

## Case Study Overview

In January of 2016 AirAdvice for Homes, in partnership with Honeywell and local AirAdvice/Honeywell contractor Neil Kelly, collaborated on an indoor air quality retrofit at Mrs. Teapot's Tiny Tots preschool, in Portland, Oregon. The goal was to both improve the IAQ of the preschool, and to measure the effectiveness of the solutions installed to control the various air pollutants.



Mrs. Teapot's Tiny Tots Preschool

## Characteristics of the Building

The preschool is located in a 1950 single-family bungalow with a full finished basement. The main floor is used for a preschool Monday-Friday, and the basement level is occupied by the owners and their two small dogs. The forced air gas furnace is located in the basement. Three adults and 7-10 children occupy the facility during work hours.

## Results of the first indoor air quality test

To baseline the project, AirAdvice conducted an IAQ test. Six IAQ parameters were tested, four of which were found to have high levels. Test results showed that concentrations of particulate matter, chemical pollutants (VOCs), carbon dioxide, and relative humidity were above recommended thresholds established by industry standards.

The owner was initially shocked at the results. She was unfamiliar with the IAQ issues, what the solutions were, or what those solutions might cost. She was relieved to learn that affordable, mechanical solutions could be installed to address the issues testing had revealed.



AirAdvice M5200 Monitor

**Particulate Matter** – The AirAdvice monitor measures particles in the 0.3-10.0 micron range, the full range of particles responsible for health issues. Particles are known to trigger asthma and allergy symptoms. The average level of particulates found at the preschool was 17 micrograms per cubic meter (ug/m<sup>3</sup>), almost twice the acceptable level. Cooking is a common source of PM in homes as well as anywhere combustion takes place.

**Volatile Organic Compounds (VOCs)** – The average concentration of VOCs, also referred to as chemical pollutants, were found to be 2637 ug/m<sup>3</sup> – over five times the acceptable level of 500 ug/m<sup>3</sup>.

**Carbon Dioxide (CO<sub>2</sub>)** – The weekly average concentration of CO<sub>2</sub> at the preschool was 1456 ppm – over twice the ASHRAE recommended standard. This represents the absence of oxygen, and for IAQ professionals, serves as an indicator of overall concentration of other pollutants in a building due to poor ventilation. High levels of CO<sub>2</sub> are known to diminish cognitive function. This was the only IAQ parameter that could be noticed without sensor equipment, but the levels were surprisingly high, even to those conducting the tests.

**Humidity** – Humidity: The average weekly level was 64% with daytime peaks nearing 70% relative humidity. Humid environments can support growth of dust mites and mold. Humidity should be kept between 35% - 60% relative humidity (ASHRAE).

In Collaboration with



**& Honeywell**

# Solutions for IAQ Pollutants

## Honeywell equipment installed:

- TrueFRESH Heat Recovery Ventilator
- Prestige IAQ thermostat
- F200 Whole House Media Air Cleaner
- 24v UV Air Purifier with AirBRIGHT Odor Absorption
- UV Treatment System



Honeywell TrueFRESH HRV during installation



A Honeywell Prestige IAQ thermostat

High particulate levels were addressed by installing a Honeywell F200 filtration cabinet with a MERV 11 filter designed to capture particles in the <10 micron size range that cause health problems. The post-test results revealed the concentration of small particles decreased by more than half following the installation.

VOCs were reduced by 99% by using two different techniques.

- 1) A heat recovery ventilator (HRV) was installed to bring in outside air, to dilute indoor concentrations of pollutants.
- 2) A Honeywell AirBRIGHT. Photo Catalytic Oxidizer (PCO) was installed to break down VOCs as they pass through the air handler.

The HRV also reduced CO2 levels 46%, from 1456ppm to 726ppm. By bringing in outside air with a CO2 level of about 400ppm, and exhausting stale air, the HRV diluted CO2 to acceptable levels. In addition, the HRV recovered heat from the outgoing air stream and transferred that heat to the incoming air stream, providing energy efficient ventilation.

## Conclusions

- ▶ The problems found in the preschool are typical of regular everyday homes, but were exaggerated by the high level of occupancy.
- ▶ The preschool providers were not doing anything wrong.
- ▶ The IAQ issues were not detectable without testing with the monitors.
- ▶ The solutions provided are simple, and effective.

AirAdvice Test	Pre	Acceptable Level	Post	% Change
Particulates (ug/m3)	17	10	9	-47%
VOC (ug/m3)	2637	500	33	-99%
CO2 (ppm)	1456	750	726	-49%
Temp (F)	68	70	69	n/a
RH (%)	64	35-60	51	-13%
CO (ppm)	1	6	0	n/a

## Summary

Walking into the preschool now is a very different experience – there is a tangible change in the air quality. While this is an average-size house with a more than average number of occupants, it is common to see high air contaminant levels in typical homes. Homeowners may not be aware of health risk related problems, the solutions to them, or how they could benefit from these solutions.

