

9.3 Planning and management of air pollution monitoring systems

9.3.1 Introduction

There are two kinds of air pollution monitoring: Mobile monitoring, which is used for settlement of complaint and environmental assessments, and continuous monitoring conducted in the general ambient air measuring stations, which measure the general ambient air representative of a region, and also conducted in the automobile exhaust gas monitoring stations, which measure automobile exhaust gasses along roadsides.

An air pollution monitoring system has such aims as to accurately measure, evaluate, and use fluctuations in the state of air pollution. It consists of continuous air pollutant analyzers, data processors, a data transmission system, a central data processor, terminal equipment, and so forth.

The continuous air pollution monitoring system is required to have such functions as ① on-line processing of the measured values in a short space of time at the central monitoring station, thorough comprehension of the state of pollution in real time and reacting in an emergency, ② alliance with the surrounding local governments and the ability to thoroughly comprehend in a short space of time the state of pollution over a wide area, ③ the establishment of a base to instruct the air pollution source to reduce of the emissions of air pollutants, ④ Giving information to citizens through the use of streetfront displays, ⑤ rapid detection of system abnormalities and pinpointing the location of a breakdown, and so on.

9.3.2 Planned disposition of the monitoring system

Notice is sent out from the Environment Agency for the suitable disposition of the monitoring system. A summary is shown in Table 9.3.1.

Table 9.3.1 (1) Summary of Environment Agency notice concerning the disposition of ambient air measuring stations.

Subject	Contents
<p>“Enforcing the law to revise part of the Air Pollution Control Law” Article 5 of the Japanese environmental atmospheric plan, 25 August 1971, promulgated by the Director-General of the Air Quality Bureau</p>	<p>Monitoring and measuring sites for air pollution In considering the characteristics of air pollution, it is essential to site the measuring points effectively in locations that pay attention to air pollution.</p> <p>A. Sulfur oxides: Install at one site per 25 km² as standard. Increase as need arises in regions where the air pollution is particularly severe.</p> <p>B. Carbon monoxide: Install at sites where people normally live or are active, and which are close to roads of frequent traffic or junctions.</p> <p>C. Suspended particulate matter: Combined measuring site for both sulfur oxides and carbon monoxide.</p> <p>D. Carbon dioxide: As above.</p> <p>E. Oxidant: Install in consideration of the fact that the impact of pollution due to oxides, etc., has extended into the suburbs, where pollution has hitherto not been severe.</p>

Table 9.3.1 (2) Summary of Environment Agency notice concerning the disposition of ambient air measuring stations.

Subject	Contents
Regional representations of measurement values obtained in general ambient air measuring station (investigation committee concerning regional representations of measurement values. Environmental Agency, report submitted March 1986)	Send the "Report by the investigative committee into regional representations of measurements values" to all local governments as reference material for their discussion. [Summary] Representations of NO ₂ , SO ₂ Differences in the mean values for a given period of time between sites is expressed as a single measurement value being representative of a region in which the tolerance has been suppressed to within a given range (5ppb), and this value is called the "regional representation." When the total value for the target area is divided up into a suitable shape for the area, the measuring station is said to have regional representation, and in this way the distribution of the measuring stations is called the "appropriate distribution of measuring station."

It is essential to thoroughly comprehend the regional representation encountered in each local government area, while referring to this notice. Here, at the local government level, regions are broken down into town and village units by surface area, the mobile measurement vehicles are employed at this juncture and the state of air pollution measured, the suitable distribution of the measuring station is discussed from these results, and the regional representative point are decided.

Further, in regions where there is an abundance of measurements and a plan for reducing the total quantity of both SO₂ and NO₂ has been established (using air diffusion simulation), it is again necessary to employ these results. Table 9.3.2 shows the points for consideration listed in the ambient air continuous monitoring manual.

Table 9.3.2 Points for ambient air measuring station consideration

Name	Contents
"Ambient Air Continuous Monitoring Manual" (revised edition) (Air Quality Bureau, Environment Agency (ed.), pub. December 1990.)	Published as a reference manual for local government continuous monitoring operations (revised from the 1986 edition.) (Extract from essential points for measuring station) <u>Items to consider when siting general ambient air measuring station</u> ① Site in consideration of the characteristics of pollutant sources, source distribution and prevailing wind characteristics. ② Site with greater regard for the minutiae in areas of dense population, when compared with other regions. ③ Site along border areas in consideration of the meteorological conditions and sources distribution of the neighboring local government. ④ Site in consideration of plans for future use of the land. ⑤ Do not site disproportionately in specific regions. <u>Positioning the specimen air sampling vent</u> ① Separate as far as possible from nearby buildings and obstacles so as to avoid being affected by turbulence, etc. ② Site so as to avoid being affected by specific sources such as chimneys, smokestacks, etc. ③ Set to an appropriate height so as to accurately comprehend the state of pollution due to the measurement target substances. "The ideal height is 1.5 to 10m above ground level." (Quoted from the notice.) <u>Points to consider when siting roadside air pollution monitoring stations (given in the latest revision.)</u> The state of roads, traffic volume, and so forth is considered so that the state of air pollution due to automobile exhaust gas can be effectively monitored. ① Considering the meteorological conditions of the region and the locality, the state of the topography, road construction, and the surrounding buildings, and the volume of traffic and the state of traffic jams, decide on sites that enable effective comprehension of the state of air pollution. ② Select sites and locations in the vicinity of traffic-laden roads or intersections, and where people normally live and work, or else a site close to such a location. Further, considering the fact that automobile vehicle exhaust gas wane with distance, the ideal site is as close to a road as possible.

