AABC Commissioning Group

AIA Provider Number 50111116

Maintaining Temperature & Humidity in Critical Zones

Course Number: CXENERGY1702

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Course Description

The battle to maintain temperature and humidity within critical zones has given HVAC engineers “headaches” and caused havoc for years. This presentation discusses the points of difference between the standard designs of humidity and temperature control versus the “predictable indoor environment” humidity and temperature control. Learn how technology can provide a neutral air zone in the most sustainable and efficient manner while providing real world, third-party validated data.

Learning Objectives

At the end of the this course, participants will be able to:

1. Learn the main zone variables of temperature, humidity and particulates.

2. Understand what it means to create neutral air.

3. Learn how to provide the “predictable indoor environment” using a technology that controls temperature and humidity via packaged rooftop units.

4. Learn the relationship of improper temperature and humidity to mold issues, sick building syndrome and increased asthmatic occurrences.

Course Description

Not controlling both temperature and humidity properly can cause a multitude of issues within a building. Course will describe how to balance these two zone attributes while delivering the proper BTUh, CFM and ACH to the zone?

Topics include:

1. The main zone variables of temperature, humidity and particulates.
2. What does it mean to create neutral air?
3. How to provide the “predictable indoor environment” using technology that controls temperature and humidity.
4. The impact of “over cooling” and the “cold damp” zone syndrome.

The Typical Scenario

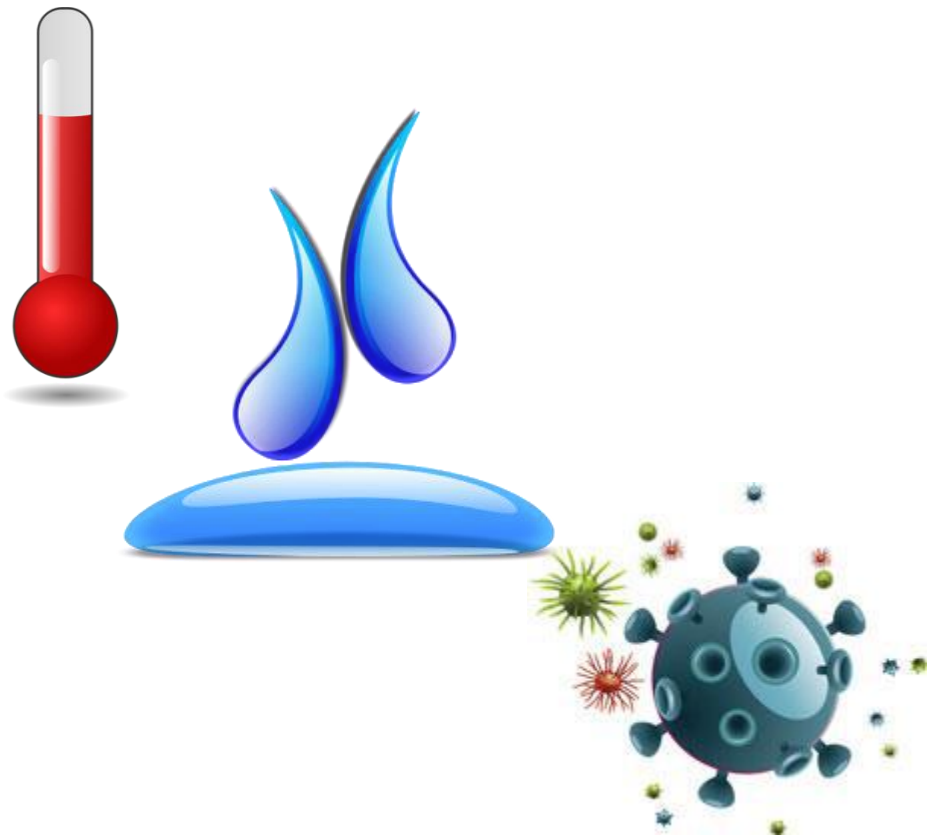
Standard Design: Single Packaged Roof Top serving multiple zones

- One HVAC System
- One Thermostat
- Multiple zones
- Fixed Outside Air intake
- Poor Maintenance

The Main Zone Variables

What Effects the Condition of a Zone:

- Temperature
  - Cold or Hot
- Humidity
  - Dry or Damp
- Particulates
  - Dust, Grease, Oils Pollen, Hair, Skin



Source: ASHRAE

Temperature, Humidity and Particulates

The Main Zone Variables: Above Average Temperature Set Points, Ideal Zone Conditions

