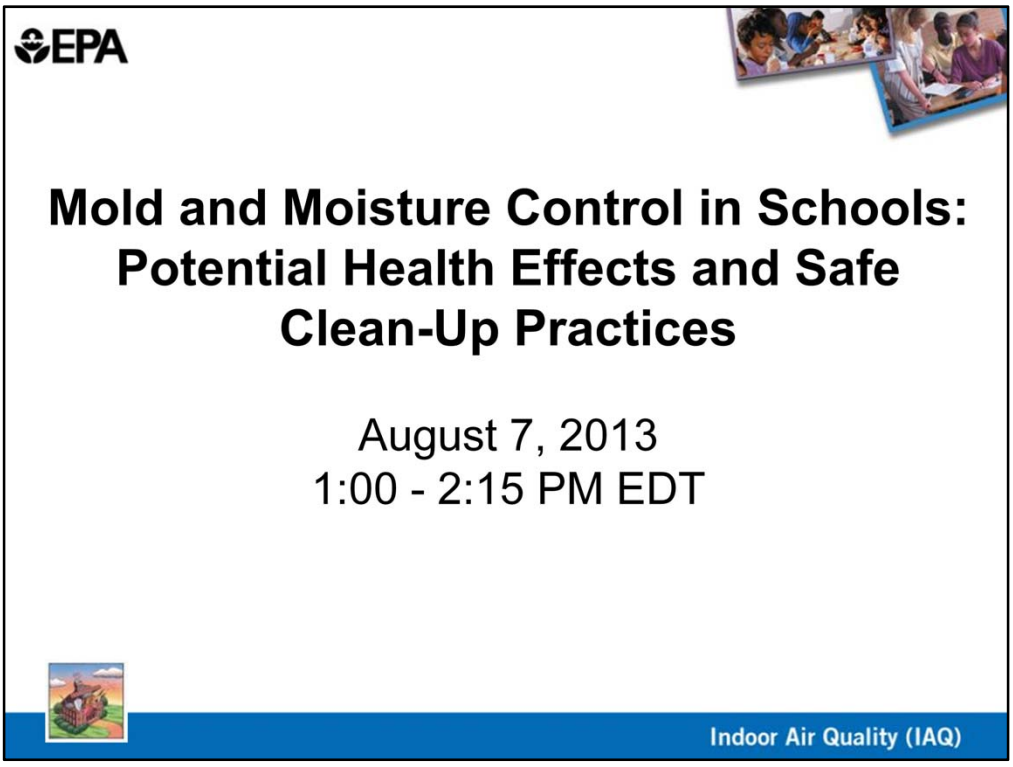
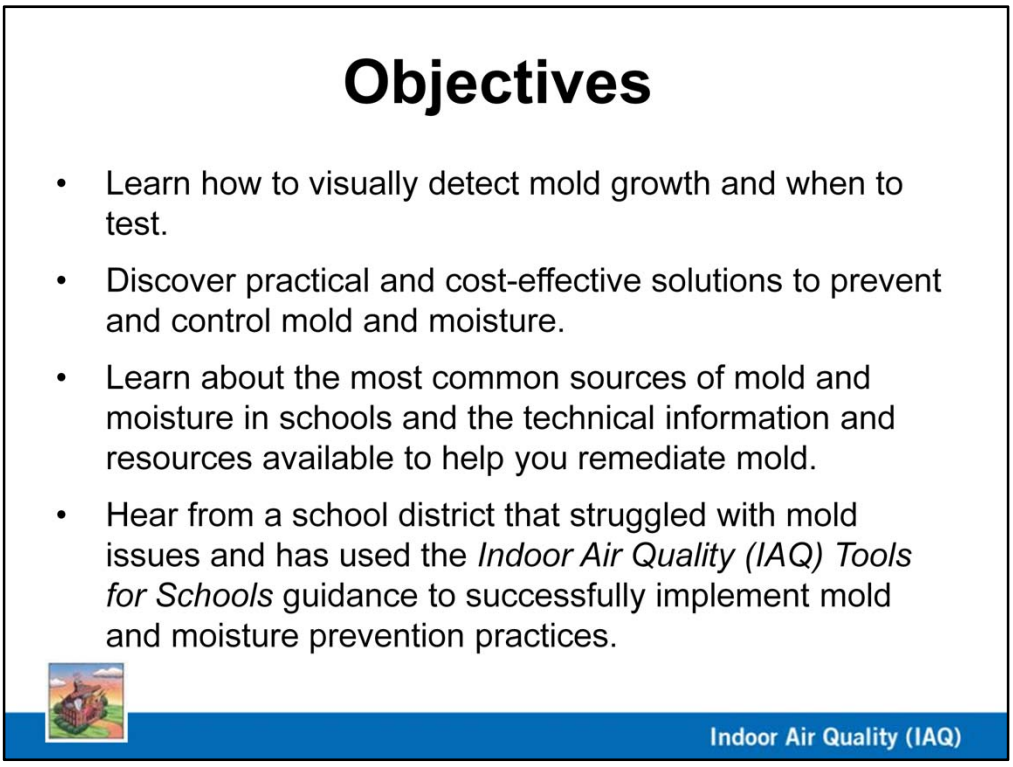


Jennifer Lemon:
Hi, good afternoon, good morning everybody! Thanks for attending our Mold and Moisture Control in Schools webinar. We have about an hour and fifteen minutes to learn all we can about mold. We're calling this kind of a "mold 101" webinar.



Jennifer Lemon:
We're going to address a couple of things: We have some great speakers on the line to provide some great expert knowledge about this issue, and we're going to give you some cost-effective solutions for how to find mold, detect it, and prevent moisture control, which is mainly the cause of mold, anyway. And we're going to hear from a great school district from Maine later on, about a successful mold strategy and how she used it in her district. And I definitely want to thank her very much, because she's doing this on her vacation time and giving us an hour and fifteen minutes.

Introductions

Facilitator:
Jennifer Lemon
Indoor Environments Division
U.S. Environmental Protection Agency, Washington, D.C.
Lemon.jennifer@epa.gov

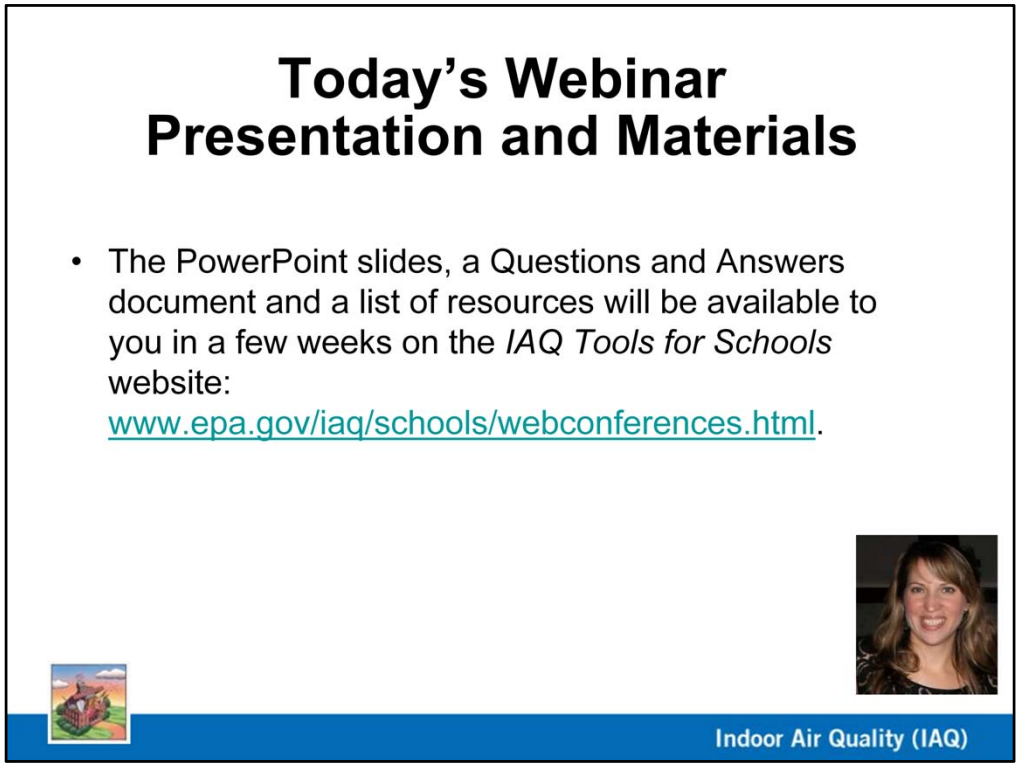
Speakers:
Steven Caulfield
Senior Vice President, Turner Building Science and Design, and President of the Maine Indoor Air Quality Council
Harrison, Maine
scaulfield@turnerbuildingscience.com

Alyce Swan
Facilities Supervisor, Maine Regional School Unit 21
Kennebunk, Maine aswan@rsu21.net

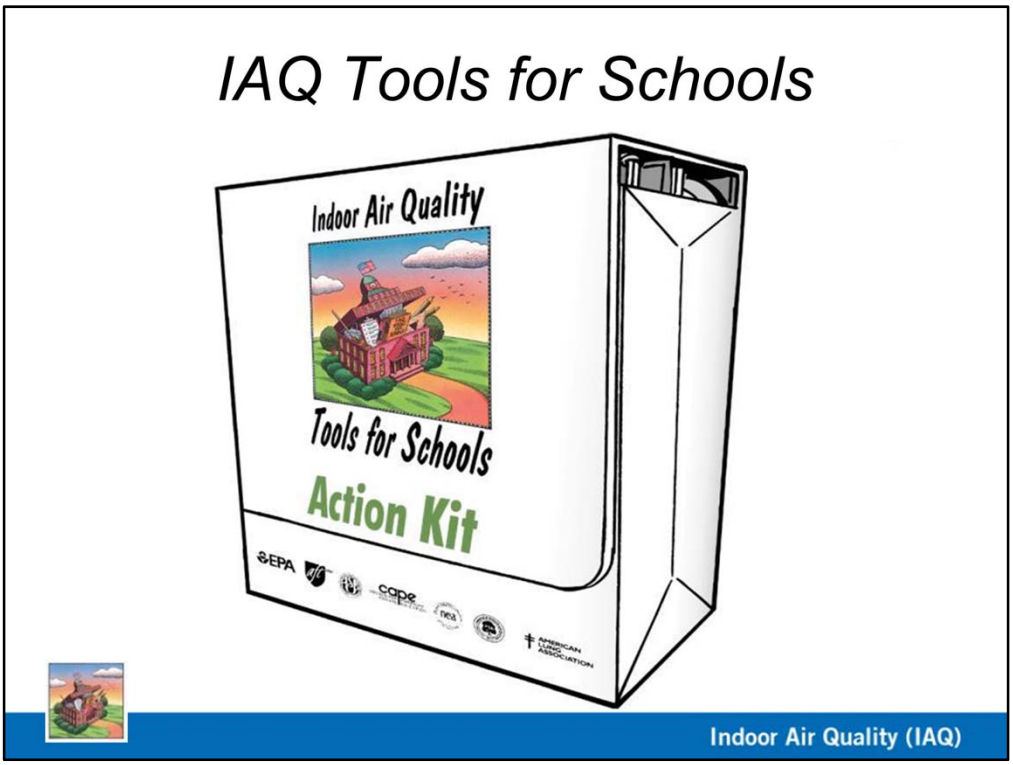
Indoor Air Quality (IAQ)

Jennifer Lemon:

I, again, am Jennifer Lemon. I am going to be your facilitator for today, and you are lucky enough to be able to hear from Steven Caulfield, with Turner Building Science & Design. And later on, like I said, you will hear from the school district facility supervisor, Alyce Swan, with Maine Regional Unit School District 21. She will provide her successful story later on in the presentation.

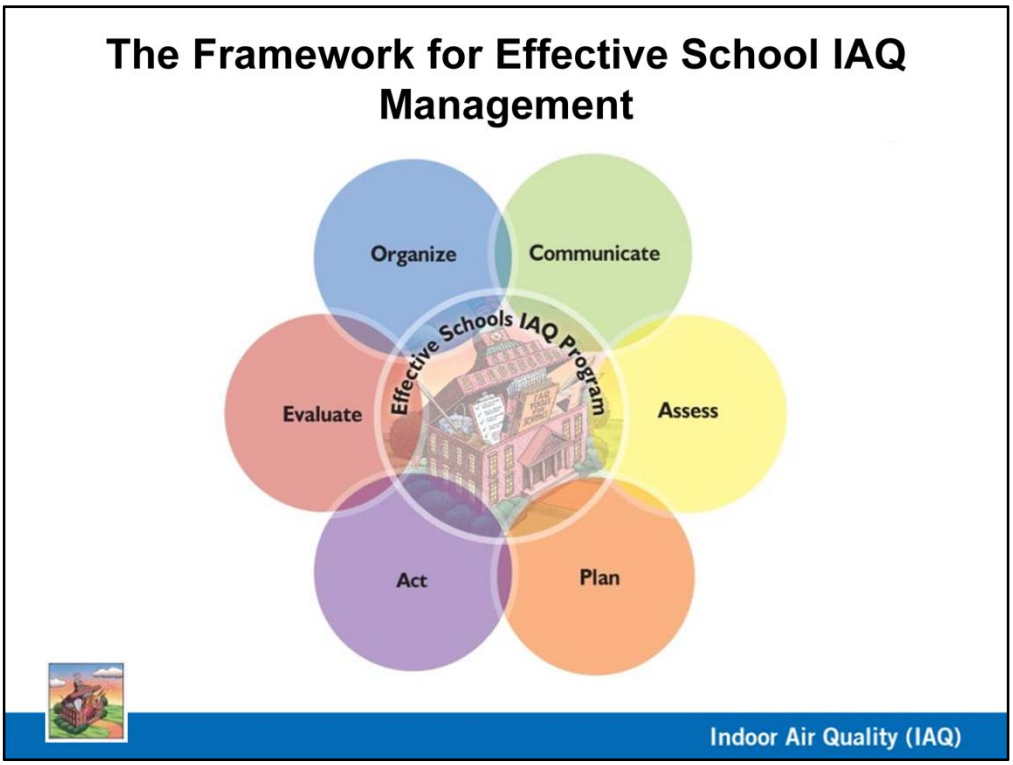


Jennifer Lemon:
I just want to let you know that we will provide you this webinar in our archive, and you'll be able to access it online in a couple of weeks. We'll send you an email on how you can access the slides, review the question and answer document and be able to have access to the presentation for future use and pass on to your colleagues, if that's helpful.



