### Table 1.4 Gaseous and particle air pollutants and their measurement methods

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<thead>
<tr>
<th>Observable</th>
<th>Measurement method</th>
<th>References</th>
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</thead>
<tbody>
<tr>
<td><strong>Individual gases (Common gases can also be measured with instruments shown in the “Multiple gases” category below)</strong></td>
<td>Passive:</td>
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<tr>
<td>Carbon monoxide (CO)</td>
<td>Chemical reagent impregnated on silica gel, based on colorimetric dosimeter or solid absorber such as Na-Y-zeolite (LZY-S) using chemisorption or physisorption, followed by TD-GC-FID</td>
<td>McConnaughey et al. (1985); Lee et al. (1992), Jantunen (1998), Monn (2001), Lodovici et al. (2003), Orr (2003), Abi Esber et al. (2007), Bhoga &amp; Singh (2007)</td>
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<td></td>
<td>Continuous:</td>
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<td></td>
<td>NDIR detector</td>
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<td></td>
<td>Electrochemical sensor</td>
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<td></td>
<td>Often use TEA- or sodium iodide-/sodium hydroxide-impregnated filter; also use passive colorimetric dosimeter with strip of impregnated paper</td>
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<td>Integrated:</td>
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<td></td>
<td>Saltzman impinger or bubblers with colorimetric detection using a mixture of sulfanilic acid, N-(1-naphthyl)ethylene diamine dihydrochloride, and acetic acid</td>
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<td></td>
<td>Sampling with front filter to remove particles, followed by TEA-impregnated cellulose-fibre filters for IC analysis of nitrate (NO₃⁻) as NO₂</td>
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<td></td>
<td>Continuous (some absorbents can be used for NO and NO₂):</td>
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<td>Chemiluminescence (catalytic reduction of NO to NO₂; reaction of NO with O₃), including: (1) photolysis: photolytic converter to reduce NO₂ to NO, followed by chemiluminescence, and (2) luminol (5-amino-2,3-dihydro-1,4-phthalazinedione): reaction with NO₂, followed by chemiluminescence methods</td>
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<td>Electrochemical sensor to detect NO₂ by an amperometric method</td>
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<td>Photoacoustic spectroscopy</td>
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<td>Long-path absorption photometer</td>
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<td></td>
<td>See: Nitrogen dioxide (NO₂)</td>
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<td>Nitrogen oxide/ nitrogen oxides (NO/NOₓ)</td>
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<td>Huey sulfation plate: Petri dish with glass-fibre filter layered with lead peroxide; other absorbents include sodium tetrachloromercurate (Na,HgCl₄), potassium carbonate (K₂CO₃), sodium bicarbonate (NaHCO₃) and sodium carbonate (Na₂CO₃), sodium hydroxide (NaOH), and TEA</td>
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<td></td>
<td>Colorimetric dosimeter with strip of impregnated paper</td>
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<td>Integrated:</td>
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<td></td>
<td>Gas-wash-bottle method using cellulose-fibre filters to remove particles (gas bottle containing an acidified peroxide solution, gas meter, restrictor, and pump), followed by IC analysis of sulfate as SO₂</td>
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<td>Observable</td>
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<td>Sulfur dioxide (SO\textsubscript{2}) (cont.)</td>
<td>• Sampling with front filter to remove particles, followed by potassium carbonate (KCO\textsubscript{3})-impregnated cellulose-fibre filters for IC analysis of sulfate as SO\textsubscript{2}</td>
<td>Kring et al. (1981), McConnaughey et al. (1983), Tang et al. (1991)</td>
</tr>
<tr>
<td>Hydrogen sulfide (H\textsubscript{2}S)</td>
<td>• Continuous: UV fluorescence</td>
<td>Sips et al. (1973), Sips &amp; Martin (1975)</td>
</tr>
<tr>
<td></td>
<td>• Passive: Colorimetric dosimeter with strip of impregnated paper</td>
