Restorative drying made SIMPLE!

Lessons from a water damage expert

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Kris Rzesnoski, CR, WLS, FLS, CLS, RTPE

Encircle Hydro - Restorative drying made simple!

Restorative drying made SIMPLE!

LESSONS FROM A WATER DAMAGE EXPERT

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This book is dedicated to the trainers, experienced restorers and those who helped me find my way in this industry. This is my small contribution of continuing the tradition of sharing the information you learned, adding to the knowledge base, and passing it forward to the next generation of restorers.

This book belongs to:

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CHAPTER ONE

THE FUNDAMENTALS OF WATER DAMAGE RESTORATION JOBS

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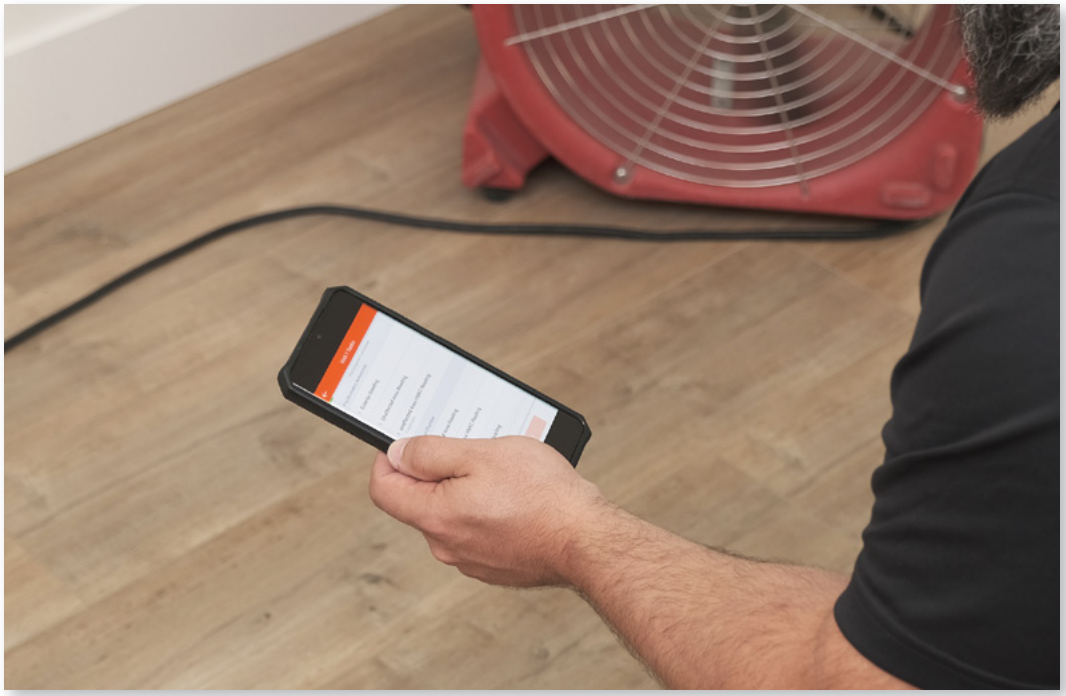
The Fundamentals of Water Damage Restoration Jobs

Want to be a professional restorer? Of course, you do! That's why you're reading this book!

On the surface, it might look easy—just place your equipment and walk away. Do that... if you want to help your competitors build their mold remediation business.

Water restoration is a complex trade! It requires a fundamental understanding of building science, structural building practices, and the science surrounding water damage restoration. The deeper your knowledge of building science and the greater your understanding of how building materials respond to moisture, the more likely you'll be able to increase your profitability and deliver a successfully dried project.

Become a sponge and learn everything you can about the science and let the knowledge soak in. After all, drying a building is about atmospheric sciences inside and outside the structure. It's about the molecules and microorganisms that live within your job, and it is the application of science that allows you to pull the moisture out.



Here's the good news! *Encircle Hydro: Restorative Drying Made SIMPLE!* will break down the difficult science to help a novice, intermediate or expert restorer make better decisions in the field. This book won't replace the courses and hands-on knowledge & experience that you will get from the classroom and field, but it will help supplement your learning.

At Encircle, we know it's hard to master every skill - and that's ok. We're going to help you understand the concepts and manage all the information that comes your way. By the end of this book, you will have the skills needed to start drying a building and not make common mistakes that can cost you thousands. In addition, we have released a new water damage restoration tool, Encircle Hydro, to help make it easy for you to implement these best practices. Learn more at getencircle.com/hydro.

However, note that nothing replaces the technical training of the IICRC and the advanced learning of the Restoration Industry Association. The time you spend with a qualified trainer who has field knowledge and can help you learn by relating to their experience is key.

If you're using Encircle, you'll have the playbook that helps you unleash the full potential of your business.

Want to be a 'Power Restorer?' Want to own your town and be known as a 'Drying Wizard?' Do you have dreams of being called on stage for your Super Hero-Like Skills? Keep reading and join the elite team of Encirclers.

The fundamentals

Sometimes, we forget the fundamentals of water damage restoration. Our goal as a restoration professional is to return the building materials to a **dry standard** or the same moisture level as the other unaffected materials in the building or remove, clean, and disinfect the structural materials. The following terms are essential to understand:

Moisture Level (ML): the measurement of the amount of moisture contained in a material on a relative scale. If a restorer is measuring materials with an instrument that is not calibrated for that material, then it is recommended that the term moisture level be used (IICRC S500 V5, 2021, 19).

Moisture Content (MC): the measurement of the amount of water contained in a material, expressed as a percentage of the weight of the oven dry material. If a restorer is measuring materials with an instrument that is calibrated for that material, then it is recommended that the term Moisture Content be used (IICRC S500 V5, 2021, 19).

The dry standard is the target moisture content for the particular material in its normal (unaffected) state within that structure or specific microclimate. Materials become 'dry' once they reach the dry standard.

This level depends on the type of material, the location of the material in the building, and even where you live and the current season. The various tools you use on the project may also provide you with relatively high or low readings depending on the circumstances.

For example, a piece of oak wood in a dry climate might have a dry standard (drying goal) of 6% moisture level. Whereas the same piece of wood on the West Coast might have a dry standard of 10%.

These levels can fluctuate from structure to structure and change throughout the year depending on the prevailing weather. This is why it is highly recommended that you **do not use a regional dry standard** for drying materials but use a specific dry standard for that structure when possible.

Don't be a Marvin Mold Grower!

> Scared about making mistakes and screwing up someone's building by causing a moldy mess? **You should be!**

It doesn't take much to lose track of moisture, especially when you are not paying attention to where it might be going within a building. **If you think all the moisture is heading to the dehumidifier, then you probably have been running fast and loose with your drying strategy.** There is a good chance you are leaving moisture where you do not want it.

> **As a professional restorer, you are expected to understand where and how moisture will travel within a structure.**

You are also required to understand the drying forces and how they apply to the structure. Cocky restorers who think they can dry a structure in three days by throwing in equipment and walking away scare me, and they should scare you too. Yet, they're the ones who should be scared as they tend to need their lawyer and liability insurance more often.

It's a double hit to your business when you make a mistake and cause a mold issue. **First, your reputation for handling water losses drops and word spreads quickly in this industry.** The second is that you help your competitors enter the mold remediation business, because like it or not, it is another restorer that has to clean up your mess.

Let's review each factor that applies to a drying project and connect them together so you have a full working knowledge. **We will start off with what might seem like heavy science, but we'll simplify it for you.**

Personal Story

When I first became a restorer, it took me two years to fully comprehend temperature, relative humidity, and humidity ratio (formally referred to as specific humidity). I couldn't understand how they are interrelated and what they meant. Effectively, I was doing things that were counterproductive to my drying goals.

Having learned how to apply vapor pressure differentials to the buildings I was working on, I became fully aware of where I might encounter the dew point and other challenges to drying a structure. That knowledge has helped me avoid big mistakes and avoid getting into liability troubles. *I can't stress enough that you will need to get your advanced water training sooner than later and retake it in a year to understand and retain these concepts.*

The Laws of Thermodynamics

Understanding the forces that you apply to a building will increase your chances of success. Thermodynamics are the laws that manage energy. For this book, we'll simplify the laws. You can apply them to your jobs as these concepts will help you understand drying:

1. The Law of Conservation:

> **This law states that you cannot create or remove energy in an isolated system. Energy can only be transferred.**

To a restorer, this means that heat energy in the air can be transferred to the wet and affected materials. Transferring heat into the materials lowers the room air temperature and increases the materials' temperature. As a material's temperature increases, the energy is transferred into the moisture. The moisture molecules then get excited as they start to leave the material. The heat energy leaves the materials, and this results in evaporative cooling. The energy is transferred to the moisture in the air.

We add energy by increasing the room temperature using heat from the equipment and heaters to allow more energy to be transferred into the materials.

2. Law of Equilibrium:

> **Energy will remain balanced and will seek to find balance.**

Simply put this means if you add higher energy in one area of your structure, that energy will try to balance itself out by finding an area of low energy.

You can simplify this further to the following statements:

High energy ›››› low energy

Hot ›››› cold

Think of air as having energy. An easy way to do this is to look at the weather. Hot, wet air has a lot of energy in it. A fierce thunderstorm will often follow a hot, humid day. You rarely see a thunderstorm in the winter in Canada and the northern United States because colder air has less moisture and energy to create those spectacular storms.

When you add heat to the room, and the air movers circulate that heat over the wet materials, the energy is transferred to the materials. Hot moves to cold, and the energy transfers into the material to heat them up.

> **Thinking of air through the lens of energy can help you understand how the different parts of the drying job interact.**

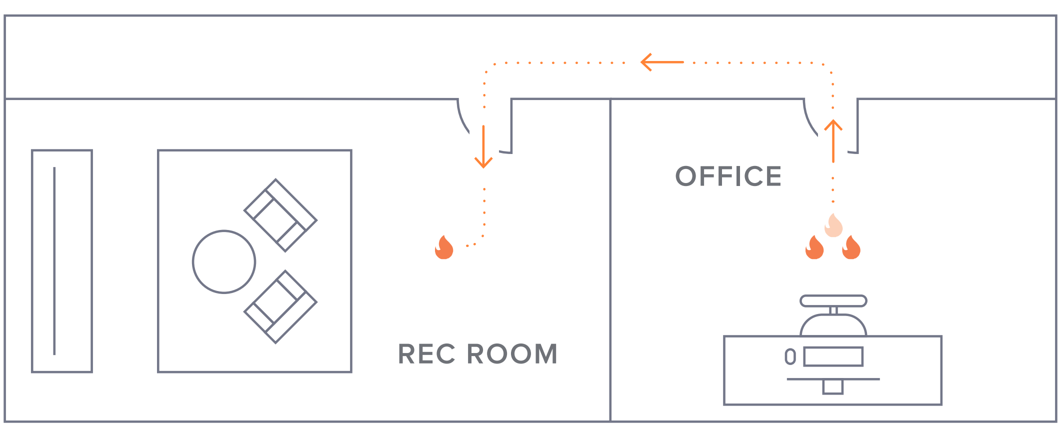
When using a thermohygrometer (the tool we use for measuring the atmospheres of a drying chamber), you will be measuring the relative humidity (the percentage of humidity) or humidity ratio (actual amount of moisture in grains per pound—GPP) of the air, and the associated temperature. From there, the tool can calculate vapour pressure, which is a measurement of the energy being applied by the air. Not all devices will provide this measurement.

Applying Thermodynamics to your jobs

As we take the Laws of Thermodynamics and apply them in the real world, it gets complicated as you have many different temperatures and different amounts of heat energy loads in and around the building.

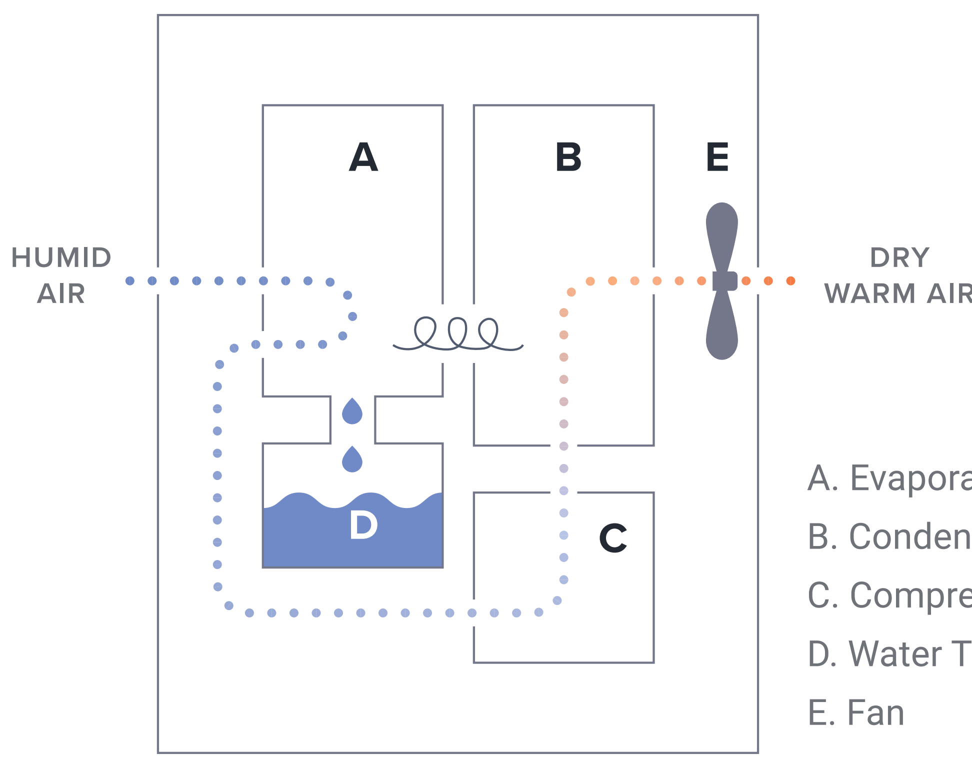
It takes a lot of energy to evaporate moisture into the air. **(Law #1 says we cannot destroy energy, we can only transfer it)** so as we release the moisture from the materials into the air, the air is now holding onto that energy. For air to move energy, it needs to hold the energy.

According to the Second Law of Thermodynamics, the Law of Equilibrium, energy in the air wants to balance with an area of lower energy in the surrounding environment.



For example, if you had three rooms in your atmosphere: a rec-room, hallway, and office, the atmospheres would be working to find balance. **A drier room in the chamber would pull moisture from the other rooms**. The rooms in the entire chamber would essentially have similar psychrometric readings. Although there might be slight differences, you would only need to take one reading inside your drying chamber instead of taking readings in each room.

Now that we know that hot, humid, high-energy air is looking for areas that are drier and have less energy, we can investigate the property to look for areas of lower energy and address them as areas of concern.



A. Evaporator
B. Condenser
C. Compressor
D. Water Tank
E. Fan

Many restorers make the assumption that moisture will always head towards the dehumidifier. Most LGR dehumidifiers use a mechanically driven fan to bring the higher energy, warm, moist air through an intake and force the air to pass over a colder surface. **This process moves the air over cold coils, forcing it to reach the dew point and release the energy in the form of moisture condensing on the coils.** As a result, moisture is removed from the air by condensation.

The air then passes over the by-pass and picks up the additional heat energy leaving the machine with increased heat and with less moisture in the air.

> **This results in a lower vapor pressure (hot dry air) of the air leaving the machine.**

You would be familiar with this process if you measure the exhaust on the dehumidifier and are looking for the grain depression.

What restorers sometimes forget or fail to recognize is that many other areas in a structure have lower energy. These areas are likely cooler, drier environments such as the unaffected areas of the structure or a colder surface like concrete and metal. Alternatively, the outside might be drier and apply forces to the project that pull the moisture into the walls toward the exterior. The moisture will also be attracted to the cooler surfaces such as exterior walls, windows, ventilation systems, and doorways. It is never safe to assume that the moisture will go where you think it will go.

High energy seeks to balance itself with low energy, and hot, moist air will go to hot, dry air or seek out colder surfaces. This is where you need to be aware that the moisture is not travelling to just your dehumidifier. It's time for you to build and plan your 'A game.' You need to know where moisture will travel and have a plan for controlling it.

CHAPTER TWO

VAPOR PRESSURE, DEW POINT, AND TEMPERATURE

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Vapor pressure

I'll let you in on a little secret: the best restorers use vapor pressure differentials for drying structures—and for a good reason. Vapor pressure is a constant measurement that measures the pressure of the air. Different air masses, such as the affected chamber and the unaffected chamber, will have their own vapor pressure. **The difference between these two air masses creates the vapor pressure differential**, and it is this difference in pressures that determines where the water vapor will travel.

Understanding the Laws of Thermodynamics, we know that high energy wants to move to low energy. In restoration, we would say high vapor pressure wants to move to low vapor pressure. The greater the difference in energy (heat and moisture) of the two air masses, the greater the vapor pressure differential.

Water Vapor Pressure: The pressure of the water vapor exerted by the molecules of water vapor on surrounding surfaces (IICRC S500 V5, 2021, 21).

"Why do you need to buy what I am selling?"

In the past, I was not as sold on vapor pressure use in restoration as I am today. Why? **Because I didn't understand the considerable control you have on your structural drying projects** once you understand and control vapor pressures.

> **I didn't pick this up until I started to attend the advanced restoration classes and began tackling technically complex jobs.**

To be completely honest with you, when it clicked for me, it really changed the way I approached jobs, and it scares me to think about how I was operating before.

It's essential to inspect and evaluate the different measurements of the vapor pressure differential between the energy of one area compared to the energy of another area. **Vapor pressure remains constant regardless of elevation, temperature, or changing conditions.** And it is critical for running your jobs. With all the variables that you need to manage, vapor pressure is the only one that allows you to consistently compare results.

When you measure vapor pressure and track the vapor pressure differential, you can determine the “drying forces” exerted on the job. This will help you understand what forces are helping or hurting your efforts. You’ll be able to clearly identify situations that need your attention and situations that you should prevent from happening as you build your ideal drying chamber and drying strategy.

