

Child's Chronic Illness Related to Faulty Home Furnace

P-TRAK™ Ultrafine Particle Counter Case Study #10

Background

When diagnosis and medical treatment could not help a chronically ill 3-year-old child, the child's health specialist suggested comprehensive testing of the boy's home. A consultant was called to the home to conduct an indoor air quality (IAQ) investigation.

Problem Assessment

During a telephone interview prior to the visit, the IAQ investigator learned that the child's home was a typical rural residence subject to cold winter weather. It was heated by an oil-fired, forced air furnace and, to a lesser extent, by a propane fireplace. Additional combustion sources included a oil-fired water heater and a stove used for cooking family meals. No one in the house smoked.

Believing that one of these combustion sources could be affecting the boy's health, the investigator designed a survey approach that would

UFPs Tracked to the Source...

• Background (outside)	1,800
• House unheated	800
• House heated by propane fireplace	800
• House heated by oil-fired furnace	30,000
• Basement near furnace	429,000
• House ventilated with furnace off	2,000

isolate the impacts caused by each source. To assist the investigator, the parents adjusted the thermostat so that the furnace would be idle for at least two hours prior to the investigation. The parents also kept the fireplace off and refrained from cooking for the same period of time.

To evaluate the home's condition, the investigator would measure carbon monoxide (CO) and ultrafine particles (UFPs). UFPs, those particles less than 0.1 micrometer in diameter, often occur as combustion byproducts



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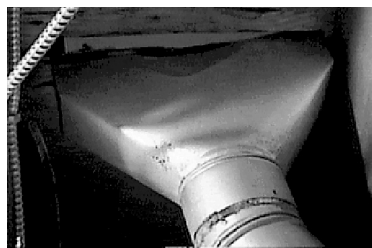
and may be accompanied by related respiratory complaints. The P-TRAK™ Ultrafine Particle Counter measured these particles in real time and reported them in particles per cubic centimeter (cc).

Once the investigator arrived, he determined the background UFP level by measuring air outside the house. In this case the level was 1,800. Once inside the house, he again measured UFPs, which were reduced by filtration to 800. The child was not showing any symptoms of respiratory impairment.

With this baseline established, the mother started the propane fireplace. CO was well below acceptable limits. UFPs were steady at 800. The child continued to play without complaint.

Next, the fireplace was turned off, and the thermostat was set to activate the furnace. Within 10 minutes, UFP levels in the living room exceeded 30,000, and the boy's symptoms began. Although these symptoms were a signal to administer medication, the mother agreed to delay the treatment for a few minutes. The investigator immediately entered the basement to survey the furnace area. UFP levels there were 429,000. CO was unchanged.

Further investigation quickly revealed significant leaks in the 10-foot exhaust duct to the chimney. These leaks, from holes and joints, permitted UFPs to enter the basement area. In addition, the vent serving the boy's bedroom was so loose that UFPs had a direct pathway to upstairs living areas.



To confirm the link between the faulty furnace and the boy's symptoms, the investigator stopped the furnace and opened the doors to ventilate the house. As soon as adequate fresh air entered the house, UFPs dropped to 2,000. The boy's symptoms began to subside, and he resumed normal activity.

Health Effects

The exact link between UFPs and IAQ complaints is still not clear. The complaints may stem from sheer quantity of ultrafine particles, their overall chemical makeup or some combination of both. Current evidence shows that UFPs can trigger immune system reactions in susceptible individuals. Scientific and medical communities in concert with regulatory agencies believe the link between UFPs and human health is important. In support of that belief, they are committing significant resources towards understanding the exact mechanisms and effects of ultrafine particles on our health.

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 for more information on the P-TRAK™ Ultrafine Particle Counter and TSI's full line of IAQ instruments.

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