A MESSAGE FROM YOUR SWFL ASHRAE PRESIDENT:

CASEY A. HAZEN

Greeting SWFL ASHRAE,

Welcome to the January edition of our monthly newsletter!
First off, I hope you enjoy the diverse collection of industry articles we've curated for you this month. These pieces offer some valuable insights into the latest advancements and trends in the industry and I hope you take something from them you can put into action this month.

Also, our February lunch meeting is coming up & will be scheduled February 19th to accommodate the AHR Expo in Orlando! We are extremely excited to welcome back our good friends from Aqua Air to present on the latest & greatest advancements in Cooling Towers! Details about this presnetation, as well as a link to RSVP, will be forthcoming. So please keep your eyes peeled for our February Lunch Meeting announcement coming soon!

Lastly, I want to encourage all of our members to join us in Orlando for the AHR Expo this year! It's a fantastic opportunity to experience the latest and greatest in HVAC&R technology, network with industry peers, and reconnect with old friends.

Stay tuned for further announcements regarding other exciting events planned for the month of February.

Cheers,

Casey Allen Hazen, BSME
SWFL Chapter President 2024-2025

Government Affairs

Government Affairs Chair - Trevor CItek

Federal Government Affairs

The U.S. Department of Energy (DOE) has created a new webpage that highlights the work DOE’s national labs are doing with artificial intelligence (AI) in energy, scientific research, and national security. In terms of energy, DOE is applying AI to improve energy efficiency with AI-powered control systems for buildings, as well as modernizing the energy grid to increase reliability, and developing new energy technologies such as next-generation batteries using AI. The DOE webpage can be found here.

Global Government Affairs

On November 12, an ASHRAE delegation led by Franco D’Atri, the President of ASHRAE’s Argentina Chapter, as well as Jason Alphonso, Bill McQuade, and Eleazar Rivera met with the Argentinian Ministry of Environment and Sustainable Development. The Ministry was represented by Cristina Goyenechea, the National Director of the Undersecretary for the Environment, and Juan Rodrigo Walsh, the Director of International Affairs of the Undersecretary. The ASHRAE team established action plans for energy efficiency and decarbonization, tailored to the Latin American perspective, and shared the importance of the built environment to the climate and a transition to new refrigerants. This meeting, which strengthened collaboration between these key regulators and the national ASHRAE Chapter, was the result of substantial effort by the Argentina Chapter, ASHRAE leadership, and Government Affairs to promote sustainable development in the region.

History of Air Conditioning

Refrigeration Chair - Kevin Jewell

One of the fascinating facts that I discovered listening to David was that the term "air conditioning" originally referred to the conditioning of cotton by using humidified air to treat it. This means it's not the condition of the air that is in question, but of the subject to which the air is applied. "This means you," as the old army recruiting posters and a million passive-aggressive memes tend to say

The precursors to air-conditioned buildings in the 19th century were large theaters and concert halls. Air was blown through ducts built into the building fabric using huge centrifugal fans. Cooling, when included, was achieved by blowing the air over blocks of ice. The ice would typically be harvested during winter from frozen lakes and rivers, stored for months in crudely insulated sheds and shipped to the city for sale for domestic and commercial use. The cooling of people at work in offices and factories was not a priority but during their leisure time, when increased comfort could be equated to increased spending on drinks and candy, cooling was paramount

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MONTHLY MEETINGS

- **February 19th: Lunch**
- **March 12th: Dinner**
- **April 9th: Dinner**
- **May 14th: Dinner**

2024-2025 Sponsorships Oppourtunities

Research Promotion Chair - Gary Devore

Diamond Sponsorship:

Trane Technologies

Gold Sponsorship:

Tom Barrow Company (TBCo), Commercial Air Management (CAM), B&I Contractors, Manhattan Construction, Gilbane Building Company, Thermal Concepts

Silver Sponsorship:

Diversified Fluid Controls, Integrated Cooling Solutions

Bronze Sponsorship:

Victaulic, Johnson Controls International (JCI), George A. Israel Jr. Inc.