<td>Kring et al. (1981), McConnaughey et al. (1985)</td>
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<tr>
<td>Ammonia (NH\textsubscript{3})</td>
<td>• Passive: Colorimetric techniques with KI-impregnated cellulose-fibre filters</td>
<td>Sips et al. (1973), Sips &amp; Martin (1975)</td>
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<td></td>
<td>• Continuous: UV fluorescence</td>
<td>Kring et al. (1981), McConnaughey et al. (1985)</td>
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Table 1.4 (continued)

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<th>Observable</th>
<th>Measurement method</th>
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</table>
| Volatile organic compounds (VOCs and SVOCs), including carbonyls, organic acids, alcohols, PAHs, and pesticides (present in gas phase and/or particle phase) | Passive:  
- Activated charcoal, Tenax, or other thermally desorbed sorbent, followed by GC-MS; can be used to analyse HCs and chlorinated HCs  
- POPs: started with semipermeable membrane devices (SPMDs), now primarily using PUF disks or XAD-2 resin filled into stainless steel mesh cylinders; samples are extracted in organic solvent before chemical analyses; can be used for PCBs, PBDEs, and other POPs  
- Pesticides: PUF disk or XAD resin; applied to organochlorine, organophosphate, pyrethrin, triazine, and other PCBs  
- SVOCs: PUF disks or XAD resin, for PAHs and other organic compounds  
Integrated:  
- Canister, bag, or Carbotrap sampling for HCs including CH$_4$, C$_2$–C$_7$, and C$_8$–C$_{10}$, and Tenax for C$_{11}$–C$_{20}$  
- Filter/PUF or filter/Tenax (US EPA method TO-13) for volatile PAHs  
- Filter impregnated with DNPH or cryogenic traps for carbonyls  
- HCHO: mostly with DNPH-coated substrate to form hydrazones, followed by HPLC analysis, or using a Palms-type tube coated with sodium bisulphite (NaHSO$_3$); method also applied to acetaldehyde, propionaldehyde acetone aldehydes, amines, etc.  
- Quartz-fibre filters or base-coated filters for organic acids  
- Charcoal, canister, impinger with water, cryogenic trap, or condensation sampling for alcohols (C$_1$–C$_4$)  
- Filter/XAD or filter/Tenax (US EPA methods TO-4 and TO-10) for semivolatile pesticides  
Continuous:  
- HCs by auto GC-FID for CH$_4$, speciated C$_1$–C$_6$ (including 1,3-butadine), NMHCs including isoprene, CH$_3$OH, (CH$_3$)$_2$CO, CH$_3$CHO, CO, aldehydes, ketones, alcohols, halocarbons, NO, PAN, and organic nitrates  
- Oxygenated HCs by automated GC-FID using selective column  
- PAN and its homologues (PANs) by CIMS  
- Carbonyls by electrochemical sensor  
- NMHCs and oxidized HCs by proton transfer reaction-MS (PTR-MS)  
- Organic acids by negative-ion CIMS  
### Table 1.4 (continued)

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<tr>
<th>Observable</th>
<th>Measurement method</th>
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<tr>
<td><strong>Multiple gases</strong></td>
<td>• Laser-induced fluorescence (LIF) for OH, NO, NO₂, NO₃⁻, N₂O, SO₂, CO, and HCHO</td>
<td>Thornton et al. (2000), Matsumoto et al. (2001), Cleary et al. (2002), Day et al. (2002), Thornton et al. (2003)</td>
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<td></td>
<td>• Differential optical absorption spectroscopy (DOAS) for NO, NO₂, HONO, NH₃, SO₂</td>
<td>Alicke et al. (2002), Dunlea et al. (2007), Platt et al. (1980), Pundt et al. (2005)</td>
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<td></td>
<td>CS₂, NMHCs, benzene, toluene, phenol, HCHO, ClO, BrO, I₂, etc.</td>
<td>Eyring et al. (2002), Mazurenka et al. (2003), Kebabian et al. (2005), Osthoff et al. (2006)</td>
</tr>
<tr>
<td></td>
<td>• Cavity ring-down spectroscopy (LAS) for CH₄, HCs, NO, NO₂, NO₃⁻, HONO, Hg, I₂, and O₃</td>
<td>Evertsen et al. (2002), Mazurenka et al. (2003), Kebabian et al. (2005), Osthoff et al. (2006)</td>
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<td></td>
<td>• Tunable diode LAS including IR absorption (LAS) for CO, CO₂, CH₄, HCs, liquid water (H₂O), H₂O₂, NO, NO₂, nitric acid (HNO₃), N₂O, NH₃, halocarbons, HCHO, and O₃</td>
<td>Evertsen et al. (2002), Mazurenka et al. (2003), Kebabian et al. (2005), Osthoff et al. (2006)</td>
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<td></td>
<td>• Integrated cavity output spectroscopy (ICOS; LAS) for NO, CO, and CH₄</td>