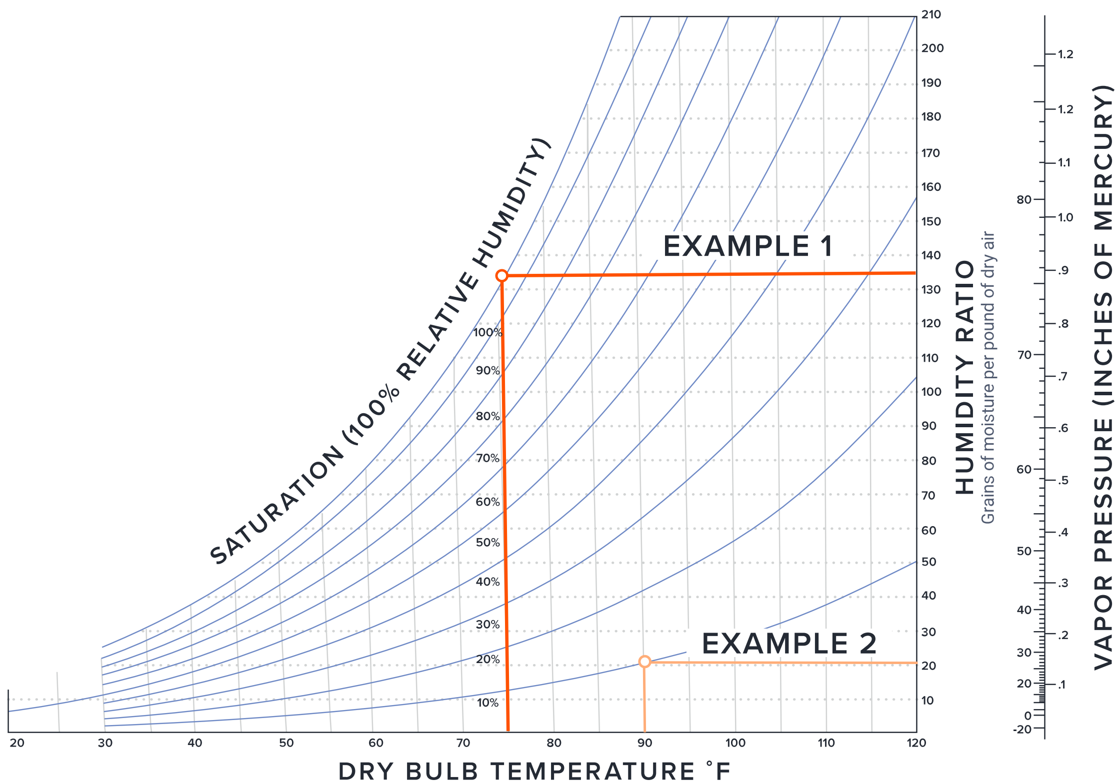
The objective of any water job is to dry wet materials. You may have to dry the air to prevent secondary damages, but you need the materials to dry in order to be successful. Understanding vapor pressure differential allows you to control your drying project and will get you closer to becoming a drying wizard!

An example of vapor pressure differentials

We’ve all experienced vapor pressure differential, although you may not have realized it at the time. When you boil water in a kettle, you will see the vapor pressure building in the container. The heat that we add to the container transfers into the water molecules and they absorb the energy. This increase in energy also increases the pressure. When the water vapor reaches the boiling point, the vapor turns from a liquid to a gas and is released into the air. We know that the second law of thermodynamics says that high energy wants to move to low energy, and the pressure in the kettle forces the water vapor from the kettle (high energy container) to the outside air (lower energy). The amount of pressure and the speed of the pressure cause the kettle to whistle.

On a macro level, that is what you are doing to your structures when you are drying them. You are adding heat energy, creating excitement in those water molecules. They, in turn, leave the container (the wall, the wood, the drywall) and move to the lower energy or drier air.

Let's look at this on a psychrometric chart.



If we have a hygroscopic material that is **75°F (23.9°C)** with a **100% moisture content**, it has a humidity ratio of 132 GPP (grains per pound) and a dew point of 75°F (23.9°C). Because it is 100% saturated, we are at dew point. The vapor pressure would be .88 inHg (inches of mercury).

If the drying chamber air is **90°F (32.2°C)** and has **10% moisture content**, it has a humidity ratio of 21 GPP and a dew point of 27°F (-2.8°C). The vapor pressure would be .13 inHg.

You have created a vapor pressure differential of .75 inHg. As a general rule, try to get a vapor pressure differential of over .3 inHg. The greater the delta vapor pressure—the better. (In other words, the greater the vapor pressure differential between the liquid and the environment, the greater the rate of net evaporation.)

Dew point

Dew point should be a concern whenever you are drying contents and structures. **Dew point** is the temperature at which humidity in a parcel of air reaches the saturation point (100% RH), below which the water vapor will condense from the air onto surfaces.

An excellent example of this would be to take a glass of water filled with ice and move it into a warm, humid environment. Moisture condenses on the outside of the glass as the warm air moves to the cold surface, and the moisture reaches saturation. It is actually the atmospheric air condensing on the side of your cold glass that causes this reaction. The heat energy from the air is being transferred to the glass. The temperature of the glass is colder, which must be at or below the temperature that the moisture will condense or reach the dew point.

Applying this to drying projects, ensure that surface temperatures are well away from the condensation temperature or dew point.

Some examples of surfaces and materials that you will want to be concerned with are:

- Windows & doors
- Metals such as the HVAC, steel studs and pipes, dryer vents, etc
- Voids in walls
- Chimney vents
- Exterior walls
- Concrete floors
- Metal beams
- Electrical & chases
- Exhaust fans/vents
- Computer rooms or cold storage within the building

It is not always possible to capture all the material temperatures inside a building as they may be inaccessible due to the construction of the building systems and assemblies. You'll have to use surface temperatures, temperature probes, or other means of obtaining the inner wall and floor assembly temperatures.

In addition, consider the daily changes in temperature from day to night.

In general, you want a 10°F to 15°F (5.6°C to 8.3°C) difference between your surface temperature and lowest dew point. However, when you are drying in extreme conditions, you'll have to adjust that difference to compensate for the change in temperature during the job, either day-to-day or hour-to-hour.

In colder climates, you might want to consider a 15°F to 20°F (8.3°C to 11.1°C) difference to ensure that the systems behind the surfaces are not at dew point.

Temperature

Temperature is an important factor to observe, maintain, and control to achieve a successful drying project. You'll need to consider the temperature of materials as well as the temperature of the air.

Air temperatures

When drying a structure, you'll need to manage the air temperature inside the affected space **while controlling the unaffected space's humidity and temperature.** If the unaffected space is occupied, you'll need to maintain a pleasant temperature for occupants using supplemental air conditioning or heat. Maintaining the proper moisture levels may also require you to remove moisture from the air to maintain a comfortable humidity and temperature.

The normal comfortable temperature range is approximately 67°F to 82°F (19.4°C - 27.8°C), but this can fluctuate depending on humidity levels, seasons, and the occupants' individual preference. You'll need to find out what the normal comfort zone is for occupants and determine if they will be comfortable and safe in the drying environment.

Pay particular attention to high-risk occupants: children under the age of six, adults over the age of 60, and those with medical conditions or under the care of a doctor. These occupants may have a rapid, adverse reaction to temperatures, humidity levels, and contaminants. **The health concerns of the occupants must take precedence over the actions of the job.**

Inside the affected area, you must understand how the temperature will impact your drying efforts. An air temperature of 90°F (32.2°C) does not mean that you have built a drying chamber that will work. Heat energy must be transferred to the materials and requires using air movers to apply convection heat to them.

> **The temperature of your drying chamber is also important to maximize the efficiency of dehumidifiers.**

Low Grain Refrigerant Dehumidifiers (LGR) generally require between 70°F - 95°F (23.9°C - 35°C) as their effective operating range. If your drying chamber air is colder than 70°F (23.9°C), the condensation coils in the dehumidifier may not work properly. If the air is higher than 95°F (35°C), the air may not cool fast enough to hit the dew point and remove the moisture from the air. Each dehumidifier brand and model will have its own optimal range.

We add heat energy to the air and raise the temperature. Air movers help transfer that energy to the materials as they lose that energy during the evaporative cooling process. Increasing the temperature of the material also increases the internal material vapor pressure, triggering the mechanism of high pressure (material) seeking low pressure (air) and allowing abnormal amounts of moisture to diffuse in a vapor state through the material. This happens due to the water vapor pressure differential (the driving force) that you create in your drying chamber.

A material with a surface temperature of 60°F (15.6°C) and 100% moisture content/level would have a vapor pressure of .51 inMg. If you can transfer energy into the material and increase the temperature by 10°F (5.6°C), the vapor pressure will increase to .73inMg.

Transferring heat to materials is critical to the success of your drying project. **Yet, it's not as easy as just applying heat or energy.** Too much heat can also be a bad thing. Materials like vinyl-wrapped cabinets can warp as low as 90°F (32.2°C). Trust me on this one, I've personally peeled the foil off the cabinets, and it wasn't pretty. Contents on a job site can also be dramatically impacted by heat. I once melted an entire box of Christmas candles and found Santa Claus in a puddle of wax with his hat left in the middle.

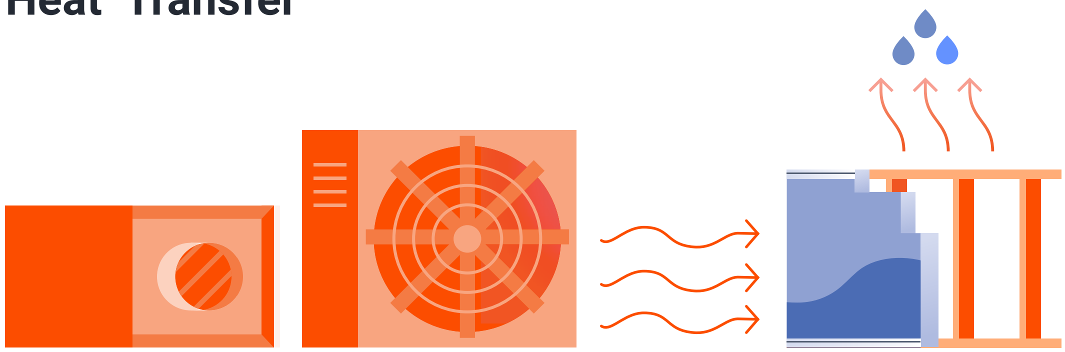
Wine, taxidermy, pets, plants, candles and many other items do not fare well over 80°F (26.7°C) inside the structure. When you crank up your drying plan to 100°F (37.7°C), you are going to see unintended stuff happen. Too much heat can lead to over-drying of materials and irreversible damage.

Material temperature

Understanding how temperature can impact the drying of building materials is an important principle to master. Materials can become cooler than the ambient air temperature due to colder surfaces on exterior walls, evaporative cooling of the water leaving the material, the wall assembly housing an air conditioning duct, or even a void in the building that is not heated. You need to focus on these pockets or areas of colder air and inspect them regularly during a drying project.

We already talked about the risk of being too cold and reaching the dew point temperature. What about the other end of the spectrum of applying too much heat to the materials? Some interesting issues happen when you heat materials up. The obvious one is overheating the material to a temperature that it was not designed for, resulting in permanent damage. **When you exceed the maximum temperature range of a material, the material can dimensional change or suffer irreversible damage such as microscopic damage.** We usually see this when restorers get very aggressive with their heat strategy.

Heat Transfer



STEP ONE
We add heat energy to the air and raise the temperature

STEP ONE
Air movers help transfer that energy to the materials

HEAT ENERGY

STEP ONE
The transfer of heat energy allows the moisture to leave the materials by increasing the vapor pressure.

The last thing you want to do is destroy materials on the job. I have damaged the thermal foil of cabinets, melted plastics, and cracked windows. And that's the damage I can see. But I am sure I've destroyed the cell structure of the wood floors that I was drying, and I definitely case-hardened the wood to prevent my drying efforts of large timber. I have melted candles, ruined bottles of wine, and shrunk taxidermy. There were also jobs where the moisture I was removing from materials didn't go where I anticipated it to go because I ignored the forces at play on the job. Probably leaving the building with moisture in places I did not intend to leave it. The result is water that has a high likelihood of causing mold.

We had a large 12”x16” 100-year-old timber that was saturated with moisture. We needed to dry it and restore the structural timber. I was forced to use a heat drying system due to the lack of a desiccant dehumidifier, and I set up a ventilation system using the hot air circulation through the crawlspace and placed an air mover to pull it out on the other end. I failed to realize that applying the heat of 120°F (48.9°C) to the material caused the material to dry very quickly at the surface, and it prevented the moisture from being able to exit the wood. The capillary action was stalled and the moisture was driven deeper into the core of the wood.

Why do some materials dry faster than others?

When you dry materials, they have inherent qualities that limit the speed with which they can be dried. This is why three-day drying is a myth.

The permeance factor is a measure of water flow through material(s) of specific thickness. Permeance factors (typically referred to in the field as “perms”) specify the vapor flow in grains of moisture per hour, through one square foot of material surface, at one inch of mercury (1inHg) of vapor pressure (IICRC S500 V5 2021, 142).

The permeance of a material is based on three characteristics: the thickness of the material, the permeability (ability to breathe), and the surface area of the material.

Materials dry at different speeds. An unpainted gypsum board that is 1” thick will have a perm rating of 50 perms. Not bad—we can dry this fairly quickly. If we add latex paint to this material, the perm rating goes down to approximately 2-3 perms.

Here are some other comparisons:

- Mineral wool insulation, 4” infaced - approximately 30 perms
- ¼” plywood - approximately 1.9 perms
- ½” OSB - ranges between 1 and 7 perms

It’s important to know that materials dry at different speeds and to leverage moisture detection tools to consistently measure the materials to ensure that they are drying effectively.

Many restorers overlook the importance of understanding the permeance factors of materials. Permeance is a reference rating that represents the speed at which water vapor will pass through a material.

Permeance challenges in drying

In a built environment, materials are put together in assembly units that form a wall or structure. These materials have various finishes on them that can affect your drying strategy. The permeance of materials is critical to understanding where moisture will travel. A finished piece of drywall will have a low permeance factor; 2-3 perms on a painted surface. The unfinished surface of the back of the drywall will have a permeance factor of 50. This means it will dry between 16.7 to 25 times faster on the backside. Keep in mind that water will take the path of least resistance. In this case, the moisture will be leaving your drywall from the backside much faster.

Factors such as permeance, the thickness of material, and the surface area have to be considered. Some materials will be more difficult to dry, will take longer and need more drying to achieve the dry standard.

> **Think of the thickness of a material as the distance that the moisture has to travel.**

The material permeance is the speed limit that the moisture must follow. The higher the perms, the higher the speed, the faster the distance can be covered.

Many instructors will use the analogy of a travelling car. If a car has to go 60 miles and travels at 60 mph, it will take 1 hour to drive that distance. If the car travels the same distance but can only go 10 mph, it will take six times longer to cover the same destination.

This is precisely what you see in the field. If you have two materials that are the same thickness, but one is drywall, and the other is plaster, the permeance factor of the two will differ substantially. Plaster on metal lath has a perm factor of 15, while plaster on wood lath has a perm factor of 11. Drywall has a perm factor of 50.

If we were to start with the same saturation point. It would take plaster 3.3 to 4.5 times longer to dry because plaster can not release its moisture at the same rate as drywall.

Knowing this information will enable you to engage the drying project with predictable results and an informed drying strategy.

CHAPTER THREE

HOW HUMIDITY RATIO AND AIR PRESSURE AFFECT THE JOB

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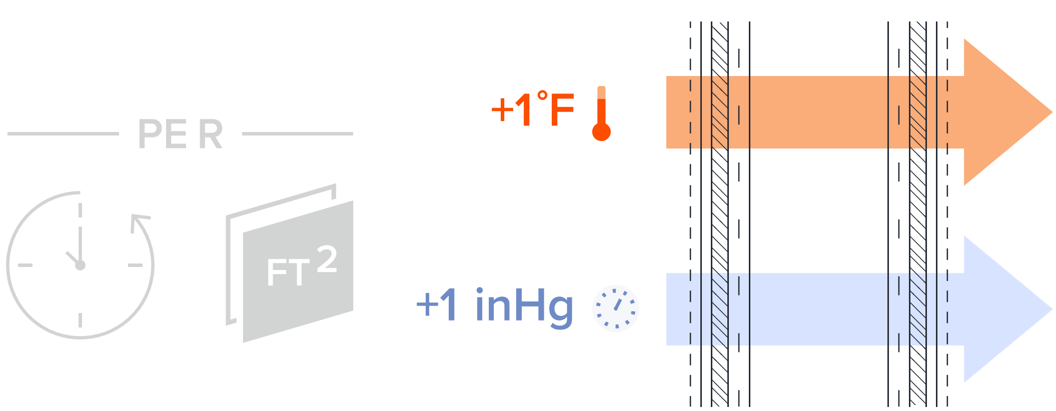
Relative humidity

"**Relative humidity** is the amount of moisture contained in a sample of air compared to the maximum amount the sample could contain at that temperature. This definition is accurate in concept; but strictly speaking, relative humidity is the ratio of the partial pressure of water vapor in a sample of air to the water vapor pressure at saturation of that air, at a given temperature and barometric pressure" (IICRC S500 V5 2021, 20).

For the purpose of this eBook and for practicality in the field, you can draw a close association between relative humidity and the potential to store additional energy or moisture.

Restorers measure the relative humidity for a few reasons. The most common reason is to prevent your air from being too close to saturation. **As a general rule, you want to keep the relative humidity below 60%.** Many restorers choose to be below 40% RH to create an improved drying environment and prevent secondary damages in colder climates.



Relative humidity is one of the primary readings from your thermohygrometer and is a key part of your psychrometric readings. It will help you calculate the dew point and vapor pressure if your meter does not provide that information to you.

Humidity ratio

In the restoration industry, the humidity ratio was mistakenly referred to as specific humidity. This happened as restorers were incorporating science and terminology from other fields as the water damage industry was maturing. The wet-bulb reading of specific humidity was used incorrectly. It has since been corrected, but many will still incorrectly call this specific humidity.

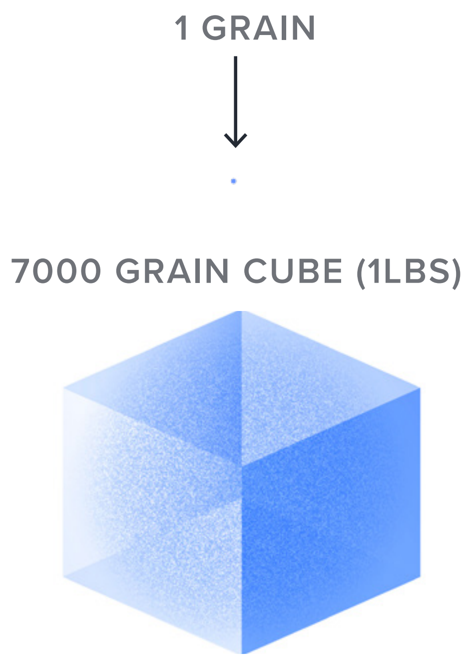
The humidity ratio of a given moist air sample is defined as the ratio of the mass of water vapor to the mass of dry air in the sample. It is expressed in grains per pound (grams per kilogram) of dry air, sometimes shortened to GPP or gr/lb (GPK for metric readers).