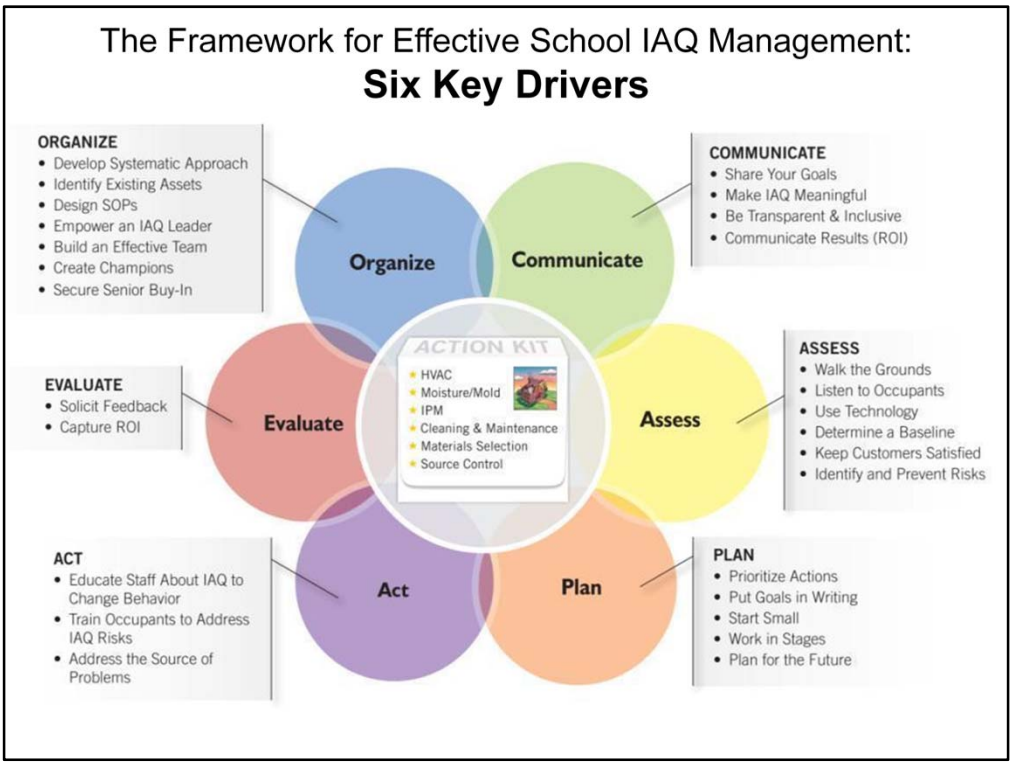
Jennifer Lemon:
So, I am going to ground you just where we are with *IAQ Tools for Schools* briefly, before we jump into the meat of the presentation. This Action Kit is probably very familiar to a lot of you, with the corner stone of our guidance. The *IAQ Tools for School* program began back in 1995 and the Kit has been a wonderful resource for us to pass on our information about all issues regarding indoor environmental health. The Kit we use a lot is an evolving resource and it's a strong foundational element of our program. We have checklists in there; it provides policies best practices and plans to help schools and school districts take immediate action. There's also an online version that you can access that's interactive, and we do have checklists inside that can be transferred to your needs in your school district. We are very excited to have this for such a long time and it is something that's really helped us implement IAQ management effectively in tens of thousands of schools nationwide.

http://www.epa.gov/iaq/schools/actionkit_text.html



Jennifer Lemon:
This is our framework for effective IAQ tools or IAQ management. We organize the Framework to help kind of place the vocabulary or, you know, 'common language' around the drivers of an IAQ program. I refer to this as the life cycle of IAQ management, since it offers proven strategies, helps with organizational approaches and provides the fundamental effectiveness to a program. This is something we use a lot to guide schools on how to start a program, and it's something that you continually do in all aspects of sustaining an IAQ management program. So, it's a very flexible, adaptable structure and sometimes schools have used it to initiate other programs not affiliated with IAQ, but it helps them sustain other environmental health issue programs.

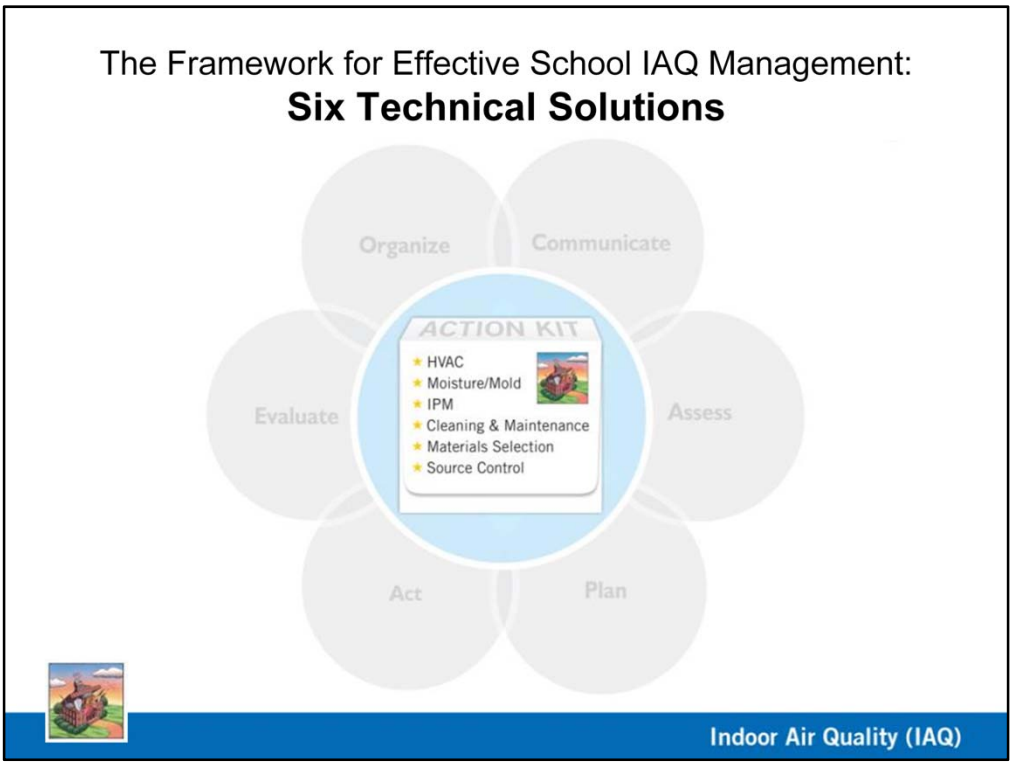
http://www.epa.gov/iaq/schools/excellence.html



Jennifer Lemon:
So please don't be frightened by all the words – I know this is a lot of information, but these are what we found to be the six Key Drivers. And we talk about these under a sort of a cycle, like I say, for me, it's like a life cycle and it talks about continuous assessment, planning, action and evaluation. And these six Key Drivers work together to deliver effective school IAQ management, as you can see, as you follow the wheel of colors.

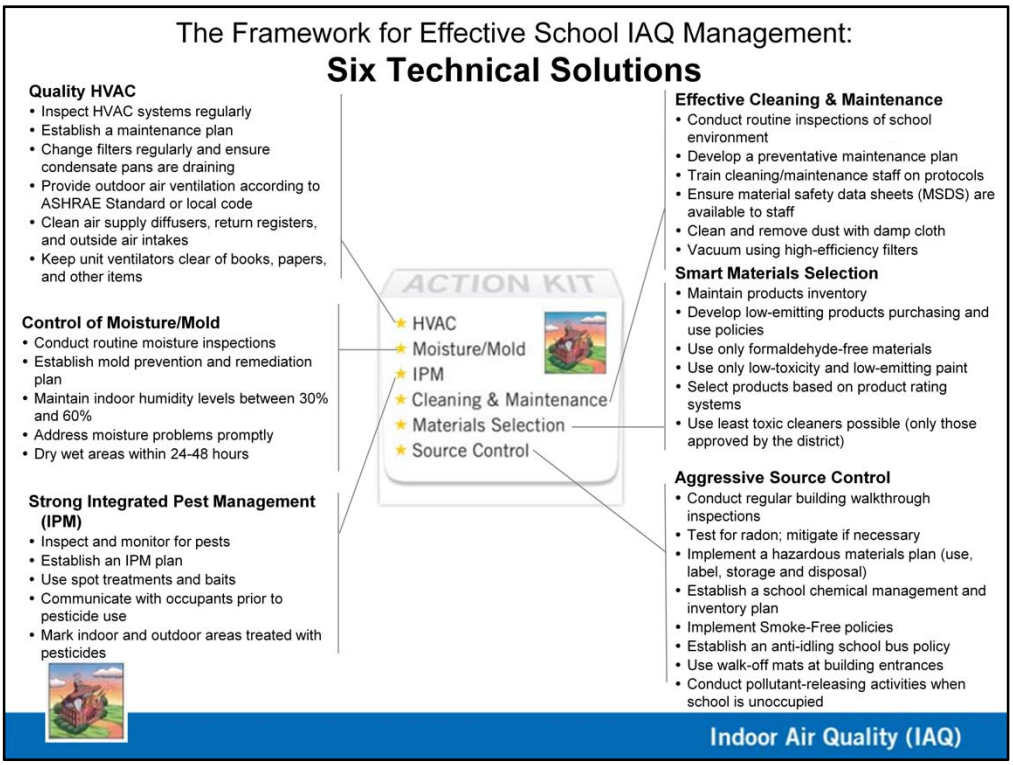
Organize your program; communicate with everyone all at once; assess your score with IAQ environment and how occupants are doing and how occupants are doing continuously; plan your short and long-term actions based on assessments and other important factors; act to solve or prevent IAQ problems addressing structural, institutional and behavioral issues; and evaluate your results all the time. Alyce, who you'll be hearing from shortly, will describe how – in this factor, using this manner – how she addressed mold in her program in Maine, in her school, using these Key Drivers.

http://www.epa.gov/iaq/schools/starting.html



Jennifer Lemon:
So, breaking it all down, we're talking about the six Technical Solutions. And, as you can see, mold and moisture is definitely one of them. And so when you address all these systematically and aggressively for an IAQ program, we're going to focus altogether on how to deliver a healthier school environment.

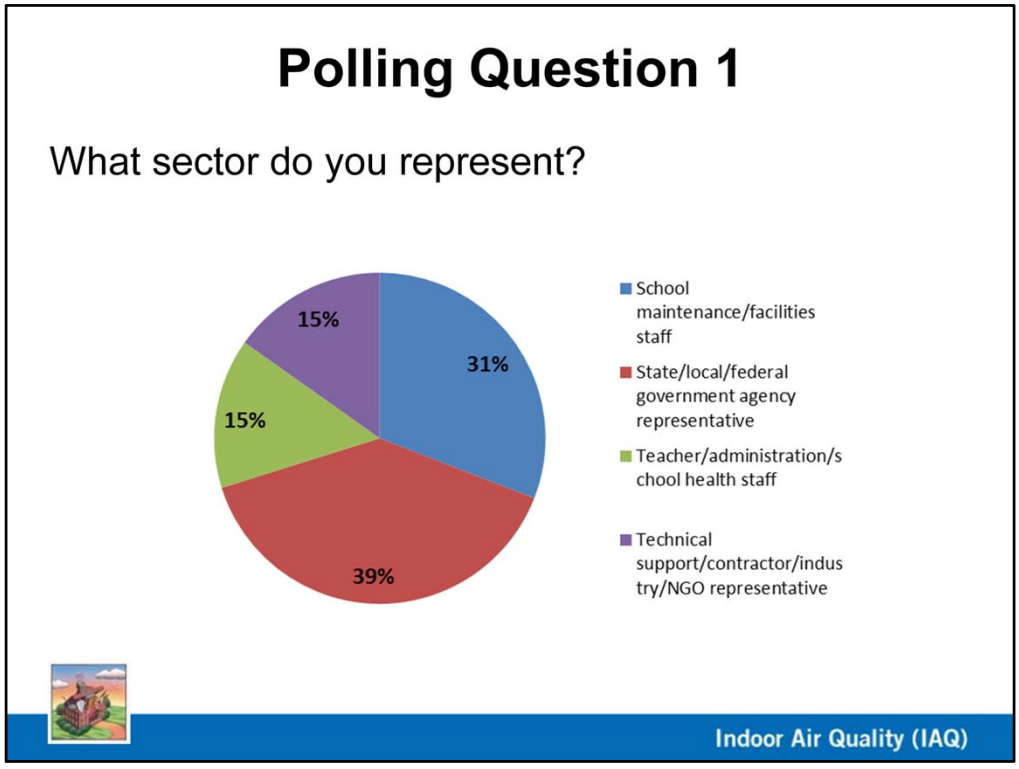
http://www.epa.gov/iaq/schools/technicalsolutions.html



Jennifer Lemon:
As you can see, with the six Technical Solutions, there's great information that feeds into a comprehensive IAQ management program. We certainly want to ensure quality inspection operation and maintenance of your HVAC system. You want to actively, aggressively control mold and moisture, which hopefully this presentation will help you do or sustain a program area in place.

You want strong Integrated Pest Management; effective consistent cleaning and maintenance activities; smart, low admitting, low toxicity material selection; aggressive source control for our example, and to either link school bus policies right on testing or proactively managing your schools chemical inventory. http://www.epa.gov/iaq/schools/technicalsolutions.html

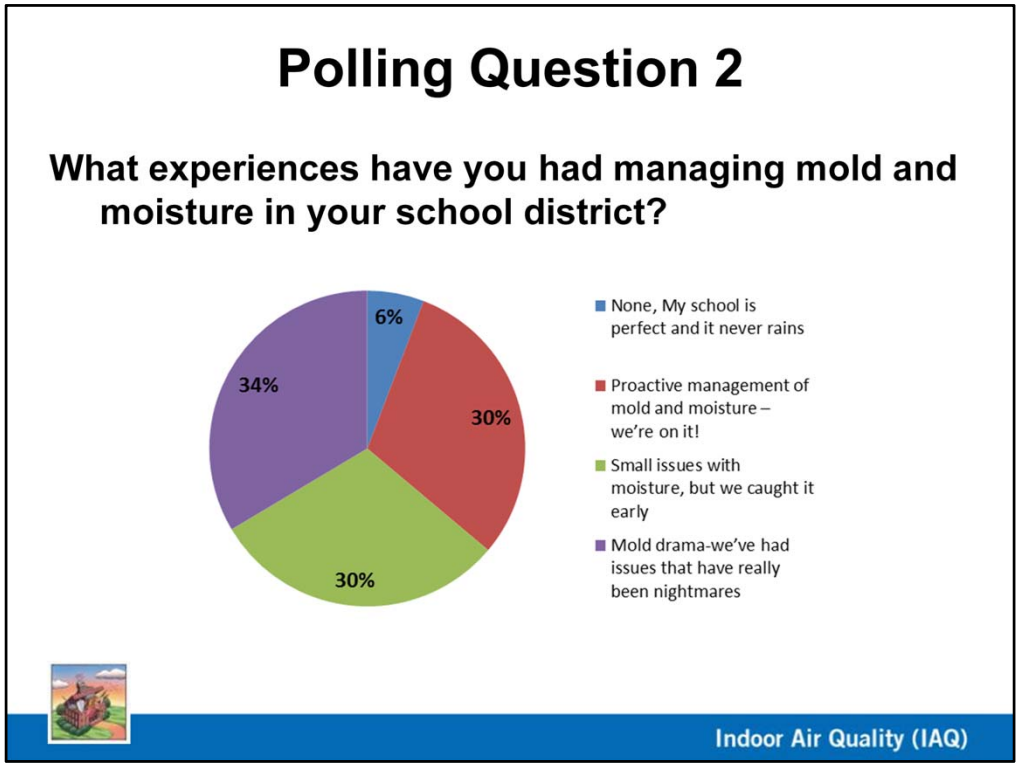
So now that I've sort of laid the foundation of where we're coming from, from EPA perspective regarding a comprehensive IAQ management program, I want to just get a quick idea of who is participating on this webinar and this will probably help our speakers to speak to different types of people who are involved in a comprehensive IAQ management program. If you could go ahead, we're going to open the poll and if you could vote real quickly.



Jennifer Lemon:
Okay, great, so we have a good representation of state and local federal government, with the close second being school maintenance and facility staff.

So, this doesn't say that you know one's better than the other; we really appreciate and see that all of these people all work toward making a successful IAQ management program. But it looks like we do have slightly more of the federal, state and local participation.

I am going to open up one more poll, and this is just going to give us a clearer understanding of what type of experiences you have had managing moisture control in your school. It might be hard to really answer this question. But maybe think about if you've been working with other districts and how you've implemented types of programs.



Jennifer Lemon:
Thanks everybody. So, great, this is kind of what I thought we would see as a result. I am sorry to hear that some of you have had a little more drama than you probably wanted. Not hopefully something that ended up on the front page of your local newspaper, but this will be a great opportunity for you to hear some strategies. You're going to have access to experts that you can ask questions to and also speak directly to a school district that's experienced this type of thing.

Now, one other thing I'd like to point out is we're going to do something a little bit different during this webinar. Through the chat function, as we go through specific resources in the slide that speak more specifically to the guidance that we have offered, we're going to place some information in the chat function that you can copy and paste, or directly click on right then and there to access our mold guidance to access some reports that we'll be speaking about. You don't have to feel very rushed on trying to make sure that you got everything down on the slide, even though we are going to provide this information later.

And I am going to allow you to copy and paste it to your own personal Word document to be able to access this information after the webinar is concluded. So, just wanted to let you know that that will be going on in the side chat function, and then you'll have the option to copy and paste it.

Jennifer Lemon:
So, without further ado, I am going to go ahead and pass it on to Steven Caulfield, and he is going to delve into the world of mold and moisture control. Take it away, Steven.

Steven Caulfield:
Thank you. Well, good morning or good afternoon to all of you. I am Steven Caulfield, with Turner Building Science & Design. I am also currently the President of the Maine Indoor Air Quality Council, and I've been looking at their mold and moisture issues for about 20 years – some good, some bad. So, we'll get right into it.

