**Principle of Operation**

As a passive sampler, the Radiello system does not contain any active mechanical components such as pumps to sample ambient air. Instead, the system relies upon its patented radial symmetry to achieve high sampling rates and negligible sensitivity to wind and air turbulence.

At the heart of the system is a cylindrical collection cartridge that is housed inside of a cylindrical diffusive barrier.

Deriving from Frick’s Law, the quantity of material sampled \( (Q) \) is a function of the diffusion coefficient of a given compound \( (D) \) and the geometric constant of the sampler \( (K) \):

\[
Q = D K
\]

Since the diffusion coefficient is always the same for a given gas, it is the geometry of the sampler that determines its performance. The geometric constant of the sampler \( (K) \) is a function of the diffusive surface \( (S) \) and the distance between the diffusive and adsorbing surfaces \( (l) \):

\[
K = S / l
\]

The diffusive surface is very large in the Radiello sampler relative to the adsorbing surface due to the unit’s radial design (the adsorbing cylinder inside a diffusive cylinder). In addition, the distance between the diffusive and adsorbing surfaces is very small. Both of these factors contribute to the very high and constant collection rates of the Radiello Passive Sampling System.

As compared with traditional axial passive samplers, the Radiello sampler’s diffusive surface is cylindrical instead of flat, and the adsorbing substrate is contained in a coaxial cylindrical cartridge. With this geometry, the diffusive surface is larger than the adsorbing surface, and the sorbent volume is small. In conventional systems, the diffusive and adsorbing surfaces are of equal size. The innovative diffusion material used in the Radiello sampler (synthesized microporous polyethylene) provides for a very consistent sampling rate.

**Collection Cartridge**

Inside of Diffusive Body.

Diffusion from the Ambient Concentration \( (C) \), Through the Diffusive Body \( (S) \), to the Adsorption Surface of the Collection Cartridge \( (S_a) \).

**Supporting Plate**

Molecule Flow Direction

Cylindrical Diffusive Surface

Collection Cartridge Inside of Diffusive Body.

**Axial Sampler**

Diffusive Surface

Adsorbing Surface

Radial Sampler

**Check out our specialty web site at:**

www.passivesampling.com
The Radiello Passive Sampling System provides an effective means of sampling gases for industrial, indoor, outdoor, and personal exposure applications. As a passive sampler, the device does not require any electric power; its light weight and small size, high and constant sampling rate, and well-documented sampling and analytical procedures make it the ideal platform for determining gaseous concentrations (see list of sampled gases).

The Radiello system contains a patented geometry developed by the Fondazione Salvatore Maugeri of Padova, Italy, that results in very high selectivity and sensitivity, and gas sampling rates. The institute has worked with the European Commission’s Joint Research Center and other leading institutions to characterize the performance of the system. It continues to be very active in new methods development to expand the range of gases addressed by the system.

The Radiello system is included in the ISO 16200-2 standard for the sampling and analysis of volatile organics, and has played a major role in a number of major international projects for assessing the concentration of benzene and ozone precursors.

**Applications**

The Radiello Passive Sampling System is geared for the following applications:

- Monitoring exposure of workers to hazardous substances.
- Determining the concentration of gaseous species that have been assigned a maximum exposure limit (MEL) or have an occupational exposure standard (OES).
- Saturation sampling in cities or other areas to map concentration gradients with high spatial resolution.
- Personal exposure assessment.
- Indoor sampling in homes, offices, schools, public facilities, etc.
- Outdoor monitoring around industrial sites, along traffic corridors and other busy areas.
- Identification and assessment of pollution sources.
- Measuring the environmental impact of new materials used in buildings, furniture, and other fixtures.

**Listing of Sampled Gases**

- NH₃ (ammonia)
- BTX (benzene, toluene, xylenes)
- VOC’s (44 volatile organic compounds)
- NOₓ, SO₂ (nitrogen dioxide and sulfur dioxide)
- O₃ (ozone)
- HF (hydrogen fluoride)
- HCl (hydrogen chloride)
- Aldehydes (formaldehyde, acrolein, acetaldehyde, propanal, butanal, isopentanal, hexanal, benzaldehyde, and glutaraldehyde)
- Anaesthetic Gases and Vapors (nitrous oxide, forane, ethrane, halothane, and sevorane)

**Sampling and Analysis**

For each gaseous component sampled by the Radiello system, the Fondazione Salvatore Maugeri has developed specific protocols for sampling and analysis. The sampling procedures are easily carried out by end users in the field, while the analysis protocols use common techniques that can be carried out by the user’s or an independent laboratory. Rupprecht & Patashnick and its international distributors have also made arrangements for the analysis of collected samples and reporting of data by third-party institutions.

In most cases, the only items that distinguish one sampling configuration from another are the collection cartridge and the color-coded diffusive barrier. The collection cartridge is approximately 5 cm (2”) long, and contains the materials that react with the gaseous species being sampled. Different diffusive bodies provide the desired properties in the various system configurations, and make the system virtually immune to turbulence.