I would like to thank those of you who have already committed to sponsorships for the 24-25 society year.

We would encourage anyone who values their membership in SWFL ASHRAE to review the many benefits of sponsorship detailed in the annual sponsorship letter attached at the end of this newsletter.

If you have agreed to be a 24-25 sponsor and do not see your name listed above, please reach out.

gdevore@bandiflorida.com / (239) 671-6448

Thank you, we appreciate your continued support.


David Schurk

It's More Than Just a Drip

The Fundamentals of Condensation

BY DAVID SCHURK, LIFE MEMBER ASHRAE

In air-conditioning system design and operation, sensible cooling is often achieved with dehumidification, a by-product of lowering the supply air's temperature. However, dehumidification should always be a deliberate and intentional engineering goal. In most modern buildings, dehumidification is accomplished through mechanical means, either by removing moisture from the air via the surface of a cold cooling coil or, in more advanced systems, through adsorption using a desiccant material. In both cases, dehumidification results from the condensation of moisture from humid air, and this process is central to maintaining optimal indoor air quality and comfort.

Background

The composition of dry air by volume at sea level is approximately 78% nitrogen and 21% oxygen, with lesser amounts of argon, carbon dioxide and other gases. Moist air can contain up to 4% water vapor by mass.[1] The amount of water vapor in the air at any given time is typically expressed by its humidity ratio. Humidity ratio is the mass of water vapor to the mass of dry air in a sample, or volume of moist air. Humidity ratio, water vapor pressure and dew-point temperature are mutually dependent properties. The air around us always contains water molecules as vapor, which most of the time cannot be seen, while condensation may be easily visible to the naked eye.

We can define condensation as a change of phase of a vapor into its liquid form by extracting heat from the vapor. For this discussion, condensation is the process by which water vapor in the air is changed (condensed) into liquid water.

How is Condensation Formed?

A water molecule consists of two hydrogen atoms bonded covalently with an atom of oxygen. Water molecules (H_2O) can interact and be attracted to each other in three ways: hydrogen bonding, van der Waals interactions and electrostatic interactions. Most important is the forming of hydrogen bonds between these molecules. Therefore, water molecules can create extensive chains that form infinite clusters of liquid water.[2] A single water molecule is 2.75 angstroms (Å)

David Schurk is director of Healthcare and Applied Engineering Markets for Innovative Air Technologies in Covington, Ga.

