

Indoor Air Quality of Weatherized Homes in the Northeast

A Cornell University study, funded by the Alfred P. Sloan Foundation

BACKGROUND

Indoor air quality (IAQ) plays a significant role in human health. Particles and microorganisms in the air and on surfaces have been associated with various illnesses, toxicity, allergies, and cancer. Possible route of exposures include ingestion, inhalation, and through direct contact. The United States Environmental Protection Agency (EPA) estimates that we spend more than 90 percent of our time indoors, where we are in constant contact with indoor air and surface environmental pollutants.

OUR STUDY AND HOW YOU CAN BENEFIT

Weatherization is the sealing of homes to improve energy efficiency by reducing air exchange rate between the indoor and outdoor. Our study aims to assess indoor air quality in single-family homes with a basement before and after weatherization. To do so, we are seeking to evaluate indoor air quality at two time points (Fall and the following Spring or the other way around) of both non-weatherized and weatherized homes. Participation in our study is of no cost to homeowners and renters. Though we cannot provide mitigation steps, all findings will be available to you.

Our assessment of indoor air quality will include the following measurements:

Radon levels in the basement and living room: Among non-smokers, radon exposure is the number one cause of lung cancer. In previous studies, radon exposure has been associated with lung cancer in residential homes.

Formaldehyde level: Formaldehyde is a colorless gas that can cause watery eyes and trigger asthma attacks at high levels.

Temperature and relative humidity of all living spaces: High temperature and relative humidity inside the home can increase concentrations of some indoor pollutants.

Air exchange rate: Low air exchange can increase indoor pollutant levels by not bringing in enough air, or not carrying indoor pollutants out adequately.

Bacterial and fungal concentration and composition (in air and on surfaces): Exposure to infectious bacteria can cause diseases. In addition, fungal spores can lead to the development of allergies in children.

Particle counts in air: Small particles are inhalable and, once inside the body, can lead to bronchitis, lung cancer, and respiratory infections as well as irritation to the eye, nose, and throat.

Water activity on basement surfaces: High water content on surfaces can promote microbial growth, including fungi (mold), and certain pathogenic bacteria.

WHAT TO EXPECT DURING SAMPLING

We will sample your house twice for 4 consecutive days each time. The first sampling will occur in the Spring or Fall, and the second in the following Fall or Spring, respectively. The same procedure and measurements will be taken each time. Indoor air quality assessment is generally a slightly intrusive procedure, but we will minimize any disturbances to the best of our ability.

Day 1: (4-5 hours)

During sampling set up, the following equipment will be placed around the house:

Temperature and relative humidity monitors: Small monitors will be placed on the counter or magnetized to surfaces in several rooms and living areas.

Radon monitor: One radon monitor will be placed in the living room, and one small radon sampling tube will be placed in the basement.

Carbon dioxide CO₂ tank and monitors: A CO₂ tank will be placed in a first floor closet, and programmed to release CO₂ gas four times a day for 15 minutes each time. Two CO₂ monitors will be placed in the home to measure gas mixing and air exchange.

Particle counters: Two particle counters will be placed indoor and outdoor to count the number of particles in the air.

Particle samplers: Two particle samplers will be connected to high-capacity pumps and placed indoor and outdoor to collect particles microorganisms in the air. We surround these pumps with mufflers to reduce the noise generated to a comfortable background level.

Formaldehyde sorbent tubes: One small formaldehyde collection tube and a small pump (with a muffler) will be placed in the living room to collect formaldehyde from the air.

Also on Day 1, we will also perform a general survey of the house to note factors that may affect any of the above measurements.

Day 2: (15 minutes)

We will collect the formaldehyde sampling tube and set up a second sampling tube for additional sampling.

Day 3: (10 minutes)

We will collect the second formaldehyde sampling tube.

Day 4: (2-3 hours)

We will turn off and remove all sampling equipments. Also on Day 4, we will wipe floor surfaces and swab for dust samples on door- and window-sills. We will also vacuum sections of carpet areas for settled dust that could potentially be “kicked up” into the air.

Post-sampling:

We will analyze most data (including formaldehyde, radon, air exchange rate, water activity, and particle counts) within one month of sampling. These data will be available to you at this time, and our researchers are more than happy to discuss the results with you.

Bacterial and fungal samples require more intensive processing and analyses procedures. These data may take up to a year to become available to you.

Your participation in this study is very much appreciated. For further questions and/or concerns, please don't hesitate to contact us by phone or email (details below). Thank you for your consideration!

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