<td>Behrentz et al. (2004), Clemitshaw (2004), Larkin (2011)</td>
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<td></td>
<td>• FTIR spectroscopy: a vibrational spectroscopy technique for molecular structure and functional groups like HONO, and HCHO</td>
<td>Clemitshaw (2004)</td>
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<td></td>
<td>• LIDAR or differential absorption LIDAR (DILA) for NMHCs, NO₂, and O₃</td>
<td>Huey et al. (1995), Edwards et al. (2003), Huey (2007)</td>
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<td></td>
<td>• CIMS for OH, HO₂, HONO, and HONO₂</td>
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<td>Passive:</td>
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<td>Dust sampler: collects particles electrostatically with a charged electret; requires knowledge of particle electrical mobility and electret charge</td>
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<td>Dust monitor: uses light extinction to estimate index of mass concentration</td>
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<td>UNC passive aerosol sampler: developed by the University of North Carolina, USA; based on deposition velocity model; collects particles on a stub by gravity, diffusion, and convective diffusion; followed by SEM or TEM and auto-image analyses to get PM concentration and particle size distribution; may exhibit errors when sampling volatile aerosols; used carbon substrate for SEM or TEM analyses or glass substrate for PM₁₀–₂·₅ (coarse particles) by optical microscopy; uncertainties include assumption of particle density and shape factors, wind speed, turbulence, etc.</td>
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<td>Integrated:</td>
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<td></td>
<td>Peaked-roof sampler for TSP without size-selective inlet for particles of 30–50 μm; integrated samplers for PM include inlet, sampling surfaces, substrates, flow controllers, and pump</td>
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<td>PM₁₀: using a size-selective inlet with a 50% collection efficiency of 10 μm</td>
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<td></td>
<td>PM₂·₅: using a size-selective inlet with a 50% collection efficiency of 2·₅ μm</td>
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<td>Observable</td>
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<td>References</td>
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</table>
| Mass (cont.)                | • Using filter sampler for TSP, PM$_{10}$, and PM$_{2.5}$ samplers following Federal Reference Method used by US EPA for compliance monitoring. Filters are equilibrated in a temperature-controlled (20–23 °C) and relative humidity-controlled (30–40%) environment for a minimum of 48 hours before pre- and post-gravimetric analysis of filter substrate for mass  
  Continuous:  
  • Measurement by beta attenuation monitor (BAM): based on beta attenuation  
  • Filter dynamics measurement system (FDMS) and tapered element oscillating microbalance (TEOM): based on inertial microbalance  
  • Particle light scattering by nephelometer, a surrogate for PM$_{10}$ or PM$_{2.5}$ mass: particle scattering of visible light, relates scattered intensity to concentration (nephelometer; most often single-wavelength [λ = 530 nm] or 3-wavelength [e.g. λ = 450, 5258 (or 550), and 635 (or 700) nm]; DustTrak)  
  • AMS for mass of particles with aerodynamic diameters < 1 µm (PM$_{1}$)  
  • Optical particle counter: measures intensity of individual particle scattering, surrogate for PM mass | Butterfield et al. (2010), Heal & Quincey (2012)                                                                                      |
| Light absorption coefficient ($b_{abs}$); also called absorbance (abs), light absorption, or light transmission | Integrated:  
  • Sampling onto Teflon-membrane filters, usually after gravimetric analysis; densitometer measurement of filter light absorption/light transmission (2-wavelength [λ = 370 and 880 nm] transmissometer); or by reflectometer; used as a surrogate for BC | Butterfield et al. (2010), Heal & Quincey (2012)  
| Elements                    | Integrated (preferably on thin-film Teflon-membrane filter):  
  • XRF: measures ~50 elements from sodium to uranium, except beryllium  
