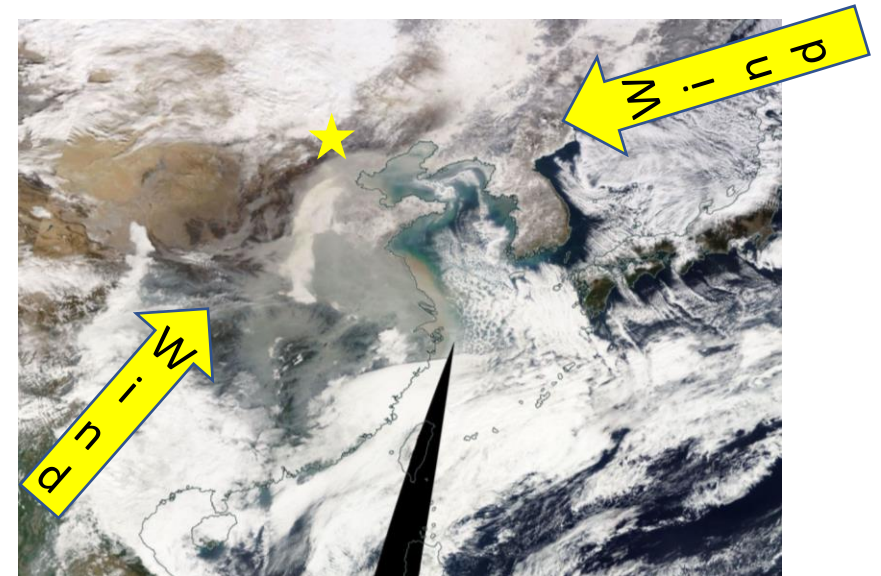
- Objective: evaluate an extreme air pollution event scenario and determine whether triggers are met
- Activity: participants given event/air quality conditions and triggers
- Report out
  - Will the event impact post?
  - Is the event impacting post?
  - How bad is the air quality?
  - Is the bad air quality unusual for post?
  - How long is the poor air quality expected to persist? Will it get worse?
  - What are key uncertainties? Do we know enough?

# Breakout session I: are triggers met

Daily average PM2.5 concentration and corresponding AQI, Embassy Beijing



- Started early January 2013
- Slightly colder temperatures than usual: -3 to -2 C versus +2 C
- Low winds: 2-4 mph
- Typical wind direction: from South-southwest, Northeast
- Forecast shows similar conditions over several days
- No precipitation in forecast



Satellite imagery of aerosol  
NASA MODIS, 10 January 2013

# **Breakout session I: are triggers met**

## **Inventory of post measures to assess air quality conditions and protective measures**

- Real-time air quality data publicly available
- Monitor at post and robust city network
- Office building has high-efficiency centralized air filtration system
- Room air cleaners in homes
- Enhanced air filtration in international schools
- Indoor play areas for children
- Post health unit, limited medical specialists locally
- N95 respirators available for staff who work outdoors

# Breakout session I: are triggers met

## Post at a glance: air quality and resources to reduce exposures and health risks

Choose your post in the dropdown menu to the right. Blank sections indicate no data exist. Hover over a section and click the "pop out" icon for a bigger view.

Choose Your Post

Beijing

### Tour of duty

Tour Length (years)	Hardship Differential	R&Rs	Unaccompanied
3	0.15	2	No

### Is air quality reported hourly?

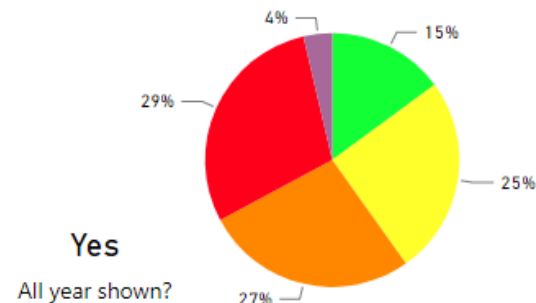
Real time data	Air Monitor Type	AirNow.gov	AirVisual.com	aqicn.org	Government website
Yes	Monitor at post	Yes	Yes	Yes	