9.3.3 Measurement sites and area of measuring station

Notice and notification from the Environment Agency concerning the height of the specimen sampling vent, the site of the ambient air measuring station, and so forth, when setting the environmental standards is shown for each air pollutant in Table. 9.3.3.

Table 9.3.3 Height of the "sampling vent" and "measuring site" of the air pollution continuous measuring station.

Measurement	Site	Collection vent height	Exceptions
CO	Site in the vicinity of a traffic-laden road or crossroads, or else close to such a site.	Approximately 1.5m	
SO ₂	Set the measuring points at one point per 25 km ² as standard, and increase as necessary in regions of severe air pollution.	As a rule 1.5m or greater, 10m or below	For heights of 10m or more such as high-rise housing or other sites where many people are living, set appropriately given the conditions.
SPM	Measuring points are combined for sulfur oxides and carbon monoxides.	As a rule 3m to 10m above ground level	In order to alleviate the effects of sand and dirt being blown up from the ground, set the height as a rule to 3m to 10m above ground level.
NO ₂	Measuring points are combined for sulfur oxides and carbon monoxides.	As a rule 1.5m to 10m above ground level	Same as SO ₂
Ox	Site measuring points in consideration of the fact that the effects of pollution due to sulfur oxides, etc., have reached the suburbs, where they were not severe before.	As a rule 1.5m to 10m above ground level	Same as SO ₂

Further, in addition to being able to accommodate basic meteorological (wind direction, wind speed, temperature, humidity, sunlight, etc.) measuring equipment and measuring equipment for each air pollutant, the area of the measuring station also needs the space in which to install office desks for data processing, sluices for cleaning, lockers for storing parts, and so forth. The floor space for a measuring station requires 20 to 30m² as a rule.

9.3.4 Installation conditions of measuring equipment

The installation site for measuring equipment comes equipped ideally with the following conditions:

- (1) To prevent vibration: Countermeasures against vibration so as not to transmit to other equipment tremors from the suction pump, etc.
- (2) Avoid or prevent corrosion from corrosive gasses and dust.
- (3) Avoid high humidity or, when the room temperature is 40°C or below, ideally control temperature fluctuations to within $\pm 5^\circ\text{C}$ in a room temperature range of 10 to 30°C, and avoid contact with direct sunlight as far as possible.
- (4) Ensure that there are few fluctuations in the electrical voltage and frequency. Also, discuss anti-lightening measures.
- (5) Set the equipment level so as to prevent tilting.

- (6) Ensure that maintenance work can be carried out easily and safely.
- (7) Manage with short air sample tubes. Further, ensure that rainwater, exhaust gasses, and so forth, are not absorbed directly.
- (8) Part of the waste solution from the wet method analyzer must be managed by qualified personnel with the “special industrial waste manager” because it is specific industrial waste matter.

9.3.5 Maintenance and management of measuring equipment

When supporting telemeter systems that accurately obtain measurement data, which fluctuates from moment to moment, accumulates, processes, and passes on that data, it is essential to religiously conduct spot checks and maintenance on the measuring equipment, and to pay close attention so that no fault arises in the data. Here, the types and content of the various measuring equipment support and management is shown in Table 9.3.4.

Table 9.3.4 Types and content of maintenance and management

Management section	Objective	Frequency of implementation	Content
Daily checks (Normal checks) (Rounds checks)	Continuous normal operation of automatic measuring equipment. (Data gathering)	Min. once/week	1. Check measuring equipment operations status. 2. Replace and resupply expendable parts. 3. Easy calibration and checks. 4. Easy cleaning and replacement of parts.
Periodic checks (Close checks) (Check transmission accuracy)	Support equipment functions and guard against breakdowns. (Keep within accuracy standards)	Min. once/year	1. Inspect flow paths 2. Inspect detector 3. Inspect control and transmission systems 4. Inspect amplifiers and recorders
Emergency checks	Rapid and prompt checks when a malfunction or breakdown occurs (restore normal status.)	During a malfunction	1. Identify the breakdown and execute minor repairs. 2. Identify and repair cause (depending on the manufacturer.)
Function tests	Prevent trouble and safeguard sustainability regarding maintenance or data evaluation (thoroughly comprehend the equipment characteristics.)	When purchasing equipment (including remodeling, replacement, and renewal) One month	1. Equipment function test (standard gas meter, etc.) 2. Equipment stability test (flow fluctuations, zero, span drift, etc.) 3. Measurement data evaluation (compatibility with obsolete equipment, etc.)
Dynamic calibration	Determine the contents of the accuracy range.	When necessary	1. Check by standard gasses 2. Compile calibration curve