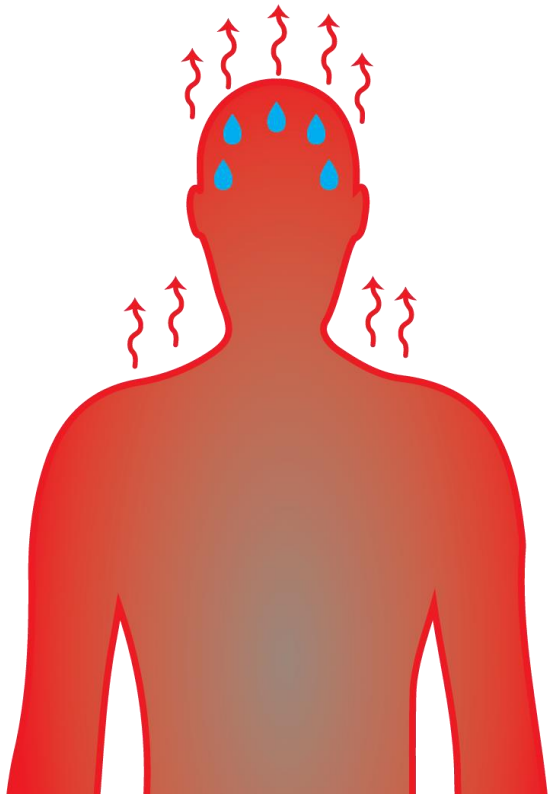
	Air Temperature (Degrees F)								
Relative Humidity	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
0%	56	61	64	69	73	78	83	87	91
10%	56	62	65	70	75	80	85	90	95
20%	57	62	66	72	77	82	87	93	99
30%	57	63	67	73	78	84	90	96	104
40%	58	63	68	74	79	86	93	101	110
45%	58	63	69	74	80	85	94	103	114
50%	58	64	69	75	81	88	96	107	120
55%	58	64	69	75	81	89	98	110	127
60%	59	64	70	76	82	90	100	114	132
70%	59	64	70	77	85	93	106	124	144
80%	59	65	71	78	86	97	113	136	157
90%	60	65	71	79	88	102	122	150	
100%	60	66	72	80	91	108	133		

Temperature, Humidity and Particulates

The Main Zone Variables: Effects of Humidity

Evaporation requires thermal (heat) energy, so evaporation is a cooling process.

Hot and Humid: When our sweat evaporates it cools our bodies. On a hot humid day, sweat does not evaporate as easily, so the body's cooling mechanism does not work as well. The limited evaporation in humid conditions is not enough to cool the body.



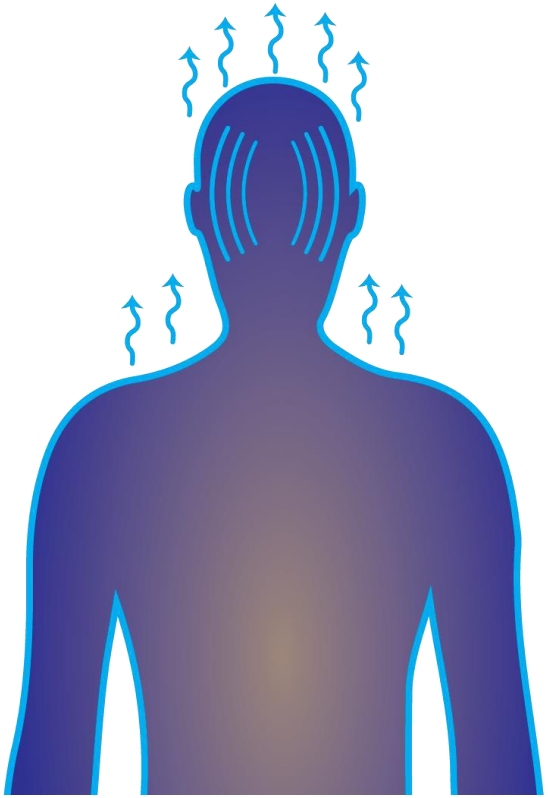
Temperature, Humidity and Particulates

The Main Zone Variables: Effects of Humidity

Evaporation requires thermal (heat) energy, so evaporation is a cooling process.

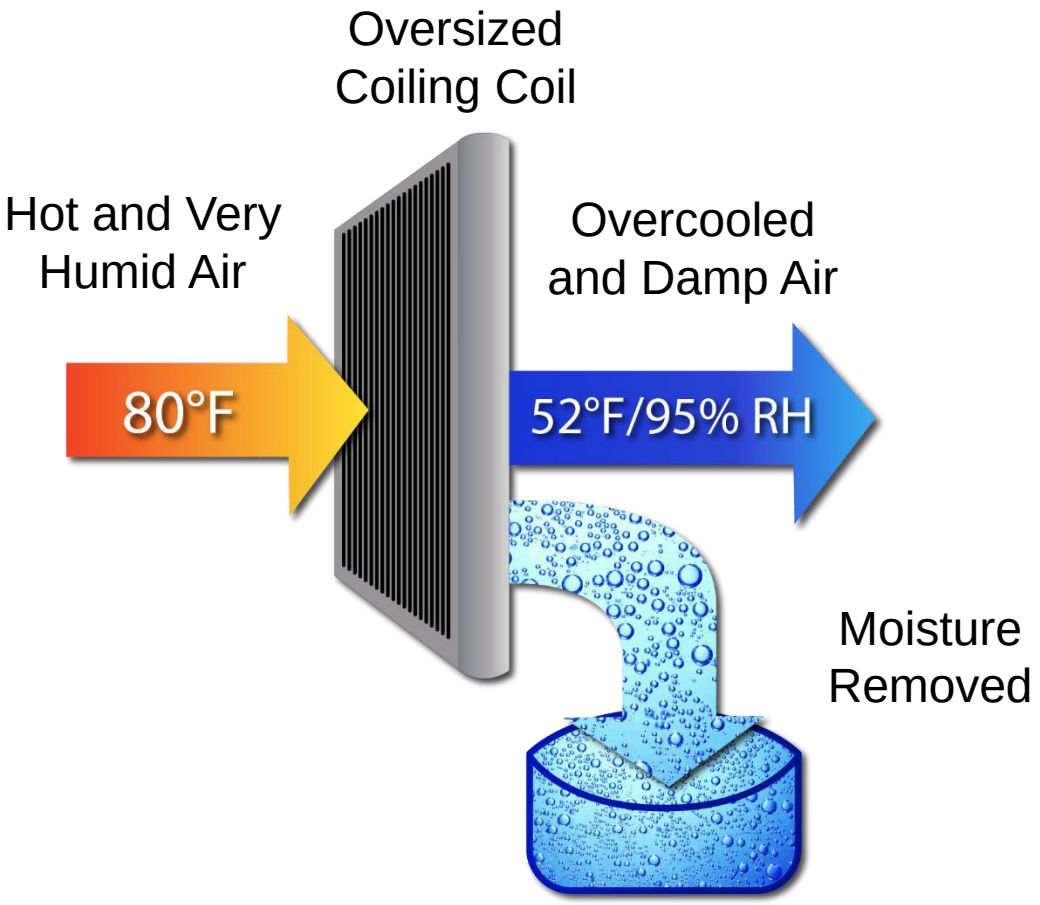
Cold and Humid: The body does not need a cooling mechanism, so the body sweats less. The high humidity does effect not therefore limit evaporation to keep the body warm as it does on a hot humid day