Real-time data availability

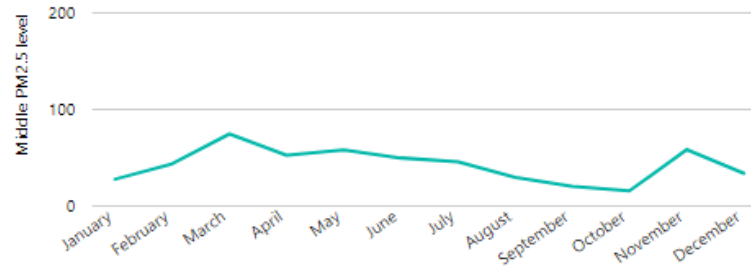
### Level Definition

2 Annual average PM2.5 2 times above highest U.S. community but less than 3-fold higher

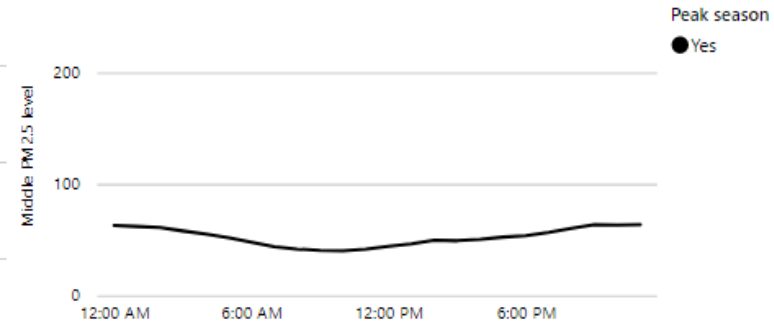
### Year breakdown by daily AQI category



### Seasonal changes in air quality



### Average air quality throughout a day



Typical air quality patterns

### Exposure and health risk reduction measures =

### Medium pollution-many resources



#### Main office building

Office filtration type  
Central Air Filtration-high efficiency



#### Homes of U.S. families

Residence filtration type  
Room air cleaners or central air filtration

Does or can post test indoor air quality?  
No data



#### International school

School filtration type  
Room air cleaners or central air filtration

Outdoor recess canceled during poor air quality  
No data

#### Percentage of school hours by AQI

● Unhealthy ● Very Unhealthy/Hazardous



#### Medical resources

Local cardiologist  
Limited

Local pulmonologist  
Limited

#### Post health unit

Yes

Asthma management plan  
No data

Post resources

# **Breakout session I: Questions to answer**

- Will the event impact post?
- Is the event impacting post?
- How bad is the air quality?