The owner of the preschool noticed the change in IAQ immediately, and stated that she plans to mention this new system to parents considering enrollment at the preschool.

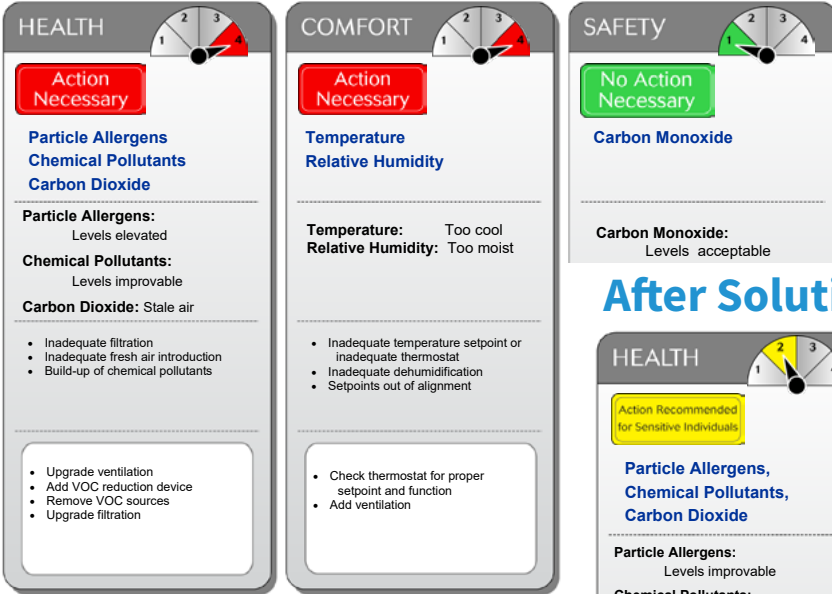
The added benefit for the owner is that the new system saves energy. The HRV installed into the existing ductwork not only brings in outside air while exhausting stale air at a balanced rate to dilute the concentration of indoor pollutants, but also recovers energy by using the latent heat in the outgoing air to temper the incoming air. This is much more energy efficient than a simple exhaust fan which relies on leaks in the house and brings in outside air via house leakage.

The most important profound impact, however, may be upon the children’s health. Environmental triggers such as VOCs, particulates, and high humidity contribute to the development of asthma and allergies, especially in sensitive populations like children. Parents can be reassured that their children spend their days in an environment in which they can breathe healthy air.

“The results are being shared with me and I am so proud to offer such a high quality of air for the children to breathe... I can literally say: ‘Let’s go inside to get some fresh air!’ I want to thank Honeywell, Neil Kelly, and Air Advice for... the gift of fresh air. We are all healthier now because of this project.” - Teri Fisher, Owner, Mrs. Teapot’s Tiny Tots, Portland, Oregon

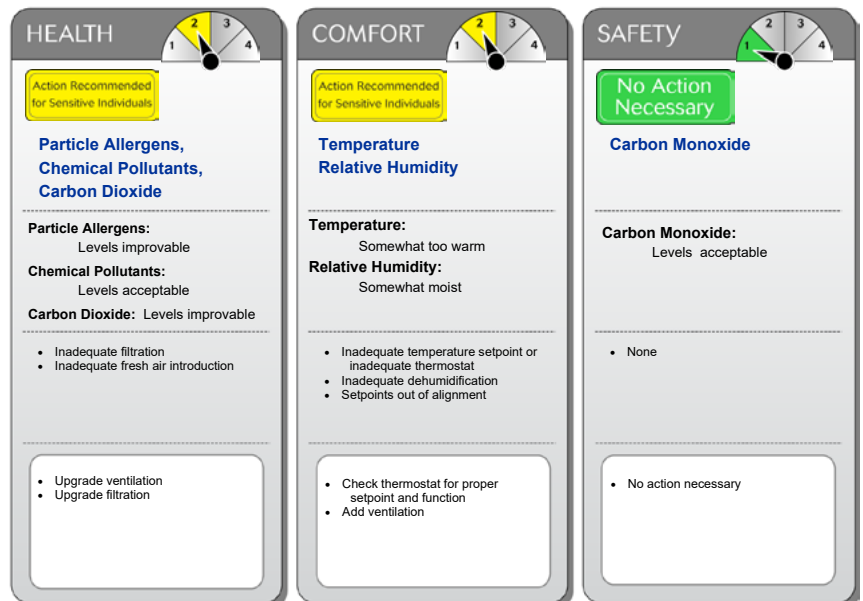
## DayCare Case Study Test Results - Overview

### Before



AirAdvice monitor data is collected and uploaded to a server. AirAdvice contractors can view data and generate reports such as this one. These charts & graphs are from a SmartIAQ report.