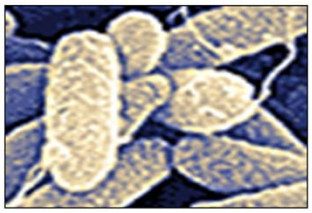
Steven Caulfield:

Okay, so, today, as Jennifer said earlier, we will talk about the basics of mold and moisture. I've given this presentation before and tried to go through the whole gamut of issues associated with mold and moisture, and it's become too much to fit into one hour. So, we do have another webinar scheduled in November, and I am sure the folks from EPA will be giving you more information about that as the time comes closer. But for today, we want to talk about the basics with mold growth and moisture in school buildings and give you some background in mold and moisture, so that you can start to understand, and maybe proactively solve, some of these problems.

Steven Caulfield:
So, we'll start with the health effects, because I think that's why we're all concerned about mold in buildings. The issue is not necessarily one of specific types of mold, but more the fact that any large exposures to mold can affect some of the people in your buildings. Some of the molds are more likely to affect more people in buildings, but if there is a large source of mold there is likely to be a health response, and I'll preface this by saying that I am not a doctor, so don't take medical advice from me.

Repeated exposure to lots of mold is not healthy, may be hazardous.

- ACGIH Guidelines:
  - – Allergic / Asthma
  - – Irritants / Toxins
  - – Opportunistic Pathogens



Steven Caulfield:
But what we see in the literature is that the majority of symptoms associated with mold exposure tend to be of the allergic, asthmatic, respiratory type responses, not the things at the bottom of the list – exposure to toxins or pathogens – that are causing serious disease now. Some of you may be thinking, 'but that's what we hear about in the news.' Well, we hear about it in the news because it's the outlier. Most of the exposures result in people having responses that could be indicated by other contaminants in the building or anywhere, and have breathing difficulties, asthmatic symptoms, skin irritation, nose, throat, and eye irritation, those types of things.

So, that's the majority of health effects that are seen with most of the mold exposure in buildings. So it's not a real definite signal that you have mold because other things cause similar reactions in people; chemical exposures can cause asthmatic and allergic responses, as well as dust exposure and other things.
The important thing to remember about mold and mold growth in buildings is that mold is driven by a number of factors, but only one of those is in our control. Mold grows based on having a food source and most of the things in buildings can be a food source, including skin cells that we slough down during the day and dust and things like that. Mold grows better in the dark, but we generally turn off lights in our buildings, or we have wall cavities that are perfectly suited to molds. And molds

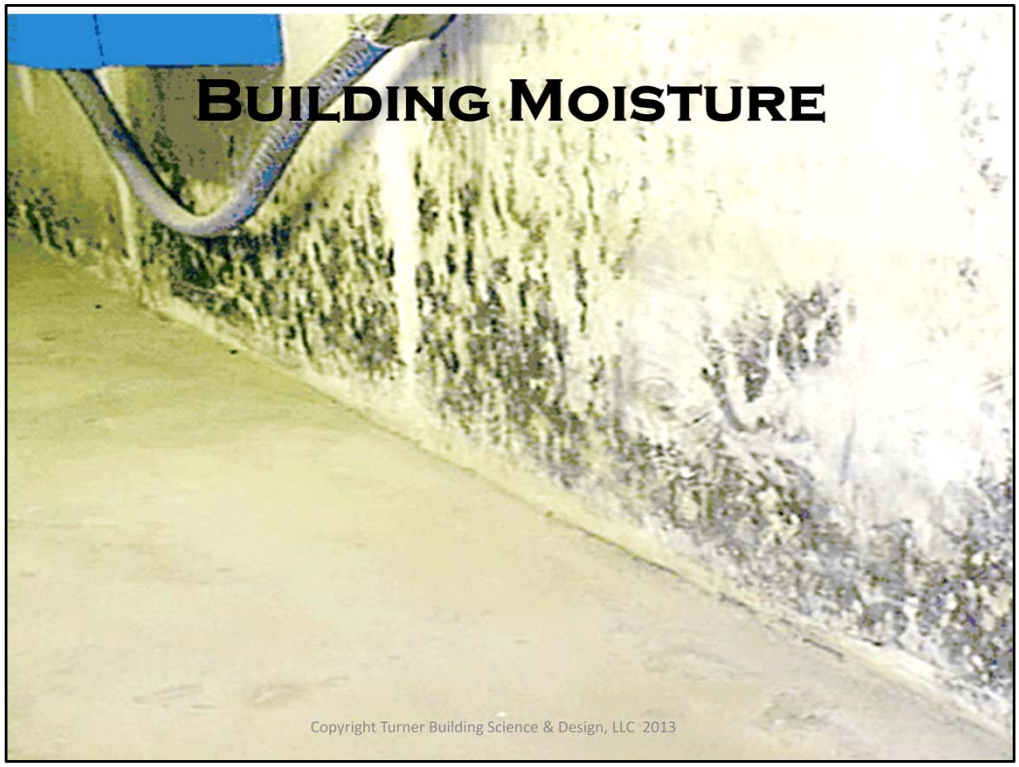
grow in temperatures that we like – typically in 55 to 85 degrees Fahrenheit. We'll see a lot of the molds that grow in buildings really proliferate.

Mold (fungi) Amplification is Limited by Moisture

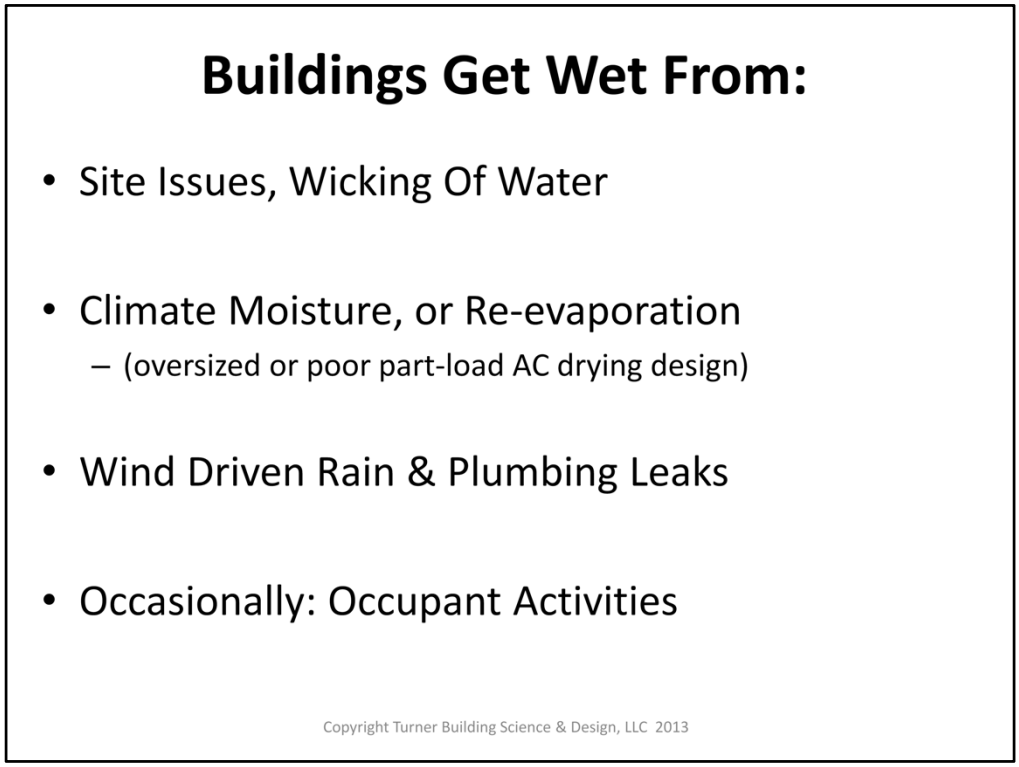
- **Liquid moisture needed to initiate growth**
- **55 - 85 deg. F preferred** (ACGIH)

Steven Caulfield:
So, the final thing that mold needs to grow is moisture. What it needs to start that growth is liquid moisture, so you need a wet surface with that food and the temperature conditions, and then you will get mold growth. But once you have initiated that mold growth, even if it stops growing, the mold will not completely die but can be reactivated simply by high humidity in the space, causing 'local micro-condensation,' if you will. The mold essentially grabs the moisture out of the air when it's humid enough and will restart growth.

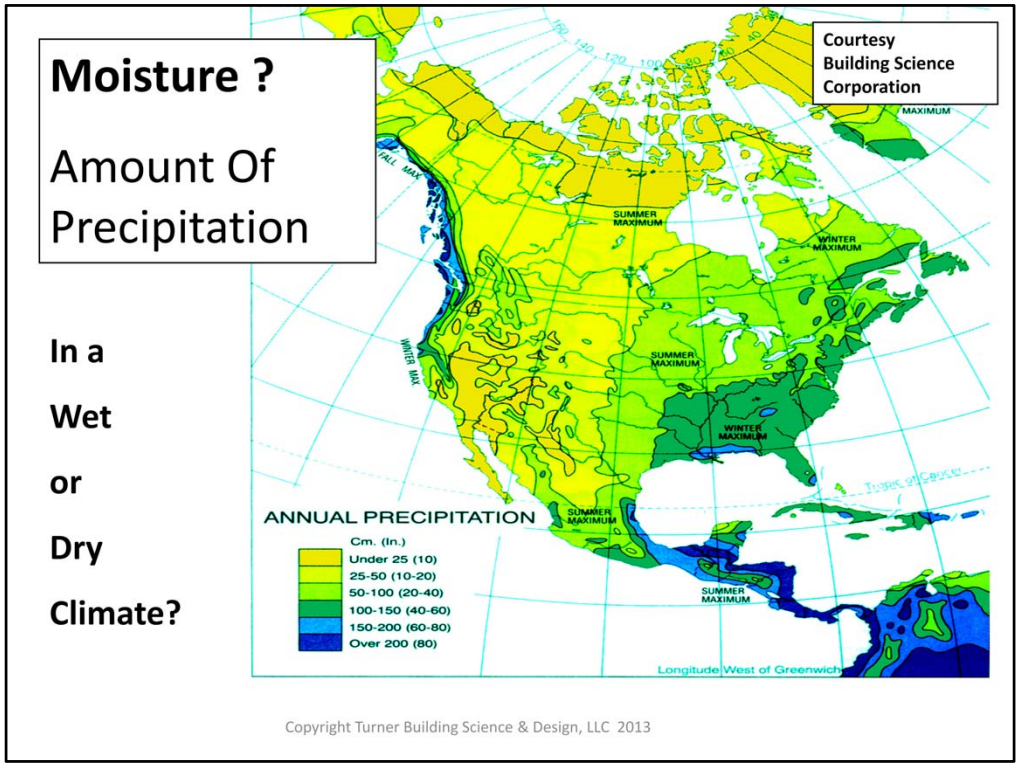
So, it's important to remember that you have a wetting event that starts the mold growth, but after that you don't necessarily need to get the surface wet again. There just has to be enough moisture in the air for the mold to grow, and different molds grow based on different water conditions. But we can get into that in the mold 201 course later on.



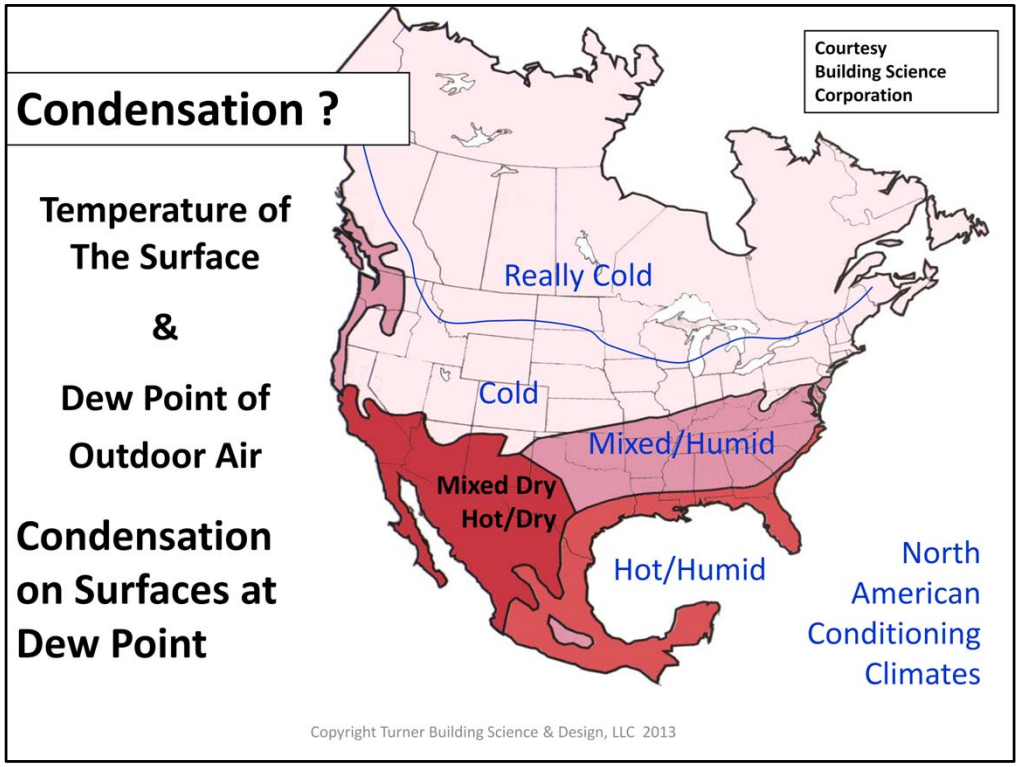
Steven Caulfield:
Since the only thing that we really have control of regarding mold growth is moisture, we're going to spend a lot of time talking about building moisture; where it comes from, how to look for it and how to solve those types of problems.



Steven Caulfield:
The primary issues with wetting of building materials are associated with issues on the building site – issues from climate moisture, rain humidity, things like that, wind-driven rain plumbing leaks, roofing leaks, actual liquid moisture coming into buildings and, occasionally, in specialized conditions, occupant activities. Things like showering, boiling water without exhaust and heavy, heavy athletic activities indoors can generate sometimes enough humidity to cause moisture problems. But, in general, we're going to talk about the top three: the site, the climate and the internal sources of moisture.



Steven Caulfield:
Okay, so, looking at the climate. I assume many of you are from different parts of the country. So often we talk about the North East, but if you look at the map of average annual precipitation, you can see that, other than the western third of the country, we get a lot of moisture. And those of you who are on the East Coast or the Upper West Coast understand that we get a lot of moisture every year, some of it in the form of rain and, where we are, some of it in the form of snow. But eventually all of that moisture affects our buildings.

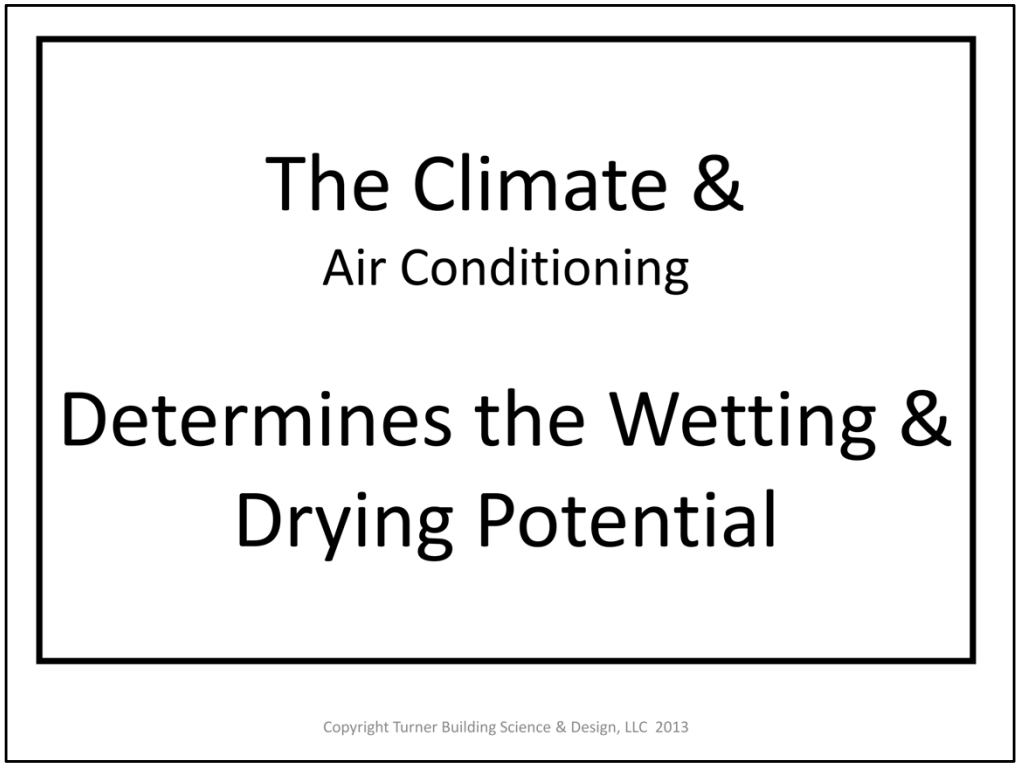


Steven Caulfield:
So, your potential for mold growth depends to a certain extent on whether you're in a wet or a dry climate. And it's not always evident to people that their climate is actually a wet climate, and a lot of other things go into that, one of which we'll get to now.