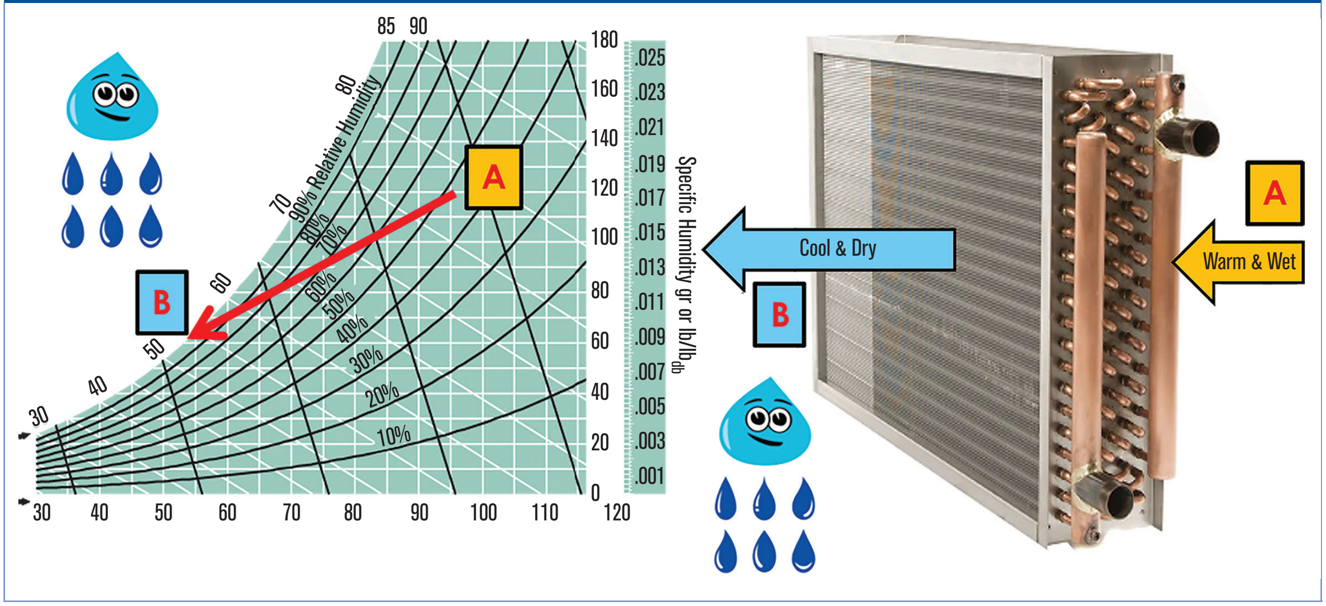


FIGURE 1 Psychrometrics of cold coil dehumidification.

(0.00000000275 m), and as a vapor it can pass through small openings in materials. Note that the size of oxygen is approximately 3.46 Å; so, while slightly larger than H_2O, it is still very small. Weather barriers used in building construction can be engineered as breathable, non-perforated materials with millions of microscopic pores that allow water vapor to pass through (to allow for drying) while restricting or blocking bulk water and airflow (air barrier). It is the clustering of multiple H_2O molecules that allows materials like these to be hydrophobic, repelling liquid water.

The arrangement of molecules in the air transforms as water changes phase between its gaseous (vapor), liquid and solid forms. Condensation occurs when enough energy is removed from this gas so that the strength of attraction between molecules will eventually become stronger than the kinetic energy of the moving molecules, and the gas will become a liquid, condensing when heat is released to the atmosphere as a result.[3]

The quantity of energy required to change a substance from its gas phase to its liquid phase at constant temperature and pressure is called the *latent heat of condensation*. Water's latent heat of condensation varies from 970.10 Btu/lb (2256.47 kJ/kg) at 212°F (100°C) to 1075.20 Btu/lb (2500.93 kJ/kg) at 32°F (0°C).[4] Also referred to as the *condensation process*, an approximation of 1,060 Btu/lb (2465 kJ/kg) of energy at 60°F (15°C) is sometimes used for convenience in the world of traditional heating, ventilating, air-conditioning and dehumidification (HVAC+D) engineering.

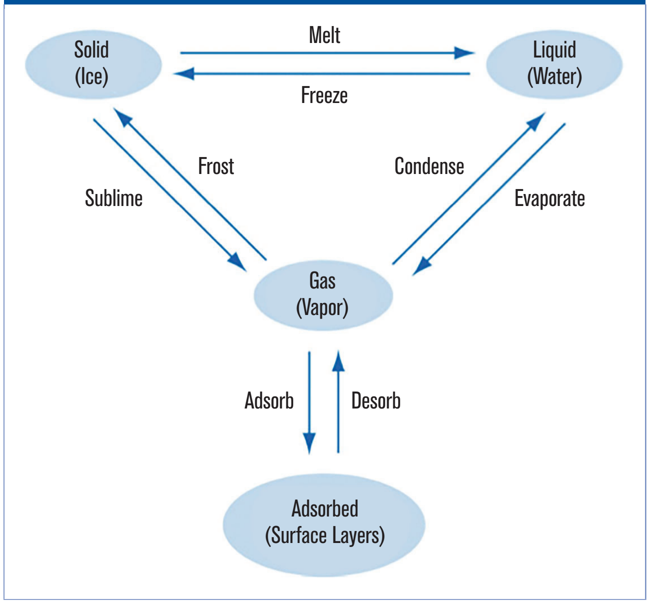
Water molecules on their own are too small to effectively bond together to form a droplet and will resist condensation without having sites on which to do so. According to the National Oceanic and Atmospheric Administration, condensation nuclei are minute solid and liquid particles found in abundance in the atmosphere that allow water vapor to condense into liquid water droplets. These particles are hygroscopic, meaning they attract water molecules, and are found in many forms such as smoke, ocean spray and wind-blown soil. Without condensation nuclei, water vapor would need to reach a relative humidity of 300% to 400% before it could condense into droplets.