To understand the humidity ratio, we can think of it as a measurement similar to milliliters or ounces. The difference is that grains per pound (or grams per kilogram in the metric system) is based on tiny measurements. Grains (grams) are used to measure very small, precise measurements. You'll often find this unit of measurement for the weight of arrows and arrowheads in archery or gunpowder or bullet weight for firearms. Tiny, accurate readings can make a big difference in the performance of a drying scenario.

What is a grain?

To put how small a grain is in relation to a pound, it would take 7000 grains to form one pound. In other words, 1 grain is 1/7000th of a pound. This is a tiny measurement.

The average pound of dry air has a volume of 14 cubic feet, which means every 14 cubic feet of dry air has 7000 grains.



Restorers use humidity ratio readings from their meters to determine their drying strategy. Depending on your location, the humidity ratio can be misleading. Still, it is a reading that your meters will give you—and the humidity ratio and vapor pressure somewhat correlate to each other.

Both internally and externally, reviewers will watch how the grains are being removed from the air. It is a common misconception that a dehumidifier is broken or that it needs to be removed (as 'it's not doing anything') because it is pulling very few grains on the exhaust.

If this happens—it can be a mistake. The grain depression shows that a unit is removing more moisture than is going into the unit. However, even a small grain depression later in the job could significantly improve the drying situation.

Watch out for grain pirates!

Have you ever had a reviewer question your grain depression and state that you were wasting your time with the dehumidifier running because it was pulling out a small grain count? Not sure why keeping the dehumidifier on-site made sense? Take a look at this example.

> **Your dehumidifier has a 3 GPP grain depression, meaning when you take the exhaust reading, the grains coming out of the machine are 3 GPP lower than what's in the atmosphere or entering the intake.**

14 Cubic Feet = 1 lbs or dry air = 1 lbs of dry air = 7000 grains

The key to understanding how effective the dehumidifier is operating is to determine how many Cubic Feet Per Minute (CFM) of air the machine is moving. The thermohygrometer is reading how many grains there are in a pound of dry air. As we know 14 cubic feet are equal to a pound of dry air, we can do the math to see how many grains per minute we are removing from the drying chamber.

First, we calculate how many pounds of dry air are being moved every minute. If we know the cubic feet per minute of the dehumidifier, we can calculate the number of pounds of air being processed through the machine.

325 CFM divided by 14 Cubic Feet equals 23.21 lbs of dry air per minute

What does it mean to be removing only 3 GPP when we take our thermohygrometer reading? Let's take this reading and convert it into how many pints we are removing from the air.

325 CFM   23.21 LBS OF AIR/MINUTE   69.64 GRAINS/MINUTE

69.64 grains removed / minute x by 60 minutes =
4178.4 grains x 24 hours in a day = 100,281.60

If we are removing 3 GPP of air, we are removing 3 grains from every pound of air. 3 grains times 23.21 lbs equals 69.64 grains removed per minute. If we multiply 69.64 grains by 60 minutes (an hour), we are now removing 4,178.4 grains per hour. If we multiply 4,178.4 by 24 hours (a day), we get 100,281.60 grains per 24 hour period.

There are 15 grains for every millimeter of water, and it takes 480 ml to make a pint. Our dehumidifiers are rated in pints per day. So it is crucial for us to see how many pints of water we are removing per day.

If we want to determine if our dehumidifier was productive that day we would say:

- Grains Removed = 100,281.80
- Convert to ML = 100,281.80/15 grains per ml = 6,685.44 ml
- ML to Pints = 6,685.44/480 ml (1 pint) = 13.928 pints/day.

The dehumidifier is removing 13.928 pints per day and is effectively removing moisture from the air. As a restorer, this may be effectively doing the job you want it to do, and it may be helping to keep your vapor pressure differential intact for your drying strategy. Interesting that a small number like 3 grains or 2 grains could result in such a successful day of drying. ***It looks like the unit is working after all.***

Air movers and air pressure: Bernoulli's Principle

We've talked about the energy in the air (vapor pressure) and the differences between two air masses' energy (vapor pressure differential). Vapor pressure and vapor pressure differentials are used when talking about the moisture or water vapor in the air and their relationship to energy. This is related to the use of dehumidifiers to remove moisture from the air.

You should become familiar with air pressure and how air pressure differentials can be applied to restoration jobs. **Bernoulli's principle follows the first Law of Thermodynamics—that all energy along a fluid streamline must remain the same, meaning that it cannot gain or lose energy.**

> **Why should you know this? Bernoulli's principle works by explaining how air pressure works when you increase the velocity of air.**

You can boil Bernoulli's principle down to these two statements:

1. When air pressure is high, the air velocity is low, or the slower the air moves, the higher its pressure.

2. When air pressure is low, the velocity of the air is high, or the higher the speed of the air, the lower the pressure it will have.

Let's put this into 'restoration speak,' applying Bernoulli's principle to the field. If we apply air movers with a high velocity of air movement across the material's surface, the velocity will create a lower pressure than the stagnant air in the material and will have a lower pressure than the air pockets behind the material. This will draw the moist, stale air into the airstream.

When you choose to use high-velocity air movers (not to be confused with high CFM air movers), the speed of the air creates low-pressure and a void that allows the high-pressure air (stagnant air) to move in.

Did you know that the velocity of the air from your air movers can be increased by simply changing the angle of attack? Point your air mover at the wall at a 5° to 45° angle. The air being forced out of the air mover will hit the surface of the wall and will be forced to move at a greater speed. This increase in velocity along the wall's surface will create a low pressure, fast-moving airstream. In contrast, the wall cavity has stagnant air with higher pressure. As mentioned before, high pressure will move to low pressure, thus creating a force differential to assist with driving that stagnant air out to the airstream created by the air movers.

An example of this would be when you open the window of your car. The immediate pressure change from the car to the exterior will create an airflow pulling the stagnant air inside the car out the window. The faster airflow on the outside of the car (lower pressure) will cause the air inside the car (high pressure) to exit through the open window(s). If you increase the amount of air leaving the car by lowering all the windows, the air becomes more equalized, and you feel less pressurization as the two pressures look for equilibrium.

How does this apply to your drying strategy? Your materials have stagnant air that has pressure to it. As you increase the velocity of the air across the building materials, you are decreasing the pressure. **As you create a greater pressure differential between the high pressure within the materials, the materials will look to find balance** and move the air to the low pressure and equalize with the surrounding air of your drying chamber (low pressure).

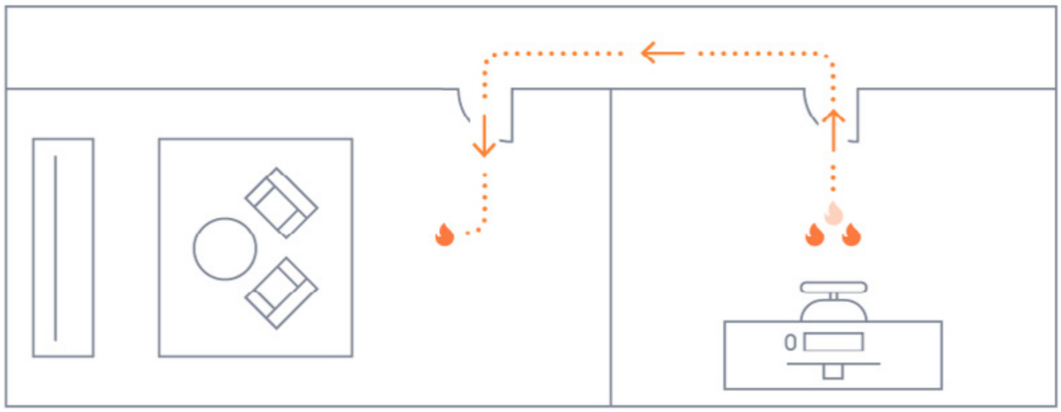
Why is this Bernoulli's principle and not Bernoulli's law? There are times in the spectrum of velocity and pressure where the principle fails due to the incapability of working at absolute zero speed or when the pressures are negative and will fail under those conditions. However, we are unlikely to encounter these conditions in the restoration industry, which means you can confidently apply this principle to your work in the field.

Putting this all together to become a drying wizard!

> **Using the Laws of Thermodynamics, we know we cannot create or destroy energy: we can only transfer it within an isolated system.**

When we place a heater or create heat from our drying equipment we are adding energy to the system from outside the drying chamber (transferring energy into an isolated system). We use air movers to transfer that energy into the materials of our drying environment and add new energy to the equation.

The heat energy is being transferred to the wet materials and the moisture vapor leaves the materials and enters the air. Our dehumidifier removes the moisture from the air, thus releasing the energy back in the form of a hotter dry exhaust from the dehumidifier. This heat energy is then released back into the drying environment to be re-applied to the materials within the drying chamber.



We also use the second law of thermodynamics (that high energy wants to move towards low energy, see above). We apply our air movers to the environment, directing heat energy into the materials and increasing the vapor pressure inside them.

Inspect the site, measure moisture, and manage vapor pressure differentials to fully understand the conditions of the site and to determine the impact the exterior, the unaffected space, and the HVAC system will have on the chambers. This will result in pressure differentials and vapor pressure differentials that can help, be neutral, or hurt your drying efforts. You will have to manage the various materials and drying chambers to ensure that the pressures are drying the materials and not negatively impacting the other parts of the structure.

There is a lot of information to manage and understand, even the “simplest” of drying jobs.

“A word of caution”

Even the smallest jobs that appear to be inconsequential and easy to handle may cause you the most exposure to liability. Smaller water losses appear to have a lower liability limit. However, these jobs are typically where less monitoring and time is spent fully understanding the conditions. Due to rushing there is a likely chance that the structure will not be dried properly and your documentation will not be thorough enough to explain the actions your team took on the job.

You should also monitor the surface temperatures of materials to determine how close they are to reaching the dew point. As the materials dry, the drying chamber air increases its energy load (vapor pressure). You’ll want to prevent the higher energy from finding a lower energy surface and condensing on it. There’s a real risk that the environment’s surfaces will reach dew point if uncontrolled and unmonitored, so inspecting the job regularly is essential.

In addition, the restorer will want to control the temperature of the materials and the conditions of the air to increase the vapor pressure differentials between the drying chamber and the materials. This means directing the heat energy and controlling the relative humidity to prevent secondary damages. Your drying plan should require a relative humidity of less than 60%. Many restorers look to keep the relative humidity below 40% to build a safe distance between mold growing water activity levels in the materials and their well-built drying environment, especially in colder environments. If the moisture levels exceed 60%, the moisture will allow for secondary damage to photographs, books, materials, and, worst of all, may create the conditions for microbial amplification.

Choosing the right equipment and placing it correctly is critical to reaching your drying goals. **The equipment being placed should be specifically chosen to prevent condensation, meet the vapor pressure needs of the building, and circulate the air over the structure.** Your equipment must operate and be effective at the temperatures of the job. Understanding that not all materials will dry at the same rate means you may need to dial down your aggressiveness on material drying, as some materials take longer to dry. There is nothing a restorer can do to speed that process up. Therefore, cranking up the heat or applying a lot of heat to the job is not practical in most circumstances.

Lastly, take readings, inspect the job properly, and focus on the dew point and vapor pressure differentials. Ensure your readings are indicating your equipment is working and make adjustments to your job.

If you have reached this point in the book, you have the basics for structural drying. Don't stop now as it gets even more interesting from here. In addition, look up some accredited advanced drying courses and get your WRT.

CHAPTER FOUR

REDUCING LIABILITIES

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If you have reached this part of the eBook and feel you have a grasp of the drying world, keep going because now we'll take you through how to apply your skills to an actual drying environment.

Winning the job!

If you want to win the job, the customer needs to believe you're a professional. Empathize with them early: show compassion, take control of the situation, and there is a good chance the customer will follow your lead.

> **The sooner you become proactive in the process and connect with your customer, the faster you begin building a trust-based relationship.**

"Mrs. Jones, I am sorry that we've met under these circumstances of you having a loss today. I want to reassure you that my team and I can help you out. Can I ask you a few questions before we figure out what manpower and equipment to send to your house to fix this problem for you?"

Notice that we don't say: *"Hey Mrs. Jones, how are you?"* I hate when those words come out of my mouth. As I am saying those words I already know it is going to be an awkward response from the customer and I look less prepared and less professional. I know what kind of day they are having! Why ask that?

Simple blunders like this can happen if you do not have a standard process for engaging with your customers.

> **Using a professional approach when greeting the customer means they are more likely to give you the information you need to effectively do your job.**

Begin by asking them a few simple questions:

- The year, style, floor coverings, and wall coverings of their home
- Have they ever had a flood before
- How long have they owned it
- What caused the loss
- How many rooms are affected
- Are there any sentimental items that they are concerned about, or tell them if
- Is there anything they don't want wet and if so can they move the items to higher ground.

You are demonstrating your professionalism and skill by slowing down the process and providing guidance. When the customer feels that you are focused on helping them keep what is important to them safe, they'll cooperate with your needs in the future. People are judging you by how you make them feel. Your professionalism and leadership will bring comfort to the customer. A great way to end the call is by telling them:

> *"We have the right people being dispatched to your home and the right equipment to handle this job. We are on our way to take care of you. We will see you soon."*

Finish the call with a powerful statement that reassures the customer that you'll take care of their loss. Remember, you're selling security and comfort in addition to mitigation services.

As restorers, we are the emergency service providers who go out and help people on some of the worst days of their lives. But we don't need to rush into a job, inadvertently making mistakes and placing ourselves and our company at risk of taking on large amounts of liability. We know that insurance companies are risk-averse. What you should learn from them is that everything you do is either reducing or increasing risk. Limit your liability as much as possible to ensure the highest chance of success for you and your company.

C'mon guys! We don't start working on homes, businesses, and properties until we get the proper paperwork completed. We need to start reducing liability from the very first interaction all the way to getting the completion certificate signed. Do you have a proper contract that limits your liability, explains the risks, and clearly provides direction for getting paid?

Remember, the customer probably never thought they would need your services, and chances are, they have little knowledge as to what restoration contractors do. They most likely found you via a Google search or were referred by their broker or insurance company or another means of referral. And now you're on their doorstep on what is very likely an unpleasant day for them. It's your time to shine and show them what a restoration professional can do.

The insured may not be thinking rationally when you first visit. Your customer may be on an emotional roller coaster. Imagine what they are feeling, experiencing a loss, the fear of the unknown, and the insecurity that they feel. Then they have a contractor telling them that they can fix the problem, but it will cost thousands of dollars. Maybe their adjuster has said that they aren't sure if it is a covered loss, and they need to come to look at it. This is a stressful and very emotional time for them.

✓ **Does your company have a great image?**

✓ **Do you look professional and competent when you arrive?**

✓ **Are you confident in your process?**

"Before we can start Mrs. Jones, we need to get the paperwork out of the way. This is our contract and it authorizes us to inspect your home and perform any safety precautions and emergency work before we start. We won't surprise you with any invoicing, but we do need your permission to perform our services."

Take action quickly and effectively. It should be noted that in some jurisdictions, you may be required to provide a quote or estimate before starting the work. It would be advisable that you provide that to the insured and outline why you need to perform the work.

Safety assessment/job hazard assessment

Regardless of where you live, ***safety is of the utmost importance*** when attending any project. You and your team must do a site safety inspection before doing any work. This doesn’t have to be a complex routine, but it has to be thorough and ***something that you do each day or whenever there is a change.***

Your goal is to protect the occupants, your employees, and anyone else who might be on the job site.

The first responder should identify any hazards and try to eliminate them. If the hazard cannot be removed, the first responder should attempt to mitigate it through other actions.

Walk the site and identify any slip or trip hazards. The stairs are a hard, smooth surface and workers with wet boots may find them slippery. You cannot eliminate the stairs from the job, but you can apply a rubber stair cover to increase traction and decrease the likelihood of a slip and fall.

Another hazard might be a freezer in the basement on blocks with the electrical cord in the water. The optimal solution would be to

remove the freezer from that environment. However, if that is not possible due to the workforce limitations or the building design, a way to mitigate the chance of a shock would be to use a GFI cord and attach it to the wall above the water. A hazard overlooked on day one can become a significant liability the next day.

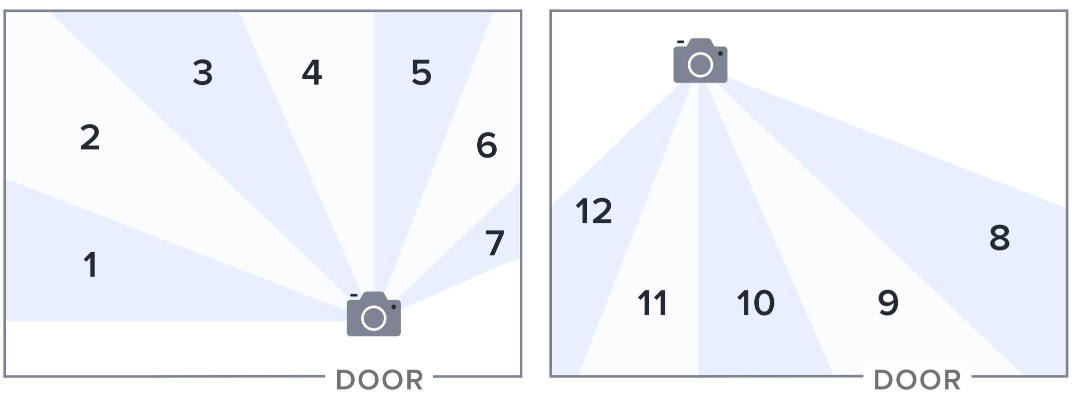
On the next visit, the restorer observes the power cords are loose and hard to walk around. This is a trip hazard that was overlooked the day before because the restorers weren't detailed enough during their site assessment. Before work began on the site, the restorer should have secured the power cords by taping them down to the floor. When these hazards are identified, immediately reduce the risk by taping down the cords to the flooring.

> **You're a professional restorer, and the job site reflects your attention to detail when it comes to site safety.**

Initial inspection

The initial inspection is a critical process. This is the first real opportunity to see the job site and assess the project's liabilities, risks, and requirements. **It is also one of the most overlooked and poorly documented stages of the job.**

Before you pull a piece of equipment off the truck, start documenting the condition of the property.



Pre-existing documentation

Using the industry-accepted photo-documentation method, take a horizontal photo of the exterior structure. Then take photos from left to right in a vertical format, slightly overlapping. Once inside, take pictures from the doorway, moving left to right, slightly overlapping to provide a consistent room view.