Therefore the mechanism that causes a humidity to make a hot day feel hotter does not apply in cool weather



Why the Cold Damp Zone?

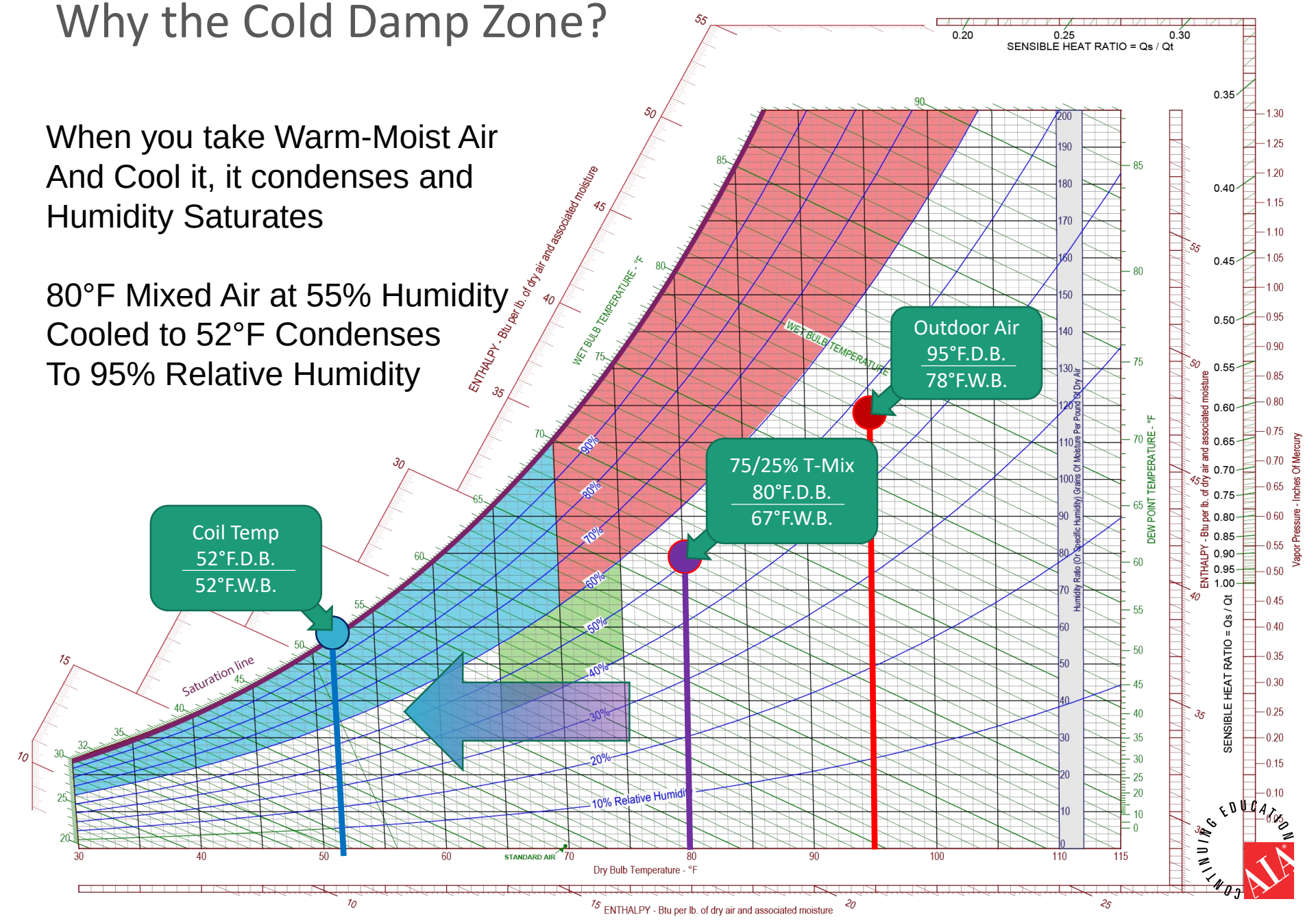
Creating the Cold Damp Zone



Why the Cold Damp Zone?

