



Family Air Care[®]

Indoor Allergens & Mold Test Kit

FamilyAirCare.com

The Science behind the Family Air Care[®] Indoor Allergens & Mold Test Kit

While there are several methods for assessing indoor levels of mold and allergens, we believe we have chosen the combination of collection and analysis methods that will provide an accurate, time-integrated assessment of potential allergen and mold exposures. Historically, the assessment of exposures to airborne substances has focused on collecting air samples, that are pulled through a filter to collect the airborne substance and analyzing the filter to determine how much of the substance is in the air. The reasons for collecting air samples are fairly obvious in that people usually must breathe the substance into their respiratory tract in order to experience a health effect – in the case of mold and allergens – allergy or asthma symptoms. While air sampling is still the only assessment method to directly estimate the amount of substance a person might inhale, the shortcomings of air sampling have long been evident including the following:

- Air samples are only collected over a very short duration of time; the measured exposure only represents the levels of allergens or mold that were present during that short time period. Allergen and mold levels during other times and under different conditions, including different occupant activity levels and different ventilation system settings, may be much different than levels measured by another air sample in different conditions. Large numbers of samples are required to assess the temporal variation of exposures.
- Air samples cannot effectively measure short-term peak exposures that are likely important for allergens.
- Air sampling is inefficient for allergens such as cockroach and dust mite which are carried on fairly large particles that remain airborne for only a short time.
- Air sampling is inefficient at measuring the low airborne concentrations of allergens that may cause symptoms in sensitive individuals.
- Air sampling requires expensive specialized equipment and trained personnel to operate the equipment.

Sampling of settled dust takes a different approach to assessing and managing exposures to allergens and molds. The allergens and mold in settled dust represents a time-integrated collection of those substances that have accumulated over a long period of time. Measurement of mold and allergens in settled dust allows us to determine the current burden of these allergens in a residence. Since exposure to these molds or allergens usually occurs from re-suspension of the allergen particles from household “reservoirs”, such as carpets and furnishings, the amount of allergens and mold in the settled dust represents the overall “potential” exposure and is not as dependent on the timing and conditions during the collection of the sample. In addition, collection of settled dust samples does not require any specialized equipment or training.

We have translated a well established, standardized dust collection protocol developed by the U.S. Department of Housing and Urban Development (HUD) to allow consumers to collect their own settled dust sample using the Duststream™ Collector. Research has shown that consumer collected settled dust samples are equivalent to those collected by trained researchers.

Researchers have been using settled dust levels of allergens as “indirect” measures of exposure for many years. Many studies have correlated the risk of allergy and asthma with increased levels of settled dust allergens. We have established our thresholds for “Low”, “Moderate”, and “High” levels based on an extensive review of this medical literature.

Use of settled dust for assessment of mold burden within a home is a much more recent scientific development. Mold levels within homes have typically been assessed using air sampling by comparing samples collected inside the home with samples collected outdoors. There are two ways to collect and analyze air samples for mold: (1) Spores are collected directly onto a nutrient plate using a special air sampling device. This nutrient plate is incubated and the growing mold colonies are identified and counted by a mycologist (mold specialist). (2) Spores are collected onto a transparent, sticky plate using a special air sampling device. This plate is analyzed under the microscope by a mycologist to identify and count the spores present. For both methods, the types of colonies or spores and the numbers of colonies or spores are compared between indoor and outdoor samples. In buildings without mold problems, the types of mold indoors and outdoors should be similar. Significant increases of one or two kinds of mold indoors as compared to outdoors may indicate a moisture problem. While these assessment methods have become the industry standard, each of the methods have specific shortcomings including:

- In order for spores to grow on a nutrient plate they have to be viable which means they have to have the capability to grow into a colony. The air sampling process often destroys the spore making it unable to grow. In addition, not all molds can grow on all nutrient plates. Normally a generic nutrient plate is used that will support a wide variety of molds. However, sometimes molds present in a building will not grow on the specific nutrient plate chosen.
- A trained mycologist is required to analyze the samples for both methods. While there are standardized protocols for visually identifying molds, there remains a great deal of variability between individuals in the counting of mold colonies and spores.
- Both methods rely on short-term (maximum 15 minute) air samples. As such, each sample is only a short “snap-shot” in time of the mold level in a building. Longer sampling times overload the microscope plate or dry-out the nutrient media. This means a large number of samples will be required to characterize different conditions and locations in a building.