As you get to the right wall, walk across the room and take a series of photos left to right until you end up where you started.

> **It's important not to bounce around.**

1. **Take photos at eye level** to tell a story of the structure.

2. **Photograph pre-existing damages.** Start at the left of the doorway and then continue to work left to right, top to bottom.

3. **Each pre-existing condition should receive a macro photo (distance photo) to provide context as to where the damage is located.** Zoom in and take a series of micro photos to tell a visual story. In some cases you might want to take one or more photos, increasing your zoom into the area.

Remember that you're creating a visual story for someone who will never be on the worksite and who may never get a chance to see the structure firsthand.

After you have documented pre-existing damage, let's look at the other components of the initial inspection.

Liability reduction

> **You only have one opportunity to document the pre-existing conditions, and that is when you first arrive.**

If you fail to document the pre-existing conditions and do not have evidence of them during or after the mitigation and rebuild work, you will likely be held responsible for damages you did not cause.

It should be your company's practice to document the work paths your workers take through the home in order to perform work. This might include the unaffected walking paths, the path to operating restrooms, storage areas, areas where contents will be moved to, and the affected space.

Exterior

It starts with your vehicle placement as you first approach a loss. When you arrive, try not to drive on the property (not applicable to large commercial losses or residential homes with a long driveway). **Be sure to document the condition of the pathways, driveways, and parking pads.**

Oil stains, tire treads, and cracks in driveways are all complaints that have been lobbed over at restorers as damages they allegedly caused. Sometimes this happens in hopes of being able to negotiate free services or even replacement of damaged materials on their property. In some cases, the claims against you may be correct in that your actions damaged the insured's property. However, in most cases, people just do not observe those imperfections when they live in their homes and therefore assume you caused the damage.

If the job appears to have seepage, or an abnormal or persistent issue, it's prudent to take exterior photos of the drains and downspouts and the earth against the structure's wall to determine if it is sloping away or sloping towards the structure. Fully document the relevant parts of the property as if you need it in a court of law. Share this information with the insured to ensure there are no discrepancies regarding the condition of the parts of the property you will be working in. Take every opportunity to reduce the chances that you will be in a negative situation with the customer.

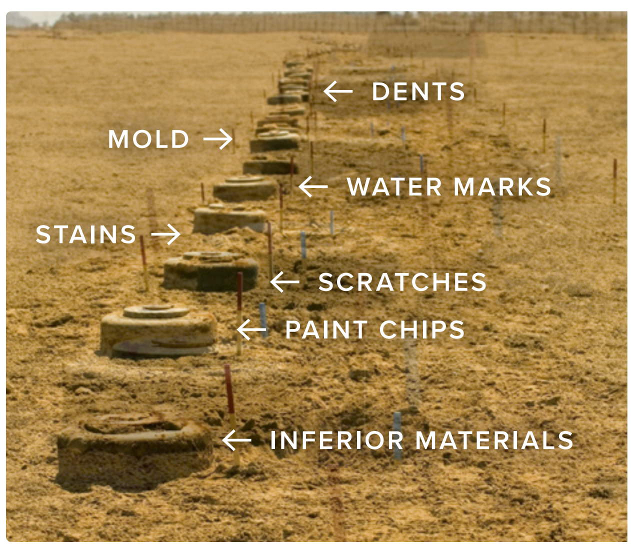
Interior - unaffected

As mentioned earlier, we tend to run straight to the cause of loss instead of cautiously looking to reduce liability. Stop and ask yourself: *where do your problems come from?* Train yourself to get familiar with the entry of the property and start looking for pre-existing damages from normal wear and tear in all unaffected spaces you or your crew might be walking through as you move to the cause of loss.

The location of bathrooms, facilities, electrical panels, and water shut-offs are all critical for daily job activities.

Liability Landmines

Dents, dings, scratches, paint chips, or even paint splatter from previous work completed are all things that policyholders will walk by and not think twice about in their day-to-day lives. You should see those items as liability landmines. If you don't see it at the beginning of the claim, chances are you will step on it, and trust me it will definitely hurt later.



Part of your discussion with the customer is to ask questions regarding any past issues, water damage (that has not been reported), or structural changes to the home. You will be surprised at what you can find out from the property owner when you follow a straightforward script.

> *"Mrs. Jones, you have a lovely home here. Your basement looks fantastic. I was wondering, have you ever had any water issues before this? Appliance leaks or condensation in the basement? How does your basement do in the spring with melting snow or during heavy rains?*
>
> *Did you have another contractor work with you on this issue?"*

At this point I have not asked any offensive questions, so chances are you are going to get straight answers.
If you see an aquarium, ask specific questions.

> *"I love aquariums. How many gallons is that aquarium? How long have you had it? Oh my, I could not imagine how bad it could be if it leaked* (yeah, you can - you're a professional

restorer. You know what will happen.) *Have you ever had it overflow or break?*

Is this a saltwater aquarium or a freshwater aquarium?"

If they answer yes, follow up with a non-offensive question.

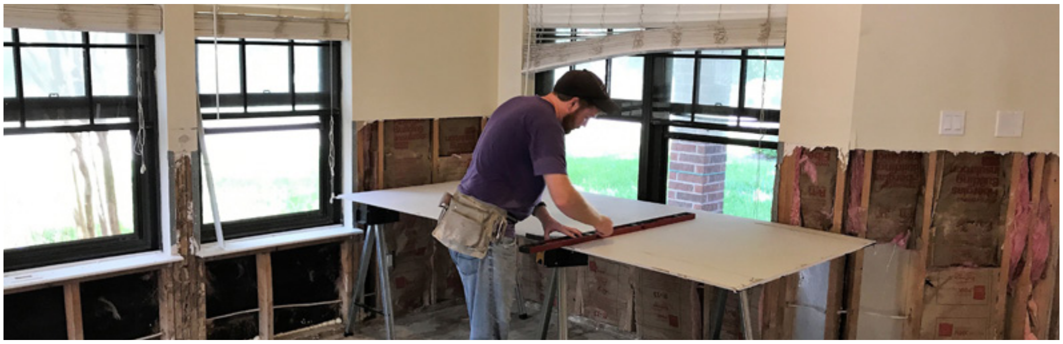
"Did you lose any of your fish when that happened?"

At this point I haven't asked many building questions, because I am focused on connecting with the customer on items that may hold more value to them. There is a difference between the customer's priority and the restorer's priority. Customers value the things they have acquired and been given in life. The restorer values the structural drying component of the job, as well as the contents an owner possesses. However, focus on what matters more to the homeowner before moving to the structural damage.

Now that we have addressed items of importance to the owner, we can focus on the structural damages. If I see water-stained ceilings or tiles, I will ask questions about that.

"What caused those stains in your ceiling tiles?"

The challenge is not to make assumptions. Give the property owner an opportunity to tell you. You'll be surprised by what you learn.



Previous water damage

> **Previous water damage is a genuine concern, and mold could be an unseen reality.**

Your goal is to determine what is recent water damage and what is historical or long-term damage. Previous water damage is not always easy to find, but there are some things you can look for that include but are not limited to:

- Water stains on materials
- Corroded & rusted metals: nails, staples, electrical wires/connections
- Crusty carpet
- Delaminated carpet
- Mold
- Rot or decay of structural materials
- Signs of water damage in areas removed from the affected area (need to investigate that there is no path to impacted spot)
- Drywall that was previously cut at 2’
- Insulation that is a different color at the 2’ mark or has been cut at the 2’ mark.

Red flags

This is an important time to notice if you are being set up for owning someone else's problem. Some red flags are:

- Most answers to questions about the property are: "I don't know."
- Policyholders give vague answers, trying to not share information
- They tell you to stop wasting their time and get on with the process. For you, this is the process and rushing through will cost you down the road.

Be cautious of someone who wants to rush you. This is where you should probably follow your process and do a detailed job of documenting the claim. If they are this critical of you when they need you, how much more difficult will they be when they don't need you?

Of the clients I wished we would have never taken, 9 out of 10 times, they attempted to derail our efforts to understand the job early.

Pre-existing damages to contents

Contents are personal. These are possessions that have value. When a home burns, it is not the structure that is missed. It's the memories and items in the structure that people are emotionally attached to.

Document any pre-existing scratches, dents, and dings on the items that will be entering your possession. People often don't see those imperfections until they look critically at the work you and your team are doing. That's when the scratch on the table, dent in the refrigerator, and mark on the prized painting becomes your responsibility until you can prove otherwise.

Another great way to limit the liability of a claim is to make sure you handle the sentimental items first. **Be sure that each family member has an opportunity to get the possessions that matter most to them so that they can be saved and restored.** These are the items that will make or break a claim, and if you take the time to help the customer, you will be a long way down the right path to a successful claim.

Cause of loss

The cause of loss is one of the most important items to document. You need to identify the actual cause of loss, which can be difficult when there are many potential sources. This may require controlled disassembly of finishes, built-ins, wall and flooring systems. Interview the occupants of the structure, look at the physical signs of the loss, and determine the cause.

Remember, the cause of loss is critical to your clients' insurance contract. If you make an error in determining the cause of loss, it could result in a conflict between the insured and their carrier as to whether the insurance company is responsible for covering it.

A proper way to document the cause of loss is to take a macro to micro photo set, and if needed, record a video that is no shorter than 15 to 30 seconds and no longer than a minute.

You will want to create detailed notes of when the loss happened, why it took place, the events leading up to and immediately after the loss, and the resulting damages.

> **Consider hiring a specialized expert to identify the cause of loss if you cannot identify it.**

Resulting damages

Restorers often under-report the details of the resulting damages. This under-reporting can lead to the customer's insurance company not understanding the scope of work involved and the severity of the damages. This can cause the customer a lot of stress and anxiety as they have to deal with results of the insurance carrier and the contractor not communicating properly.

> **The resulting damages can be permanent or temporary, depending on the severity of the loss.**

Document the claim by performing a sketch of the loss area and clearly indicate what areas are affected. Also, document the unaffected areas that might have been cross-contaminated and require cleaning.

In the case of water damages, explain why some damages may not be visible at the time of the loss such as water damages inside wall cavities that may not have had an opportunity to saturate the materials. Thorough documentation and communication is the key to reducing conflict. It is easier for you to walk away from a highly conflicted job when you haven't invested time and money into the mitigation.

CHAPTER FIVE

DRYING CHAMBERS, READINGS, AND MORE

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Creating drying chambers

A drying chamber can be a room, a floor, or a section of the building segregated and blocked off from the unaffected area or other parts of the structure. The goal is to contain the wet, affected materials and air to the smallest, most controlled environment possible.

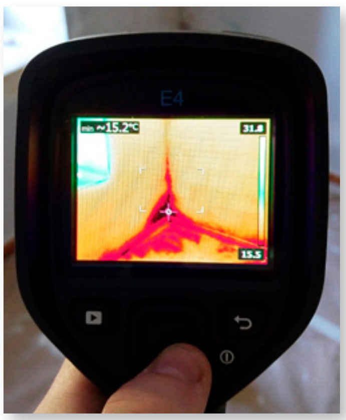
We build artificial walls or barriers using polyethylene, poly poles, magnet poly clips, wood studs, steel studs and zippers to create the drying chamber. Using containment strategies allows you to prevent moisture from migrating to unaffected areas.

The drying chamber allows you to have more control of your drying environment, increasing the efficiency of your equipment, and dramatically reducing the risk of secondary damage in unaffected areas.

Drying chambers can be an effective strategy when working in a commercial space or large environment that is only partially impacted by the water. When power, resources, and equipment are scarce, you can gain increased control over those environments, maximizing the return on your equipment and improving your drying efforts.

Taking your readings

Psychrometry is a sub-science of physics relating to the measurement or determination of the thermodynamic properties of air and water mixtures (e.g. humidity and temperature). For restorers, this is the fundamental skill of measuring water vapor in the air and moisture levels in materials.



We record air readings using a thermohygrometer to capture the ambient environmental conditions such as temperature, relative humidity, and humidity ratio. Some meters will also provide the dew point and vapor pressure.

The most common psychrometric readings are:

- **The Exterior:** the outside of the structure that is not impacted by any controlled air from the structure.
- **The HVAC:** in larger homes or commercial buildings, there may be multiple HVAC systems that need to be monitored if operating.
- **The Unaffected Area:** you may have more than one unaffected air reading in a larger complex with multiple floors or multiple wings of a structure.
- **The Affected Areas:** each drying chamber would be considered an affected area. Affected areas are NOT individual rooms located within a drying chamber.

You are measuring the psychrometric readings of all the atmospheric conditions that will impact your drying plan. These various forces are either helping, hurting, or not impacting (neutral) your efforts in a significant way.

The exterior

We cannot control what Mother Nature throws at us, but we appreciate that she can place vapor pressure differentials that can help, hurt, or have a neutral impact on your drying strategy.

You do not need to be as concerned about the seasonal weather changes as you need to know how changes in weather from hour to hour and day to day can impact your drying project.

In extreme climates, a 20°F - 40°F (11.1°C - 22.2°C) fluctuation in temperature over a few days and/or rapid changes in humidity will significantly impact the vapor pressure differentials on your jobs.

Restorers will often refer to the weather as helping, neutral, or hurting regarding its impact on the drying strategy. However, this is not a constant helping or hurting pressure that is being applied to your drying environment. When you have a closed drying system (a system that is not using the exterior environment) to dry your project, then the exterior cold and dry weather, extremely hot and dry weather, or extremely hot and wet weather will be working against your goals of drying the structure. To put that into perspective, most of the time the weather is negatively impacting you because it is competing with your dehumidifiers to pull the moisture deeper into the building structure towards those outside conditions.

How does this hurt you? When you are building your drying environment, your goal is to release the moisture from the materials until you return those affected materials to their predetermined dry standard. Once the moisture is released, it can travel away from your dehumidifier and towards a cold wall with lower vapor pressure.

Remember: High to low or hot, wet (energy) air to cold, dry (low energy) surface.

Here is an example of extreme conditions that you would find if you were in a climate like Arizona or Las Vegas? If the outside environment of the desert is 120°F (48.9°C) at 10% RH with a VP of .35inHg and your drying chamber is 90°F (32.2°C) at 55% RH with a VP of .64 inHg, the vapor pressure differential of .29inHg might overpower your dehumidifier. The exterior vapor pressure is much lower than that of the drying chamber causing water vapour to move through the walls and windows instead of the dehumidifier. The pulling force of the outside conditions will pull the moisture to the exterior with greater force than that of the conditions of the drying chamber. The high-energy air inside the building will want to travel outside to the lower-energy air, with only the building systems preventing that from happening.

This partially explains why some jobs dry faster while other jobs can take longer.

What if the outside is hot and humid like a Florida summer day? Let's say that it is 95°F (35°C) and 80% RH with a VP of 1.33 inHg. The inside of our job is the same as the one in Vegas at 90°F (32.2°C) at 55% RH and a VP of .64 inHg. We have an outside force that is trying to drive energy and moisture into our building. In this case, we may need to increase our dehumidification to offset the incoming moisture, considering that our building systems will hinder the penetration of that outside force but will not prevent it entirely. In doing so, we will increase the differential in hopes of being able to counteract the forces working against you.

What if it's a Florida evening with 75°F (23.9°C) and 80% RH with a VP of .63 inHg, and our building is at .64 inHg? The inside and outside are essentially neutral, and the outside is not impacting the drying chamber. In this situation the building systems will retard any moisture attempting to leave the building.

In both scenarios where the equipment load was not modified to deal with the extremely humid outdoors, we are only drying effectively for 12 hours overnight. During the day, we would essentially be stabilizing as a result of the increase in water vapor entering the building. Taking this into consideration, you might be drying for only 12 hours a day.

Let's look at my hometown of Winnipeg, Manitoba. It was -67°F (-55°C) when it was -45F (-42.8°C) in Chicago. The vapor pressure at those temperatures is approximately .03 inHg. Almost zero. If your drying chamber is running the same as in Vegas, 90°F (32.2°C) at 55% RH with a VP of .64 inHg, you have the same extremely powerful differential working against you, except the moisture is trying to escape the structure. Hot, wet air is trying to go to a cold, dry exterior wall, window, door, and the outside.

To counteract those forces, you need to heat up the surfaces and the material temperatures inside the walls and keep the moisture in the structure. You have to understand that these are extremely powerful pressures acting against your drying systems.

The heating and ventilation system (HVAC)

One of the most overlooked support mechanisms is the HVAC. Heating and cooling systems can assist in your drying efforts. **The HVAC system is also an area that can easily hurt your efforts by allowing the outside air or affected air to interfere with your drying efforts.**

A ventilation system functions as the lungs of the building and allows the air to circulate, transferring heating and cooling around the building to control the temperature and humidity. Monitor the HVAC system readings to understand what if it assists or hurts your drying project. The goal is to ensure that the HVAC system, with the proper application of heating and cooling, will assist your efforts.

Another reason to manage the ventilation system is to see if moisture has penetrated the ducting. You can determine if the system has been compromised by measuring the air leaving a register in one part of the structure and comparing that to the air leaving another register in a different part of the building. You may do this on the same run of the HVAC system or another system all together to determine what is happening.

If overlooked, you may be allowing moisture to sit in a closed system thus preventing it from remediating the problem. This may result in further damage to the HVAC system, secondary damages to other parts of the structure, and microbial amplification/mold growth.

The HVAC system is a free piece of equipment on-site that you can use to achieve your temperature and humidity goals, if it has not been compromised. If the HVAC system is in direct contact with category 3 water, the system should remain off until it can be properly inspected and cleaned by qualified experts. If the affected areas are impacted by category 3 water, turn off the mechanical system until the area is thoroughly cleaned.
When completing equipment sizing calculations, be sure to determine if the HVAC system is providing assistance to the drying plan and if the HVAC system is keeping the moisture contained where you want it.

There are going to be plenty of times that the system is not helping or hurting your strategy. The end result is that you will be covering the vents and returns to segregate the system from your drying environment.

The unaffected atmosphere

This is the part of the structure that is not directly impacted by the water loss and is located behind or in a different atmosphere. The unaffected area is not something that you can ignore **since the vapor pressure differentials may drive moisture towards these areas.** It may become critical for you to manage and control the climate conditions of this area.

You will want to monitor these areas to prevent them from dropping below 67°F or exceeding 82°F (19.4°C to 27.8°C) when there are occupants. This is the generally accepted comfort zone depending on humidity and time of the year and the occupant's personal preference. Be cautious with temperature ranges that are colder or warmer than this range, as it can result in complications for the occupants and discomfort.

When your unaffected space is outside of this range, you should consider moving the occupants off of the worksite and into other living arrangements or add in heaters or air conditioners to control the environment.