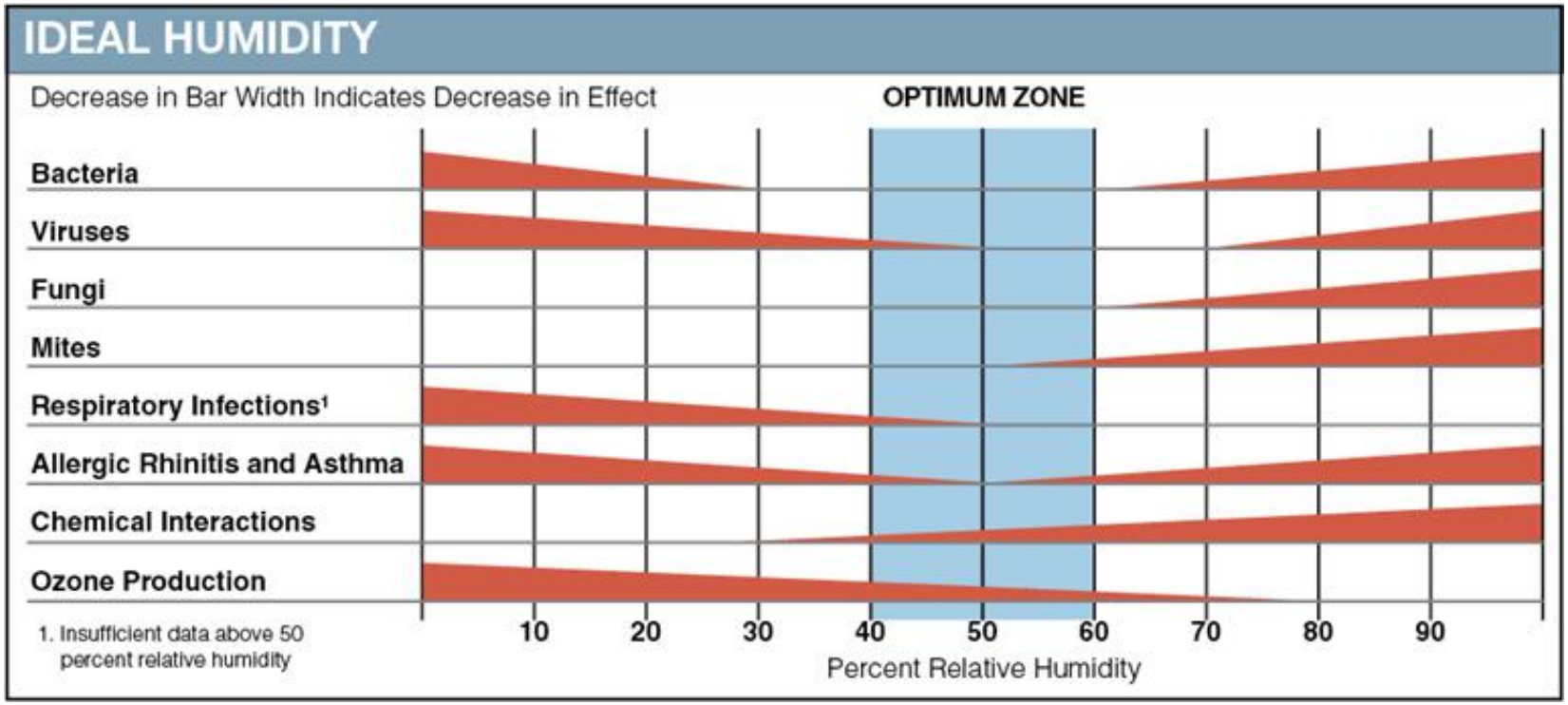
When you take Warm-Moist Air
And Cool it, it condenses and
Humidity Saturates