Condensation is the basis for dehumidification. ASHRAE has defined dehumidification as the removal of water vapor from air, gases or other fluids.[5] The formation of condensation upon a suitable nonporous surface is the principle behind how HVAC+D systems have traditionally removed and managed moisture in the air. Moisture management controls the air's specific humidity and regulates its dew-point temperature to help maintain safe, comfortable, compliant and productive indoor built environments, particularly in hot and humid regions of the world.

Traditional Condensation Methodologies

In traditional HVAC+D applications, condensation of moisture occurs when air is chilled below its dew-point

FIGURE 2 Four "phases" of water.



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temperature through contact with a cold surface such as a cooling coil supplied with refrigerant or chilled water. As warm, humid air passes through the coil's tubes and fins, its sensible temperature is reduced as heat is absorbed into the cold circulating medium. Depending on the leaving temperature of the air, latent heat may also be removed through formation of liquid condensate, which lowers the specific humidity of the air (*Figure 1*).

Hydrogen-bonding between neighboring water molecules produces a strong cohesive effect that is responsible for water's liquid nature at ambient temperatures. As water vapor condenses, molecules join, forming droplets, which combine with each other (also known as coalescence). They then fall, by gravity, down the surface of the cooling coil into a sloped drain pan to exit the building through a drain line to a suitable disposal site.

Alternative Condensation Methodology

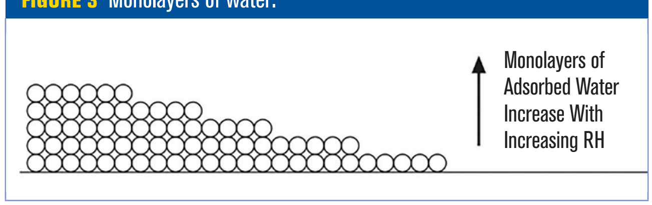
Another common phase of water is the "adsorbed" state. Adsorption is considered by some to be the fourth state of matter, in addition to gaseous, liquid and solid forms (*Figure 2*).

It is also referred to as "sorbed," "hygroscopic" or "bound" water. Adsorption is a process in which fluid molecules are concentrated on a surface by chemical or physical forces or both. In the adsorbed state, water is like liquid water in that it has condensed from the vapor form to a lower energy state, yet it is different in that it is more tightly held to a surface and at an even lower energy than liquid water.[1] Sorption, the effect of adsorption, is a property that relates the amount of moisture a material will hold at a specific relative humidity and temperature. If a material is hydrophilic ("water loving") and capillary active, meaning that it has internal surface area for water molecules to be adsorbed, and it has small interconnected passages or capillaries for moisture to gain access, then it has some water storage potential. Water vapor molecules can be attracted by the complementary polar nature of the molecules that make up a solid material. Water vapor molecules may strike the surface of a solid and be captured for a time by attractive forces.[6]

Adsorbents are materials that can attract and adsorb (hold) gases. Many materials used in the construction of modern buildings (gypsum board, ceiling tile, wood, carpeting and more) are hygroscopic in nature, meaning they can adsorb moisture from the air. All hygroscopic materials will adsorb water vapor until they reach equilibrium with the vapor pressure of the surrounding air. Most building materials do not have the moisture holding capacity required to dehumidify air to indoor environmental standards nor are they designed for this task. Engineered desiccant materials can be used in HVAC+D equipment for this purpose with silica gel being a common desiccant material used for removing large quantities of moisture from the air. Its high hydrogen bonding capabilities make it an ideal desiccant.[7] Its structural porosity allows it to adsorb and retain up to 40% of its mass in water. It is economically priced, commercially available, chemically inert, odorless, nontoxic and noncorrosive.[8]

For water molecules going from the liquid to the adsorbed state, energy is given off, and this is termed the *latent heat of adsorption*. Adsorbed water molecules adhere to surfaces in "monolayers." Water can begin to exist in the adsorbed state within desiccant materials at low relative humidity levels—and as relative humidity

FIGURE 3 Monolayers of water.