  • Particle-induced X-ray emission (PIXE); part of accelerator-based ion beam analysis (IBA)  
  • Instrumental neutron activation analysis (INAA)  
  • Inductively coupled plasma atomic emission spectroscopy (ICP-AES) or ICP-MS  
  • Flame or graphite AAS (FAAS or GAAS)  
  • Lead by high-volume sampling, followed by acid block or hot plate extraction and AAS analysis (US EPA method 40 CFR Part 50)  
  • Lead by cold trap sampling, followed by analysis by GC-AAS  
  Continuous:  
  • Laser-induced breakdown spectroscopy (LIBS)  
  • XRF filter tape (commercially available, used mostly by industry), measures a limited number of elements  
Table 1.4 (continued)

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<th>Observable</th>
<th>Measurement method</th>
<th>References</th>
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<td></td>
<td>• IC for anions (e.g. F(^-), Br(^-), Cl(^-), NO(_2)^-, SO(_4)^2-, and PO(_4)^3-) and cations (e.g. Na(^+), Mg(^2+), K(^+), Ca(^2+), and NH(_4)^+)</td>
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<td></td>
<td>• Ion-selective electrode, mainly for NH(_4^+)</td>
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<td></td>
<td>• Automated colorimetry, mainly for NH(_4^+); can be analysed for NO(_3^-) and SO(_4^{2-}); often on chemically impregnated filters</td>
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<td></td>
<td>• AAS or GAAS for Na(^+), Mg(^2+), K(^+), and Ca(^2+)</td>
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<td>Continuous (measures precursor gases as well as ions):</td>
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<td>• Field IC: grow particles with steam, then collect precursor gases and multiple ions (e.g. ambient ion monitor [AIM]; PILS; wet annular denuder/steam-jet aerosol collector [MARGA]; gas-particle IC [GPIC]; gas-collector IC; or flash volatilization for SO(_4^{2-}) and NO(_3^-) [R&amp;P 8400S and 8400N, respectively; no longer commercialized]); and AMS</td>
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<td></td>
<td>• Thermal methods for OC and EC and their thermal fractions with NDIR detection of CO(_2): Switzerland two-step method, Lawrence Berkeley Laboratory (LBL) method, Brookhaven National Laboratory (BNL) method, and General Motors (GM) method</td>
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<td>• Coulometric titration for CO(_2) by VDI 2465/1, VDI 2465/2, and Centre National de la Recherche Scientifique-Commissariat à l’énergie atomique et aux énergies alternatives (CNRS-CEA) method</td>
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<td></td>
<td>• Thermal magnesium oxide (TMO) method</td>
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<td></td>
<td>• Thermal/optical methods for OC and EC; FID detection of CH(_4) including thermal/optical reflectance (TOR) following the Interagency Monitoring of Protected Visual Environments (IMPROVE_A) protocol that has been applied in long-term non-urban (IMPROVE) and urban (Chemical Speciation Network; CSN) networks in the USA, National Institute for Occupational Safety and Health (NIOSH) thermal/optical transmittance (TOT) protocol, and European Supersites for Atmospheric Aerosol Research (EUSAAR-2) TOT protocol</td>
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<td>Brown carbon</td>
<td>• Various origins at blue or near-UV wavelengths, commonly found in the smouldering phase of biomass burning (e.g. humic-like substances); see: Bioaerosols</td>
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<td>Observable</td>
<td>Measurement method</td>
<td>References</td>
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<td>Water-soluble organic carbon (WSOC)</td>
<td>• Total organic carbon (TOC) analyser: speciated WSOC classes by HPLC-UV/VIS; IC-pulsed amperometric detection (IC-PAD) for carbohydrates; IC-conductivity detection (IC-CD) for organic acids&lt;br&gt;Continuous:&lt;br&gt;• Semicontinuous real-time carbon aerosol analysis instrument for OC and EC by thermal/optical method&lt;br&gt;• Electron ionization high-resolution MS for non-refractory fraction of OC&lt;br&gt;• PILS for WSOC: combining PILS with total carbon (TC) analyser; can use XAD-8 resin as preceding denuder to separate hydrophobic and hydrophilic carbon fractions&lt;br&gt;• British Smoke/coefficient of haze (COH) for BC: British Smoke quantifies filter darkness by reflectance as air is drawn through; called COH in the USA, light transmission measured based on optical density of filter deposit; reported as COH/1000 linear feet&lt;br&gt;• Filter transmittance (e.g. aethalometer; $\lambda = 370$–$880$ nm for 2-wavelength, also $\lambda = 370$–$950$ nm for 7-wavelength); multi-angle absorption photometer (MAAP; $\lambda = 670$ nm)&lt;br&gt;• Single-particle soot absorption photometer ($\lambda = 565$ nm, also $\lambda = 466$, $520$, and $660$ nm for 3-wavelength) by laser incandescence</td>