# **Breakout session I: Questions to answer**

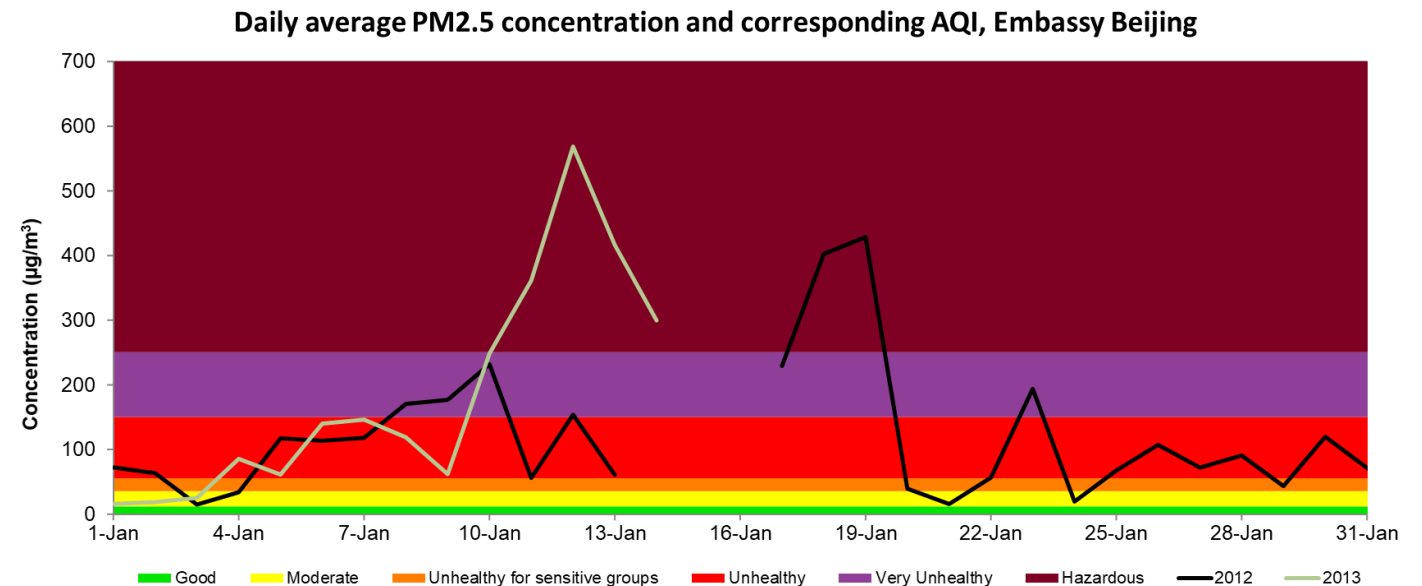
- Is the bad air quality unusual for post?
- How long is the poor air quality expected to persist? Will it get worse?
- What are key uncertainties? Do we know enough?

# **Breakout session II**

- Objective: evaluate initial conditions and post resources and propose actions and communications
- Activity: participants given event/air quality conditions and list of potential actions
- Report out
  - What actions are recommended? Yes or No?
  - Why?
  - What needs to be communicated and to whom?

# Breakout session II: initial assessment and actions

- PM2.5 levels decrease but remain hazardous for 2-3 days
- Temperatures -3 to -2 C
- Low winds: 2-4 mph, from South-southwest, Northeast
- Forecast shows similar conditions over several days
- No precipitation in forecast





# **Breakout session II: initial assessment and actions**

## **Measures to assess air quality and mitigate exposures**

- Real-time air quality data publicly available
- Monitor at post and robust city network
- Office building has high-efficiency centralized air filtration system
- Room air cleaners in homes
- Enhanced air filtration in international schools
- Indoor play areas for children
- Post health unit, limited medical specialists locally
- N95 respirators available for staff who work outdoors

# **Breakout session II: Questions to answer**

- What actions are recommended? Yes or No?
- Why?

