

# Respiratory Complaints Clouded by Smoke Then Traced to Vacant Space

P-TRAK™ Ultrafine Particle Counter Case Study #9

## Background

Suffering from eye irritation and breathing difficulty, retail workers at a clothing store had complained for over a month. Shopping mall management could not identify any reason for the symptoms. This concern was rapidly transformed to urgency when one of the workers suddenly experienced severe respiratory symptoms, including a nosebleed, and coworkers rushed her to the hospital for treatment. The property manager was unable to explain the cause, and the storeowner insisted on an air quality investigation.

## Problem Assessment

The property manager, familiar with IAQ investigations, authorized a special survey employing a P-TRAK™ Ultrafine Particle Counter. He suspected that recording and tracking ultrafine particle (UFP) levels could be the key to solving this serious problem. (All readings were recorded in particles/cc.)

When the investigator first arrived at the shopping mall, he recorded outdoor UFP levels of approximately 6,000. He then learned that each store was served by its own air-handling unit. Since the air handler supplied 100 percent outside air through 20 percent efficient dust spot filters, the investigator set a goal of 5,000 for air in the store. Given the earlier incident, he expected much higher levels.

### UFPs Tracked to the Source...

• Background (outdoors)	6,000
• Dress store supply air	5,000
• Dress store actual	50,000
• Adjacent maintenance area	50,000
• Dress store after corrective action	5,000

The investigator did find much higher levels within the store. The large doors opening into the mall's main corridor and the number of cigarette smokers there immediately suggested the corridor as an obvious pollutant source. Concerned that this source might mask the true problem within



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the store, he needed to prevent this smoke from entering the store during the investigation. The quick solution was closing the doors to an approximate 2-foot opening. The resulting positive air pressure differential prevented cigarette smoke from entering the store and clouding the investigation.

With the possibility of cigarette smoke eliminated, the investigator checked the supply air and found UFP levels near the expected goal of 5,000. Levels at other locations within the store were as high as 50,000. Experience told him that UFPs throughout the store should soon drop if the cigarette smoke was the cause. If not, one or more additional sources had to be present.

UFP levels did not drop. He knew that the source was either within the store or that UFPs were entering the store through an unknown pathway. He found the highest UFP level—over 50,000—rushing from a 1-inch hole through the wall and behind the dress rack where the affected clerk had been working.

The property manager explained that the space next door was vacant and that its doors were kept closed. These confined conditions caused pressure to build up in the vacant space and explained the high velocity of the air that streamed through the hole. However, it did not explain the high UFP levels.

When the investigator entered this adjacent space, he noted that UFP levels again rose to over 50,000. When the property manager reported that the space was used to charge batteries of several snow-sweeping machines, the investigator knew he was closing in on the problem. UFP levels increased as he approached the machines, which were adjacent to the wall separating the vacant space from the dress store. The highest UFP levels were flowing from the caps of the sweepers' water-filled, lead acid batteries. With this knowledge, the charging operations were terminated immediately. UFP levels dropped to the 5,000-count goal. The investigator returned to the store and checked UFP levels once again. UFP levels were also 5,000 within the store.

## Outcome

To prevent any recurrences, the sweepers were moved to a well-ventilated area of the mall, and the 1-inch hole was sealed. The clerk was soon able to return to work without further incident.

## The P-TRAK™ Ultrafine Particle Counter from TSI....

Tracking UFPs with the P-TRAK™ Ultrafine

Particle Counter is a new and effective method for identifying the root cause of problems.

Targeting the true source, or sources, of unexpected ultrafine particle

concentrations helps to clarify indoor air quality and other

problems. Removing, repairing or

controlling the source and shutting down pathways has been shown to effectively eliminate related complaints.



The P-TRAK™ Ultrafine Particle Counter uses fundamental measurement technology proven around the world in research and industrial applications since 1978. Its data logging feature allows the user to download field measurements for evaluation in TSI's TRAKPRO™ Data Analysis Software or in common word processing and spreadsheet programs, simplifying record keeping and reports.

See [www.tsi.com](http://www.tsi.com) for more information on the P-TRAK™ Ultrafine Particle Counter and TSI's full line of IAQ instruments.

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