

## Module 6: Ambient Air Monitoring Site Selection Procedures

Objectives (include participation of stakeholders and public)

- Monitoring network design objectives
- Spatial settings
- Match monitoring objectives to spatial settings
- Site sampling criteria
- Monitoring location priority

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## Monitoring Network Design Objectives

- The design should determine one of the following:
  1. Highest Concentrations Expected in Area
  2. Representative Concentrations in Highest Population
  3. Impact of Ambient Pollution Levels
  4. Generate Background Concentration Levels
  5. Regional Pollutant Transport Among Population Areas
  6. Welfare-related Impacts in Rural Areas

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## Spatial Settings

- Microscale
- Middle scale
- Neighborhood
- Urban
- Regional
- Global

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### Microscale

- Ambient air sampling airspace **ranging from several meters to approximately 100 meters** of the sampler
- For PM10 sampling, microscale is **used to characterize emissions from a nearby point source**
- For gaseous monitoring, microscale is **used to evaluate distribution of the gas within a plume over the terrain or within building cavities**
- Microscale is **used to assess health effects of exposure of individual in a fixed location**

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### Examples of Sources for Microscale

- Vehicular exhaust a police officer breathes while directing traffic at an intersection
- Stove-top fumes a cook breathes in at a restaurant kitchen
- Dust a construction worker inhales at a cement factory
- Short stack emissions inhaled by nearby workers

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### Middle Scale

- Ambient air characterized **from 0.1 km to 0.5 km** from the sampler
- Characterizes **air quality in areas up to several city blocks in size**
- For gaseous and PM10 monitoring, this middle scale is **used to assess effects of control strategies and to monitor air pollution episodes**
- Related to a **source impact**

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### Examples of Sources of Middle Scale

- After many years of operation, a refinery places scrubbers on stack after high levels of SO<sub>2</sub> are reported in sections of city.
- A new cement factory was recently opened in the northwest sector of a city, the health department wants the plant to install samplers in the nearby fields to determine change in air quality.
- The effect of construction at a new apartment building site in a local city neighborhood.

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### Neighborhood Scale

- Ambient air sampling from **0.5 km to 4 km** from the sampler
- Characterizes air quality in areas where gaseous and PM<sub>10</sub> concentrations are **relatively uniform** (suburban areas surrounding an urban center)
- Associated with **baseline concentrations in areas of projected growth** and in **studies of population responses to pollutant exposure**
- Concentration measurements **represent the entire neighborhood**
- **Meets most objectives of city and regional planners for decision-making**

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### Examples of Sources at the Neighborhood Scale

- Small individual emitters in a neighborhood such as:
  - Residential heating devices such as fireplaces, open pit fires, or wood stoves
  - Dust accumulation from uncongested traffic flow on roadway
  - Children playing in fields

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### Urban Scale

- Characterizes conditions **over an entire metropolitan area**
- Measurements are used to **assess trends in citywide air quality that would inform large-scale pollution controlled strategies**
- Measurements that **represent citywide areas also serve as a basis for comparisons among cities**

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### Examples of Sources in Urban Scale

- A mixture of particles from many sources with an urban complex
- Conglomeration of emissions of neighborhoods in metropolitan area

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### Regional Scale

- Ambient air sampling for **hundreds of kilometers** from sampling site
- Measurements are **applicable mainly to large, homogeneous areas that are sparsely populated**
- Measurements **provide information on background air quality and interregional pollution transport**
- **Network of sites**

12

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### Examples of Sources of Regional Scale

- Combination of naturally occurring aerosols from windblown dust and marine aerosols
- Particles generated in urban and industrial areas that may be more than 1,000 km away

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### Global Scale

- Characterizes concentrations for the **entire globe**
- Measurements are useful to **determine pollutant trends, studying international and global transport processes, and assessing the effects of control policies on a global scale**

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### Examples of Sources of Global Scale

- Concentrations transported between continents
- Naturally-emitted particles and precursors from sea spray, volcanoes, and windblown dust.

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### Matching Objectives to a Scale

| Monitoring Objectives   | Appropriate Siting Scales            |
|-------------------------|--------------------------------------|
| Highest concentration   | Micro, middle, neighborhood or urban |
| Population              | Neighborhood, urban                  |
| Source Impact           | Micro, middle, neighborhood          |
| General/Background      | Neighborhood, urban, regional        |
| Regional transport      | Urban/regional                       |
| Welfare-related impacts | Urban/regional                       |

16

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### Site Sampling Criteria

- U.S EPA criteria
- Vertical and horizontal placement criteria for sampler inlet
- Air flow restriction
- Closeness to trees
- Nearness to roads

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### U.S EPA Criteria

- All of the following criteria are from the appendices of the Code of Federal Regulations (CFR) Title 40, Part 58.
- <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=%2Findex.tpl>

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**Vertical and Horizontal Placement  
Criteria For Sampler Inlet**

Based on Middle, Neighborhood, Urban, and Regional Spatial Setting:

1. The height of the inlet for gaseous pollutant samplers should be between 3 and 15 meters above ground surface.
2. The height of the inlet for particulate samplers should be between 2 and 15 meters above ground surface. For Microscaling, the sampler inlet should be between 2 and 7 meters.
3. For samplers located on roofs or other structures, the minimum separation distance between the inlet and any structure should be greater than 2 meters.

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**Vertical and Horizontal Placement  
Criteria For Sampler Inlet (Cont'd)**

Based on Middle, Neighborhood, Urban, and Regional Spatial Setting:

4. The sampler should be located away from obstacles so that the monitor is at a distance least twice the height of the obstacle. For example, a tree is 10 meters tall and is east of the sampler. The sampler would need to be placed at least 20 meters away from the tree.
5. Sampler inlet should be at least 2 meters, but not greater than 4 meters from any collocated sampler.

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**Air Flow Restriction**

Based on Middle, Neighborhood, Urban, and Regional Spatial Setting:

An unrestricted air flow of 270° must exist around the inlet.

If the sampler is located on the side of a building, a 180° air flow clearance is required.

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### Closeness to Trees

Based on Middle, Neighborhood, Urban, and Regional Spatial Setting:

Sampler inlet should be placed at least 20 meters from the drip line of any tree.

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### Minimum Separation Between Roadways and Sites Measuring Ambient CO, O3, NO2, and PM10

| Average Daily Traffic (vehicles) | Minimum Distance Between Roadway and Monitoring Site to Assess Ambient Conditions (meters) |      |     |      |
|----------------------------------|--|------|-----|------|
|                                  | CO   | O3   | NO2 | PM10 |
| <10,000                          | ≥10  | ≥10  | ≥10 | >10  |
| 15,000                           | 25   | 20   | 20  | 20   |
| 20,000                           | 45   | 30   | 30  | 30   |
| 30,000                           | 80   | -    | -   |      |
| 40,000                           | 115  | 50   | 50  | 50   |
| 50,000                           | 135  | -    | -   |      |
| ≥60,000                          | ≥150   | -    | -   |      |
| 70,000                           | -  | 100  | 100 | 100  |
| ≥110,000                         | -  | ≥250 | ≥10 | >250 |

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### Monitoring Location Priorities

- Residential
- Industrial or business
- City center (Commercial)
- Upwind
- Consider electrical power, shelter security, and the permanence

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## Module 6 Review

In Module 6, we considered each of the following topics.  
Let's review them.

- Monitoring network design objectives
- Spatial settings
- Match monitoring objectives to spatial settings
- Site sampling criteria
- Monitoring location priority
- Importance of involving the public

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