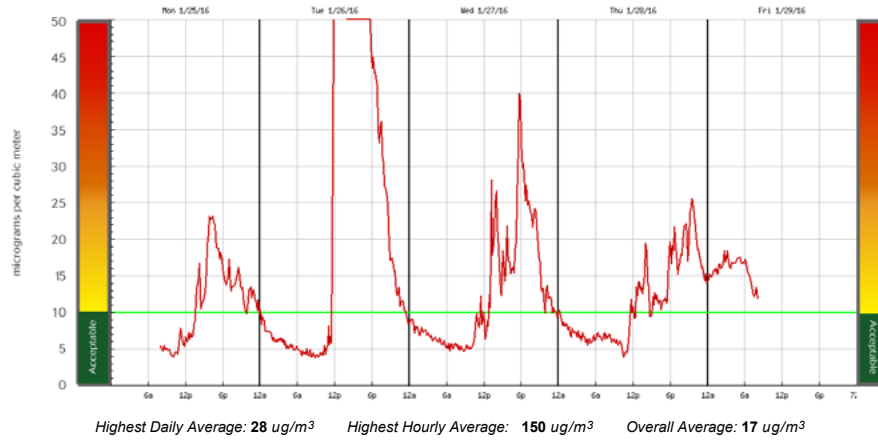
### After Solutions Installation



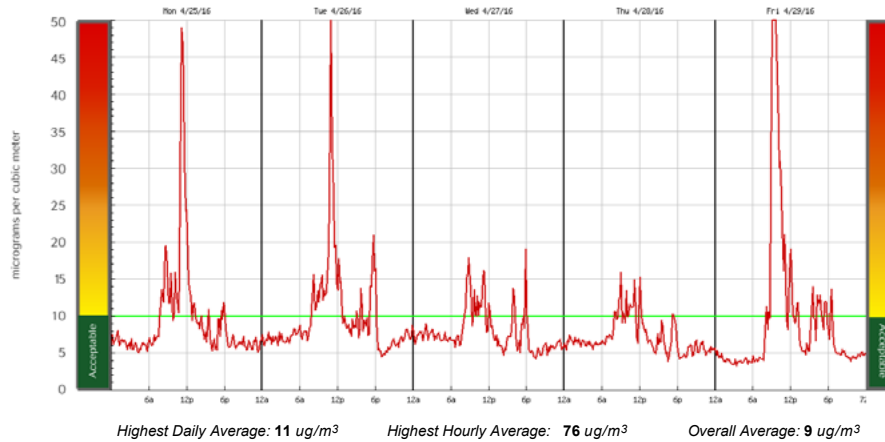
The following pages contain detailed graphs of the Particulate, VOC and CO2 concentrations and Relative Humidity for the 5 days of testing.