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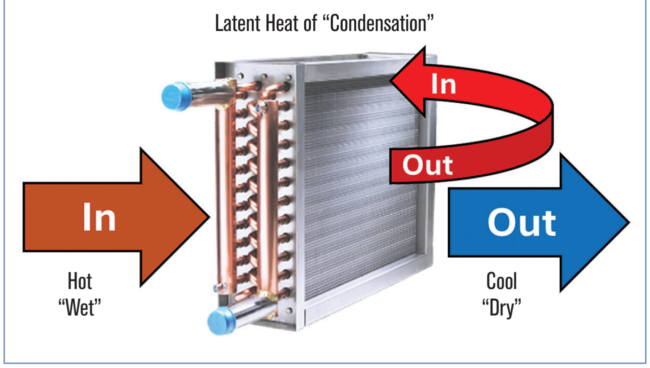
(RH) increases the number of adsorbed layers held in the porous structure of the desiccant also increases (*Figure 3*).

The adsorbed film layer can increase from approximately one or two to several water molecules thick. The heat of adsorption is related to the adsorbed film thickness and is a measure of the excess binding energy of the water molecules to the desiccant over that between the water molecules in the liquid state.[1]

Managing the Latent Heat of Dehumidification

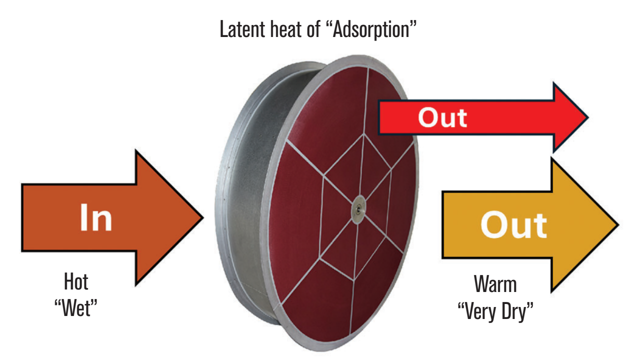
As explained earlier, when water vapor in the air is either condensed into liquid form or transformed to an adsorbed state, energy is required for this change to occur (latent heat of condensation or adsorption). The latent heat released becomes a sensible gain to the air with its dry-bulb temperature increased and its humidity ratio lowered. Regardless of the condensation methodology used, the principles of thermodynamics and psychrometrics hold true.

FIGURE 4 Latent heat of condensation "removed" from airstream.



In a traditional refrigerant-based cold-coil dehumidification system, the sensible heat, which is imparted to the air, is immediately absorbed into the refrigerant or chilled water being circulated within, so the leaving air does not see a marked increase in temperature (*Figure 4*). It most certainly becomes a part of the refrigeration load, however, and its temperature must be elevated further (typically through compression) before being transferred to a suitable system component that rejects it from the building,

FIGURE 5 Latent heat of adsorption left in airstream.



typically some type of condensing unit or cooling tower.

Removing moisture from the air requires that the coil's surface be at a lower temperature than its entering air's dew-point temperature. Therefore, the coil must be maintained at that specific temperature, which will condense enough moisture from the air. Sometimes this ends up requiring a very cold coil, resulting in supply air temperatures too low for occupant comfort. In cases like this, new energy in the form of reheat must be added to the leaving air to warm it up (sensibly) before distribution to the space. Sometimes the amount of moisture to be removed requires a surface temperature colder than the coil can support. Cold-coil air-conditioning systems are restricted to a surface temperature no colder than where frost-or-freezing of condensate occurs on the coil's surface when moisture is being removed. This temperature typically ranges from as high as 34°F (2.2°C) but certainly no lower than 32°F (0°C).