<td>Hill (1936), Ingram &amp; Golden (1973), Thorne (1978), Hansen et al. (1984), Brimblecombe (1987), Horvath (1993), Jayne et al. (2000), Weber et al. (2003), Li et al. (2003, 2009), Petzold &amp; Schönlinner (2004), Petzold et al. (2005), DeCarlo et al. (2006), Miyazaki et al. (2006), Park et al. (2006), Sullivan et al. (2006), Sullivan &amp; Weber (2006), Peltier et al. (2007), Slowik et al. (2007), Chow et al. (2009), Kreisberg et al. (2013), Hansen &amp; Mocnik (2010), Lambe et al. (2010), Müller et al. (2011)</td>
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<td>Organic speciation</td>
<td>Integrated:&lt;br&gt;• Using filter/PUF/XAD sampling system, followed by solvent extraction-GC (SEG-GC) with FID, electron capture detector (ECD), photoionization detector, flame photometric detector (FPD), MS, or TOF-MS for both polar and non-polar organic compounds and volatile halocarbons, NMHCs, aromatics, and PAN; also speciated PAHs&lt;br&gt;• Using an aliquot of filter, followed by direct injection with thermal extraction- or TD-GC-MS for non-polar alkanes, alkenes, cycloalkanes, hopanes, steranes, and PAHs&lt;br&gt;• FTIR for molecular structure and functional groups&lt;br&gt;• HPLC coupled with MS detection, or UV fluorescence: based on water or organic solvent extraction for polar organic compounds or macromolecules&lt;br&gt;• LC with MS detection, or UV fluorescence: for organic fractions such as PAHs, peroxides, carbonyls, and derivatives of organic acids, polymers, and proteins&lt;br&gt;Continuous:&lt;br&gt;• TD aerosol GC/MS-FID (TAG); or auto GC-FID for speciated organic composition of non-polar and polar organic compounds&lt;br&gt;• CIMS for non-polar and polar organic compounds</td>
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### Table 1.4 (continued)

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<th>Observable</th>
<th>Measurement method</th>
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<tr>
<td>PAHs</td>
<td>• Photoemission aerosol sensor (PAS); photoelectric charging of particles by irradiation with UV light for PAHs of four or more rings</td>
<td>Käpylä &amp; Penttinen (1981), Mielniczuk et al. (1993), Douwes et al. (1995), Rantio-Lehtimäki (1995),</td>
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<td>Douwes et al. (1996), Fox et al. (1996), Terzieva et al. (1996), Hairston et al. (1997), Miller &amp; Young</td>
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<td>(1997), Mullins &amp; Emberlin (1997), Nielsen et al. (1997), Saraf et al. (1997), Rylander et al. (1999),</td>
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<td>Bünger et al. (2000), Pashynska et al. (2002), Shelton et al. (2002), Fang et al. (2005), Hogan et</td>
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<td>al. (2005), Kaye et al. (2005), Maron et al. (2005), An et al. (2006), Brodie et al. (2007), Caseiro et</td>
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<td></td>
<td>al. (2007), Menetrez et al. (2007), Bauer et al. (2008), Nehme et al. (2008), Vanhee et al. (2008),</td>
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<td>Chen &amp; Hildemann (2009), Tripathi et al. (2009), Lee et al. (2010), Lindsley et al. (2010), Bowers et</td>
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<td>al. (2011)</td>
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<td>Bioaerosols</td>
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<td>Integrated:</td>
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<td></td>
<td>• Culturable airborne bacteria and fungi: collected using AGI impingers and Andersen impactors, cultivated, and counted on a solid or in a liquid culture</td>
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<td>medium</td>