The unaffected area should not have a relative humidity of more than 60% and should remain between 40% and 50% RH.

When the vapor pressure increases in the unaffected areas, they may become an affected space. This may require heating and cooling equipment or dehumidifiers to prevent secondary damages.

The affected area: the drying chamber

The affected area is defined as part of a room, a room, a series of rooms, a floor or even an entire wing of a building that shares the same controlled air space.

These affected areas are often referred to as a drying chamber when they share the same air. The goal is to reduce the drying environment to the smallest cubic footage possible. This allows the equipment to operate more efficiently and reduces the need to process higher volumes of cubic feet of unaffected air.

How do affected areas work when you have a two-story loss, and only a couple of rooms are impacted on each floor?

If you have a natural barrier between floors and they will be contained separately, you will effectively have 2 chambers. Your equipment calculations will be based on the affected area of each floor. In this example, we will assume that the rooms are side by side and connected by an opening like a doorway or entrance without a door. The two rooms on the second floor would be a chamber. Let's call these rooms 'Chamber 2' and the two rooms on the first floor 'Chamber 1'.

It is also highly likely that the two chambers would be classified differently and this would impact your equipment calculation of each chamber.

The IICRC classifies water losses to help restorers estimate the starting dehumidification and humidity controls required at the start of the loss. This is a guideline that allows restorers to get to a more accurate starting point than just guessing.

The IICRC defines the classifications as:

- **Class 1: Least amount of water absorption and evaporation load.**

  Water intrusion where wet, porous materials (e.g., carpet, gypsum board, fiber-fill insulation, concrete masonry unit (CMU), textiles) represent less than ~5% of the combined floor, wall and ceiling surface area in the space; and where materials described as low evaporation materials or assemblies have absorbed minimal moisture (ANSI/IICRC S500 V5 2021, 46).

- **Class 2: Significant amount of water absorption and evaporation load.**

  Water intrusion where wet, porous materials (e.g., carpet, gypsum board, fiber-fill insulation, concrete masonry unit (CMU), textiles) represent ~5% to ~40% of the combined floor, wall, and ceiling surface area in the space; and where materials described as low evaporation materials or assemblies have absorbed minimal moisture (ANSI/IICRC S500 V5 2021, 46).

- **Class 3: Greatest amount of water absorption and evaporation load**

  Water intrusion where wet, porous materials (e.g., carpet, gypsum board, fiber-fill insulation, concrete masonry unit (CMU), textiles) represent more than ~40% of the combined floor, wall, and ceiling surface area in the space; and where materials described as low evaporation materials or assemblies have absorbed minimal moisture (ANSI/IICRC S500 V5 2021, 46).

- **Class 4: Deeply held or bound water**

  Water intrusion that involves a significant amount of water absorption into low evaporation materials (e.g., plaster, wood, concrete, masonry) or low evaporation assemblies (e.g., multilayer wallboard, multilayer subfloors, gym floors, or other complex, built-up assemblies). Drying may require special methods, longer drying times, or substantial water vapor pressure differentials (ANSI/IICRC S500 V5 2021, 46)

The second floor has only a wet floor that represents approximately 30% of the total affected surfaces of the walls, floors, and ceilings. Therefore, we consider this to be a Class 2 loss. The main floor has wet ceilings, walls, and a floor covering approximately 65% of the surfaces. This would be considered a Class 3 loss because more than 40% of the square footage was impacted.

After we start the equipment, we would re-evaluate the drying plan compared to our drying goals and make the NECESSARY adjustments.

Pre-restoration stabilization vs drying

I have written articles explaining why only taking three days to dry a structure is a myth. Many restorers & adjusters do not realize that when you deal with a Category 2 or Category 3 loss, **you must decontaminate the affected surfaces and materials before implementing your drying equipment.** This means no air movers to kick up aerosolized particles and other contaminants. Air filtration devices may be employed to remove airborne contaminants.

> **Stabilization is not drying. You do not size the equipment the same way you would if you were drying a structure.**

Stabilization has one goal only: **prevent secondary damages like high humidity and mold growth while dealing with the contamination.** Other delays like insurance coverage issues or determining who is paying for the job can occur while you deploy stabilization on Category 1 losses. But more often, it is used on Category 2 and Category 3 losses before the building has been decontaminated. Only after cleaning can a job enter the drying phase.

The new *ANSI/IICRC S500 V5 2021* now includes language about the use of stabilization during the decontamination of the structure and when evaluating content.

The *Leadership in Restorative Drying* defines Pre-Restoration Stabilization objectives as environmental controls that are primarily designed to prevent secondary damage through the temporary control of the atmospheric conditions while the structure undergoes preparation for the restorative drying phase (Larsen, 374).

The client should be informed that the stabilization process will be used until the asbestos or lead tests are returned, the abatement is completed, or the structure has been properly cleaned.

Drying uses air movement and dehumidification to create vapor pressure differentials by passing large volumes of air over a wet surface to transfer heat energy.

During stabilization, you are not moving large volumes of air; **you are only removing abnormal amounts of moisture from the air to prevent environmental conditions that support microbial growth and secondary damages.**

A drying project that is not stabilized will often allow for secondary damages within a couple of days and cost the client substantially more if a Condition 3 (active growing) mold growth occurs. A prudent restorer deploys pre-restoration stabilization methods when the need arises.

CHAPTER SIX

TAKING MATERIAL READINGS IN AFFECTED AREAS

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Dry standards

A **dry standard** is a reference reading taken from a similar material located in the unaffected area of the same structure. You should try to use a material in the same structure to accurately represent your drying goal.

ANSI/IICRC S500 V5 2021 defines the dry standard as; “a reasonable approximation of the moisture content or level of a material prior to a water intrusion” (IICRC S500 V5, 2021, 48). One of the significant changes in the new *ANI/IICRC S500 V5 2021* is how a restorer determines drying goals, as “it is recommended the drying goal be within 10% of the dry standard.”

The standard states: “drying goals may be at, or above the dry standard and should be documented as they relate to specific materials. The restorer should establish drying goals that would be expected to:

- return structure, systems, or contents to an acceptable condition; and
- inhibit microbial growth” (IICRC S500 V5, 2021, 48).

Consider consulting with specialized experts if you are unable to determine the appropriate dry standard and drying goals. Many restorers will want to take the perceived shortcut of using regional dry standards as their dry standard. The issue with regional dry standards is that they change from week to week, month to month, and season to season. Although technology allows restorers to use regional dry standards to be more accurate than using the same current readings from one job to the next. This method of determining the dry standard is more widely accepted when unaffected materials are not present.

However, there are many associated risks with using regional dry standards, such as:

Increased liability

Your liability goes up when you use an unachievable dry standard or forget to record a dry standard at the start of the project.

For example, if the regional dry standard of drywall is 4% moisture level and the meter indicates 7% as the lowest reading you can dry in that building, you will not be able to achieve that dry standard.

There are two negative outcomes from this scenario. Your dry standard of 4% may or may not be correct, but a 7% moisture level reading might indicate a problem on-site that requires your attention. This can be a problem that may get overlooked.

If you follow the *IICRC S500 Standard V5 2021*, along with other considerations outlined in the standard, it recommends the drying goal be within 10% of the dry standard, this may be above or below the dry standard. This makes your dry standard 4.4% to 3.6%. The 7% on the meter would not provide you with the deviation required to reach your dry standard on the project (IICRC S500 V5, 2021, 49).

If you're dealing with wood and the dry standard was 8%, your drying goal is within 10% of the dry standard as well. In this case, the wood could be 8.5 % to 7.2%, and any range in between would be considered acceptable, as long as it does not support conditions for microbial growth or rot.

The second issue is if someone questions your restoration efforts. **Geographical dry standards reduce your ability to defend your actions.** You and your staff would be placed under oath and asked to defend your company's position and processes in mediation, arbitration, or court. A keen professional reviewing the file and providing expert opinion would hone in on this major liability.

If a third-party evaluation takes place, the dry standard will be recognized as the drying goal. When the restorer fails to reach the accepted goal, the drying process may be considered incomplete and creates a very difficult position to defend.

May establish unreasonable objectives

> **Part of the initial investigation is to understand how the building is constructed and what is considered normal.**

An investigation into the unaffected part of the structure can yield many clues as to the building's history and the potential impact that it may have on your drying strategy.

Imagine if you found out that the building was prone to ice damming every other spring because you noticed the carpet displayed signs of long-term water damage. Would you change your approach? Would you investigate the loss area even further? How do you properly take a dry standard reading?

It is critical to the job's success that the current moisture levels are recorded so that you and your clients do not have misguided goals or misaligned understandings of reasonable objectives.

After you have completed your survey of the affected materials and determined what materials are wet and affected, record the dry standard in an unaffected part of the building. This is not a dry reading, although your meter might not be sensitive enough to pick up a reading. The reading is to gain a perspective of what a normal material reading would be with the meter you are using. If the reading on drywall is 0% moisture level, then your dry standard is 0%.

There is a time when you may have to use a geographical dry standard. Typically restorers will use geographical dry standards in the case of a completely affected structure or when there is a catastrophic loss and the time is too limited to conduct a full survey.

Moisture points & moisture mapping

One of the best ways to protect yourself from undue liability while creating a drying plan is to create a moisture map of the affected area.

Moisture mapping

A **moisture map** is a visual representation of the affected room or floor plan through a hand-drawn or digital sketch. It includes details about the loss, the affected materials, materials of concern, and materials to be removed or that have been removed.

A great moisture map shows the extent of the moisture impact to the floor plan, with the perimeter of the water damage highlighted, along with basic key points of reference such as doors, windows, and measurements. This does not replace the need to photograph the job site in detail but creates a supplemental document that allows you to follow a process of measuring, quantifying, and establishing the drying goals. Even images of the moisture meter readings can be calculated and attributed to the moisture point in today's digital world. This was unheard of just a few years ago.

Create your sketch on a digital platform (like Encircle). You'll have the ability to share the information with co-workers and outside experts who can help you build your drying strategy for difficult jobs or situations.

A moisture map is critical to visually communicate the extent of the water impact on the structure. This can become invaluable days, weeks, or months in the future when a claim is being discussed or disputed. The visual identification of where moisture points were placed on the sketch provides context to the information instead of a series of numbers on a spreadsheet that cannot tell the same story.

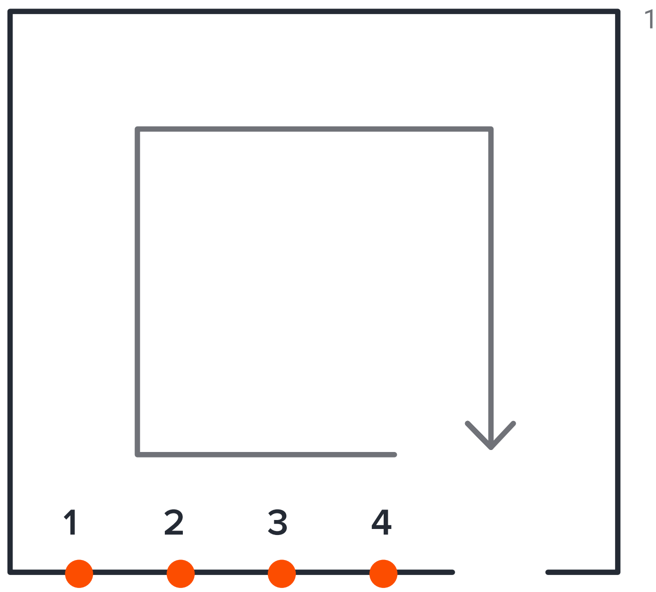
It is your responsibility to document the damage to the structure and the restorability and/or restoration efforts needed for the project. The success and failures must also be documented and provided to the customer. Items that cannot be restored or that failed to be restored are not necessarily a negative reflection on you as long as you followed the standards.

Moisture points

The purpose of a **moisture point** is to create a repeatable measurement location on a project to indicate the effectiveness of the drying strategy or plan.

There are a few ways to indicate your moisture points on the physical structure. Some restorers will use painters' tape and mark a number on it to indicate their measuring point. Others will use measurements on the moisture map to indicate the location of the moisture point. Some will place a description of the moisture point within a mobile app to describe its location. Regardless of the method used, consistency is the key to building an inspection sample set for your moisture points that are repeatable and used by everyone in the company.

A common practice is to start at the left of the door (similar to how you capture your photos) and mark the wall where you took your reading. Then place a number on the tape as you work around the room: 1,2,3,4. Each number represents a sample site where various materials are measured, monitored and recorded.



What you are measuring is just as important as where you are measuring.

Many restorers are not measuring the harder to dry materials such as the sill plate, the subfloor, or even the second layer of the subfloor.

These materials are thicker and are often located in more difficult drying locations that reduce the vapor permeance factor and therefore require more invasive disassembly and/or longer drying times. In these circumstances, you will need to increase vapor pressure differentials.

1. 128667_PIRC photo field guide_7.22." Property Insurance and Restoration Conference, Property Insurance and Restoration Conference, July 2019, static1.squarespace.com/static/577001bd725e2552c36cb4a8/t/5d389cb55f713 d0001a2ff54/1563991224598/Photo+Best+Practices+FINAL+7-23-19.pdf

Drawing from my experience as a consultant in arbitrations, legal actions, and my time at Encircle, I can tell you that many restorers measure the fast-drying high permeance factor materials without much regard for the slower drying materials. The liability they expose themselves to as a result is extraordinary. If your moisture readings do not show the measurements of those low permeance materials and there is a mold situation that results in a claim against your company, you only have two defences:

1. **There were pre-existing conditions, and the mold was present during your inspection.**
2. **The materials were dry when you completed the job, and the mold formed afterwards.**

Those defences are reasonable and would typically be defensible if you properly documented the moisture penetration of all affected materials.

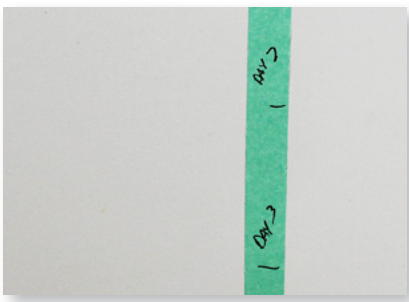
1. Did you document the pre-existing conditions before you started work on the job or recorded that previous water damage occurred on the job site?
2. If you never recorded the readings at the time of your visit, you cannot claim the second defence that the mold formed after the job because you didn't record the material moisture levels. This is typically where major gaps can occur.

So how do you mark the walls for moisture readings?

Listed below are some examples of marking the walls:

Painters' Tape

It makes your job site look rough and unprofessional, but it gets the job done.

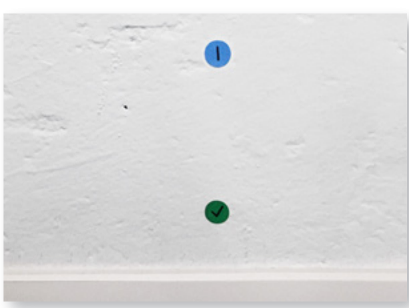


Painters' Tape Line

This method shows the progression day-to-day. Although it works well, it also makes your site look messy and unprofessional.

Sticker Dots

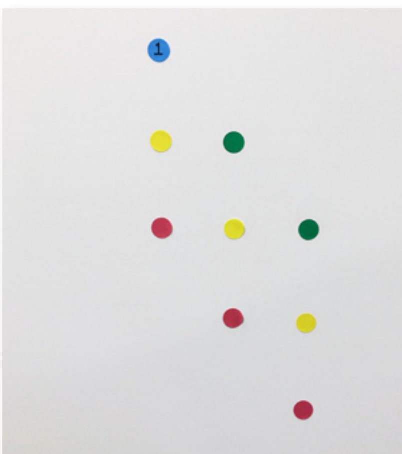
A tried and true method, the sticker dot tracking system makes the job look good. There are a few variations of this system.



Single Sticker Dot

Most restorers will use this method when using paper or software documentation. It is a sticker to indicate the area where you want to record your readings. It is a simple on-site identifier that provides a quick room reference to where the reading is and what number correlates to your records.

This method is preferred at Encircle because it is quick and easy. We often see restorers using a blue dot for wet materials, and once they reach a dry standard, they will add a green sticker over top of it to show that they reached the dry standard. It provides a quick visual for the technicians in determining areas of concern.



Sticker Dot Progression

A progression method simply follows the wettest reading. On drywall the reading will trend down the wall. A dot is placed at the saturation point each day as it progressively moves down the wall until the materials are dry.

The saturation point is key to tracking the drying of moisture. A wall may be wet 24” up the wall on day 1, wet 18” up the wall on day 2, then wet 8” up the wall on day 3. Lastly, it may be damp at the bottom of the wall on day 4.

The use of multiple stickers on a single point is tedious and is more costly. However, a benefit of this is that the progress of a drying record is very visual. Although, we would not expect to see many restorers deploying this method or a variation of this method.

CHAPTER SEVEN

DEHUMIDIFIER AND AIR MOVER CALCULATIONS

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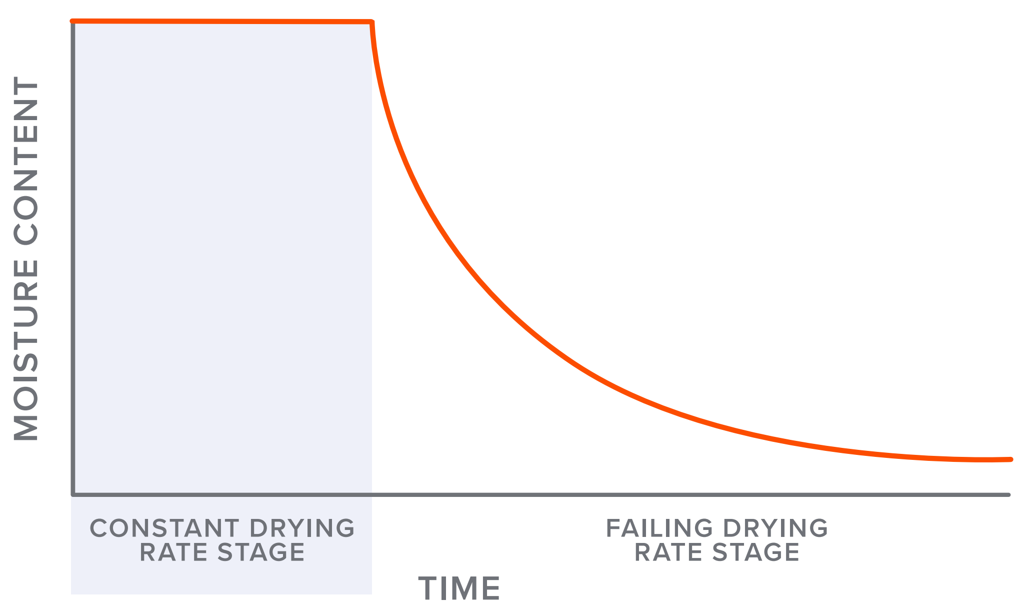
Understanding the drying cycles

Want to know a secret to start your job off right? **Size the job right from the very beginning.**

You must understand the three stages of the drying project before you unload your truck and place equipment.