With desiccant dehumidification systems, the latent heat of adsorption also imparts an associated rise in temperature to the airstream flowing through the desiccant material (*Figure 5*). In actual practice, the dry-bulb temperature heat gain in the desiccant process is 10% to 30% greater than predicted by a pure conversion of latent heat to sensible heat due to the residual heat carried over or retained by the desiccant and its supporting structure (the regeneration process) and a phenomenon called *the heat of wetting*.[4]

Sensible only post-cooling can be provided to further cool this air, and since the moisture has been removed (desiccated) from the air prior to entering the coil, there is no condensation so the coil temperature is not limited to that which would freeze liquid water on a traditional cold coil surface. Leaving air temperatures well below 32°F (0°C) can be achieved while also providing much lower leaving dew-point temperatures—perhaps as low as -80°F (-62°C) if necessary. Leaving the converted sensible heat gain in the desiccant's process airstream can allow it to be used as "heat-recovery" to help reduce or eliminate the requirement for energy intensive reheat, contributing to overall energy savings and sustainability.

Conclusion

HVAC+D engineering professionals are constantly dealing with water vapor in the air, along with its condensation upon and within surfaces and materials, as they endeavor to design air-conditioning systems for buildings. Unfortunately, many times dehumidification may receive little consideration, simply being a by-product of sensibly cooling the air. HVAC+D should be regarded as a process which, among many things, removes the proper amount of moisture from the air to maintain indoor built environments that are productive and compliant for various commercial/industrial applications and comfortable for the occupants who inhabit any building. Hopefully this primer on the condensation process and its various methodologies will help provide a better understanding of this important and fundamental phenomenon and shed light on various ways it can be accomplished.

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Refrigeration Tour 2024

Historian Chair- Sidney Feldman

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THANK YOU FOR YOUR SUPPORT!

From: ASHRAE Southwest Florida Chapter

Subject: ASHRAE Southwest Florida Sponsorship Opportunities for 2024-2025

The ASHRAE Southwest Florida Chapter RP fund-raising events are excellent sponsorship opportunities. Your company reaches many key decision makers and sends a strong message of supporting the research that the community relies upon for comfort and sustainability.

The Southwest Florida Chapter is continuing to make sponsorships even easier by offering levels that include the promotion of your company at all chapter events! If you are unable to contribute at one of these levels, sponsorship opportunities for the Golf and Fishing tournaments will be offered separately before each event!

Go To: **https://www.swflashrae.org/sponsorship** for an on-line payment option!

Annual Sponsorship Levels

Gold Level - $3,500 (Savings: $885)

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- Signage at each monthly meeting (Value: $100)
- Logo on Monthly Newsletter (Value: $100)

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- Golf Tournament: Silver Sponsorship Package (Value: $1,265)
    - (4) Player Entries, (1) Tee Sponsorship, (4) Mulligans, (1) Arm Length Raffle, (4) Putting Contest Entries
- Fishing Tournament: Silver Sponsorship Package (Value: $425)
    - (2) Entries, Company Logo on Shirt
- (2) YEA Cornhole Tournament Entries (Value: $50)
- (5) Monthly Meeting Tickets (Value: $175)
- Signage at each monthly meeting (Value: $100)
- Logo on Monthly Newsletter (Value: $100)

Bronze Level - $1,000 (Savings: $350*)

- Golf Tournament: Tee Sponsorship (Value: $500)
- Fishing Tournament: Bronze Sponsorship Package (Value: $625*)
    - (1) Entry, Company Logo on Shirt
- (1) YEA Cornhole Tournament Entry (Value: $25)
- (2) Entries in either Golf or Fishing Tournaments (Value: $250)
- Signage at each monthly meeting (Value: $100)
- Logo on Monthly Newsletter (Value: $100)