# **Breakout session II**

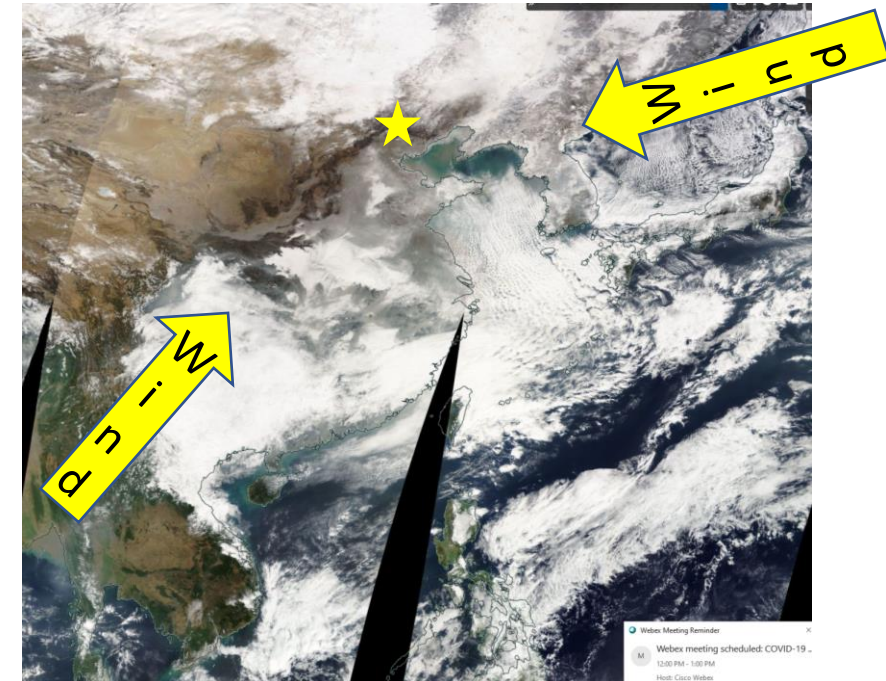
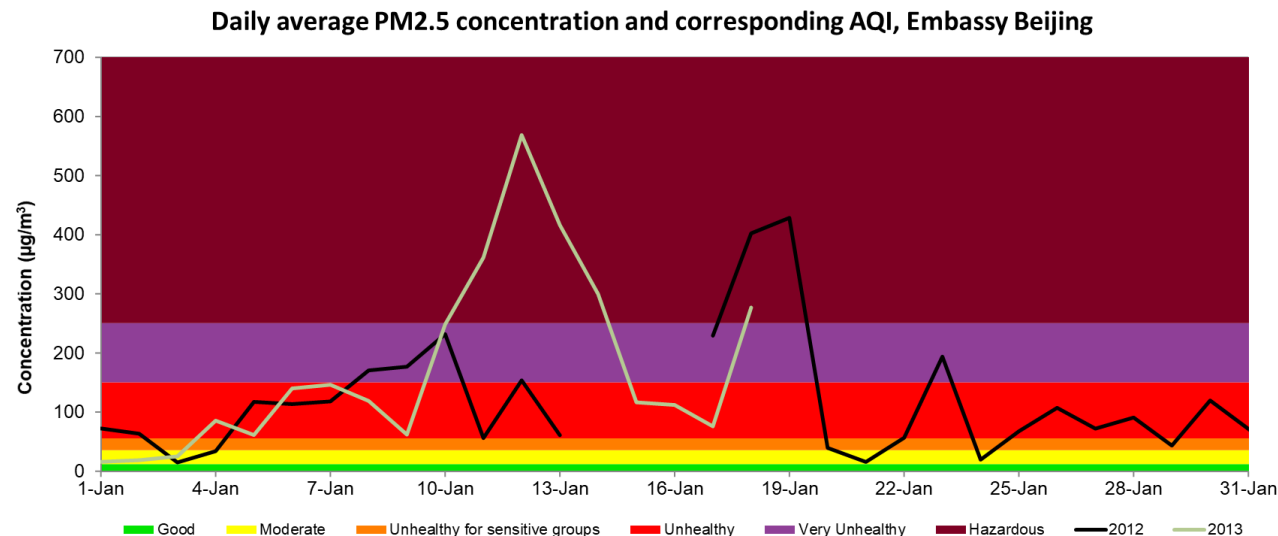
- What needs to be communicated and to whom?

# Breakout session III

- Objective: monitor ongoing conditions and decide on follow-up actions
- Activity: participants given updated event/air quality conditions and list of potential actions
- Report out
  - Should actions remain the same?
  - Is an increased response warranted?
  - Should post return to typical operations?
  - Why?
  - What needs to be communicated and to whom?

# Breakout session III: follow-up assessment

- PM2.5 levels continue to decrease, range Unhealthy to Hazardous
- PM2.5 levels similar of typical conditions
- Forecast shows low winds but warmer temperatures
- Satellite imagery shows large cloud cover over region



# **Breakout session III: Questions to answer**

- Should actions remain the same?
- Is an increased response warranted?

# **Breakout session III: Questions to answer**

- Should post return to typical operations?
- Why?
- What needs to be communicated and to whom?