**In-Field Sampler Preparation**

The collection cartridge is housed in a sealed glass tube both before and after sample collection. The user can easily install the cartridge into the diffusive body and then remove it after sampling without touching the cartridge. The rigorous approach taken toward the transport, insertion and retrieval of the sampling cartridge ensures sample integrity.

After the user installs the sampling cartridge into the diffusive body, the body is screwed into the supporting plate. For personal sampling applications, the user can install an optional adapter that permits the diffusive body with collection cartridge to be worn in its vertical position. For outdoor measurements, an optional shelter provides weather protection for up to four samplers.
The Radiello Passive Sampling System provides an effective means of sampling gases for industrial, indoor, outdoor, and personal exposure applications. As a passive sampler, the device does not require any electric power. Its lightweight and small size, high and constant sampling rate, and well-documented sampling and analytical procedures make it the ideal platform for determining gaseous concentrations (see list of sampled gases).

The Radiello system contains a patented geometry developed by the Fondazione Salvatore Maugeri of Padova, Italy, that results in very high selectivity and sensitivity, and gas sampling rates. The institute has worked with the European Commission's Joint Research Center and other leading institutions to characterize the performance of the system. It continues to be very active in new methods development to expand the range of gases addressed by the system.

The Radiello system is included in the ISO 16200-2 standard for the sampling and analysis of volatile organics, and has played a major role in a number of major international projects for assessing the concentration of benzene and ozone precursors.

### Applications

- Monitoring exposure of workers to hazardous substances.
- Determining the concentration of gaseous species that have been assigned a maximum exposure limit (MEL) or have an occupational exposure standard (OES).
- Saturation sampling in cities or other areas to map concentration gradients with high spatial resolution.
- Personal exposure assessment.
- Indoor sampling in homes, offices, schools, public facilities, etc.
- Outdoor monitoring around industrial sites, along traffic corridors and other busy areas.
- Identification and assessment of pollution sources.
- Measuring the environmental impact of new materials used in buildings, furniture, and other fixtures.

### Sampling and Analysis

For each gaseous component sampled by the Radiello system, the Fondazione Salvatore Maugeri has developed specific protocols for sampling and analysis. The sampling procedures are easily carried out by end users in the field, while the analysis protocols use common techniques that can be carried out by the user's or an independent laboratory. Rupprecht & Patashnick and its international distributors have also made arrangements for the analysis of collected samples and reporting of data by third-party institutions.

In most cases, the only items that distinguish one sampling configuration from another are the collection cartridge and the color-coded diffusive barrier. The collection cartridge is approximately 5 cm (2”) long, and contains the materials that react with the gaseous species being sampled. Different diffusive bodies provide the desired properties in the various system configurations, and make the system virtually immune to turbulence.

### In-field Sampler Preparation

The collection cartridge is housed in a sealed glass tube both before and after sample collection. The user can easily install the cartridge into the diffusive body and then remove it after sampling without touching the cartridge. The rigorous approach taken toward the transport, insertion and retrieval of the sampling cartridge ensures sample integrity.

After the user installs the sampling cartridge into the diffusive body, the body is screwed into the supporting plate. For personal sampling applications, the user can install an optional adapter that permits the diffusive body with collection cartridge to be worn in its vertical position. For outdoor measurements, an optional shelter provides weather protection for up to four samplers.
**Principle of Operation**

As a passive sampler, the Radiello system does not contain any active mechanical components such as pumps to sample ambient air. Instead, the system relies upon its patented radial symmetry to achieve high sampling rates and negligible sensitivity to wind and air turbulence.

At the heart of the system is a cylindrical collection cartridge that is housed inside of a cylindrical diffusive barrier.

Deriving from Frick’s Law, the quantity of material sampled (Q) is a function of the diffusion coefficient of a given compound (D) and the geometric constant of the sampler (K):

\[ Q = D \cdot K \]

Since the diffusion coefficient is always the same for a given gas, it is the geometry of the sampler that determines its performance. The geometric constant of the sampler (K) is a function of the diffusional surface (S) and the distance between the diffusive and adsorbing surfaces (l):

\[ K = \frac{S}{l} \]

The diffusive surface is very large in the Radiello sampler relative to the adsorbing surface due to the unit’s radial design (the adsorbing cylinder inside a diffusive cylinder). In addition, the distance between the diffusive and adsorbing surfaces is very small. Both of these factors contribute to the very high and constant collection rates of the Radiello Passive Sampling System.

As compared with traditional axial passive samplers, the Radiello sampler’s diffusive surface is cylindrical instead of flat, and the adsorbing substrate is contained in a coaxial cylindrical cartridge. With this geometry, the diffusive surface is larger than the adsorbing surface, and the sorbent volume is small. In conventional systems, the diffusive and adsorbing surfaces are of equal size. The innovative diffusion material used in the Radiello sampler (synthesized microporous polyethylene) provides for a very consistent sampling rate.

Check out our specialty website at:

www.pm10.co.uk