# DayCare Case Study Test Results - Particulates

Before

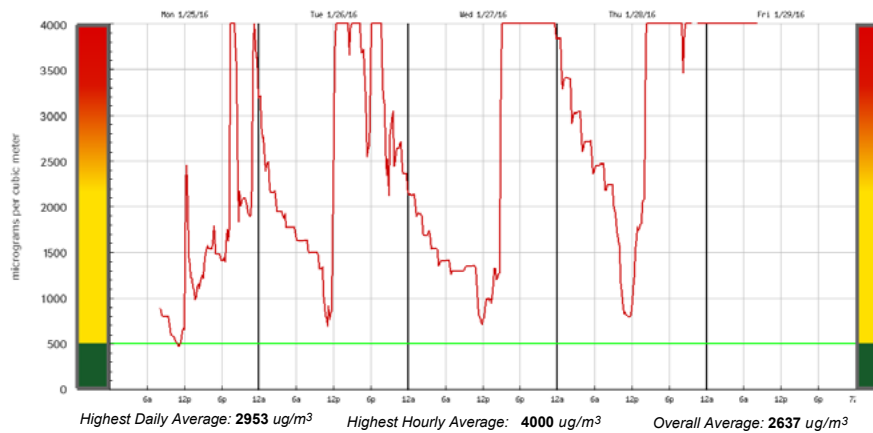


After

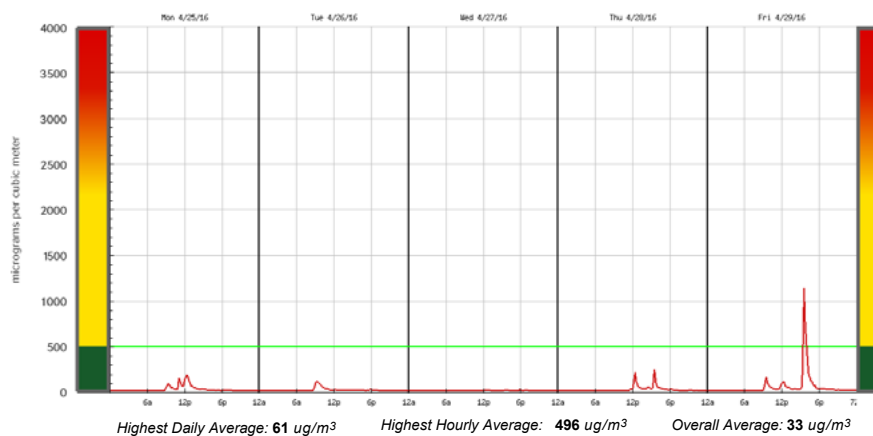


# DayCare Case Study Test Results - Chemical Pollutants (VOCs)

Before

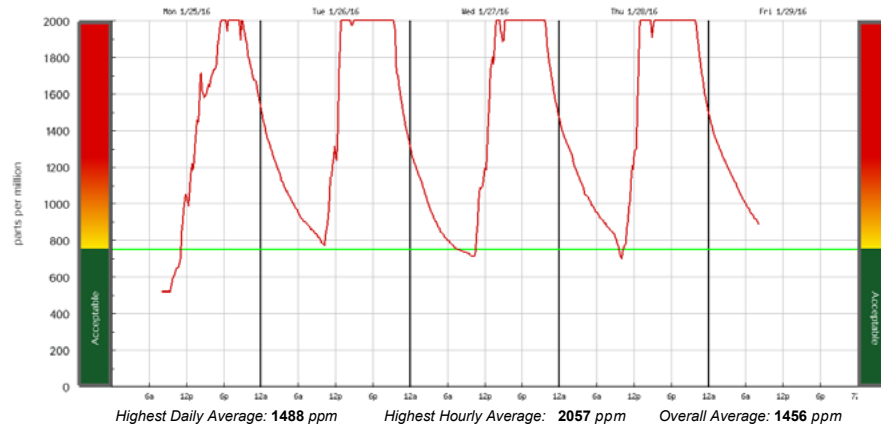


After

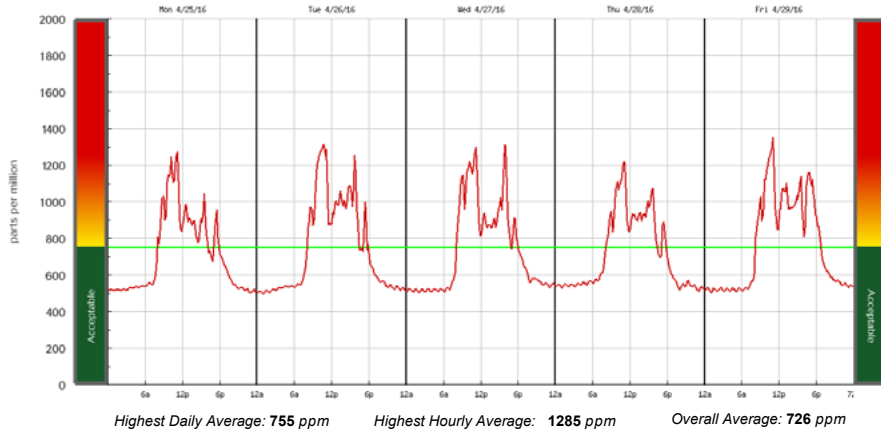


# DayCare Case Study Test Results - CO2

Before

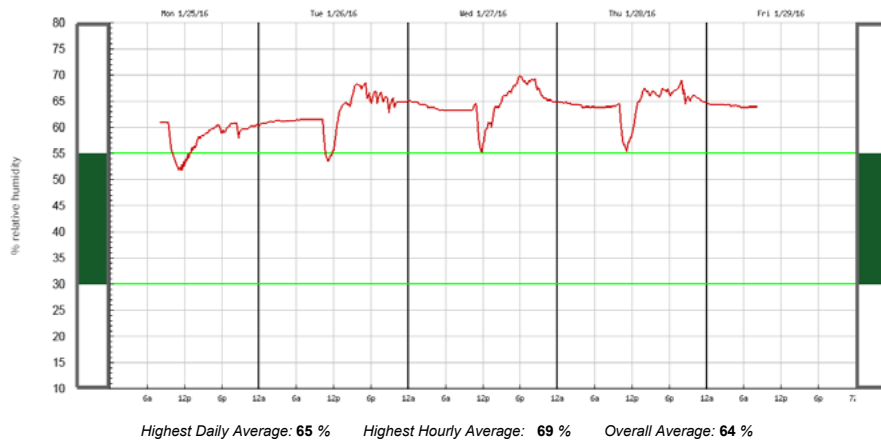


After



# DayCare Case Study Test Results - Relative Humidity

Before



After