The three stages in a drying project are the constant drying stage and the two falling drying rate stages. As highlighted in the graph below, the constant drying rate period is at the beginning of the loss when moisture can be easily removed. The falling drying rate period is when the moisture is held within the materials and requires more effort to free that moisture.



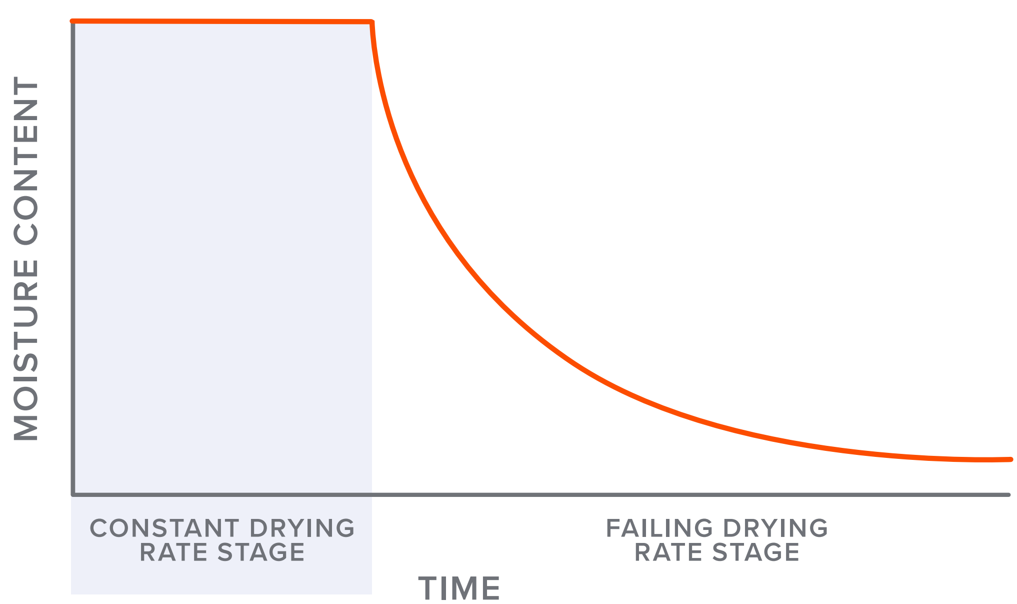
"**Constant drying rate stage** (unhindered) is that drying period during which the rate of water removal per unit of drying surface is constant, assuming the driving force is also constant. Generally, the temperature of the evaporating surface will be constant during this stage, either at or approaching the wet-bulb temperature" (IICRC S500 V5, 2021, 105).

To put this into simple terms, the constant-rate period would be experienced at the beginning of a job when the materials have free water available to be removed from the surface of the material. This free water will continue to evaporate at an even rate if all factors remain constant.

The four main principles of constant drying:

1. **Extract as much free water as you can**
    - Remember that extracting water is 800 times more efficient than drying the same amount of water. Extraction is the key to a successful project.
2. **Increase air temperature to provide energy to transfer to materials**
    - 70°F to 95°F to allow your dehumidifier to operate in the optimal operating range (LGR).
3. **Reduce the vapor pressure in the air by removing the moisture from the air and increasing the temperature**
    - Warmer/drier air = lower vapor pressure. The drier the air is, the more evaporation occurs.

4. **Transfer the energy to the free water by moving heat across wet surfaces**
    - Air volume: the CFM of your air mover may seem critical, but the direction and velocity of the air are just as important. You will want a 600 CFM or higher to effectively impact the material.
    - Air velocity: higher velocity air movement is critical in this phase.
    - Studies from the wood industry suggest wind speeds of 600 feet per minute or 182 meters per minute or greater are generally adequate.
    - More is better.
    - An axial air mover will give you a higher CFM but may not create the directed velocity you need to create an effective setup.



“**Falling drying rate stage** (hindered drying) is the drying period during which the instantaneous drying rate continually decreases. After all the water at the surface of the material has been exhausted, the moisture is diffused from the internal parts of the material to the surface. The amount of water at the surface becomes progressively scarce. As a result, the drying rate will be slower as time progresses and the material approaches its equilibrium moisture content” (IICRC S500 V5 2021, 108).

A real-world example of the falling drying rate stage is when you need to increase the vapor pressure differential between the materials with bound water inside the material and the air. A restorer will achieve this differential by increasing the energy to the material and by transferring heat from the air to the material. Air movers are mechanical tools used to push the hotter air across the surfaces to transfer heat.

Bound water is not easy to remove from a material and requires an increase in temperature to increase the vapor pressure in the material. During this phase of the drying project, your material surfaces may appear wet or dry, but the moisture content in the material requires additional energy to release it into the air.

Be aware of the Hand-o-Meter. Many people in the insurance industry, customers, and even some lesser trained restorers will put their hand on the wall and tell you if it is dry or wet based on feel. The good old Hand-o-Meter is not only inaccurate but it also is not calibrated or sensitive enough for it to work well unless the wall is at 100% saturation. If there is water on the surface of the wall, the Hand-o-Meter is a great tool. For all other situations, rely on your professional water damage tools to do the job.

At this stage of the job, the materials are slower to dry due to internal transport limitations. The bound water molecules can only pass through the material at the rate the material will allow, and various materials will take longer to reach their dry standard.

The four main principles of falling-rate drying:

1. **Increase air temperature to provide energy to transfer to materials**
    - 70°F - 95°F. However, you will find an efficiency apex for your drying project (LGR Dehumidifiers) between 90° - 95°F.
2. **Reduce the vapor pressure in the air by removing the moisture from the air**
    - Warmer/drier = lower vapor pressure.
3. **Transfer the energy to the materials by moving heat across the surface**
    - Air Movement - slow down the velocity of the air movers. Reducing the airflow across the material can assist in drying.
4. **Increase the vapor pressure inside the materials by increasing their temperature**
    - Monitor and manage the surface temperatures
    - Remember temperatures of building materials will potentially be cooler than the surface materials, such as framing, sub-floor, and multiple layers of drywall.

Initial Equipment Calculations

Before we begin, let's have a very clear understanding of how these are used. **These calculations are for the INITIAL calculations to start the job.** These calculations expire the moment you turn the equipment on. After these calculations are set, you must adjust your equipment based on how the job is responding.

These are general calculations that the restoration industry has accepted and are found in Appendix B of the *ANSI/IICRC S500 V5 2021*. It should be noted that none of these calculations are held in stone, but I am a big believer that they are very beneficial in assisting with drilling down on the **INITIAL** equipment load for the building (IICRC S500 V5, 2021, Appendix B, 172-178). This Appendix is informative and is not a part of the ANSI Standard. One of the important tasks for restorers is controlling humidity to speed up drying. *ANSI/IICRC S500 V5 2021* states… "Humidity control is established by removing water vapor from air at an equal or greater rate than evaporated from wet materials to minimize moisture migration, potential secondary damage, and microbial amplification" (IICRC S500 V5, 2021, Appendix B, 172).

There are two methods of calculating the **INITIAL** dehumidification equipment needed for a job. A simple calculation and a detailed calculation.

Both of these methods can be tedious mathematical calculations to perform in the field, but they're critical to improving your drying project. Here are five reasons why you will want to do this:

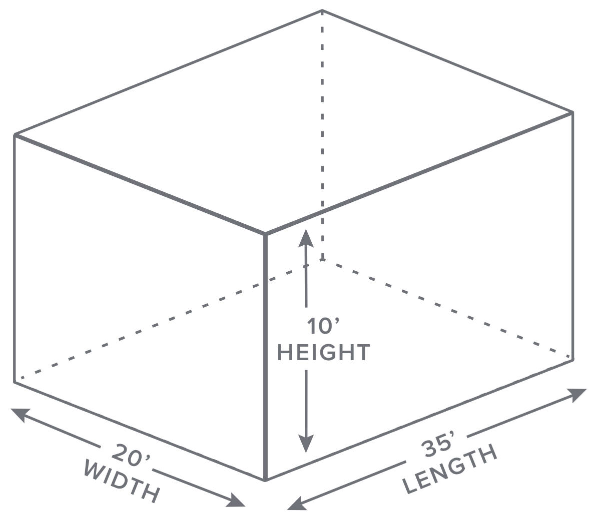
1. To determine the equipment needs at the start of the job
2. To determine if your site has enough power to support the equipment (potential delays will exist or secondary damage may occur)
3. To allow for smaller adjustments up or down as the drying project requires
4. To provide your company with the best opportunity to reduce secondary damages
5. It is a repeatable process for technicians

Initial dehumidifier calculation

For years restorers have had the use of the simplified dehumidifier calculation. For this scenario, we will use a 35 foot long by 20-foot wide room with 10-foot ceilings.

STEP 1:

First, you must calculate the volume or cubic footage of your drying chamber. This is calculated by measuring the length x width x height.



35’x 20’x 10’ = 7000 CUBIC FEET

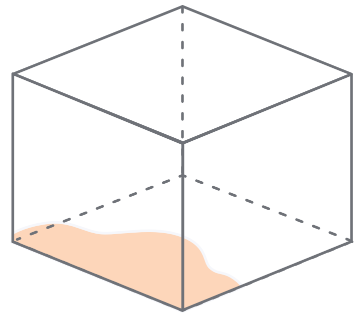
35’ (long) x 20’ (wide) = 700 square feet x 10’ (high) = 7,000 cubic feet (volume)

STEP 2:

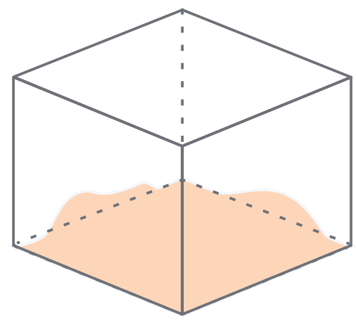
The next thing you will need to do is determine the class of loss. Class of loss is defined as the percentage of wet and affected surfaces of a drying chamber. This is the percentage of the combined total of the walls, floors and ceilings.

Below provides you some ideas of what you are looking at.

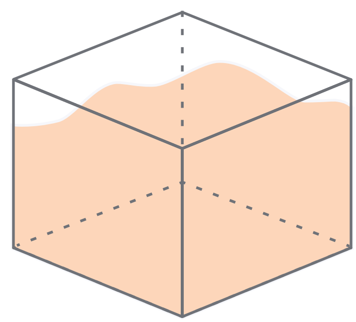
Class 1: 0% to 5% of the walls, floors and ceiling.



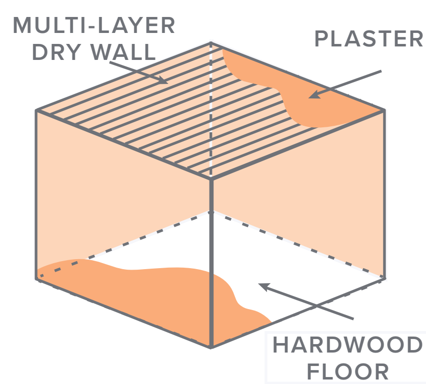
Class 2: 5% to 40% of the walls, floors and ceilings.



Class 3: 40% to 100% of the walls, floors and ceilings.



Class 4: Complex harder to dry assemblies and building materials.



A class 4 loss can have any amount of moisture present but harder to dry building assemblies and/or harder to dry building materials. The size of the loss does not matter; it is only the material composition that determines if this is a class 4 loss.

Simple dehumidifier calculation

Most restorers' go-to dehumidifier is a Low Grain Refrigerant. To demonstrate the simple dehumidifier calculation, we must take the cubic footage divided by the factor of the class of loss. This provides the number of AHAM rating pints per day as our starting point for our initial dehumidification calculation.

The calculation is found in the reference section of the *ANSI/ IICRC S500 V5 2021* in Appendix on page 172-178.

Initial Dehumidification Factors for Simple Calculation

Type of Dehumidifier*	Class 1	Class 2	Class 3	Class 4
Conventional Refrigerant	100	40	30	N/A
Low Grain Refrigerant (LGR)	100	50	40	40
Desiccant	1 ACH	2 ACH	3 ACH	3 ACH

**This chart has recommended figures used to determine initial dehumidifier requirements. They may change based on psychrometric readings and types of materials present. Technician discretion is advised.*

Using the same example of the 35’x20’x10’ foot room, we take the 7,000 cubic feet and divide that by the factor on the chart. For this scenario, we have a class 3 loss of more than 40% combined surface area affected.

7,000 cubic feet / 40 = 175 AHAM Pints required as our INITIAL dehumidification requirement.

“AHAM Rating: Dehumidifiers that are tested at AHAM (Association of Home Appliance Manufacturers) are tested in closer to real world conditions than dehumidifiers that are tested at saturation. The AHAM testing is 60% Relative Humidity at 80°F. This testing is supposed to be a universal standard that will allow consumers to compare similar products. As Ken Larsen noted in his book, *Leadership in Restorative Drying*, “this is not a specific test that is designed for the restoration industry and does not translate to direct performance in our industry applications” (Larsen, 321).

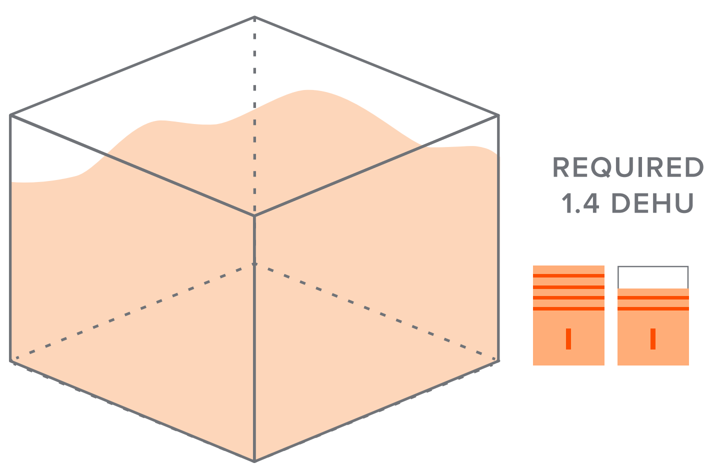
Note: *all restoration dehumidifiers should have an AHAM pint rating. Your unit should have a rating on it, but if not, you can find the rating on the internet or product specs.*

Encircle Hydro includes information about each piece of equipment, including AHAM rating, operating temperature range, power usage, and more. This information is built into our equipment placement feature to determine the equipment needed for the loss. We can also notify the restorers working on the job if the equipment placement is insufficient. We use that information to help your technician properly place the correct amount of equipment at the beginning of the job based on the sizing calculator. When equipment loads cannot be met due to complexities or complications with the job you should clearly communicate the problems to your client. Managing all of the complex factors of a job is challenging, and Encircle's goal is to make this easier for you.

Proper interpretation of dehumidifier placement

Keeping with the example of a 7,000 cubic foot drying chamber, there is a 175 AHAM Pint requirement on 7,000 cubic feet. Let's say you have Phoenix 200 LGRs on the truck, and each dehumidifier has an AHAM Rating of 125 AHAM Pints.

175 AHAM Pints Required / 125 AHAM Pints Per R200 = 1.4 Units



Based on these calculations, the job would require 1.4 R200's. We **never** round down and always round up to the next unit to ensure sufficient dehumidification at the beginning of the job. Therefore this job would require two R200's.

This is a good starting point for a quick calculation; however, this leaves a lot of room for incorrect sizing of the initial dehumidification requirements. We know the longer materials stay wet, the longer it takes to return them to the dry standard. We know that the vapor pressure differential, exterior conditions, HVAC, and all of the other varying factors can affect your job. There is a solution to get to a closer starting point.

The detailed low grain dehumidifier calculation

The detailed LGR calculation method of sizing a job is my preferred method of calculating equipment. It allows you to account for more variables and factor them into that specific job. I believe the authors of this chart were brilliant when they created this formula. It is not perfect, but the goal is to provide guidance to help move you to a closer, more accurate **INITIAL** dehumidification starting point. The reason this calculation is so important is that you're responsible for a drying project's goals, and your professional judgement is required to determine the most logical approach to restore the building.

The insurance industry is attempting to understand the restorative drying actions on a job and will use these standards as a way of managing liability. Note that the standards are only a guideline and that no calculation will be perfect in the field. But documenting the adjustments made and the job conditions will be important to helping the insurer understand why you implemented that drying strategy.

Part of building a logical drying plan is to determine the conditions that are helping or hurting you so you can make adjustments.

Encircle Hydro utilizes the Detailed Low Grain Dehumidifier calculation methodology because we noticed restorers in the field were consistently under-estimating the proper amount of equipment to use on the job. This resulted in longer drying times and materials being removed instead of dried. With Encircle's streamlined calculator, you can quickly determine an accurate starting equipment load in the field, making it much easier for the technician.

Using the detailed calculation allows you to understand a wide range of dehumidifier factors that will influence your drying decisions.

There are six parts to this calculation:

1. **Initial Pint Calculation:** cubic footage divided by a factor of 70.
   a. CF/70 = Pint requirement
2. **Build-Out Density:** how the building is laid out and constructed.
3. **Building Construction:** type of materials and complexity of the drying conditions.
4. **Class of Water:** the square footage of the walls, ceiling and floors that were impacted, expressed as a percentage. The determination of the class of water.
5. **HVAC Impact:** if the heating and ventilation system is helping or hurting your drying efforts
6. **Prevailing Weather:** describes the weather and the likelihood that the building will be impacted by it.
   a. The weather is favorable, neutral, or unfavorable
   b. The building's tightness - tight, moderate ,or loose.

The IICRC Chart looks like this

Detailed Refrigerant Calculation

					Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	
Building or Area Name	Length	Width	Height	Cubic Feet	Base Pints per Day	Build-out Density	Building Construction	Class of Water	HVAC	Weather Impact	Multiplier	Adjusted Pints per Day

Building Factors

Base Pints per Day			
	Divide by standard factor		70
Build-out Density		(x)	Multiplier
	Very open		0.6
	Fairly open		0.8
	Average		1.0
	Dense		1.2
Building Construction			
	Standard		1.0
	High-end		1.5
Class of Water Saturation & Evaporation			
	Class 1		1.0
	Class 2		1.5
	Class 3		2.0
	Class 4		2.3
Will HVAC support the drying process?			
	Yes		1.0
	No		1.3

Weather Impact Factor		Prevailing Weather Conditions		
		Favorable	Neutral	Unfavorable
Tightness of Building Envelope	Tight	1.0	1.0	1.2
	Moderate	0.9	1.1	1.4
	Loose	0.8	1.2	1.6

Enter Weather Impact Factor here:

Detailed Refrigerant Calculation Step by Step Breakdown

Building or Area Name		
Length		
Width		
Height		

The IICRC chart looks like this chart. It is located in Appendix B on page 173 in both imperial and metric formats.