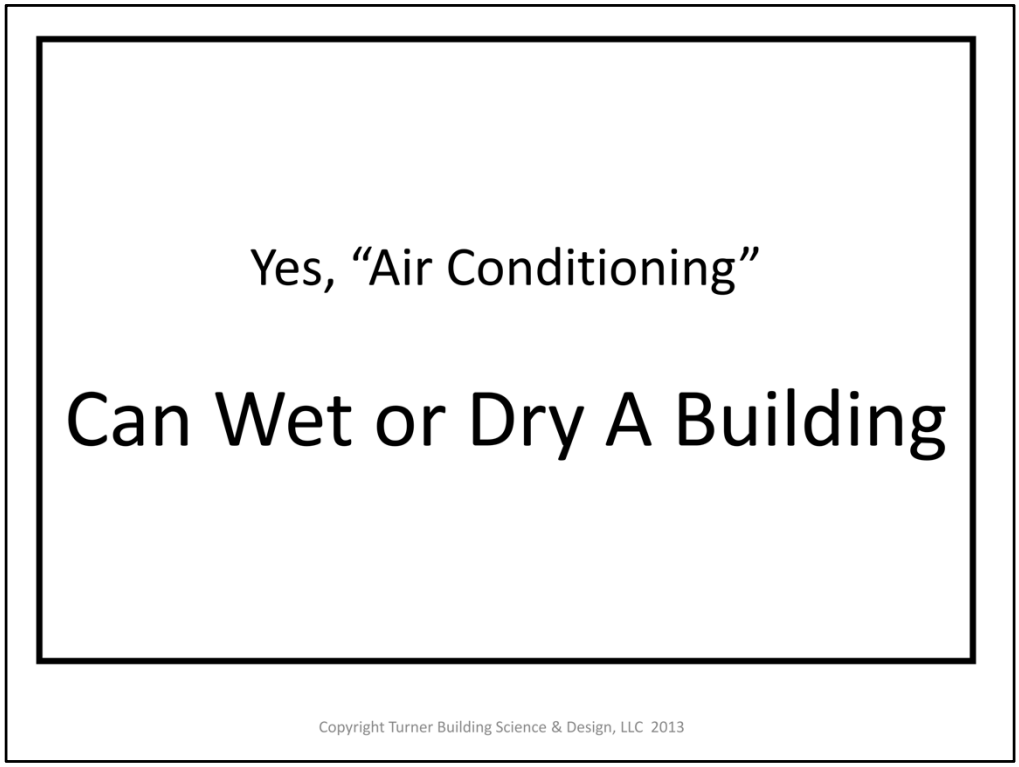
So, the other part of the equation is whether it's cold outside – cold enough to get below the dew point and can cause condensation in your building. Much of the country is in the upper regions where it is cold, at least part of the year. And what that relates to is that many times we have school buildings that have ground contact slabs. So, a slab that's right on the ground surface, the temperature below that slab is usually at the average temperature year-round. For our climate, it's somewhere between 50 and 60 degrees. And we get days during the summer when the due point is significantly above 50 to 60 degrees if that slab is not insulated. That's a significant condensation potential.

So, the temperature of surfaces and what the dew point of the air is. And, for those of you who aren't familiar with dew point, we usually hear a lot about it in the summer. It's an absolute measure of how much moisture is in the air at one time and it relates to, as it sounds like, the temperature at which dew will form or condensation will form on surfaces that are below that temperature. So, if your dew point is 70 degrees and a surface like the floor slab is at 60 degrees, you're likely to form condensation on that slab. If you have carpet on top of that slab you may not see the condensation, but the condensation will happen at the interface between the slab and the carpet, and that could lead to mold growth. Now, there are things that we do in the schools, particularly in the summer, that can raise the dew point of our indoor air (such as shampooing carpets or resurfacing tile floor), and these can add a lot of moisture into our buildings, and effectively raise the dew point above what is outside and cause even more condensation. There are

other places in the building that can have condensation issues. We'll talk about them further on. But what I am talking about, here, is basically the connection between the ground temperature and the dew point, and how the dew point can go above that ground temperature and cause condensation within buildings.



Steven Caulfield:
So, the climate really determines how much wetting and drying goes on in a building. If any of you are from the Pacific Northwest, there are extended periods of time when you get wetting and you don't get much drying. Those of us who live in the northeast, we tend to get some wetting; we'll get rain and low pressure coming through, but then, behind that, we'll get some dry weather. And that allows materials to absorb and then give off moisture over time, and hopefully prevent mold from growing.

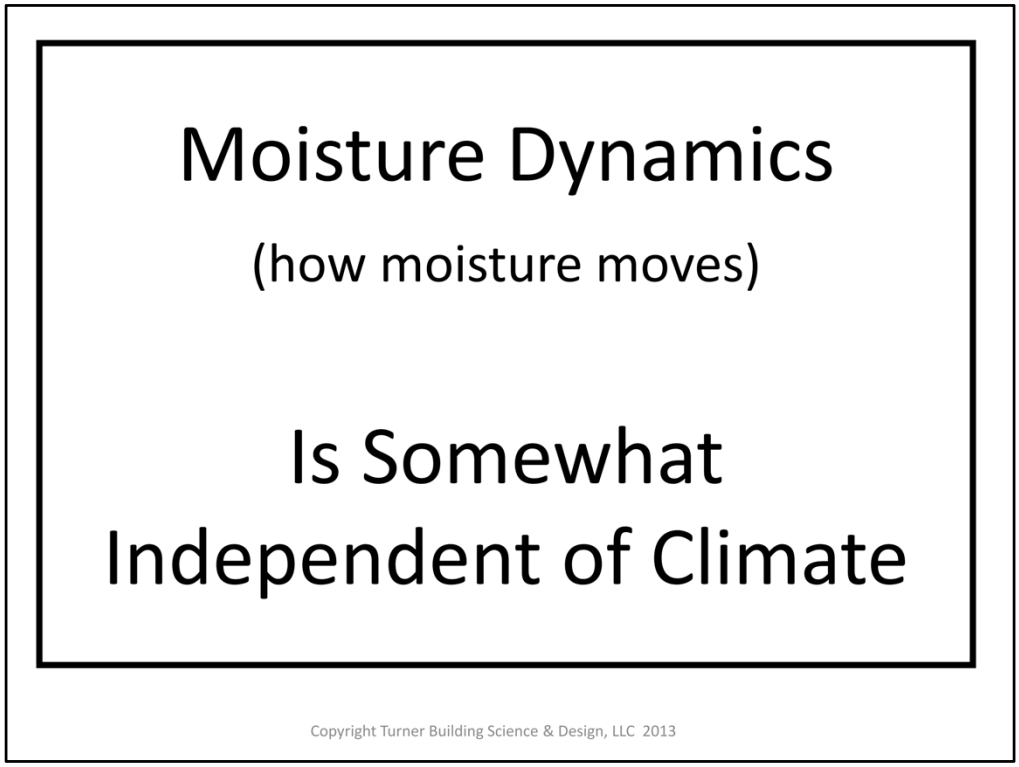


Steven Caulfield:
As you can see in smaller letters: air conditioning can help to wet or dry a building. And the way that we traditionally think of air conditioning is as drying out or dehumidifying air.

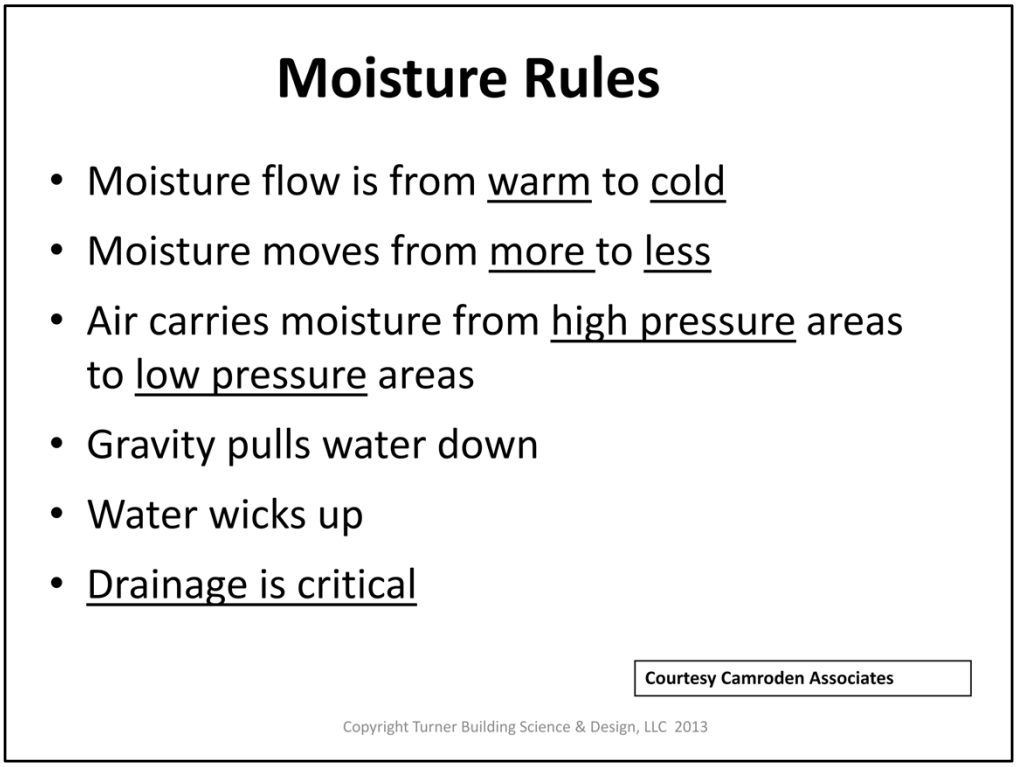
But one of the issues we see – and we'll further into this in the 201 class, but I just want to talk about this right now briefly – is that air conditioning with equipment that is too large or oversized for the cooling needs tends to run for very short periods of time and brings the temperature down rapidly. And what that does is water is condensing on the cooling coil for a short period of time, but not long enough to actually dry out the air. And when the unit shuts off, the water that condensed out of the air onto the cooling coil re-evaporates and will actually tend to make the building more humid, because what it's doing is lowering the temperature without removing any moisture. And a lower temperature with the same amount of moisture equals a higher relative humidity. And we'll go further into that at another time, but I just wanted to approach that subject briefly.

I already went into air conditioning wetting or drying a building; obviously, if an air conditioner is sized correctly, then it will run for a longer period of time, and that water that's collected on the cooling coil will drain into the drain pan and be removed from the airstream. But short run times equals water that's left on the coil

to re-evaporate into the air. So, we get that basic concept.



Steven Caulfield:
The way that moisture moves through building materials and from outside to inside is really independent of the climate, although the climate can affect it. But the 'rules,' if you will, or the forces that make moisture move, are really independent of the climate. And most of the actions that force moisture to move into or out of a building can happen in almost any climate.



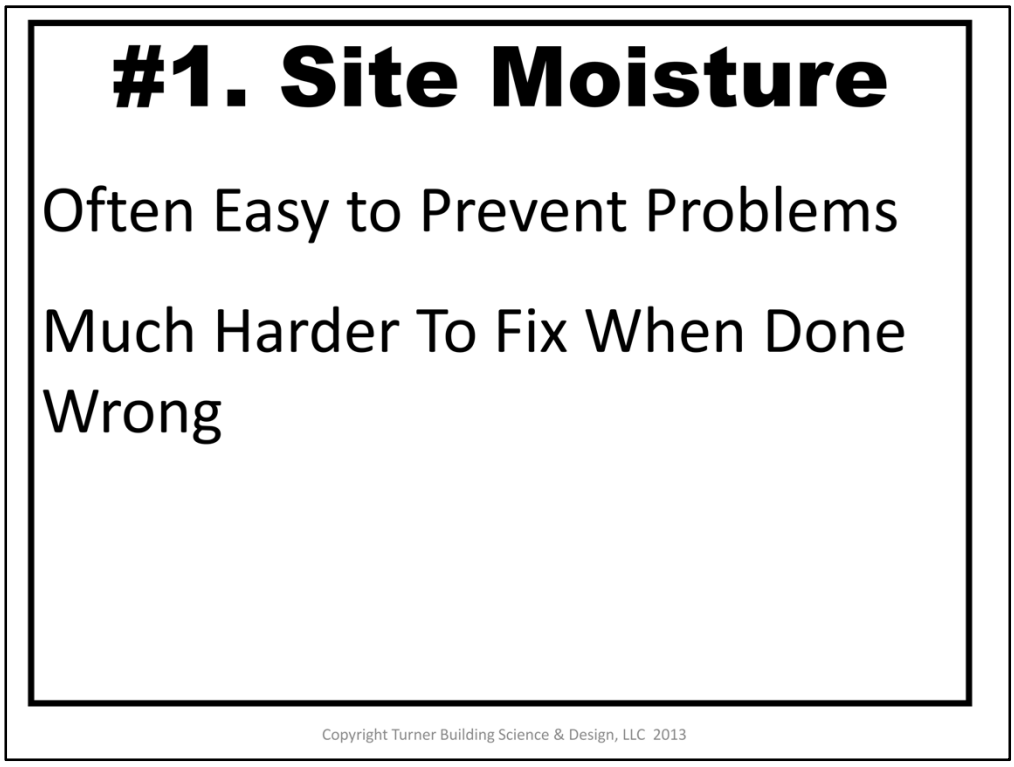
Steven Caulfield:
So, the first basic rule is that moisture flow moves from warm to cold. And when we're talking about moisture flow, here, we're basically talking about moisture that's in the air that's suspended in the air. So, humidity – the moisture that's contained within the air – will tend to move from a warm condition to a cold condition. So, in the summer, as we are now, the moisture – the humidity that's in the air outside our buildings – will tend to move toward the interior if we're air-conditioning a building. It's moving from the warm to the cold.

In the winter in the north it's the reverse, where it moves from the inside, where it's warm, towards the outside, where it's cold. Alright, so, the moisture moves from warm to cold – the moisture moves from more to less. So, again, if we're drying out the air inside the buildings in the summer, the partial pressure will be higher outside. But, basically, you can think of it as the humidity is higher outside and it will tend to move the air – the moisture that's in the air – toward the inside of the building. So that's the general flow: it's moving from a condition of higher humidity to lower humidity. And again, in the winter, that under cold conditions you tend to have more moisture inside your building than outside. So it's going to move from inside to outside because it's moving not only from warm and more, to cold and less.

Air carries moisture from high pressure to low pressure areas, so if you are exhausting air from areas inside your building, that will create a lower pressure area. So, the air will move from high pressure to low pressure and it will carry with it moisture. And this is probably the most important thing that's happening in a lot of buildings: There is a lot of air leakage where the air is leaking into our buildings in the summer, for instance, and bringing with it moisture. It brings heat and moisture with it from the high pressure outside if we're creating a low pressure inside.