80°F Mixed Air at 55% Humidity
Cooled to 52°F Condenses
To 95% Relative Humidity



Optimum Zone Conditions

The Main Zone Variables: Humidity, what impact does it have one zones



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Optimum Zone Conditions

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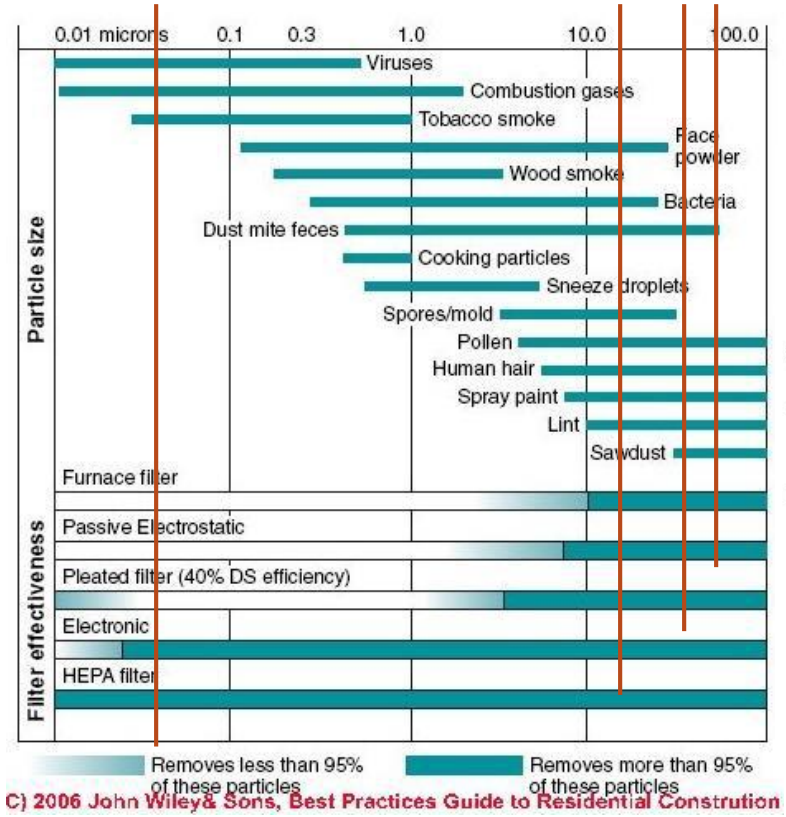
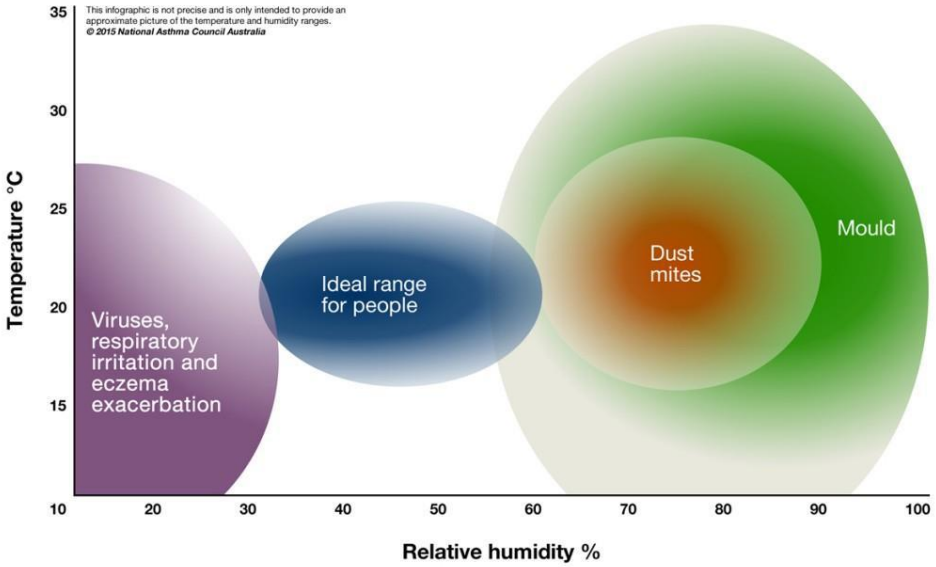




Source: John Wiley & Sons

Controlling Humidity

The Impact of the Standard Design:

- Creates High humidity issues
- Removes minimal moisture from the air
- Overcooling Causes the Cold Wet Zone
- Undercooling Causes the Hot Humid Zone

Controlling Humidity

The Impact of the Reheat Design:

High humidity issues

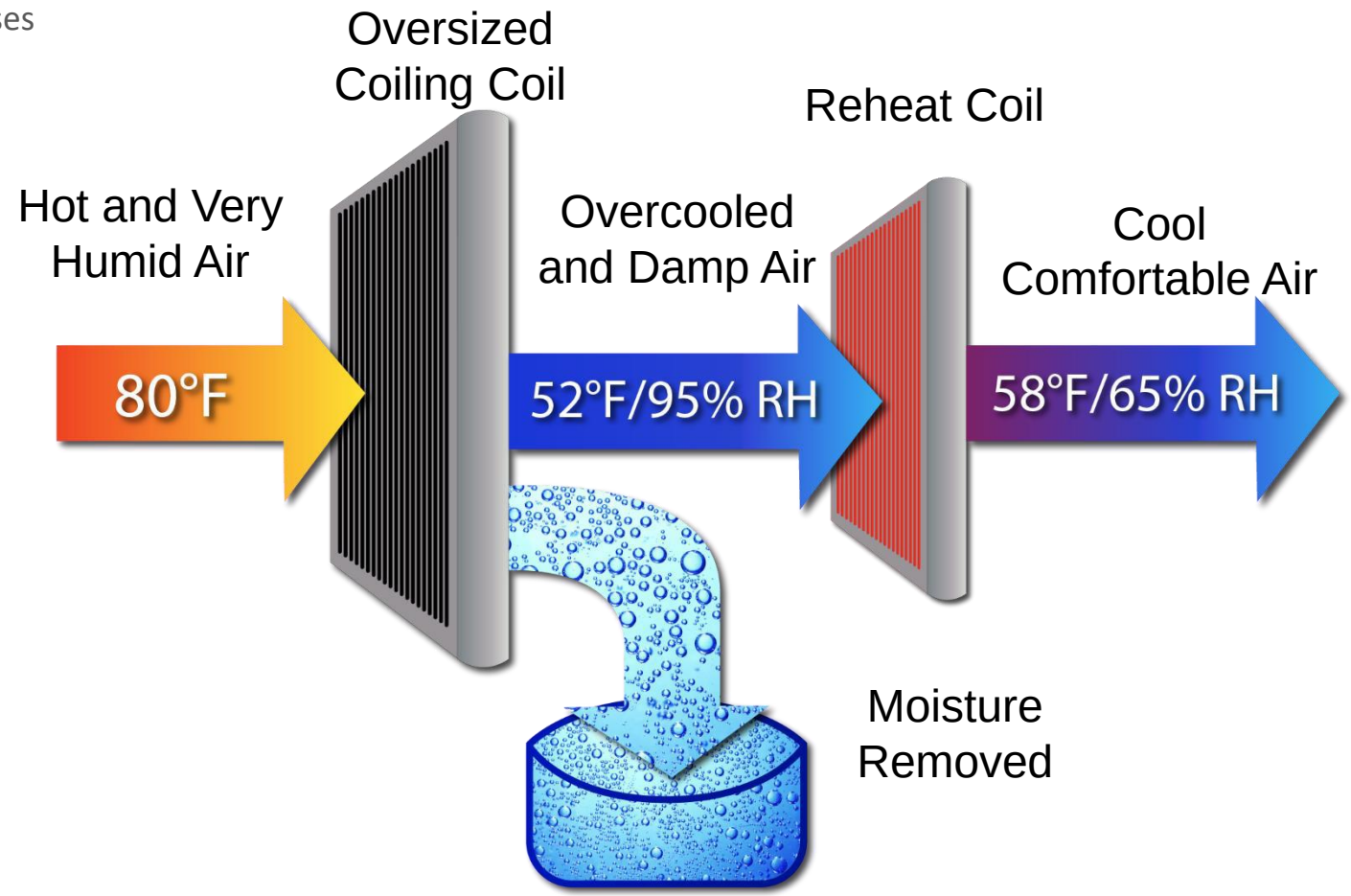
Reheat coil or heating coil in the constant air volume system is important in the relative humidity control, especially in the hot and humid regions of U.S. where the latent cooling load is large percentage of the total load.