(IICRC S500 V5, 2021, Appendix B, 173)

	Cubic Feet		
Step 1	Base Pints per Day		
	Divide by standard factor		70

Step 2	Build-out Density	(x)	Multiplier
	Very open		0.6
	Fairly open		0.8
	Average		1.0
	Dense		1.2

Step 3	Building Construction		
	Standard		1.0
	High-end		1.5

Step 4	Class of Water Saturation & Evaporation		
	Class 1		1.0
	Class 2		1.5
	Class 3		2.0
	Class 4		2.3

Step 5	Will HVAC support the drying process?		
	Yes		1.0
	No		1.3

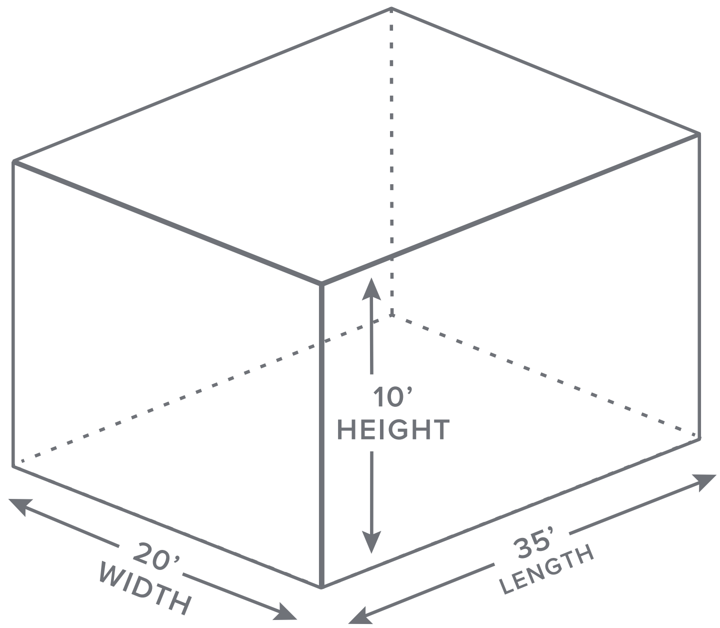
Step 6	Weather Impact

Weather Impact Factor		Prevailing Weather Conditions		
		Favorable	Neutral	Unfavorable
Tightness of Building Envelope	Tight	1.0	1.0	1.2
	Moderate	0.9	1.1	1.4
	Loose	0.8	1.2	1.6

Enter Weather Impact Factor here: ______

Step 7	Multiplier		
	Adjusted Pints per Day		

We will continue to use the same example as we did in the simple calculation chart.



35’x 20’x 10’ = 7000 CUBIC FEET

Factor of 70

The detailed calculation requires you to determine the amount of cubic footage from the drying chamber and then divide the cubic footage by a factor of 70. This creates a baseline AHAM pint calculation to then begin factoring the various conditions and their impact on your dehumidification needs.

In this calculation, we use the 7000 CF/base pints of 70 = 100 AHAM Pints.

The factoring methodology of this calculation states that you start with an AHAM Pint baseline and then apply the various factors based on the conditions in a compounding method.

The different factors are multiplied and provide a severity rating.

Build Out Density

The build out density is a way of describing the layout of the building and provides you with a general impact factor that it will have on your drying strategy. The amount of materials compared to the air space will determine the dehumidification requirement needed to restore the building.

Listed below are the four choices restorers have to choose from:

Very open: Factor .6

Factory, warehouse, convention center, large ballroom, sports complex, box store or theater are examples of these spaces.

Fairly open: Factor .8

School with large classrooms or open office areas with cubical areas or department stores.

Average: Factor 1.0

Most homes, condos, apartments, traditional office buildings or hotels

Very Dense: Factor 1.2

An executive office suite with many small 10x10 offices and few open common areas, medical offices or dormitories.

Building construction & finishes

Building construction is a factor that allows you to make adjustments depending on the type of materials that are impacted. It can increase the factor for higher-end finishes that are more complex to dry.

Standard: Factor 1.0

Standard Materials and Construction:

- Primarily carpet & pad over concrete or plywood subfloor
- Commercial glue down
- Single-layer drywall
- Little to no insulation in interior walls
- Wood or metal framing
- Painted walls on builder-grade wood or vinyl baseboards

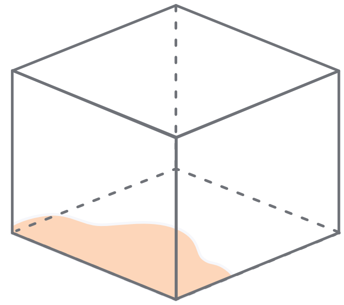
High-End/Complex: Factor 1.5

High-end materials & complex construction

- Extensive carpet over heavy pad
- Multiple layer or high-density wall assemblies
- Insulation or sound-deadening materials such as interior walls
- Fire-rated walls
- Complex assemblies such as multiple layer of flooring systems and chase walls
- Higher-end finishes such as vinyl wall coverings, architectural grade panelings, and wood trims

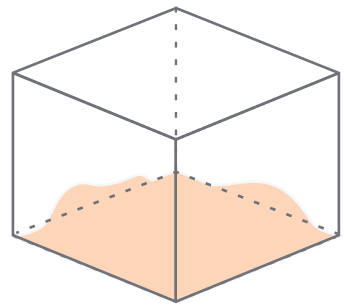
Class of water factor

Class 1: Factor 1.0



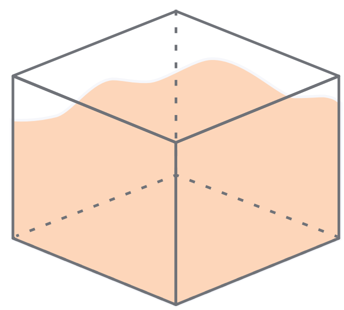
This class is defined as having 5% or less of the total square footage of all the surface areas of the walls, ceilings and floors.

Class 2: Factor 1.5



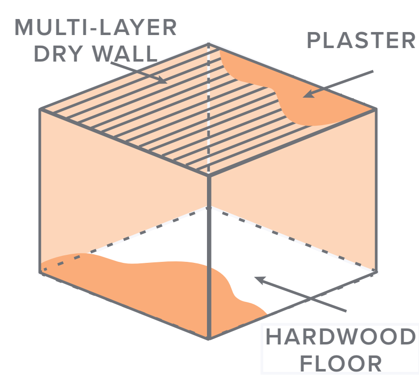
This class is defined as having more than 5% to 40% of the total square footage of all the surface areas of the walls, ceilings and floors.

Class 3: Factor 2.0



This class is defined as having 40% or more of the total square footage of all the surface areas of the walls, ceilings and floors.

Class 4: Factor 2.5



This class is unique in that it focuses on complex assemblies and harder-to-dry materials. Examples of complex assemblies are multiple layers of drywall, multiple layers of flooring or sub-floors or multiple layers of drywall. Some harder-to-dry materials include plaster, concrete, hardwood floors, ceramic tile, and brick veneer.

HVAC impact

The Heating and Ventilation & Air Conditioning system is considered the lungs of the building and can adversely move moisture to areas of the structure that you do not want the moisture to go to.

The HVAC system can change from being beneficial to non-beneficial during a project. You should note how it is helping, any risks associated with using the system, and if the system becomes non-beneficial at a later point.

Beneficial: Factor 1.0

Is the HVAC system present, operable, and will help maintain conditions favorable to the drying process?

Non-Beneficial: Factor 1.3

The system is not present or does not operate and/or will not assist in maintaining conditions favorable to the drying process.

Prevailing weather

Prevailing weather is the impact of the weather during the restorative drying project and not seasonal climate conditions.

These can fluctuate during the week from day-to-day and even change throughout the day. This can have a big impact on your structural drying projects.

For the purposes of this book, we have:

- Favorable: anticipated to aid drying
- Neutral: anticipated to have minimal impact on drying
- Unfavorable: anticipated to hinder drying

The IICRC lists examples of Favorable, Neutral or Unfavorable weather conditions—however, I would argue that in the real world, if you choose a closed drying system, which means a system where you are not using the exterior environment to assist you with drying, you should consider your answer to this question carefully. If the outdoor environment has a vapor pressure higher than .2” Hg or lower vapor pressure than .2” Hg, you should consider it unfavorable weather because moisture is being forced into the structure or pulled out to the exterior walls away from your goal of moving the moisture to the dehumidifier. If the vapor pressure is between the 2” Hg up or down of your vapor pressure of a drying system, you should consider it favorable.

The next factor tied into this calculation is determining the building envelope’s ability to keep the outside conditions from adversely influencing the drying environment. We do not just focus on the actual construction of the building’s envelope but also the occupant’s impact on the structure.

- Tight: drying conditions can be controlled without significant influence by the outdoors
- Moderate: drying conditions will be influenced somewhat by the outdoors
- Loose: drying conditions will be significantly influenced by the outdoors

Weather Impact Factor		Prevailing Weather Conditions		
		Favorable	Neutral	Unfavorable
Tightness of Building Envelope	Tight	1.0	1.0	1.2
	Moderate	0.9	1.1	1.4
	Loose	0.8	1.2	1.6

Enter Weather Impact Factor here:

The S500 lists some considerations to determine tight, moderate, or loose:

- Number of occupants and tradespeople on-site - opening doors and windows during the project.
- Damage to the building's envelope
- General construction of the building. Older buildings have less vapor barriers, insulation, and older materials
- Outdoor wind speed

It is important to recognize that extreme temperatures can create dramatic differences in vapor pressure. **This vapor pressure differential during extreme temperature differences will contribute to the ineffectiveness of your drying setup and can potentially impact the building envelope's effectiveness rating.**

An example of this situation is when you have a closed drying system where your objective is to drive the water vapor into the air and remove it from the air by the dehumidifier. However, in extremely cold climates you can get really low vapor pressure. This low vapor pressure causes moisture to move toward it through the walls and attempt to escape.

This situation can cause condensation deeper inside the building assembly. We assume that the water vapor will go where you want it to, but the reality is it will go to where the lower vapor pressure exists in leaks and poorly sealed buildings.

All of these conditions are placed on a weather impact chart where they have varying degrees of impact to the drying calculation.

Why use the detailed dehumidifier calculation versus the simple calculation?

Compared to the simple dehumidification calculation, the detailed dehumidification calculation delivers a higher degree of accuracy for sizing the job and provides a wider range of options.

Direct comparison

Let’s look at the simple calculation versus the detailed calculation with a class 3 loss that has very favorable conditions applied to it and very unfavorable conditions applied to it. We are going to look at the two extremes and how they compare to each other.

Table

Cubic Footage	Factor	AHAM Pints
7,000	40	175

7,000 Cu Ft / 40 = 175 Pints

Unfavorable Weather and Building Conditions

Cubic Footage	Factor	AHAM Pints
7,000	70	100
Factors		
Building Density	Average 1.0x	= 100 Pints
Building Materials	High end = 1.5x	= 150 Pints
Class of Loss	Class 3 = 2.0x	= 300 Pints
HVAC Beneficial	Not Helping = 1.3x	= 390 Pints
Prevailing Weather	Not Favorable & Moderate Tightness = 1.4x	=546 Pints

Favorable Weather and Building Conditions

Cubic Footage	Factor	AHAM Pints
7,000	70	100
Factors		
Building Density	Average 1.0x	= 100 Pints
Building Materials	High end = 1.0x	= 100 Pints
Class of Loss	Class 3 = 2.0x	= 200 Pints
HVAC Beneficial	Helping = 1.0x	= 200 Pints
Prevailing Weather	Favorable & Loose = 0.8x	=160 Pints

Direct comparison of the different methods

Simple Dehumidification Calculation	Detailed Dehumidifier Calculation - Unfavorable	Detailed Dehumidifier Calculation - Favorable
1.4 Units = 2 Units	4.37 Units = 5 Units	1.28 Units = 2 Units

If we used the simple dehumidifier calculation in these scenarios, we would at best, have a calculation that would slightly overcompensate for the ideal conditions, and we would be dramatically undersized if the conditions were anything other than ideal.

As a matter of fact, we would be 2.5 times undersized if the conditions were unfavorable. This would result in increased drying time and potentially hazardous atmospheric conditions in the structure, resulting in secondary damage and potentially not enough vapor pressure differential to properly dry the structural materials.

Personally, I am a fan of the detailed calculation as it provides a more accurate starting point and context for determining how much equipment you need. It is also a repeatable process that can be used on every job, and will help you and your team justify your drying plan if your work is reviewed.

At Encircle, we made it simple to use the detailed calculation built into Encircle Hydro. This is a major time saver for restorers in determining the proper initial dehumidification point.

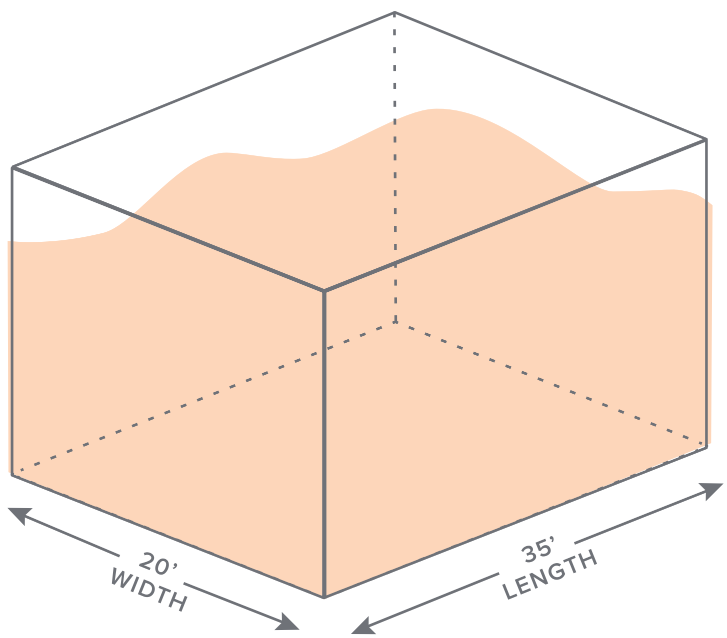
Air Mover Calculations

Air movement is a crucial part of the constant rate phase of the drying project. Calculating the correct amount of equipment is critical to ensuring your projects dry as quickly as possible.

The longer it takes for you to remove the free water from low evaporative materials and assemblies, the harder it is to move abnormal amounts of bound water to the surface of the material. Time is of the essence therefore the faster and more accurately you can get your equipment placed, you'll effectively reduce the time it takes to dry the project compared to taking your time or under-sizing your equipment. Follow these simple steps to determine the appropriate amount of air movers.

Step 1: 1 air mover for each room.
Step 2: 1 air mover for every 50-70 SF (4.5-6.5 M2) of affected floors and walls up to approximately 2ft. (60 cm).
Step 3: 1 air mover for every 100-150 SF (9.3-14 M2) of affected wet ceilings and walls above 2ft (60 cm).
Step 4: 1 air mover for each wall inset and offset greater than 18" (45 cm).
Step 5: 1 air mover for each obstruction.

Note: air movers are a part of the S500 Standard, however these become a general guideline as to how many are required, depending on whether the materials are in place or not, and the size of the obstructions (you may need more). Use your judgment on if more or less air movement is warranted. These are starting point numbers and adjustments need to be made from there. We will assume that the affected areas are a regular rectangle with our previous example of 700 SF(65 m²).



35’x 20’ = 700 SQUARE FEET

We must first calculate the square footage of your drying chamber.

Square Footage Calculation = Length x Width
20ft (6.1m)x 35 ft (10.6m)= 700 ft (65m^2)

We will continue with the class 3 loss. In this example, we have 550 ft of wet and affected walls over 2 feet, and all of the 700 SF of the floor is wet. There are no obstructions and no offsets or insets.

The following is how you would figure out the calculation.

Air Mover Addition Rules	Air Movers	Total Air Movers
New Room	+1 Air Mover	1 Air Mover
50-70 SF of floor and wall to 2 feet up.	700/50 = 14 (Maximum) 700/70 = 10 (Minimum)	15 Air Movers or 11 Air Movers
100-150 SF of wet wall or ceiling over 2 feet	550/100 = 5.5 = round to 6 550/150 = 3.6 = round to 4	21 Air Movers or 15 Air Movers
Offsets or insets	0	
Obstructions	0	
Total Air Movers Required		Maximum 21 Minimum 15

In circumstances where water migration has primarily affected lower wall sections and limited flooring (e.g., less than 2 feet or 60 cm of migration out into the room or area), install a total of one air mover for each 14 affected linear feet of wall. This calculation is independent of the above SF calculation and is not meant to be used in the same room or area that the square footage calculation is used.

In small rooms (e.g., closets, pantries under ~25 SF or 2.3 M2), a single air mover may be adequate, especially if upper walls and ceilings are unaffected. However, when any calculation for a room or space results in a fraction, the indicated number of air movers should be rounded up.

Here is the important part of this exercise—it is a guideline. You can decide to install additional air movers or even decrease the air mover count due to other factors. For example, the job site may have power limitations, and you may choose to reduce the number of air movers in exchange for other drying equipment.

The decision to deviate from the standards is up to you; however, the decision must be based on knowledge from determining if that deviation will assist with your drying strategy or not. Before departing from the stand of care, document the reasons for the deviation and notify all materially interested parties. It should be noted that a lack of power is not an excuse to not have the equipment required to complete the job properly. Electricians can typically increase the power supply to that area by expanding the power within the building or tapping into an existing feed. Supplemental power in the form of generators may be required if the structure does not have the necessary power from the incoming feed.

CHAPTER EIGHT

PERFORMING RESTORATIVE ACTIONS AND PLACING YOUR EQUIPMENT

TABLE OF CONTENTS

Regardless of the category of water, you're going to have an order of operations or a methodology of things you will want to follow to execute the job properly in the field. All too often, I see restorers dragging their equipment into the structure as the truck arrives. I am GUILTY of doing it myself, but following an order of operations for handling claims can prevent simple mistakes that will cost you a lot of money. To drive efficiency in your day-to-day operations, you should follow repeatable processes that will keep your team running like a well-oiled machine. When you arrive on-site and have fully documented the loss, you are now ready to begin mitigating the safety concerns.