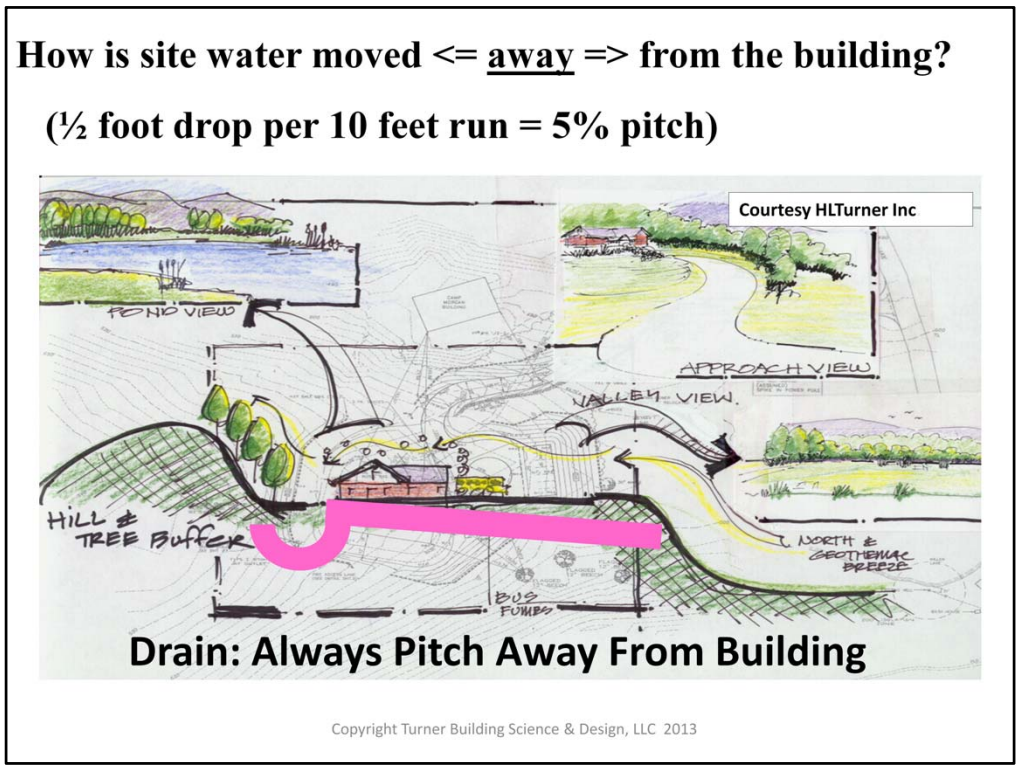
So, in the summer inside buildings we have three forces, particularly in air conditioned buildings, that are moving moisture from the outside to the inside. It's trying to move from the warm to the cold. It's also trying to move from the more to the less and it's trying to move from the higher pressure to the lower pressure. So if we negatively pressurize or de-pressurize a building during the summer, we have three forces that are moving moisture inside. Liquid water generally goes down, although there are cases – like when air pressure is pushing against liquid water – where it can rise to a height of a quarter to a half an inch and go, say, over a self-lashing.

But, in general, water is moving down; so, when we look for water in buildings, we generally look at the bottom of things for liquid water. And then it's important to remember that water can wick-up significant distances, primarily in porous materials, but in things like concrete dry wall. Anything that will absorb water it can wick up a significant distance many feet. So, to prevent having too much liquid water, it's important to have significant drainage around your building.



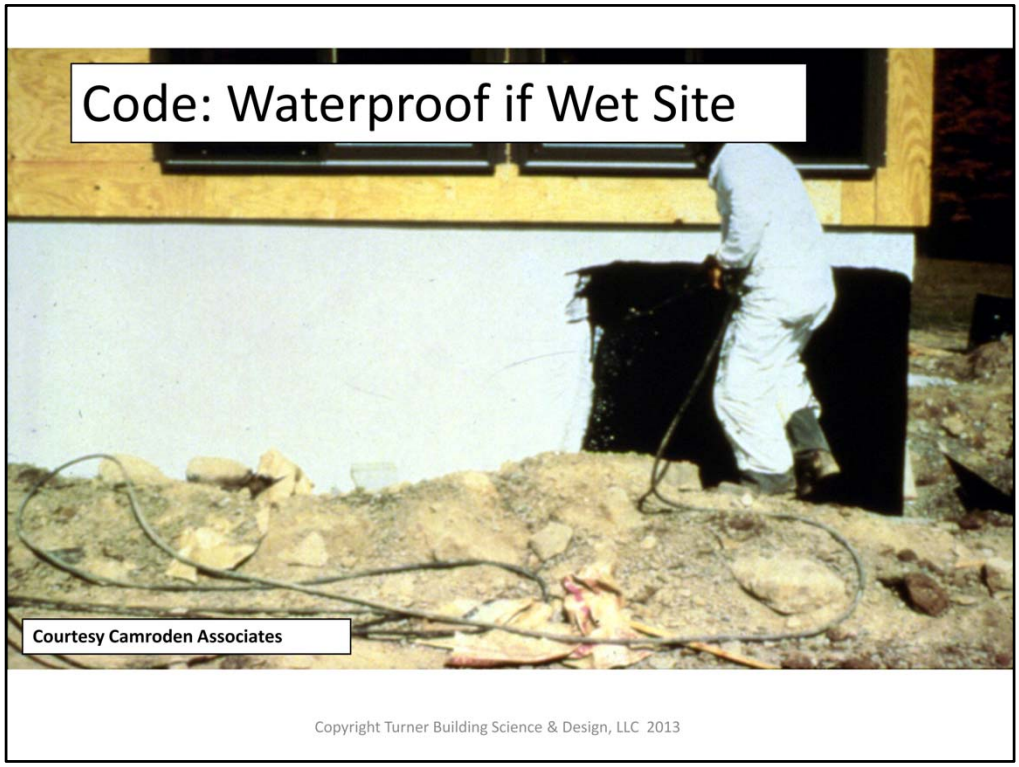
Steven Caulfield:
We'll start with one of the three items we talked about with the site moisture. The rule of thumb is, it's always easier to install your moisture management on the site when the building is built. And it's much harder to do it after the fact; to keep moisture out after a building is built is possible, but it's much harder to do. So, any of you who are planning building construction in the future, make sure that you're dealing with how the moisture that comes from the site and from the sky, so that you don't have to deal with it down the road.

Steven Caulfield:
We don't want to end up in this situation; this is extreme. But I've been working on a site in Tennessee where it's been wet for the last six months – not this wet, but wet enough that you can't drive on it without losing a vehicle – so it's important to start with a dry site. I guess we'll say that.



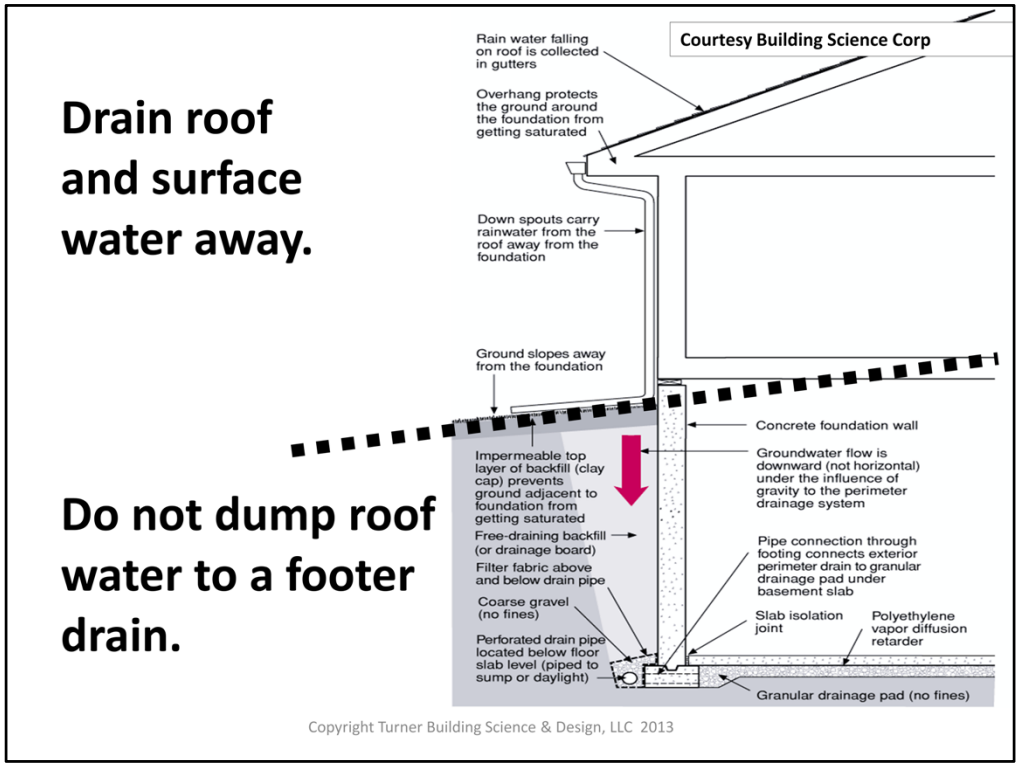
Steven Caulfield:
So, when sighting a building – when deciding where on a site a building should go – you should plan for a pitch around the building that moves water away from the building. And that should be, as we say here, at least a half foot drop in 10 feet, to make sure that water runs away from buildings and not toward buildings. In the drawing here, we see that there's a hill right behind the building which will tend to dump water towards the foundation and the slab and force it to soak up water over the course of the lifetime of the building.

So, we can see, a solution to that would be to put in a drainage swell uphill. This drawing illustrates a good location for the school building for everything other than the drainage. And so, to accomplish the appropriate drainage, what you would do is put in a drainage swell and then pitch the site away from the building where the building is located so that none of that moisture that's gathering on the hillside is funneled toward the building, but is rather directed away from the building.



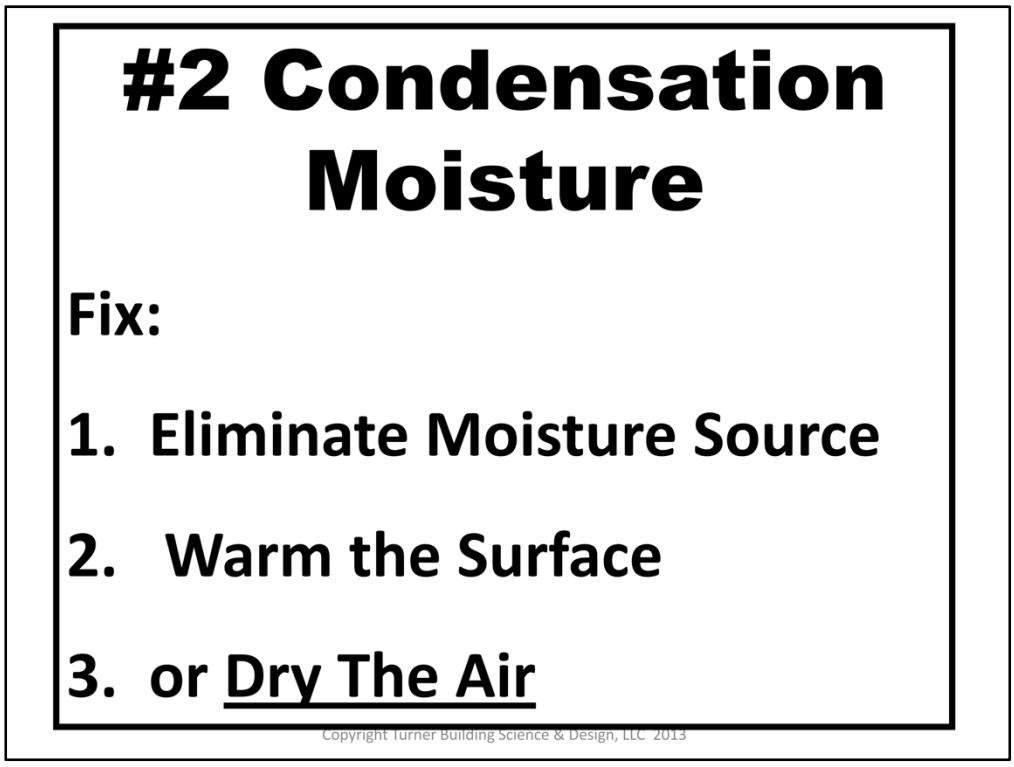
Steven Caulfield:
In general, foundations need to be at least damp proof, but if you have a wet site, the code requires you to water proof. And there's a difference between the two – different black materials that they can put on your foundation walls. But I will tell you that, as I said before, it's easier to deal with these things when you're building a building, rather than trying to excavate and do this after the fact. Waterproofing or damp proofing works best on the outside because the soil is always wetter than the inside of the building, so the moisture drive is always from outside to inside when you're underground. Having the waterproofing on the exterior forces that waterproofing against the concrete.

If you try to do this on the inside of the building, it's trying to hold on to the concrete and not get pushed away. When you put it on the outside, the vapor pressure is actually pushing the moisture – the water proofing – against the concrete and holding it out better. There are solutions to, after the fact, waterproof the interior, but, in general, they cost many times more on a square foot basis than doing it at the beginning, on the outside.

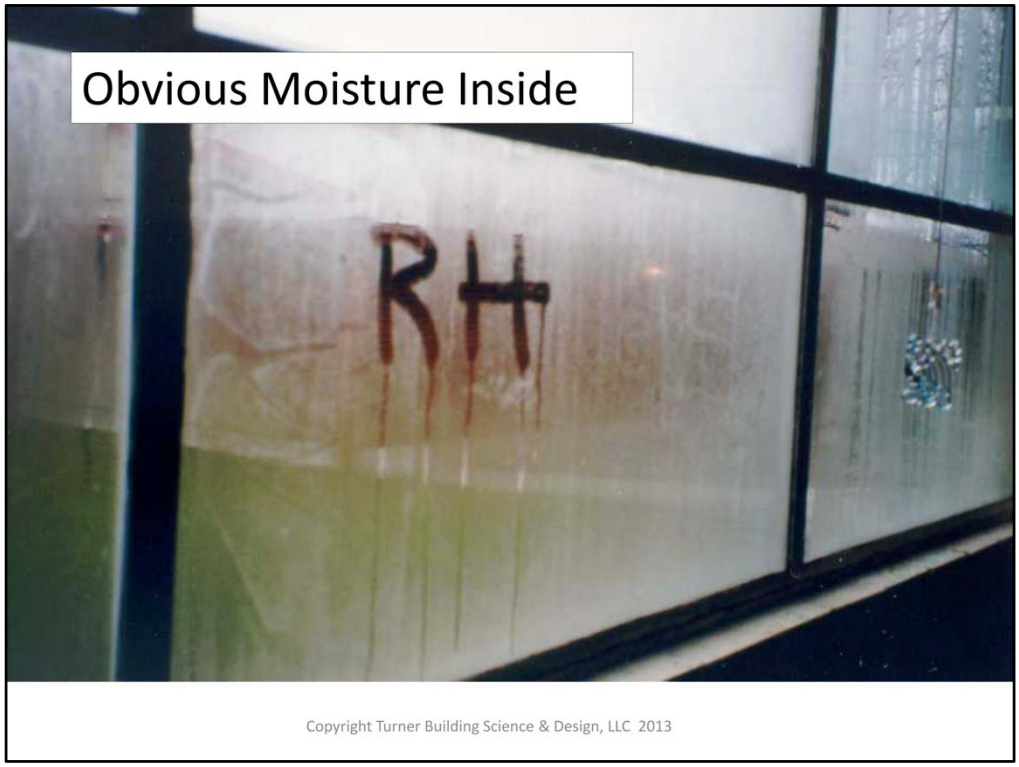


Steven Caulfield
When you're looking at the exterior of your building, you want to make sure that you have sufficient overhangs and drainage from all the water that's collected on the roof, to get that water away from the building. I've seen a few buildings where the water is collected at the edge of the roof, and the down spouts are actually connected to the footer drains, which, you know, theoretically drain to daylight somewhere on the site, but it surcharges the footer of the building with a lot of moisture and maintains a higher moisture content all around the foundation. Which, if you don't have appropriate damp proofing or water proofing outside the building, tends to lead to more moisture diffusing through the concrete foundation and into the basement or lowest level of the building.

So, it's important to have a way to manage all of that water that's coming off the roof. If it's a pitched roof, it should have an overhang. If it doesn't, have gutters and downspouts so that it doesn't cascade down the side of the building and, again, charge that exterior cladding with a lot of excess moisture. If it's a flat roof, then make sure that your roof drains are kept clean and free-flowing, and that they drain to somewhere that's not inside the building, but ultimately get outside.



