

# WIDESPREAD IAQ COMPLAINTS TRACED TO BOILER STACK EXHAUST

P-TRAK™ ULTRAFINE PARTICLE COUNTER CASE STUDY #6

## Background

Occupants throughout an eight-floor office building were routinely complaining to building management about poor indoor air quality (IAQ). Their symptoms included headaches, eye irritation, sore throat and fatigue. These widespread and persistent complaints were primarily general in nature and could not be correlated to particular locations, time of day or specific events. Management was also aware of anecdotal claims of more serious illnesses. Although never specifically related to air quality, these claims heightened occupant concern.

Building management made many attempts to address the complaints. The most comprehensive efforts related to air quality evaluations based on the ASHRAE Standard 62-1989. These evaluations failed to reveal any deficiencies based on the standard. The resulting reports were interpreted by some occupants as a message from management saying, "You're not sick. It's your imagination."

## Problem Assessment

When all conventional approaches were exhausted, building management authorized a new investigation that used ultrafine particle (UFP) levels to evaluate building conditions. This 6-hour survey employed a P-Trak™ Ultrafine Particle Counter to measure UFP concentrations in outside air and at various locations throughout the building. All readings were recorded in particles/cc

### UFPs Tracked to the Source...

• Background (outdoors)	5,230
• Expected inside	2,500
• Actual inside	16,200
• Air from air supply diffuser	22,600
• Near exhaust stack and air intake	40,000
• Average inside after retrofit	2,500

The UFP concentration in outside air, measured at ground level and upwind (south) of the building, averaged 5,230. With 60 percent efficient filters in the rooftop air-handling unit, a reading of 2,000 to 3,000 was expected. Average readings in the office, however, were 16,200. The highest indoor reading—22,600—was tracked to an air supply diffuser.

Additional testing demonstrated that UFP readings within the building were consistently higher than those outside the building. Most significantly, the highest outdoor reading—40,000—occurred where air entered the building through the outside air intake located near the roof.



These findings focused the investigation on the roof, specifically just above the outside air intakes. Readings of 40,000 between the exhaust stack and the air intake demonstrated that the exhaust from the building's own boiler was being drawn down to roof level by downdrafts caused by a 12-story building located directly south. This exhaust air was then drawn back into the building's HVAC system. Building management and employee representatives were able to easily see and understand the UFP measurement results.

## Outcome

With the suspicion that boiler exhaust was the source of the IAQ complaints, building management developed a strategy to ensure that exhaust was discharged away from outside air intakes. The first recommendation—raise the original exhaust stack beyond its original 6-foot height—was straightforward. A section was added to the stack to make it 13 feet tall.

The question now was “Did the remediation work?” Again, the P-Trak™ Ultrafine Particle Counter gave an answer. By measuring the UFP concentrations around the roof and the outside air intake, investigators showed that, while these concentrations had decreased by 75 percent, an unacceptable amount of UFPs still entered the building. The stack was then run horizontally 25 feet and the height was increased to 25 feet. An exit cone was inserted at the top to increase the upward velocity of the exhaust. The P-Trak™ Ultrafine Particle Counter showed that the particle concentrations at the air intakes were the same as those upwind of the stack.

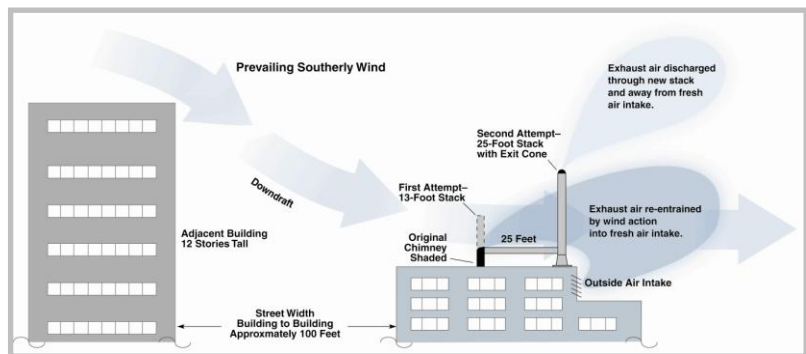
Tests inside the building showed a substantial reduction in UFP concentrations. The reduction was accompanied by a dramatic decrease in complaints and a “thank you” from the occupants for the successful effort by management to improve air quality. Total cost for the investigation and remediation, including follow-up tests of the stack, was less than \$10,000.

## 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.



UNDERSTANDING, ACCELERATED

TSI Incorporated – Visit our website [www.tsi.com](http://www.tsi.com) for more information.

USA Tel: +1 800 874 2811  
UK Tel: +44 149 4 459200  
France Tel: +33 4 91 11 87 64  
Germany Tel: +49 241 523030

India Tel: +91 80 67877200  
China Tel: +86 10 8251 6588  
Singapore Tel: +65 6595 6388