Reheat coil completely solved the humidity problem.

Oaktrust library Texas A&M

Using Reheat to Reduce Humidity

Reheating Overcooled air reduces the humidity as the temperature increases



Creating a Predictable Indoor Environment

Going Beyond Basic Reheat

- Typical Reheat provides a more comfortable environment
- It does still overcool the zone when there is no latent heat in the zone
- Can still lead to the Cold Damp zone
- The answer is to provide Neutral Temperature Air

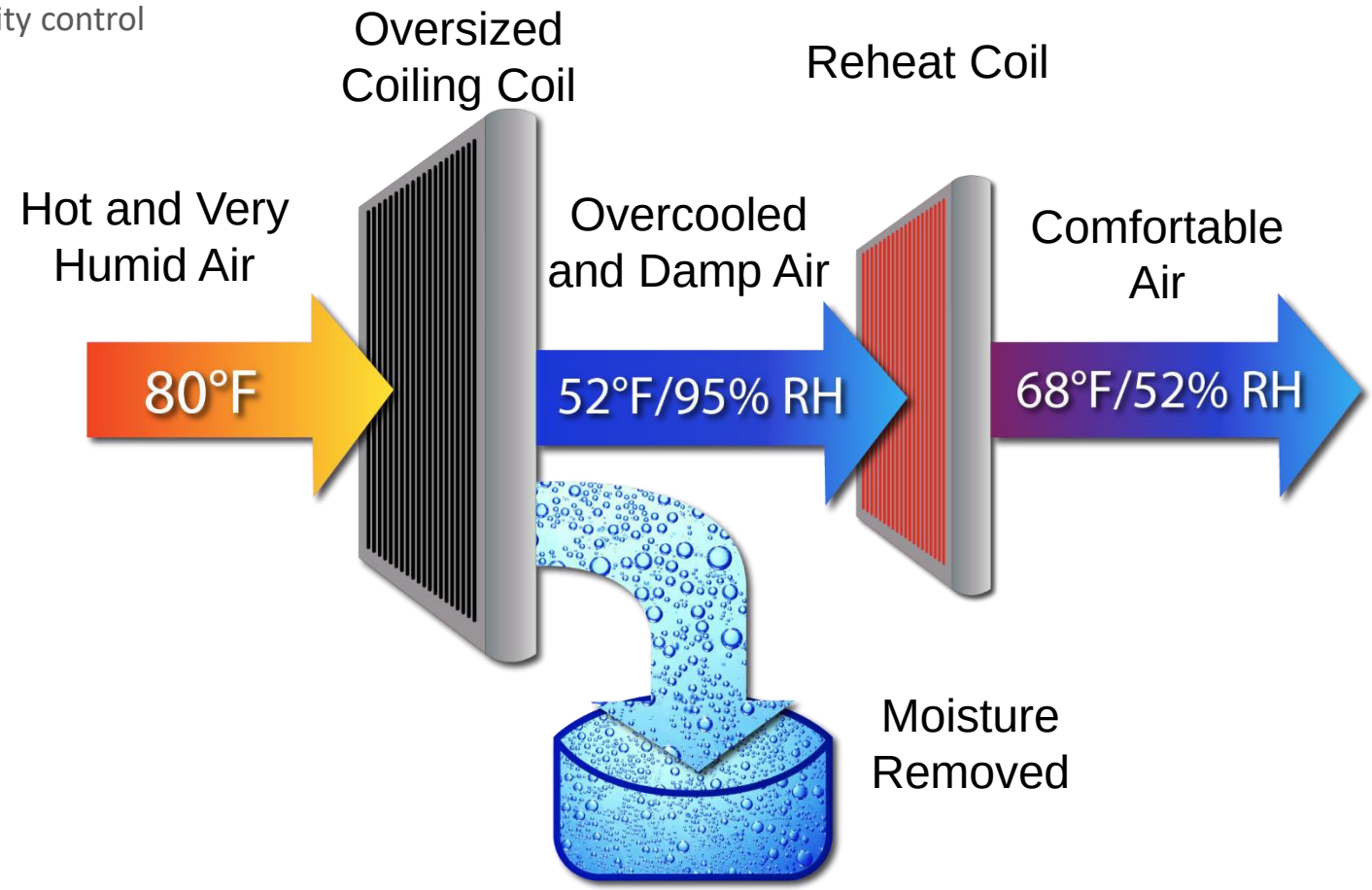
Creating Neutral Air

Define:

- What does it mean to create Neutral Air?
  - Able to bring OA & RA (Tmix) properties to a neutral temperature
- What is Neutral Temperature?
  - A Neutral Temperature is one in which the Dry Bulb of the Air Leaving the HVAC System is close to the Dry Bulb of the Air In the Zone

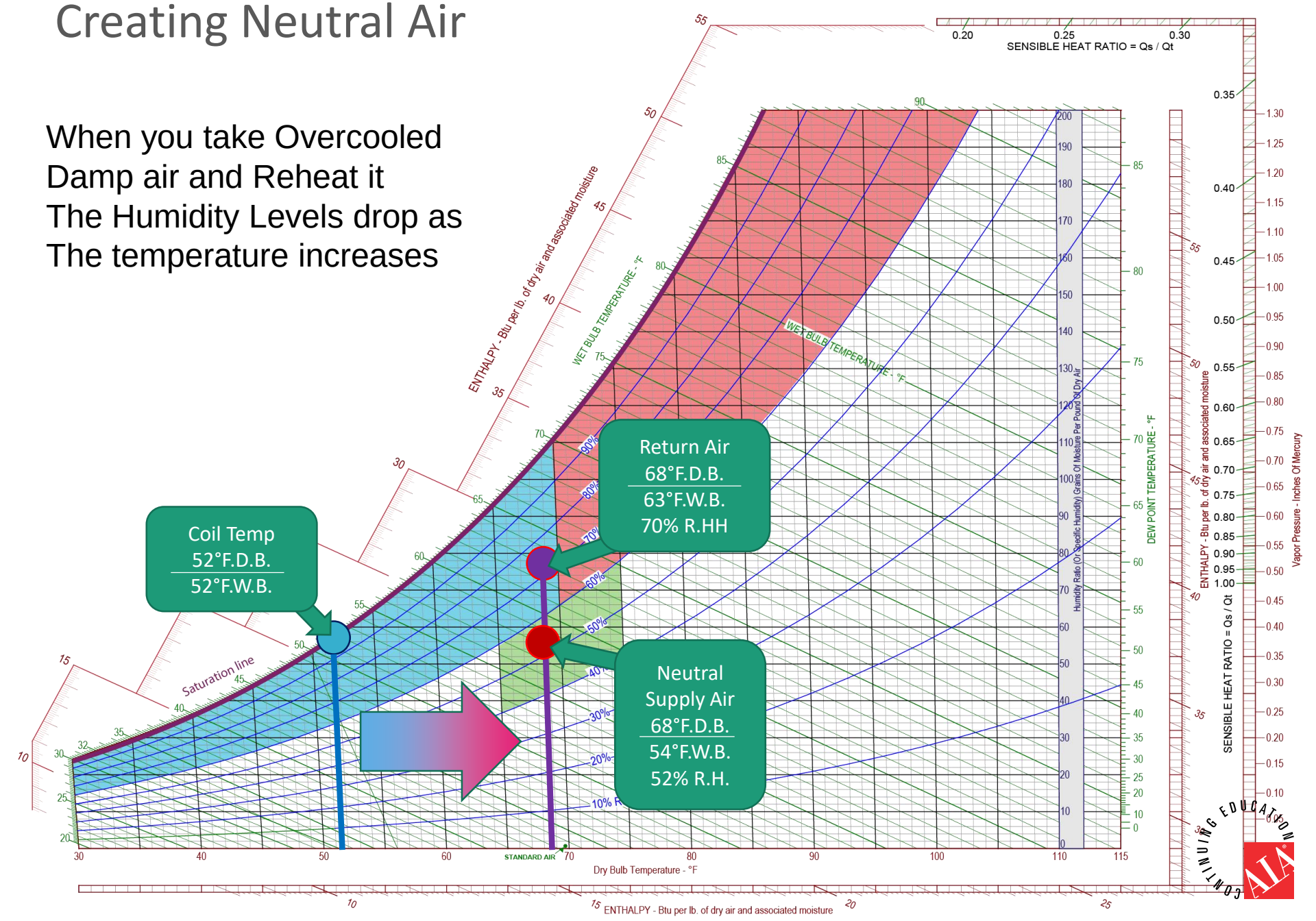
Creating Neutral Air

Controlling the temperature of the reheat cold and cooling coil allows for more accurate temperature and humidity control



Creating Neutral Air

When you take Overcooled
Damp air and Reheat it
The Humidity Levels drop as
The temperature increases