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<td>• Total airborne bacteria and fungi based on: (1) microscopy, including light microscopy (e.g. fluorescence microscopy), electron microscopy, and Raman</td>
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<td>microscopy; (2) flow cytometry that measures the number of fluorescent biological particles; and (3) qPCR that determines the quantity of DNA copies</td>
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<td>• Pollens: light microscopy that identifies and enumerates pollen grains collected via non-volumetric (e.g. Durham microscope slides, hanging slides, flags,</td>
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<td>passive impactor rods, and sticky cylinders) or volumetric (e.g. impactors, cyclones, whirling arm samplers, and Hirst-type samplers such as Burkard pollen</td>
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<td>and spore traps) sampling approaches</td>
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<td>• Viruses: qPCR that quantifies the viral DNA/RNA copies; or plaque assays that quantify viral concentrations by infecting living cells with viruses at</td>
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<td>different dilution ratios</td>
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<td>• Proteins using micro bicinchoninic acid (BCA) assay, or by nano-orange protein quantification kit</td>
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<td>• Endotoxins: based on LAL assays with activating factor C, including gel-clot LAL assay, end-point fluorescence assay, end-point chromogenic LAL</td>
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<td>assay, kinetic chromogenic LAL assay, and kinetic turbidimetric LAL assay; or by GC-MS that measures 3-hydroxyl fatty acids, a key component of endotoxin</td>
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<td></td>
<td>molecules</td>
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<td>• (1→3)-β-d-glucan: using inhibition enzyme immunoassay (EIA) or by LAL assays with activating factor G</td>
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<td>• Mannitol and arabitol: using GC-MS, GC-FID, or by anion-exchange HPLC with pulsed amperometric detection (HPAEC-PAD)</td>
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<tr>
<td></td>
<td>• Ergosterol: using HPLC, or by GC-MS</td>
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<td></td>
<td>• Muramic acid: using GC-MS</td>
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<td></td>
<td>• Microbial community: based on denaturing gradient gel electrophoresis (DGGE); terminal restriction fragment length polymorphism (T-RFLP); microarrays,</td>
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<td></td>
<td>clone library sequencing; or pyrosequencing</td>
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<td></td>
<td>Continuous</td>
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<tr>
<td></td>
<td>• Concentration and size distribution: based on UV aerodynamic particle sizer (UV-APS) and waveband integrated bioaerosol sensor (WIBS) based on the</td>
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<td></td>
<td>autofluorescence of biomolecules such as nicotinamide adenine dinucleotide phosphate (NADPH) and riboflavin; or by bioaerosol MS that couples fluorescence-</td>
<td></td>
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<tr>
<td></td>
<td>based bioaerosol detection with an AMS</td>
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</tbody>
</table>
### Table 1.4 (continued)

<table>
<thead>
<tr>
<th>Observable</th>
<th>Measurement method</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Particle number and size</strong></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• Sampling onto polycarbonate paper, followed by SEM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sampling onto TEM grid, followed by TEM</td>
<td></td>
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<tr>
<td>Particle size distribution</td>
<td>• Use cascade impactors such as micro-orifice uniform deposit impactor (MOUDI) or</td>
<td>Watson &amp; Chow (2013)</td>
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<td></td>
<td>electrical low-pressure impactor (ELPI) for particle size distribution on filter</td>
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<td></td>
<td>substrates</td>