*DUSTREAM™ collectors are produced by INDOOR Biotechnologies Inc, Charlottesville, VA (patent pending). DUSTREAM™ is a trademark of INDOOR Biotechnologies Inc

Recognizing the shortcomings of traditional air sampling for mold, researchers at the U.S. Environmental Protection Agency (EPA) developed an alternative approach involving settled dust and a technology known as mold specific quantitative polymerase chain reaction (MSQPCR). This is the technology that is used by the Family Air Care® Indoor Allergens & Mold Test. As it is clearly impractical to measure all of the thousands of species of molds that may occur in a home, the EPA's work began by identifying 36 widely occurring species of mold. These molds were separated into two groups – Group I with 26 species of mold that were associated with water damaged homes and Group II with 10 species not associated with water damage and considered typical for normal homes. These 36 species are measured using MSQPCR which is a DNA based method that is extremely sensitive and accurate. The MSQPCR method relies on high-precision, automated equipment to measure the specific DNA components from the settled dust sample. The method does not require that the mold spores are viable and does not rely on the judgment of an expert to count and identify the spores.

The EPA used MSQPCR and this 36 species mold panel to establish the Environmental Relative Moldiness Index (ERMI). In order to establish the relative scale for the ERMI, the EPA surveyed 1,096 homes across the U.S. as part of the 2006 HUD American Healthy Home Survey. Using this nationally representative sampling of homes, any new sample can be compared and assessed as to its relative mold burden (lowest 25%, highest 25% etc.). While the ERMI is not capable of separating small differences in mold burdens, the ERMI can distinguish homes with major differences in mold burdens which allow it to be an effective screening tool for identifying homes with potential water damage and mold amplification. Further research by the EPA has identified an abbreviated, more cost effective panel of 13 different mold species that appears to have over 80% correlation with the ERMI. This abbreviated 13 species mold panel is called the American Relative Moldiness Index (ARMI) and is the technology that is used by the Family Air Care® Indoor Allergens & Mold Test Kit. It is important to realize that both the ERMI and the ARMI were developed as an index of the overall mold burden of a home, not as a health index. However, two recent studies have shown a higher likelihood identifying an asthmatic child in a home with an elevated ERMI.

The Technology

The Family Air Care® Indoor Allergens & Mold Test uses **the MSQPCR technique and the ARMI system as the selected methodology for our mold test kit.**

ARMI

- The **ARMI** is an acronym for **American Relative Moldiness Index**.
- It was developed by EPA as more cost effective analytical method than the ERMI. This is the method we have chosen for the Family Air Care® Indoor Allergens and Mold test kit.
- It has been proven by EPA to have good correlation with the ERMI for predicting the moldiness of homes
- **13 different fungi make up the ARMI and are designated a Group I (found in atypical, water damaged homes) and Group II (commonly found in all homes). The fungi for the ARMI are boldfaced below.**

Group I - *Stachybotrys chartarum*, ***Chaetomium globosum***, *Cladosporium sphaerospermum*, *Aspergillus versicolor*, ***Eurotium (A.) amstalodami***, *Penicillium variabile*, *Aspergillus flavus*, ***Aspergillus restrictus***, *Penicillium crustosum*, ***Penicillium chrysogenum***, ***Aspergillus niger***, *Aspergillus sclerotiorum*, *Penicillium purpurogenum*, *Aspergillus fumigatus*, *Penicillium corylophilum*, *Aureobasidium pullulans*, ***Aspergillus ochraceus***, *Penicillium brevicompactum*, ***Paecilomyces variotii***, ***Aspergillus sydowii***, *Penicillium spinulosum*, ***Wallemia sebi***, *Aspergillus unguis*, *Scopulariopsis brevicaulis*, *Scopulariopsis chartarum*, ***Aspergillus penicillioides***, *Trichoderma viride*

Group II - *Acremonium strictum*, ***Alternaria alternata***, *Aspergillus ustus*, ***Cladosporium cladosporioides v1***, *Cladosporium cladosporioides v2*, ***Cladosporium herbarum***, *Epicoccum nigrum*, *Mucor* & *Rhizopus* group, *Penicillium chrysogenum*, *Rhizopus stolonifer*

MSQPCR

- **MSQPCR** is an acronym for **Mold Specific Quantitative Polymerase Chain Reaction**.
- The ERMI value is determined using the MSQPCR method in the lab.
- It was developed by scientists at the USEPA to detect and quantify fungi associated with indoor air quality problems.
- It's a **FAST, ACCURATE, and SENSITIVE** DNA-based analytical method for identifying and quantifying molds to the species level.
- The method looks for the presence of DNA sequences that are unique to a particular mold species.