Emerging Technology

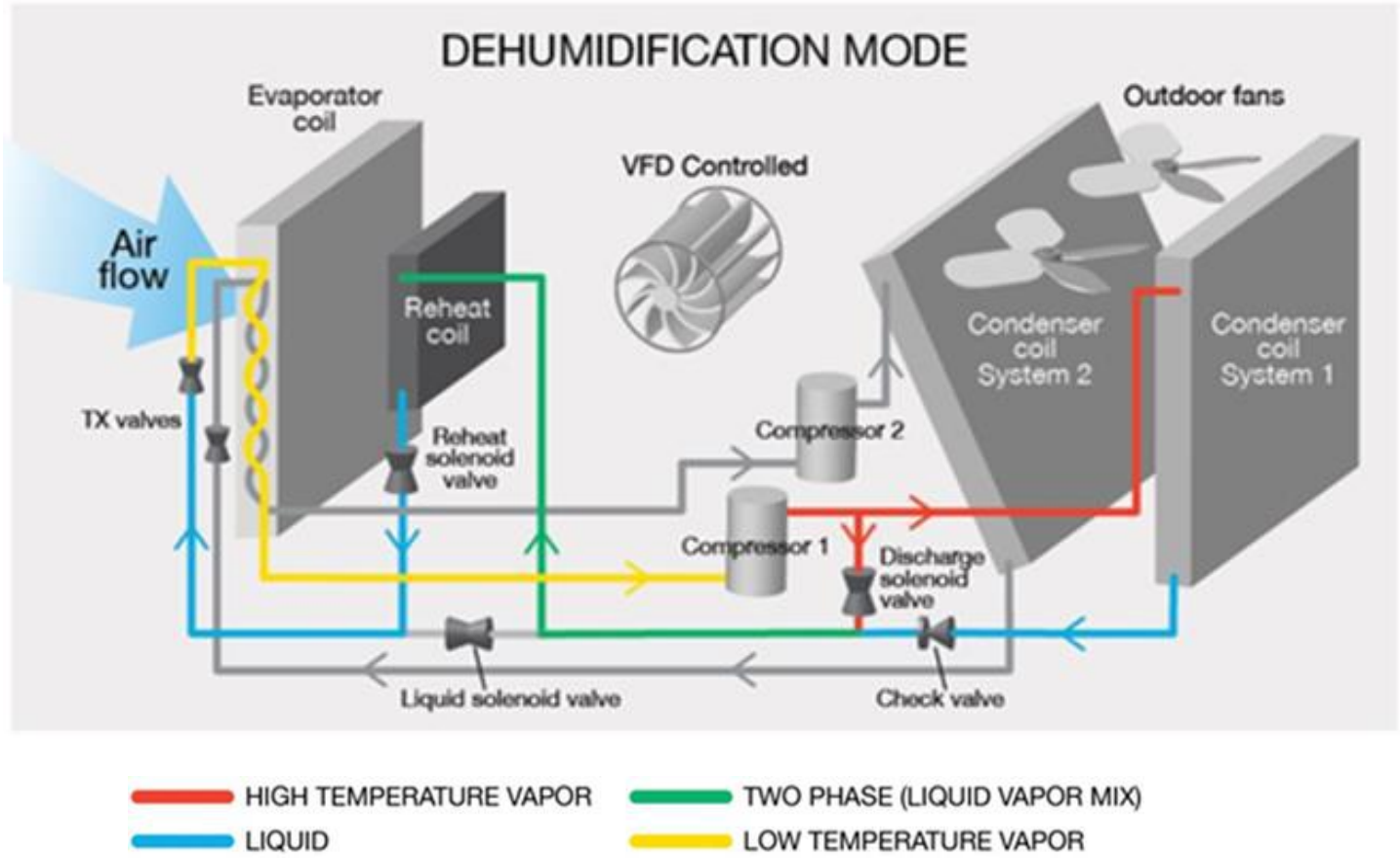
Dehumidification:

Why this emerging technology is best?

- Uses VFD Blower and Fan Controls
- It allows for more accurate temperature and humidity control
- Allows more moisture to be pulled from the air when cooling is not necessary
- Prevents Overcooling of the Zone

Emerging Technology

Dehumidification:

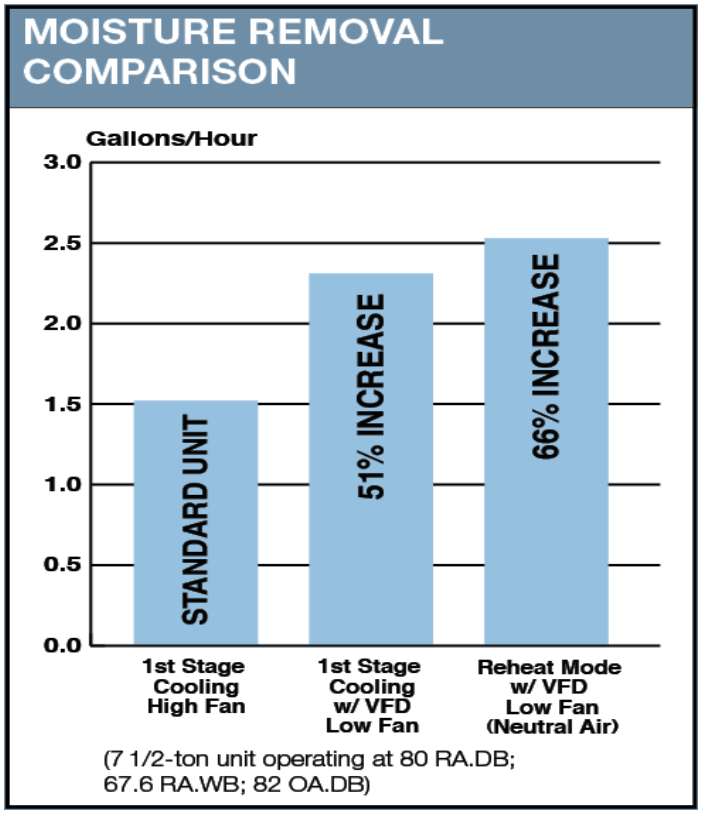


Verification of Dehumidification

Dehumidification:

Results of this emerging technology

- Variable Frequency Drive (VFD)
- Low speed in reheat mode, 1st stage cooling and continuous fan
- Meets AHRAE 90.1-2013 and California Title 24
- Saves energy
- Improves performance (IEER)
- Increases comfort (more latent removal)



Question
And Answer

What questions do you have regarding these methods:

This concludes The American Institute of Architects
Continuing Education Systems Course

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