Steven Caulfield:
Alright, so, after we've managed the site moisture, we look at condensation moisture and there are three ways to look at that. To look at solving problems with moisture that's causing condensation, the first would be to eliminate the moisture source, which, I guess, in any indoor air quality issue, if you can eliminate the source of the contaminant – in this case, water that's causing your problem – then the usually the most effective way to go. If that can't be done, warming the surface will prevent condensation because, again, condensation is happening when a surface is getting below the dew point temperature of the air. So, in some cases, warming whatever surface it is can solve problems with condensation. The third solution would be to dry the air; if there's less moisture in the air, there is less potential for condensation, because the dew point of the air will be lower than the temperature of the surfaces. So those are the three main thrusts of solving condensation moisture.



Steven Caulfield:
We've all seen now, particularly in the winter or when it's cold out, that you can get some condensation on windows. It should not be this extreme, where you can write yourself a note in the condensation that's constantly occurring. But again, metal, glass and other materials that bridge from inside to outside tend to run colder and have a higher potential for condensation.

Steven Caulfield:
On many, many materials, particularly if you store things in a closet that's located in the northwest corner of the building with no ventilation, you will quickly see that things become covered with mold, because there is a lower temperature, typically, in that location, and because there's no solar gain and then there are materials that are at a temperature below the dew point, again causing some condensation and mold growth. And the mold is going to grow preferentially on whatever materials first have the best food source. In this case, it's a leather jacket.

Avoid Moisture condensing from the air at dew point temperature

- Cold Diffusers
- Cold Walls
- Crawl Spaces
- Basements
- Cold Valves
- Cold Door Gaskets
- Windows

Steven Caulfield:
Many other surfaces within a building will be at or near the dew point – things like diffusers, exterior walls cold valves, window frames, as I said. So we need to maintain either higher temperatures at those surfaces or lower dew points – lower humidities – in the air that's surrounding those.

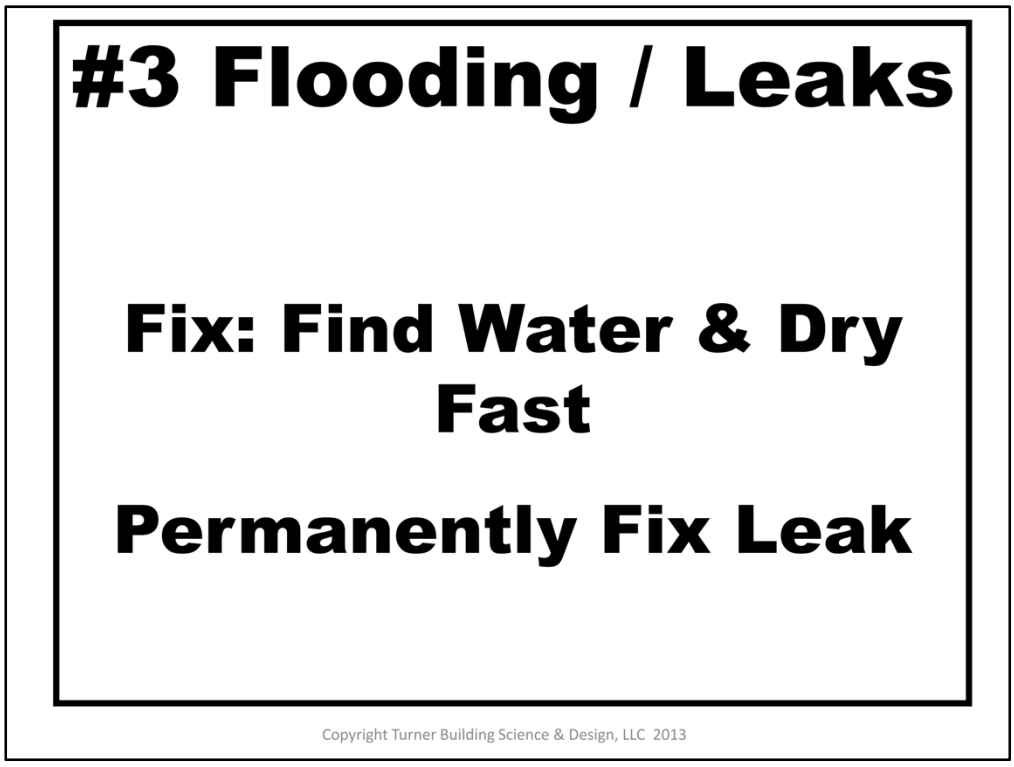
The diffuser that you see there discharges air conditioning at a temperature that's about 55 degrees, and when a diffuser like that is located in an area near an entry door, that will tend to raise the humidity locally to a point where you start condensing water and can start growing mold on the ceiling.

Serious De-humidifier

140 pints a day for same energy consumption as 40 pints a day

Energy Star Rated?
www.thermastor.com

Steven Caulfield:
The other solution, besides warming the surface or eliminating the moisture source, is to dry the air. And there are de-humidifiers that can do this, you know, particularly if you have a basement or crawl space where it is hard to do either the warming or the elimination of the moisture source. Sometimes the brute force method is the only way to go. I would say that the larger de-humidification units like this one that have either a continuous drain by gravity or a pumped condensate drain, work best. The units where you need to rely on someone to remember to empty the bucket, I've only seen those lower the humidity temporarily, and then it rises again when the unit shuts off, because someone has forgotten to empty it. Continuous drainage of the condensate from a dehumidifier is much better.



Steven Caulfield:
The third source of moisture is flooding and leaks in the building, and really the primary thing to remember. Condensation tends to happen over a long period of time, and problems with site moisture tend to happen over a long period of time. Sometimes, with the flooding and leaks, it can be an instantaneous event, and the important thing is to find the source of the water, remove it and then rapidly dry or remove materials, because if we wait for more than two to three days and leave wet materials, you will start growing mold on those materials.

So, in the first two to three days after a flooding event – and, this is, we're talking about clean water flooding, not river flooding or sewage backup, but a pipe break, a sprinkler goes off, things like that – it's important to treat those initially as a construction project. But if they're not removed quickly or dried out quickly again within two to three days, then it becomes a mold or a remediation project which is much less ‘desirable,’ let's say.

Responding to Clean Water Flooding

Find Excess Dampness Fast

- Ventilate and Dry <u>all</u> Cavities & Monitor Drying

  dry in 24 - 48 hrs?

Courtesy TBS

Courtesy TBS

Steven Caulfield:
When you're responding to clean water flooding, it's important to open up all of the cavities in walls that may have gotten wet and get those dry as quickly as possible. The best solution would be, in the first one to two days, then, it's really dealing with just wet materials prior to any mold growth. But beyond that, you're looking at treating all of this, all of this re-construction, as remediation, instead, and that's really not desirable. It's important to open up the cavities. Sometimes you need to drill holes, like, in this case, at the bottom and top of walls and actually blow dried air into those wall cavities to make sure that all of the materials that are inside those cavities get dry.

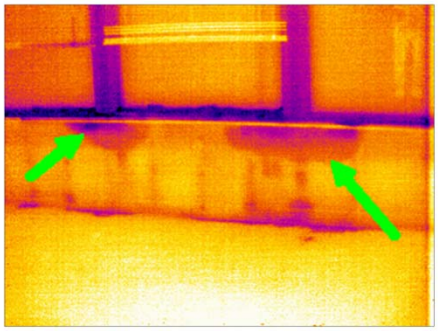
Find & Fix Moisture from Building Piping & Plumbing

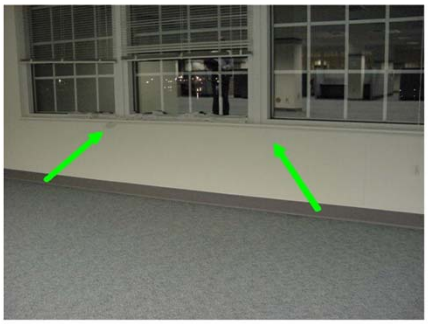
- Plumbing Leaks
- Valve Drips
- Waste Lines
- Fire Protection Leaks

Steven Caulfield:
And, as Jenifer said, part of the *IAQ Tools for Schools* Key Drivers, is to continually assess what's going on in your schools, so having a program where you're looking for moisture leaks, condensation, the leaks from piping throughout the building, is a really good step to proactively preventing the mold growth throughout your building.

http://www.epa.gov/iaq/schools/starting.html

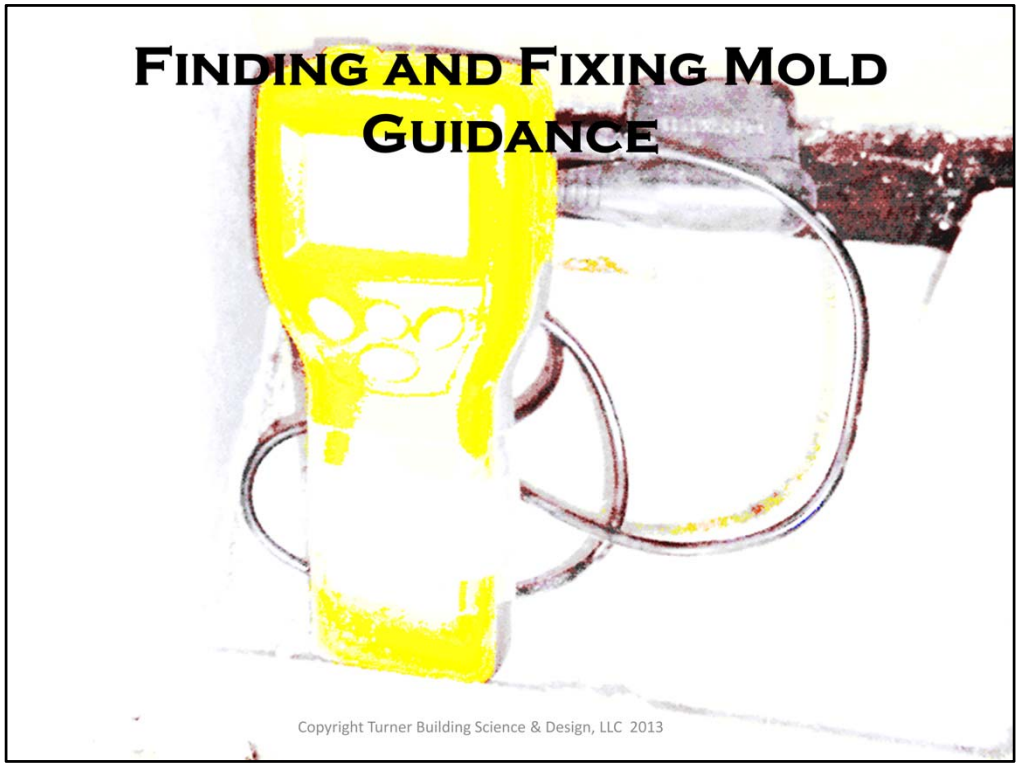
Window Leaks?



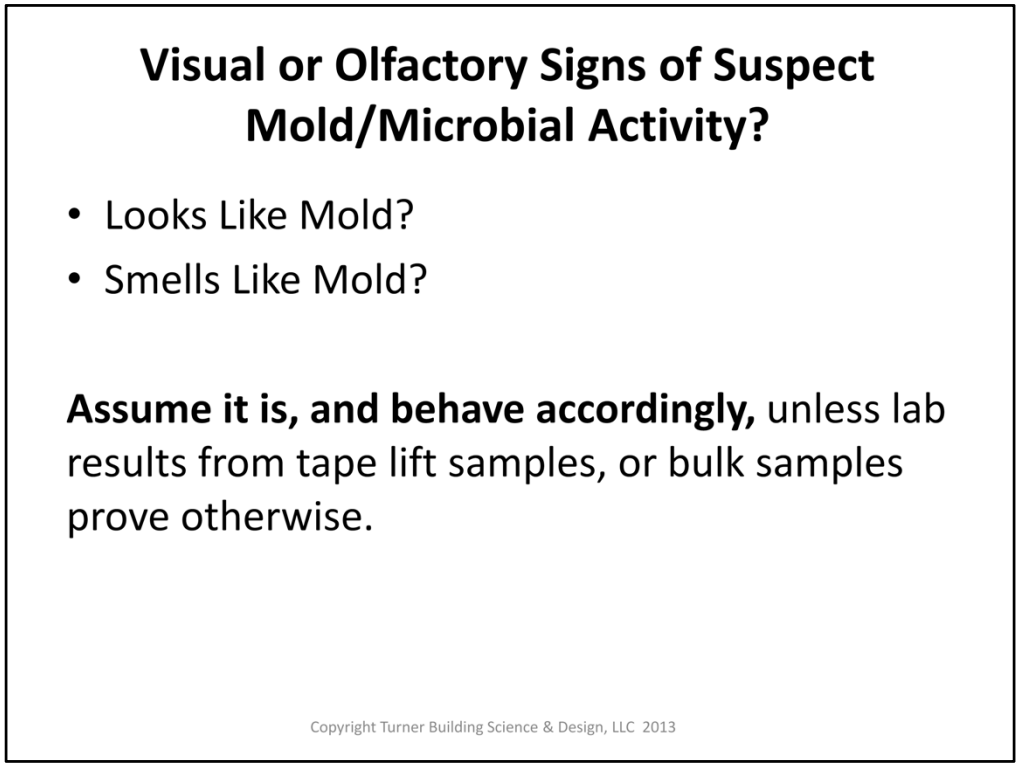


Again, one of the long-term moisture sources in buildings can be issues with flashing and sealing at windows and doors that penetrate though the walls, so it's important not to just paint over areas that get wet, but to actually address how the moisture's getting in – if that's because we don't have an overhang or because the flashing was incorrectly installed. Those things need to be addressed quickly because, over time, they will lead to issues of mold growth within walls.

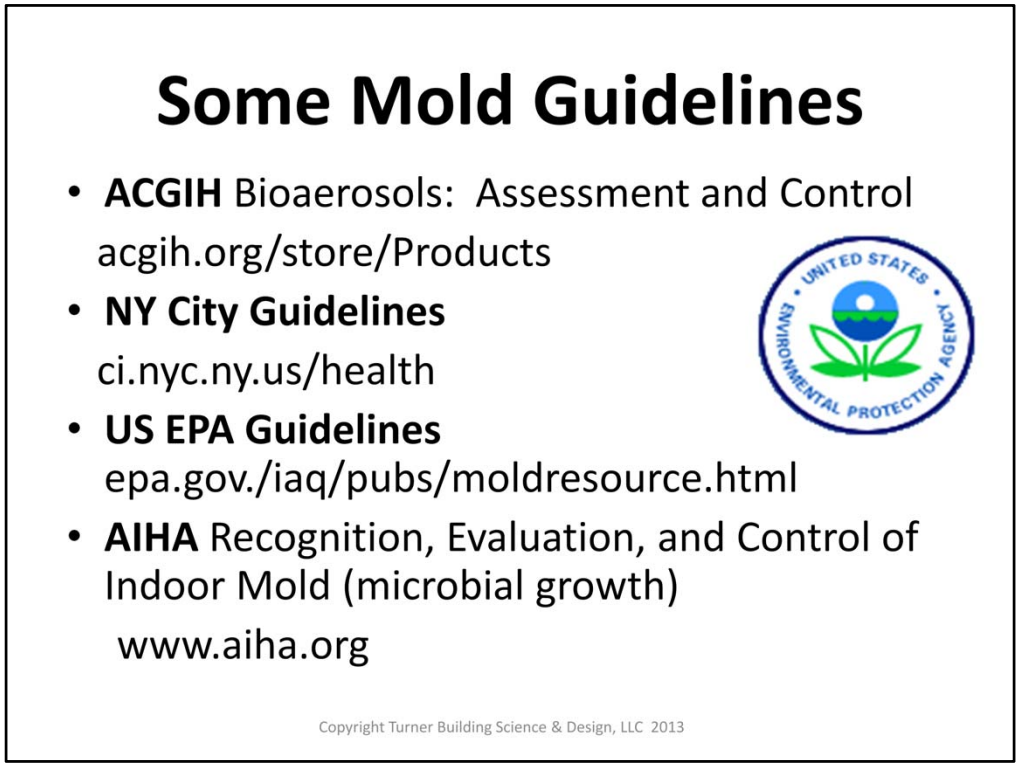
Steven Caulfield:
And one thing to remember about materials like brick: They are somewhat porous. On the left, we have a picture of a down spout coming from a roof drainage that was all blocked up. At the top, the outside of the wall was continually wet when the interior wall surfaces were removed – so, the dry wall, the insulation and the sheathing. What you see on the right is the inside of the wall, which was showing just as much moisture as the exterior. This building was built with exterior gypsum sheeting that wasn't covered with any kind of water barrier. That sheeting got wet over time, from water coming through the brick, and grew mold within the wall assembly.