Hazardous material survey

This might not necessarily be done at this point, but you should determine if there is a potential for hazardous materials to be present on the job site. Some key triggers for you to determine if the structure has a potential hazard is to run through structure-related questions:

- Is the structure older than 1990 (asbestos) or 1978 (lead)?
- Has the structure had previous water damage (mold)?
- Does the structure have lathe and plaster or concrete that needs to be removed (silica)?

There is even silica that can be found in joint compounds and drywall that might be a concern. OSHA is taking a much harder look at containment and protecting workers from silica, which should be on every restorer’s radar.

Conducting these surveys and waiting for the results may slow the progress of your claim, but it is necessary. In the meantime, it will give you time to handle the contents.

Be prepared to deal with high-value contents

Identify the sentimental, high-value monetary items, and save them first. Although restoring the structure fast is critical to a successful job, **the key to winning the customers' trust, loyalty, and business sits in the things they care most for: their possessions.**

Make sure every person has a chance to tell you what they want saved, why, and the value of it to them. This will allow you to help justify the rush service costs and the actions required to mitigate damages to those items.

Bulk water extraction

The next thing you will want to do is remove the standing water.

> **Remember, if you extract the water from the site using a mechanical extractor, it is 800 times more efficient than drying.**

Now you have a damp environment where you can place your dehumidifiers and start removing the water vapor from the air. This allows you to begin controlling the humidity levels.

Content packout & manipulation

You may have contents that need to be packed up and moved out of the way. The best thing you can do for your employees is to ensure that it is comfortable and safe to work around the equipment. Too many pieces of equipment can lead to trip and fall hazards. You'll want to be able to move the big contents out first and then the smaller contents.

The common complaint we hear is that the structural drying team needs to rush so the contents team can packout. While this seems appropriate, I believe this is a restorer's worst move. We focus a lot of training on drying structures and not a lot of training on creating a successful job. Remember, very few people are sentimentally attached to their carpet and drywall, but they are attached to the things that fill their homes. If you rush through handling the contents that are important to a customer, you are missing golden opportunities to deliver amazing customer service.

However, if you need to respond faster to the structure, you may want to attempt a rapid room-to-room packout approach. Apply more resources to a room to get the contents out, and the mitigation team can begin their process of inspecting and documenting the moisture.

The contents team can then proceed ahead of the mitigation team to the next room to pack it out. This process is scalable, so if you have two or three mini-teams, you can packout rooms quickly. However, the expectation that you can be as fast or faster than the mitigation team is unrealistic. This is where your mitigation team can start moving boxes to storage areas or the moving truck to assist with the process.

Restorers' liability is largely contained to the contents of the home, so rushing contents to dry a structure, although beneficial to the job, puts you at a higher risk of losing money, increasing customer complaints, and damaging the items that are most important to the customer. Failing to move quickly on the structure may mean that porous materials like drywall and carpet may become non-restorable, but the impact to the customer is not as emotionally devastating.

This is not a hard and fast rule. Instead, it is meant to change your perspective on handling situations differently. If you work hard to find speed and efficiency on the job, the packout and contents handling will always be a slower process but an important part of a successful job.

In cases where the contents can be dried in place, the contents team may only be securing items like paintings, pictures and loose items on counters. Their job is to reposition the contents to allow for the drying of the structure and contents.

Additional extraction

Once the rooms are free of contents or the contents have been largely moved out of the way, you can perform any deep extraction or bulk removal of water from the environment. Depending on your extraction equipment, you may also need to perform extraction after removing the carpets and pad. Wand extraction is only about 20% effective at removing the moisture from carpets and pads, while the Hydro-X and Extreme Xtractor (ride-on system) are approximately 85% effective.

Controlled material removal

Once you have decided that materials are either non-restorable or need to be removed to assist with the drying of the structure, you can now start removing materials.

If you have hazardous testing outstanding, you will still be able to perform controlled material removal on items like the carpet and pad, and potentially the trims and other non-hazardous materials. In some cases, it may even make sense to perform a three-step bio-wash (flushing with clean water, extraction, and antimicrobial application) on the affected flooring, even if you're unable to remove and clean the walls to reduce the hazardous conditions of the job site.

Reducing the possibility of cross-contamination by reducing the organic levels in the structure would be more than justified if you had a delay due to asbestos testing or other analysis coming from a lab.

Placing your restoration equipment

It's Tiiiimmmmmmmeeeeeee! (As Bruce Buffer would say). This is the most enjoyable part of the job: setting up your drying strategy. This is when you get to put your expensive drying equipment into action and apply your drying knowledge to the structure.

Here is the crazy part:

> At this point, it's not about going into your truck and trying to figure out what you're going to need. You should already know what is happening on the job, what the risks are, and how the vapor pressure differentials are working either for or against

you. You've also sized the job. Now you just need to grab the equipment and strategically place it on the job site. You feel empowered at this point if you've done your prep work.

Dehumidifiers

A simplistic approach would be to place two dehumidifiers at opposite ends of the room with their exhaust vents pointed into the airflow of the air movers. The next day in your inspection, you may want to shift the exhaust of the dehumidifier to a different part of the airflow. These small changes can have a big impact on your drying progress. You may choose to move your dehumidifier exhaust closer to harder to dry materials to try and increase the vapor pressure differential on the problem areas.

If you had the same loss with a class 4 (difficult to dry materials or multiple layers of subfloor), you may want to install dehumidifiers above the loss site. If possible, put dehumidification and air movers below the floor so that you could effectively "sandwich" dry the layer. Remember, if you apply heat and create a drying force, the unaffected space below might also be a pathway that the moisture will want to go. Even though the material you are drying is moving toward the dry standard, the conditions of the other room may be adversely affected by your strategy.

Air movers

Your air movers should be placed in a clockwise pattern around the room, with the unit being placed between 2” and 6” from the wall at a 5° - 45° degree angle, evenly spaced out. **Shift them a couple feet every day to ensure the required air velocity is moving over the surface of the materials.** Make adjustments to the setup, such as changing the angle of the air mover to the wall, the speed of the unit, or the number of units in the room.

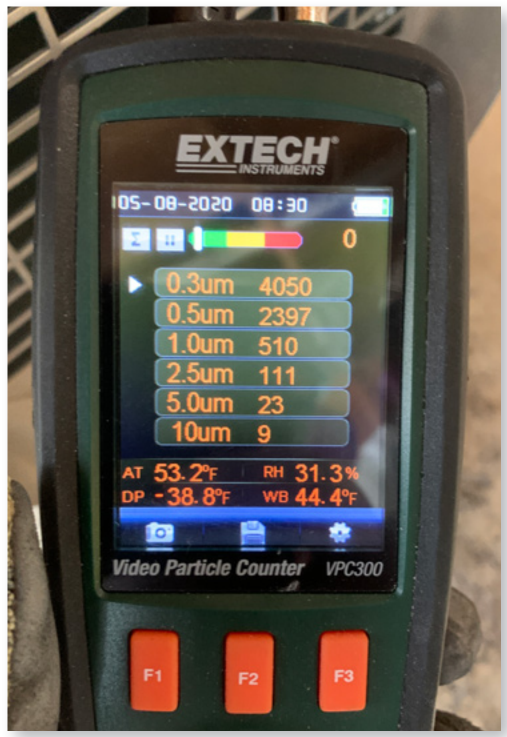
You may choose to reduce the airspeed in the falling rate phase of the process by removing units and running them on high or keep the air movers in place but reduce their velocity (turn them down to low). What option you choose will depend on the drying scenario and the materials you are drying.

Air scrubbers/air filtration devices(AFD)

Air filtration devices can play a big part in the restoration strategy by reducing airborne contaminants to maintain healthy air quality for occupants and workers. **It's recommended to install one or more air filtration devices regardless of the category of water if you can't adequately remove all particles and contaminants or if there are high-risk occupants.**

On Category 2 & 3 losses, it would be appropriate to have one or more AFD's placed along with dehumidifiers during the stabilization phase of the job. You would be justified in placing an AFD on any job where you have measured abnormal particulate counts of airborne contaminants. Pay close attention to fine particles 10um and smaller, which are respirable and ultrafine particles 2.5um and smaller as these can enter the bloodstream. Document the airborne conditions of the restoration site during all phases by measuring the particle count with a quality particle counter. You should also measure the processed air leaving all AFD's to filter the air as designed. Regular maintenance, including DOP testing of your equipment, is recommended as you need these records if you are challenged.

Unfilter Air



Filtered Air

Other equipment

In the past, this equipment may have been referred to as specialized equipment, but the reality is that "specialized equipment" are just tools that allow restorers to adapt and change the environment. They were considered specialized because of the knowledge required to use them effectively. However, as the tools become more mainstream, we use them under various scenarios to speed up the drying process or deal with challenging environments.

Tools like Injectidry® allow for installing injectors into the wall assemblies to either remove heat, add heat, or circulate the air. This is a way of preventing wetter air from condensing on exterior cooler surfaces or dry materials that have come into direct contact with the fluid from the intrusion or escape.

Adapters for the air movers that allow restorers to pressurize a cavity can be used in conjunction with the Injectidry® system or other similar systems.

Floor drying panels help draw the moisture out of hardwood floors and pull the hot, dry air under the wood floor to assist with the drying process.

Thermal air movers like the E-tes® system allow direct heat to be applied onto the surface of the material.

All of these systems have one thing in common. **They assist in increasing the vapor pressure of the material. Does this make sense now? Companies that make specialty equipment do so to create a vapor pressure differential. To do that, they are increasing the vapor pressures in the materials by transferring the heat.**

Phoenix Restoration Equipment has various heaters, including the Phoenix Firebird Compact 20 and the Dri-eaz Dragon 3600 Mobile Heater. Heating and cooling are critical to controlling the restoration environment and the unaffected area. Determining the proper BTU of heating and cooling is critical to ensuring that the environmental conditions do not get out of alignment with the drying plan. You can use thermostat-based switches to turn equipment on and off at the target temperature or target temperature ranges. They can be very helpful in controlling the temperature when you're not around to do it. Remote monitoring and equipment systems are still in their early adoption phase but some restorers are using the technology to manage the equipment remotely. We are seeing equipment manufacturers like Phoenix and Drieaz incorporate this capability into some of their new equipment offerings.

Equipment manufacturers serving this market produce drying equipment for all drying challenges, from basic to complex. It is at your discretion what tools to use for the job but keep in mind advancements in technology are allowing restorers to push the boundaries of the types of jobs they can successfully take on.

CHAPTER NINE

MANAGING CRITICAL ISSUES - THE L3CS

TABLE OF CONTENTS

Pages 53 - 55 of the *IICRC S500 V5 2021* discusses limitations, complexities, complications, and conflicts (L3Cs) in detail. For this book's purposes, we will summarize its points and explain how you can incorporate them into a plan.

Limitations

"A **limitation** is a restriction that can only be placed on the restorer by the property owner or an agent acting for the property owner. Examples of this would be a business partner, family member, or property manager. It is not the broker, adjuster, or TPA" (IICRC S500 V5 2021, 53).

An example of a limitation is when a restorer is told that they can only work after hours. Another limitation could be when the policyholders have limited funds or limited coverage, and the restorer must figure out a way to accommodate the restoration effort. The property owner may indicate that they want work done a certain way contrary to the standards. For instance, you may be asked to restore Category 3 water damage carpet. As a restorer, you must determine if those limitations are realistic and appropriate without increasing your liability.

Complexity

"A **complexity** is a condition or set of conditions that cause the project to become more difficult, although the project can still be completed. Examples of this are things like working with elevators, long passageways, or restricted spaces. This will delay the job, make it harder to do the work, although the work can still be completed. If you have to work around occupants in and around the work space, this may require additional safety precautions to be applied to the job, additional clean-up, and daily break down" (IICRC S500 V5, 2021, 53).

An example would be having limited power on the job site and requiring additional hook-ups or generators to power the equipment. Decisions can be made to reduce the equipment load, but you should consider if those choices will cause additional damages and increase the severity of the loss or if the drying strategy can be effective without the equipment.

Be sure to address complexities with all materially interested parties, explaining both the resulting costs and challenges.

Complications

"A **complication** is similar to a complexity, with the only difference being that it becomes apparent after the job has started. Complications can delay a job, require additional handling procedures, or increase the cost of the project" (IICRC S500 V5, 2021, 53-54).

Examples of complications are the location of mold, or hazardous materials such as lead, asbestos, or silica. Adverse weather could also affect your restoration efforts. Remember to address all unanticipated delays. If you have a job with rental equipment running, explain the ramifications of those delays and what it might mean to the total project costs so that decisions can be made at that time.

Complications should be explained to all materially interested parties, documented, and when required, a change order should be provided to indicate what has changed from the original scope and if it will add any additional costs and delays to the job.

Conflicts

"A **conflict** is resulting from a limitation, complexity or complication that leads to a disagreement between the parties involved in the restoration project" (IICRC S500 V5 2021, 54).

If you are asked to not follow the standard, you will have to determine your next course of action. You can:

- Stop working until a resolution has been reached
- Compromise—with sign-off of waivers and liability releases
- Decline the work

All of these options are at your discretion, and it is up to you to choose which one you feel most comfortable with before proceeding further.

Change Orders

Any significant changes to the scope of work should be documented with a change order.

The *ANSI/IICRC S500 V5 2021* defines a **change order** as; “a written document that specifies substantive changes in the scope of work, time frame, price, or method of payment, or other material provision of a contract” (IICRC S500 V5 2021, 104).

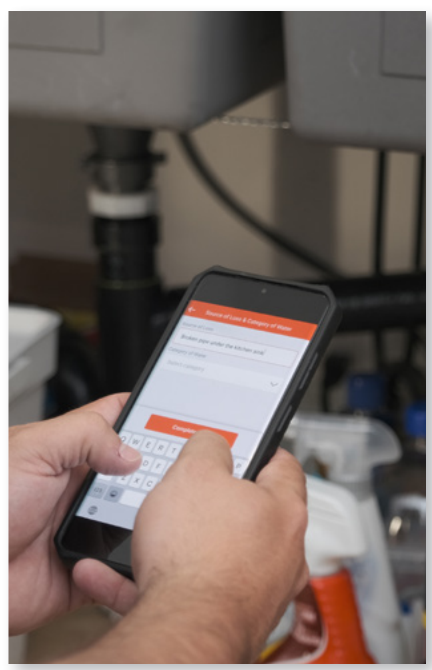
A common example of this in the restoration industry is replacing flooring. The client originally had carpet and pad, and the allowance provided by the insurance company covers the cost to replace the same. The client chooses ceramic tile instead, and the cost to install this product is $1500 more than the approved allowance. The restorer should complete a change order at this point, which includes a description of the changes, time for performance, price/fees, and payment method. **It’s recommended that the client or the client’s agent and the restorer accept the change order in writing and provide copies to all materially interested parties as soon as possible before the work begins. Protect yourself and your business.**

Communication

The biggest missed opportunity in the industry is how and when we communicate with the materially interested parties. I will write this in generalities and make a few assumptions based on my personal experience in the industry. So if this does not apply to you, count yourself as fortunate because it definitely applied to me. I had to learn the hard way that poor communication can cost you time, money, and relationships.

As an industry, we share the first responder mentality of rushing to help people when they are in need, which is very noble of us. That said, unlike emergency responders such as police, firefighters and paramedics, we do not normally write very good responder reports that detail the 5 W's and How:

- Who
- What
- When
- Where
- Why
- How



Professional restorers do not just dry the structures and restore contents; they are also responsible for documenting the water loss, pre-existing conditions, and the actions taken to restore the loss.

Restorers who document their losses proficiently and constantly communicate with the materially interested parties to set and maintain customer expectations, inherently get paid faster, reduce their litigation and file reviews, and increase their profitability.

By building a drying plan and sharing it with the customer, you lay out a professional plan that can be referred to for managing expectations and avoiding conflicts.

Building a drying plan

What is a drying plan? A drying plan is your strategy for restoring the building. This includes determining the impact on the materials within the structure and whether they need to be dried or removed. You might decide that due to the length of time it would add to the job to replace the materials, drying is more economical, reducing the impact on the customer.

You have to build your strategy for applying the proper drying techniques to the job site. Your plan is a set of drying goals and objectives that you will inspect and make adjustments to throughout the project. In his book, *Leadership in Restorative Drying,* Ken Larsen states that monitoring the job is an unfortunate term as it is a passive term, much like surveillance. He adds that restorers are involved in “inspection and

documentation" (Larsen, 416). I agree with Ken that the term inspection refers to inspecting, interpreting, modifying, and documenting the project.

A drying plan is only as good as your last set of readings.

You need to re-evaluate, determine your successes and failures, and adjust your plan accordingly. A true restorer uses the information provided to them to: assess, determine a path to a successful project, and change the environment, equipment, or strategy based on how the building is reacting to their drying strategy.

I can guarantee you that these changes become much smaller when you implement the suggestions within this book and fully assess your job at the beginning. When you follow it up with daily inspections and documentation, which is made easy with Encircle Hydro, your success will skyrocket. Having a repeatable process followed on every water loss will help you get closer to the most effective starting point to attack your job and help identify what is not working. **Repeatable processes will help drive profitability.**

Your drying strategy and plan should include:

- Cause of loss documentation
- Resulting damage to structural materials
- Resulting damage to contents
- Psychrometric readings
- Materials that are affected:
    - What materials are being removed in each room and why
    - What materials do you plan on saving and why
- Equipment calculations
- Performing restorative actions
- Actual equipment applied to the job:
    - Dehumidifiers & air movers
    - Other equipment required for the job
- Critical issues: limitations, complexities, complications and conflicts
- Communication with the materially interested parties

Being a professional restorer requires you to make serious determinations on how to dry a structure and protect the occupants from the risks associated with water damage claims. You're more valuable than just someone who places equipment and walks away. Your job is to take the proper actions on-site to remediate the loss according to the standard of care and to effectively apply your craft to the project at hand.

You can choose to be a power restorer with clearly established processes for effectively drying structures and documenting the job to defend your plan of action, or you can roll the dice on every job using assumptions and best guesses with little documentation to defend your position. The choice is yours, so with the processes clearly outlined in this book and Encircle Hydro, hopefully, we have made it easy for you to choose the power restorer path. The restoration industry is critical to the efficient operation of economies globally and should be given the respect it deserves.

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Scott McFadzen WLS, Principal Consultant & IICRC Instructor

With over 15 years of experience in the restoration and insurance industries, Kris is committed to driving Encircle's delivery of intuitive, easy-to-use solutions that improve productivity and profitability. Kris currently sits on the RIA's Restoration Council, Canadian Education Committee, and is the Chairman of the Estimating Committee.

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