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<td></td>
<td>• Condensation particle counter (CPC)</td>
<td>Spencer et al. (2007), Park et al. (2008), Giechaskiel et al. (2009), Grimm &amp; Eatough (2009),</td>
</tr>
<tr>
<td></td>
<td>• Scanning mobility particle sizer (SMPS), aerosol particle sizer, or optical particle</td>
<td>Takegawa et al. (2009), Wang et al. (2009, 2010b), Farmer &amp; Jimenez (2010), Giechaskiel &amp; Bergmann</td>
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<tr>
<td></td>
<td>counters for particle size distribution</td>
<td>(2011)</td>
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<td></td>
<td>• AMS uses single particle laser ablation based on laser vaporization, laser-induced</td>
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<td></td>
<td>plasma, or multiphoton ionization</td>
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<td></td>
<td>• Aerosol TOF-MS</td>
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<td></td>
<td>Integrated:</td>
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<td></td>
<td>• Atmospheric mercury is present in three forms: GEM, largely present in the</td>
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<tr>
<td></td>
<td>atmosphere; RGM, and reactive Hg-P; sampling train includes quartz-fibre filter for</td>
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<tr>
<td></td>
<td>Hg-P, KCl-impregnated filter for RGM, and gold trap for GEM; samples are subjected</td>
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<td></td>
<td>to thermal mercury analysis: thermal extraction followed by gold amalgamation and</td>
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<td></td>
<td>cold vapour atomic fluorescence spectroscopy (CVAFS)</td>
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<td>Continuous</td>
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<td></td>
<td>• Total mercury speciated by oxidation: measured by atomic fluorescence and UV</td>
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<td></td>
<td>photometry</td>
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</tr>
</tbody>
</table>

AAS, atomic absorption spectroscopy; AMS, aerosol mass spectrometer; BC, black carbon; CH$_4$, methane; CIMS, chemical ionization mass spectrometry; CO, carbon monoxide; CO$_2$, carbon dioxide; DNPH, 2,4-dinitrophenylhydrazine; EC, elemental carbon; FID, flame ionization detector; FTIR, Fourier transform infrared; GAAS, graphite atomic absorption spectroscopy; GC, gas chromatography; GEM, gaseous elemental mercury; HCHO, formaldehyde; HCs, hydrocarbons; Hg-P, particulate mercury; HONO, nitrous acid; HPLC, high-performance liquid chromatography; IC, ion chromatography; IR, infrared; KI, potassium iodide; LAL, Limulus amoebocyte lysate; LAS, laser absorption spectroscopy; LC, liquid chromatography; LIDAR, light detection and ranging; MS, mass spectrometry; NDIR, non-dispersive infrared; NMHCs, non-methane hydrocarbons; NO, nitrogen oxide; NO$_x$, nitrogen oxides; NO$_2$, nitrous oxide; O$_3$, ozone; OC, organic carbon; PAHs, polycyclic aromatic hydrocarbons; PAN, peroxyacetyl nitrate; PBDEs, polybrominated diphenyl ethers; PCBs, polychlorinated biphenyls; PILS, particle-into-liquid sampler; PM, particulate matter; PM$_{10}$, particulate matter with particles of aerodynamic diameter < 10 μm; PM$_{2.5}$, particulate matter with particles of aerodynamic diameter < 2.5 μm; POPs, persistent organic pollutants; PUF, polyurethane foam; qPCR, quantitative real-time polymerase chain reaction; RGM, reactive gaseous mercury; ROS, reactive oxygen species; SEM, scanning electron microscopy; SO$_2$, sulfur dioxide; SVOCs, semivolatile organic compounds; TD, thermal desorption; TEA, triethanolamine; TEM, transmission electron microscopy; TOF-MS, time-of-flight mass spectrometry; TSP, total suspended particles; US EPA, United States Environmental Protection Agency; UV, ultraviolet; VIS, visible; VOCs, volatile organic compounds; WSOC, water-soluble organic carbon; XRF, X-ray fluorescence. Prepared by the Working Group.
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Outdoor air pollution


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McConnauhgy PW, McKee ES, Pritts IM (1985). Passive colorimetric dosimeter tubes for ammonia, carbon monoxide, carbon dioxide, hydrogen sulfide,


doi:10.1021/ba-1993-0232.ch008