Steven Caulfield:
Alright, some guidance on finding and fixing mold problems.

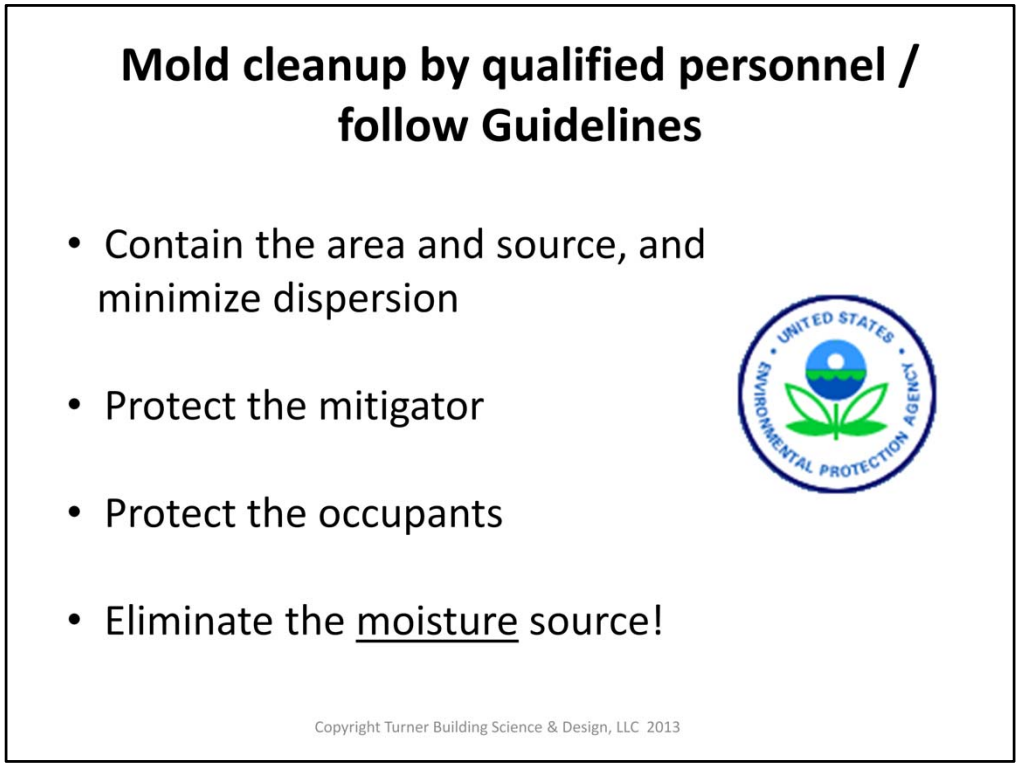


Steven Caulfield:
Okay, so the best way to determine where you have mold problems is to look and to smell. Really, there aren't good sampling methods that find hidden molds certainly, and our feeling is that once you even if you try to sample for mold – if you find mold in the air or in a surface sample – you still have to find the source of the mold and the moisture source. So the best way to address mold problems is to look for moisture sources, look for mold growth. See, if there are any reports of odors of mold, most of the air sampling methods that are used for mold tend to be very short-term, and so they don't necessarily pick up mold in the air when samples are taken.



Steven Caulfield:
Now, if you do have mold within your building, there are some guidelines. And again, as Jenifer said, we'll be posting these slides, so you will have all of these links and I don't know whether she's putting them in the chat right now, but these are some of the guidance that are used throughout the industry: The ACGIH, which is the American Conference of Governmental Industrial Hygienist, has a good book for professionals in the industry; the New York City guidelines and the EPA guidelines are more tailored to folks who are in schools commercial buildings; and, again, the bottom on the AIHIA the Industrial Hygiene Association indoor mold is more of a resource for those who are actually in the sampling and remediation end of mold – probably too technical for those who are trying to deal with mold problems from a building owner perspective or building occupant perspective. I would say the EPAs guidelines, which one of them is I think the one that's referenced here, is the mold remediation in schools and commercial buildings that's really got the best overall plain language view of how to deal with mold issues once you find them.

http://www.epa.gov/iaq/schools/tfs/guideh.html



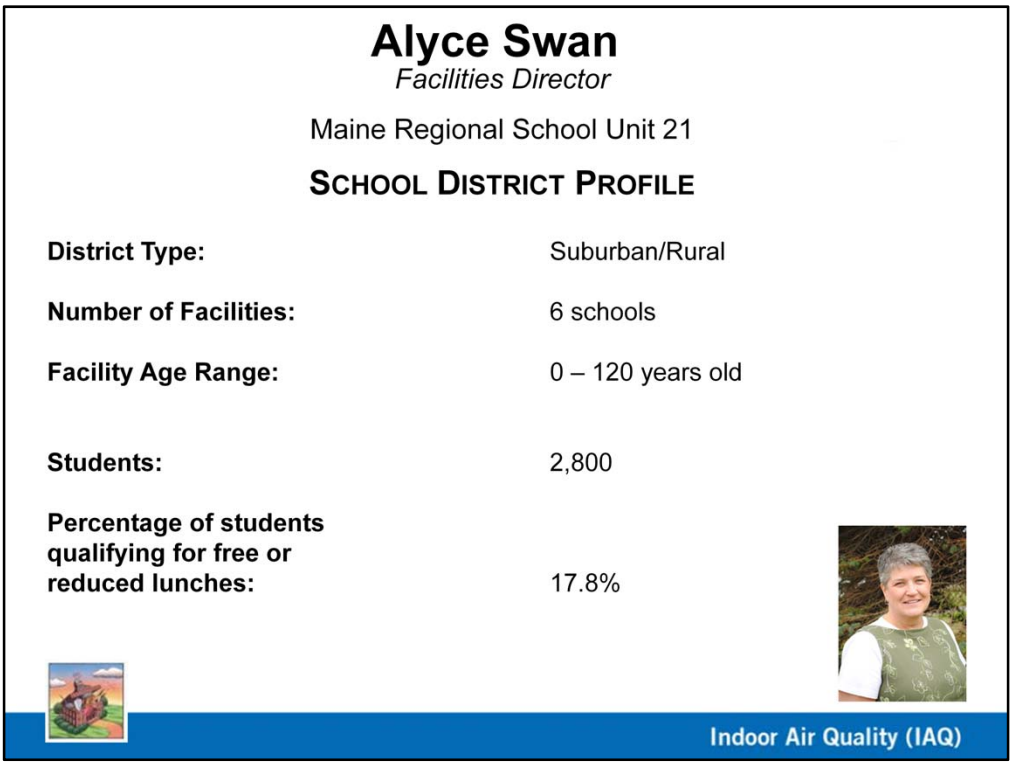
Steven Caulfield:
And, in general, what all of these recommend – all of these guidance that were on the previous slide recommend – is that the important things are to contain the area and the source and minimize dispersion of spores before you start doing any work; protect both the people doing the work and the people who are in the building at the same time – remember both – and to make sure that the moisture source is eliminated. Remember that mold is a growing thing, so even if you do your best job to remove it, if the moisture comes back, mold will re-grow there. The spores are essentially all throughout indoors and outdoors. They just need a place where there is that moisture so they can initiate growth.

Summary

- **Minimize opportunity for growth**
- When Mold does grow, **remove it without dispersing it into the breathing air.**
- Minimize the likelihood of the mold growth returning (**find the moisture & repair**).

Steven Caulfield:
So, in summary, the best way to control mold is to minimize the opportunity for growth. When it does grow within a building, remove it without dispersing it into the air that people are breathing, and make sure you remove the moisture source so that you don't get mold growth returning and go through the same process again.

And now I'll pass it over to Alyce to tell her story.



Jennifer Lemon:
Thanks, Steven, I really appreciate you giving us all the detailed information about how to prevent and control moisture control. Alyce, go ahead and take it away. We look forward to hearing your success story.

Alyce Swan:
Thank you, Jennifer. Welcome everyone. Jennifer's asked me today to talk about how RSU, our Regional School Unit, has used the Framework and Key Drivers to address mold and moisture in our school district, where we have quite a background and history with mold and moisture, unfortunately, and hopefully you'll learn something from me today that will be helpful to you, should you face these in the future. Mold and moisture is the most difficult challenges I have faced in my 20 year tenure at RSU 21.

In mid-2007, our six-year-old middle school building became the center of occupant complaints of ill health, with beliefs that it was tied to mold and IAQ issues. But how could our six year old building be the cause of so many complaints? We had full air handling systems with double filtration and expectations and a working program of high quality housekeeping practices.

Little did I know or realize at the time, that this problem will become a plague and

continue to drive my everyday focus for over six years. Unfortunately, we had no IAQ program in practice at this time and our first reactions to IAQ concerns were handled with a 'learn-as-you-go' process. Although our best intentions were in place, we had no action plan to refer to and had to develop a program of our own, on the fly. This unpreparedness contributed to the life span of complaint history. The poor quality of the construction of this building was the major contributor to the IAQ problems we faced. Eventually, the building required a new membrane roofing and insulation, the exterior EFIS was removed and replaced with sighting, every window was removed and the flashing was repaired to wick the water away from the building instead of bringing it into the building.

By the time we realized the extent of the construction problem, the contractor had long been bankrupt and we had no recourse for compensation. All interior carpeting had to be removed and replaced, and we chose a luxury vinyl product, but millions of dollars were spent on building repairs and redesigns. The *IAQ Tools for Schools* program has been in place for many years. As I walk you through my experience, I will not attempt to recreate in this presentation the excellent materials that the *IAQ Tools for Schools* program includes. It's all free to you take advantage of it.

By following the six Key Drivers, you will successfully handle any IAQ concerns your office receives in a professional and expeditious manner. Driver One: Organize; develop a strategy with key personnel and develop an action plan. What are you going to do? How will you respond to the IAQ call? This is a critical first step. Your failure to respond quickly and knowledgeably will be the foundation of your success or failure. Your obligation as a facility manager is not to determine whether the complainant is crazy, overreacting or wrong. Your duty is to refer to your action plan and take action immediately.

Driver Two: Communicate and never stop communicating; your clients want to know what you're doing and what the findings are. Share this information in a way that they will understand. Answer their questions honestly and completely. Have venue with an expert; the turn group walked with us for years as we systematically solved and resolved IAQ and mold issues. No matter what the level of your training is, you may need to partner with an independent firm of experts in order to get through these processes. A partnership is critical. The *IAQ Tools for Schools* program speaks thoroughly on effective communication.

Driver Three: Assess; take a second and think about the level of knowledge you have about your buildings and grounds; it's very important to know what you manage and manage what you know. Develop and use a checklist of your liking. Walk through your facilities using the checklist and document what you see; take photographs.

Involve your IAQ action team to solve problems, together. Make sure to perform repairs and upgrades and conduct a follow-up inspection and document your findings. We use a facilities maintenance management system that allows us to set up a PM work order and track success. Assign yourself or a reliable colleague a PM to tour the facilities if need be.

Driver Four: Plan; refer to your action plan in Driver One, but expand upon it to include priorities. Develop a plan that you can work through in stages; bite off only enough to manage and to keep the program going. We all have a lot going on; don't get discouraged by setting the bar too high at the beginning. Develop goals for success to include a measure of stick and use the checklist to determine plans for the future. The checklist is an excellent tool for your use when developing your capital improvement plan which is your future.

Driver Five: Act. *IAQ Tools for Schools* has set the framework for you in setting up a team. Within this team, you will want to educate them on IAQ concerns and best practices when addressing IAQ issues. Having an effective IAQ management plan is essential and will be the road map as you walk through IAQ issues. Your educated team, following the *IAQ Tools for Schools* format, will be invaluable to you when dealing with IAQ challenges, and they will be part of your success.

And Driver Six: Evaluate; during and after an event, evaluate your effectiveness. Was it or is it the operating team? Are they on board with your SLP treat procedures, as warranted? Your best efforts may not produce the results you wanted or expected. Have a plan to move on from this point – this may be the time to call in the outside professionals; their involvement will support your efforts and procedures, but will also help bring in another perspective. A very important tool when dealing with prolonged complaints of illness – I can't stress this enough – if you have really got to wits end and feel you've done everything you can, bring in an expert; it's time that they heard the same thing from someone else. It will, in summary, adopt the *IAQ Tools for Schools* program and follow its protocols; it's all done for you, so just get the packet and follow the program, but never ignore the program or the person who complains. If you get on the wrong foot in dealing with their concerns, you will never bridge the gap between yourself and those you serve. Take all IAQ concerns seriously and use tools to help solve the mystery, work hard to find the root of the problem and prepare swiftly, using qualified vendors. Continue using the checklist and conduct building tours to stop IAQ problems before they happen. Keep precise documentation processes through every complaint and keep records on file.

After millions of dollars in testing building repairs, airflow testing and rebalancing, and many years of constant stress and times spent away from other projects, our IAQ

issues have finally quieted down. Our staff have confidence in our abilities and know we will act when called upon. But this came at a big price.

In closing, I just want to tell you about our ace in-the-hole named Mindy. She's a small black lab from Florida, trained to detect molds. We called her in when we felt our mold concerns were over. We wanted a final check of our work. She was fascinating to watch. And since she had no opinion or care about the findings, her impartiality helped even the non-believers to feel confident that we had solved our mold issues.

Mindy found no building-related mold, only molded contents, such as abandoned fish tanks, fabric furniture, stuffed animals, classroom pillows, paper mache objects done by students, greenhouse items such as old plants and the field sneakers students wore when performing science experiments. Your IAQ plan must set a policy on acceptable contents.

Indoor air quality is everyone's concern, and all must work toward a clean and healthy environment. If you determine that a mold dog is an avenue you want to pursue, I would encourage you to do so. Mindy did not eliminate the need for repairs and testing, but she helped give a confidence to our staff that the problem had been handled to its fullest.

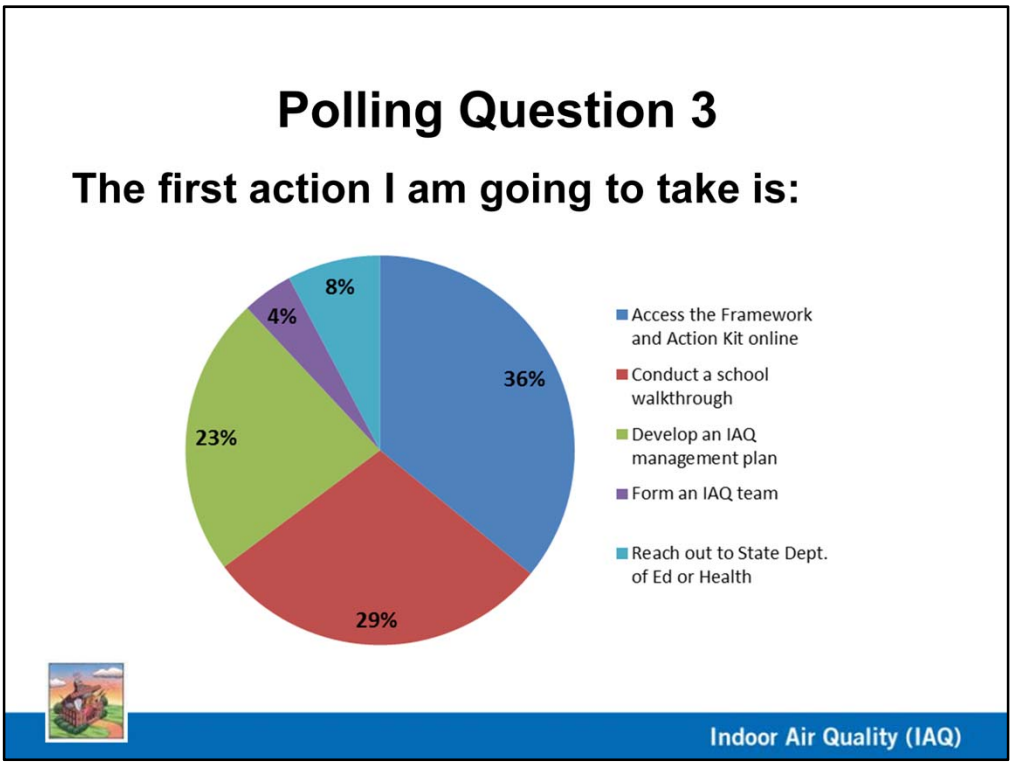
Last words of advice are for those of you that have new building or reconstruction plans in place: do not let the contractor or clerk of the work keep you offsite; inspect the walls before they're closed in; know your mechanical systems from their inception; keep good photo documentation that asks questions. You will be responsible for operating the building long after the contractors had moved on; know your buildings from the ground up. Initial construction is the place to start. Thank you all very much.