Portion of Proceeds to Benefit ASHRAE Research and the SWFL ASHRAE Chapter Endowment Fund
SWFL ASHRAE is a 501©(3) not for profit organization

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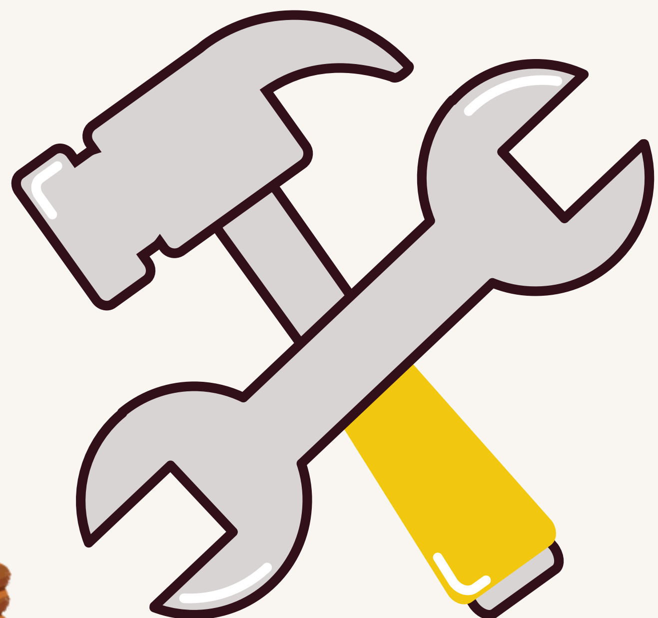
Scheduled Technical Tours at B&I Office:

- Wednesday, November 13th
  (10am-12pm) - School TBD
- Wednesday, December 4th
  (10am-12pm) - School TBD
- Wednesday, January 22nd
  (10am-12pm) - School TBD
- Wednesday, February 12th
  (10am-12pm) - School TBD
- Potential for One Additional Stem@Work



THE FOUNDATION FOR LEE COUNTY PUBLIC SCHOOLS, INC.
Enhance | Enrich | Excel

Message from the Foundation

Since 1986 the mission of the Foundation has been to enhance the quality of public education in Lee County by increasing community involvement in, and support for, Lee County Public Schools. A diverse group of local business and community leaders realized that the cornerstone of an economically strong community was a quality public education system.

The purpose of every initiative of The Foundation for Lee County Public Schools is to enhance and enrich the quality of public education in Lee County for students and educators. View our various programs to learn more about our students' unique learning opportunities and how teachers themselves are recognized and encouraged in their dedicated efforts.

Stem@Work

Our focus on STEM began with the notion that students need more opportunities in the areas of Science, Technology, Engineering, and Math related fields. The National Science Foundation estimates that 80% of the jobs created in the next decade will require some form of math and science skills.

Our STEM Initiatives are a collaboration between the Foundation and the School District of Lee County. Funded through the generosity of our business partners, this initiative offers students the opportunity to participate in field trips and internships, as well as experience hands-on activities through partnerships with businesses in the community. Check out more information at: https://leeschoolfoundation.org/

Student Advocacy & Mentoring Partnership (STAMP)

Realizing the great impact that mentors have on students, the Foundation has implemented the Student Advocacy & Mentoring Partnership (STAMP). STAMP is a program that offers students the opportunity to achieve success by providing them college and career planning resources and volunteer mentors to give students assistance, guidance, motivation and accountability to work hard and to ensure they graduate from high school to continue their education either through technical training or earning a college degree. It is a multi-year commitment for at-risk high school students to invest in their future and increase the high school graduation rate and post-secondary educational opportunities.

The STAMP program strives to accommodate eligible students, match them with mentors, and assist them in acquiring scholarships to cover the cost of attending college or other post-secondary training. Students and their families, mentors, school coordinators, and Foundation staff all work together through the STAMP program and are instrumental in helping students pursue their post-high school education and career goals. Students will also be able to attend STEM@work events to learn about local businesses.

Apply to STAMP