

# HVAC SYSTEM RECIRCULATES COPIER EMISSIONS

P-TRAK™ ULTRAFINE PARTICLE COUNTER CASE STUDY #8

## Background

Workers in first one, then two, and then three offices on the third floor of a 22-story office building were suffering from headaches and eye and nose irritation. The building manager routinely measured the standard indoor air quality (IAQ) parameters, i.e., CO<sub>2</sub>, temperature, humidity and ventilation. All tests met applicable standards and guidelines. The manager also checked the system balance and searched for evidence of mold. The building seemed to pass all the conventional tests. However, he suspected that it wasn't as clean as it appeared. Unable to resolve these complaints, the building manager called in an IAQ investigator to thoroughly study building conditions.

## Problem Assessment

The investigator conducted a study of ultrafine particles (UFPs) within the building. These particles, less than 0.1 micrometer in diameter, were measured using a P-Trak™ Ultrafine Particle Counter. All readings were recorded in particles/cubic centimeter (cc).

### UFPs Tracked to the Source...

|                                    |         |
|------------------------------------|---------|
| • Background (outside)             | 11,000  |
| • Indoor goal                      | 1,000   |
| • Third floor                      | 11,500  |
| • Main trunk to third floor        | 1,400   |
| • Supply air to third floor office | 12,000  |
| • Third floor photocopier          | 150,000 |
| • Third floor after copier repair  | 1,000   |

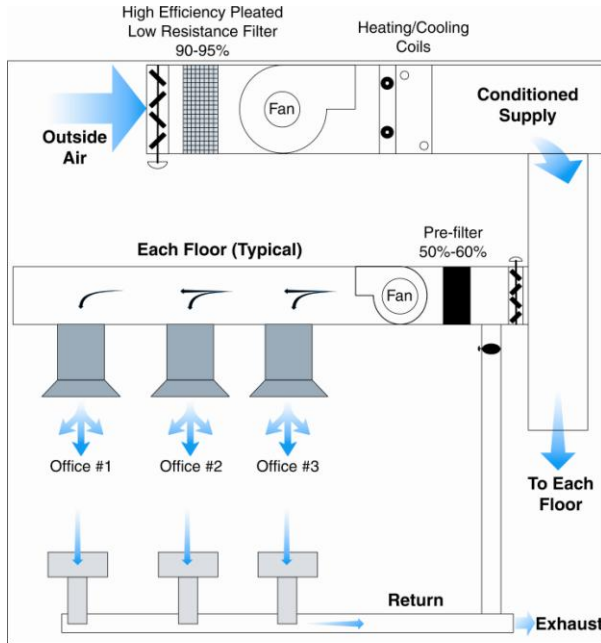
The first step in the investigation was determining background UFP levels and setting an indoor goal. Several outdoor readings provided a background level of 11,000. To set the indoor goal, he started with an examination of the building blueprints. This review showed that outside air entered the building through a central air handler and then passed through bag filters with 90 percent dust spot efficiency ratings. The air was then conditioned and supplied by a main trunk through the center of the building. Each floor drew 15 percent conditioned air from the trunk and filtered it through 60 percent efficient pleated filters. With these filters, he expected to find a UFP level of 1,000 in the building.

The investigation now focused on actual conditions within the building. Levels at locations other than the third floor were below his expectation of 1,000. However, levels on the third floor were not. In one of the offices, levels were as high as 11,500—almost 12 times the goal.

Supply air entering this office contained UFP levels of 12,000; however, supply air at the main trunk contained levels of only 1,400. The explanation for this deviation was revealed during a more detailed review of the building blueprints. The plans showed that the floor's recirculated return air made up 85 percent of the supply air to the floor. Therefore, the logical source of the complaints was located on the third floor.



The investigator then surveyed the floor office by office to locate the actual source. He soon found that a malfunctioning photocopier was producing UFP levels near 150,000.



## Outcome

Once the copier was serviced, the investigator used the P-Trak™ Ultrafine Particle Counter to determine that UFP emissions from the copier were the same as the indoor goal. To prevent future occurrences, the building manager initiated a routine maintenance program that included regular UFP surveys with goals based on outside UFP levels and building filter efficiencies.

## 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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