Jennifer Lemon:
Great, Alyce, thank you so much for that detailed, successful strategy that you used in your district. We really appreciate hearing all the information you provided. And thank you, again, for taking time out of your vacation to present this information on our webinar, today.

So, without further ado, still we have time for some questions and just some wrap up information. I am going to open up a poll real quick. So, now that you've heard all this great information, what are you going to do about it? What are you going to do when you get out of here right after the mold webinar? Are you going to take any of these actions? Hopefully you've learned some information that can help you educate

your colleagues or other stakeholders that you work with in a district. So, go ahead and vote!

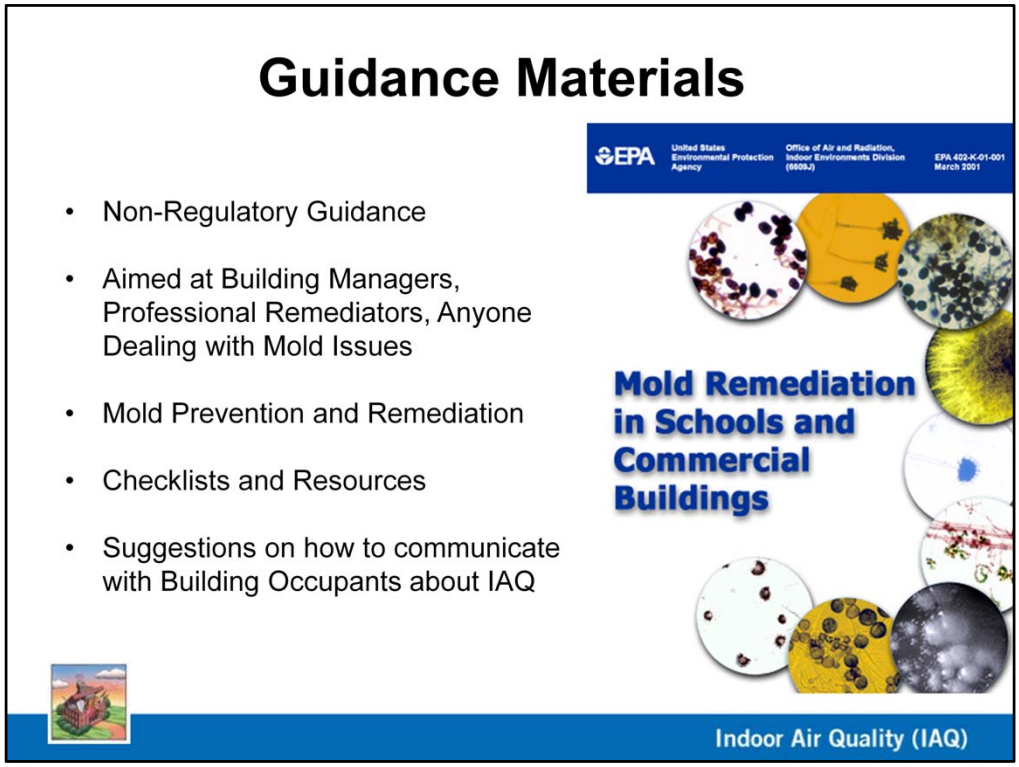
And remember that we do have the resources that I am about to talk about and what's also in the kit. All can help you perform and conduct a walkthrough without a checklist that we have, so please remember to use those online resources. I am going to go ahead and close the poll.



Jennifer Lemon:
Great! Well, I am really excited to hear that you guys will be using the Framework and that that was really a great resource for you to access. And, good to know that you'll be conducting walkthroughs. Sounds like you'll be searching for your own mold issues, and maybe you'll be engaging a dog, which is great. So, I would like to see more people form an IAQ team, but maybe, on the flip side, all of you on the phone already had one, so it's not something that you would need to worry about forming, anyway.

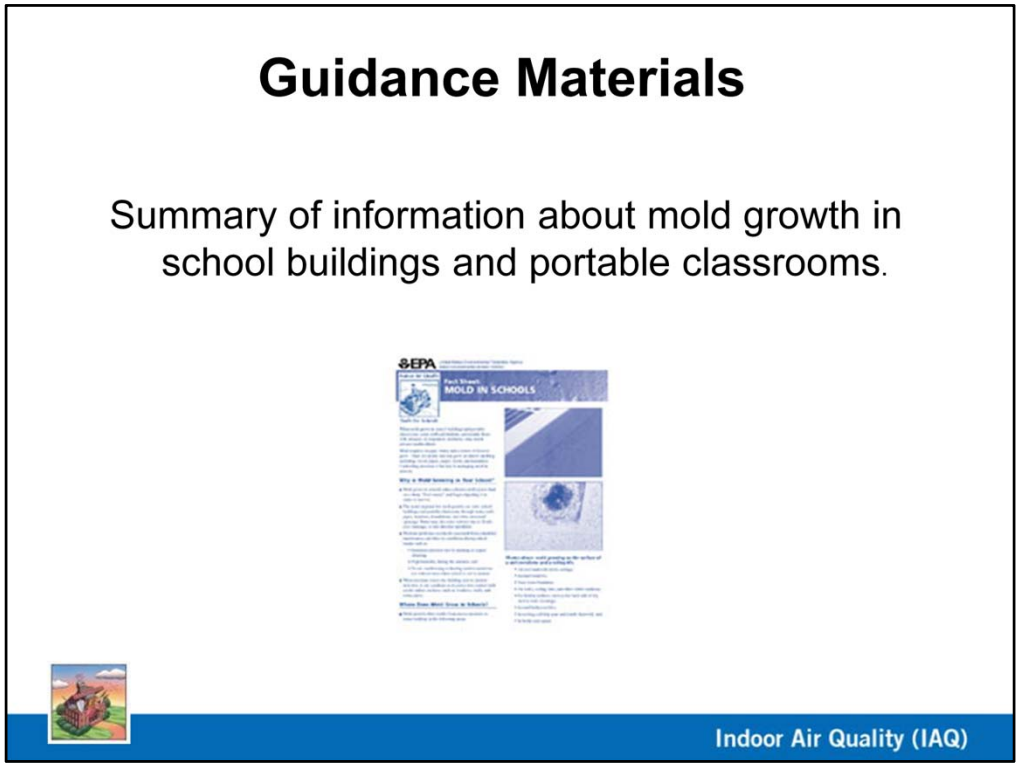
Jennifer Lemon:
So, we'll go ahead and move forward. We have some time for some questions and answers. I just wanted to remind everybody that we will be putting this information online. You'll be getting a follow-up email that provides a direct link to the presentation materials, the PowerPoint and the comprehensive question and answer document, since we may not be able to get to every single question; there's been a lot of interest, so we've gotten a lot of questions. Please still send in questions; we're trying to get as many as we can answered.

http://www.epa.gov/iaq/schools/webconferences.html



Jennifer Lemon:
So, really quickly, I'd like to go over – just reiterate – some brief guidance that we have here at EPA. This is probably a document, not only did Steven reference it, but probably a lot of you are familiar with our tools and resources. You will see along as we are talking about the chat feature, that this is something you can order for free. And you'll see a posting that will indicate a link; that way, you can place an order for this and provide them to your districts and your stakeholders and your areas. So, a very comprehensive document that not only can be used for schools but also commercial buildings.

http://www.epa.gov/iaq/schools/pubs.html#mold
http://www.epa.gov/mold/pdfs/moldremediation.pdf



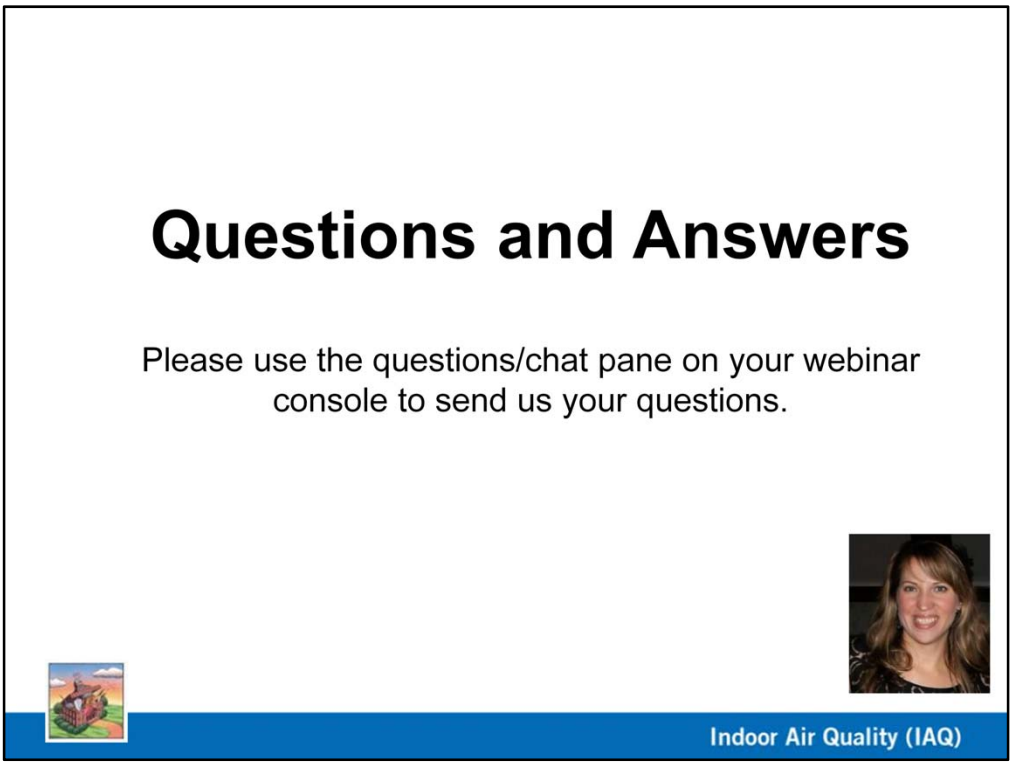
Jennifer Lemon:
We're going to go on to the next resource that we have. This is something more specific; it’s a one-pager and it's also is available for download online. It’s a .pdf, so you can print it off, or you can order copies of it as well, and it does specifically speak to portable classroom issue which, I know, they have a lot of mold issues, that it's very different than the whole commercial or school building that is on our property, so go ahead.

http://www.epa.gov/iaq/schools/pdfs/publications/moldfactsheet.pdf

Jennifer Lemon:
Steve also mentioned this: We are having a mold 201 webinar in November. And I know that's probably pretty far down the pike, but just to mark your social calendars to let you know that we are having that. And we'll go into more details about that. Steven is also the presenter on that webinar, so you'll be able to hear more information from him and have the opportunity to an engage and expert about this issue, as well.

Now, in the coming month we do have other webinars that are related to ask the management in schools what will be happening in September. And the webinar that's going to talk about IT management in tribal schools, and we will feature some successful strategies of people that have worked in tribal schools and engaged stakeholders to help make that happen. And, again, that will be in September, as well. So, as a participant on this webinar, you will receive an update about that so you can register in advance.

Jennifer Lemon:
This is our last opportunity to engage your speakers; we do have contract information that we will share with you. But if you have any specific questions for any of us, we are certainly more than willing to help you.



Jennifer Lemon:
So, if you're ready, we're going to go ahead and answer some specific questions that came in through the chat function. And Steven, Alyce, I am going to go ahead and start. I am not sure both of you could probably answer, but it looks like a lot of these potentially may be specifically for Steven. So, the first question we have is, "How damp is damp?"

Steven Caulfield:
Okay. "It depends," is the answer. But, if you're measuring with the moisture meter, it depends on the material. So, 'damp,' when you're referring to concrete is different than 'damp' referring to wood, is different than 'damp' referring to dry wall.

Now, that being said, dry wall doesn't hold much moisture before it gets to a point where it's saturated and mold growth will occur. And that's probably one of the materials that is quickest to grow mold, primarily because it's covered with paper that's made from ground up cellulose. That is really good mold food – already processed. But any source of moisture that leaves a visible stain or is visibly wet, I would consider as 'damp.'

Jennifer Lemon:
Alright, thanks, Steven. Another question we have – this one is specifically for Alyce.

A participant requested that you expand on the acceptable content policy and decide some mold is okay.

Alyce Swan:
The acceptable content policy follows along with what *IAQ Tools for Schools* recommends, like bringing in items from home, and your IPM program, which talks about chemicals in the workplace and safety in their use. I didn't catch the second part of the question.

Jennifer Lemon:
Yes, the second part is, “Due to some of your school sites, do you decide that some mold is okay?”

Alyce Swan:
Well, we know that there is mold everywhere, so I guess in that respect, yes, some mold okay. And you can't expect there not to be mold in places, but we certainly don't want mold at levels that can contribute to health concerns. And mold in the air? I guess that Steve could probably answer more scientifically than I am, but some mold is always going to be around, but we don't like it and we don't want it.

Jennifer Lemon:
Thanks, Alyce. Probably another question for Steven: “Can dirt in the loading cooling coils cause moisture to remain in the air or possibly raise the relative humidity?”

Steven Caulfield:
So, I guess we're talking about dirt that's kind of impacted and is stuck on the cooling coils. Well, there are. I don't know if I can get into the engineering associated with this, but as coils become more plugged with dirt, what happens is, the air bypasses the dirty sections. And because we're trying to maintain a constant flow rate, the air speeds up as it goes through a smaller area as you choke off the area of the coil. So, as it goes faster, it will tend to carry more moisture down the duct rather than having it drop into the drain pan.

So, I guess I mean that that's one of the issues. The other issue is that when you get dirt impacted on a cooling coil that's going to be continually wet. That is a place that you can grow mold. And, typically, the cooling coil is downstream of your filters, so you're not going to filter it out, so then you will grow mold and distribute down the duct work. So, it's kind of a double negative to let the coils get dirty.

Jennifer Lemon:
Great, thank you, Steven. As a reminder, please check your chat function. We posted

a bunch of resources where you can access our tools online. There is even a mold course on our EPA website that you can access that is free, and you get a certificate at the end of taking that course. So, another question: “How often should a visual inspection and physical assessment be conducted in areas where moist resources may be present, or where our remediation has been done?”

Steven Caulfield:
I guess you're throwing that to me; maybe Alyce can speak to how often she does it. We typically see them done maybe twice a year in a school, sort of sometime at the beginning and sometime toward the end of the school year, to keep tabs on things. But if there are ongoing moisture issues, it may prudent to do an assessment a little more often. I don't know if Alyce had something to add to that.

Alyce Swan:
In our district, if we know we have a moisture problem, the custodial staff checks it every morning. And we do have a little, very brief survey they fill out and give us to report back on what they've seen. Once we feel we have it under control, the maintenance guys, when they do their monthly PMs, will check on the systems. But every day the custodians are looking around the hot spots in the building and reporting back, and we're dealing with it, especially if you have a wet ceiling tile. In our district, the second we see a stained ceiling tile, we'll react to that by removing it and trying to find the water source. Whether it be a zone valve or a condensation or a roof leak, everything else stops and we run to that water, water problem or that stain problem, because if we don't, it gets away from you and it's really hard to get back on track.

Jennifer Lemon:
Great, thanks Alyce and Steven, both, for your time and your thoughtful comments and presentation. It is little after 2:15, so I want to be respectful of the time. I know we received a lot of questions; this is a very hot topic, and we will certainly get to all of them in a follow-up question and answer document.

So, as I said before, we will have this information available online. We will send you an email and let you know. We appreciate you taking the time out of your days to participate in our webinar. So, thank you and have a wonderful rest of the day.