BCxA ANNUAL CONFERENCE

CHICAGOLAND, IL I SEPTEMBER 25-27, 2019

"It's not Magic! A Proactive Approach to Save Money - Not Burn It"

WICK FISHER WHITE

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President

AIA Quality Assurance

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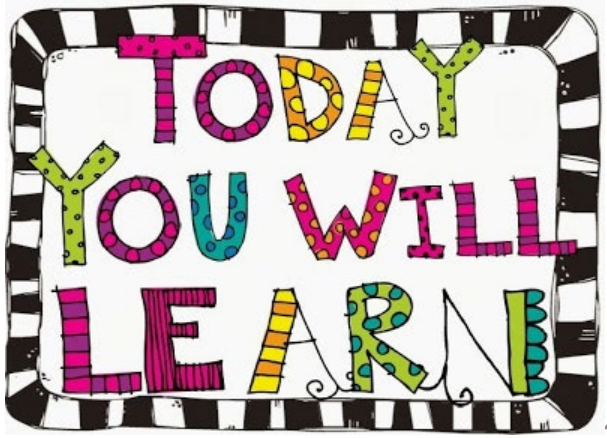
Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Learning Objectives

1. Describe the challenges of a building operator / manager with HVAC issues and how to use the EBCx proactive approach to resolve them.
2. Learn the phases of the EBCx process as described by the BCxA Best Practices.
3. Discuss how to document findings to get funding and / or how to prioritize from the Master List of Findings (MLOF)
4. Relate how the EBCx process can be a part of the training and education of the operations staff.



Interviews & Information

What does it take to Manage a Building / Property

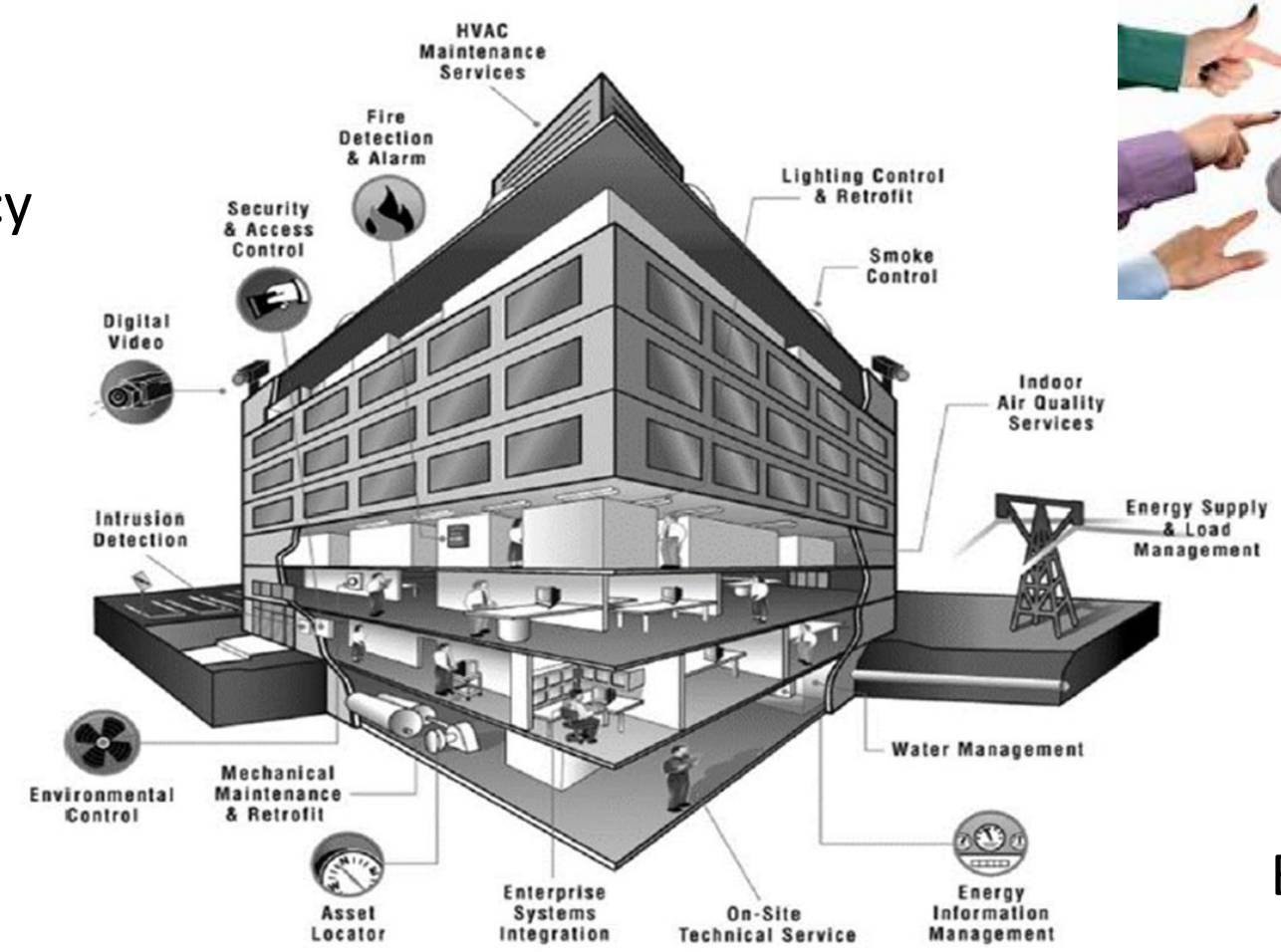
Once upon a time, there was a building. The building needed someone to manage it's contents. There was:

FM Responsibility Overview

Energy Efficiency

Life Safety

Meeting Code Requirements



Budgets

Reports

Building Systems

Make the Building Appealing

Top Challenges – Building Systems

Saving Money: Are you avoiding repairs and preventative maintenance to accomplish money savings? Budget cuts

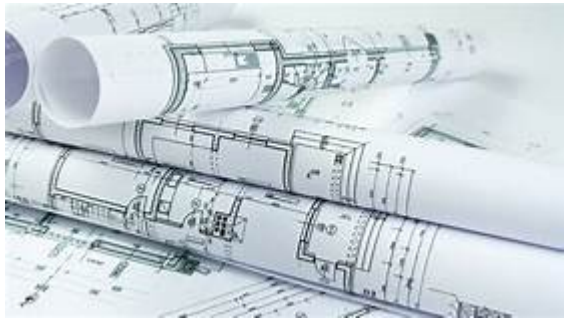
Finding ways to extend the life of existing assets (equipment and systems). Aging building and grounds.

Completing more work with Less Resources: There is a reactive response instead of proactive.

Making changes in the building without having enough reliable data: This is true for HVAC Systems and Complex Controls

#1 Challenge: HVAC System Issues

- Climate Control
- Lack of Engineered Space
- Building Systems Documentation
- Staff Education
- Part Lists and Storage
- Emergency Procedures
- Accurate Building Assessments
- Budget



Skeptical Bosses

- Most of the time, a problem or issue is listed in the reports or memo from a Facility Manager that needs attention.
- Many Bosses don’t believe or trust that these reports written by a Facility Manager are accurate.
- Many Bosses don’t understand the impact of the issue.

Skeptical Bosses

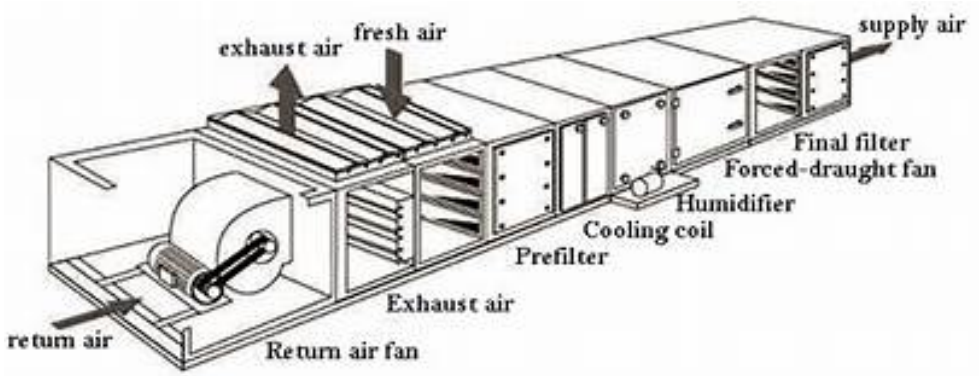
Complaints from FMs

Owners/Bosses make FMs accountable but:

- Don’t understand the Issues
- Back-up information is not adequate for superiors
- Need specific words to get anything done (ie: hazardous)
- Catastrophic Event that needs to happen to get Funding

Top Challenge – HVAC Systems

- Biggest Concerns
  - Includes:
    - Environmental Conditions (Temp. & Humidity)
    - Air Quality
    - Controls (Building Management System)
    - Other Associated Issues



How Can a FM make the Job Easier

In order to address these systems and maintain consistency throughout the life of the building, my life would be easier if….

- Good Building Documentation (Design Drawings, O&M, Shop dwgs.)
- Knowledge of the Building Systems.
- Understanding Building Systems Controls.
- A Plan to Obtain Funding for Upgrades
- Optimize the Existing Building Systems
- Proper Staff Training
- Metering and Monitoring

What is the EBCx Process

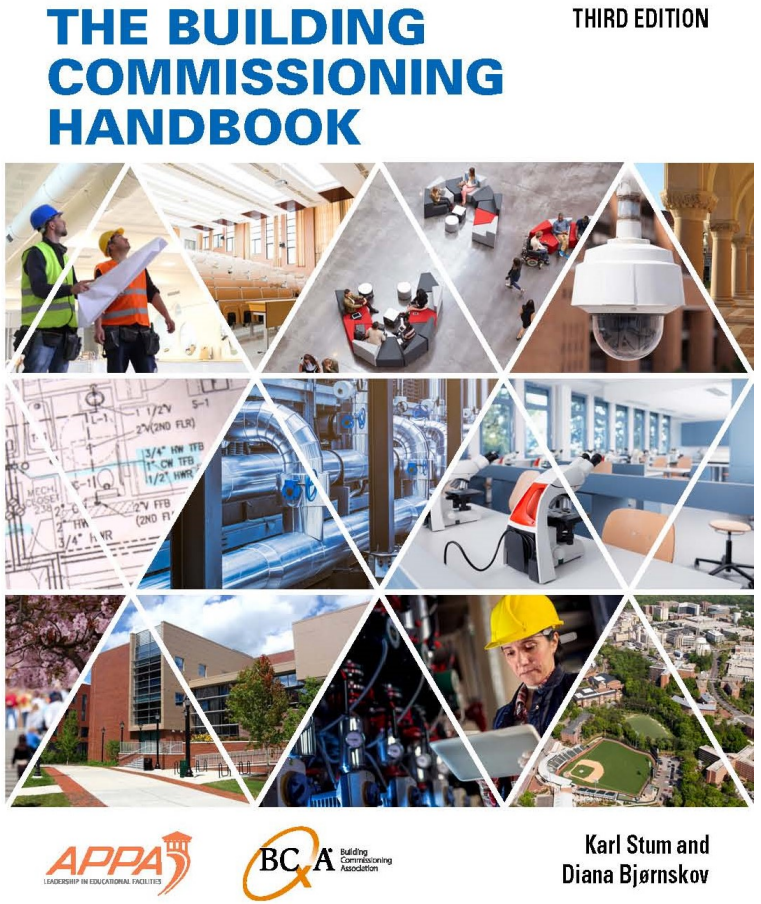
- The EBCx process will help you identify issues, understand how they need to operate and why,
- Step by Step Process
- Identify Issues or Deficiencies and Resolve,
- Have a Priority List of Items and Costs. This list can be given to owners or financial personnel.
- It is a Proactive Documented Approach for FMs / PMs

For All Building Types

- Retail Malls
- Data Centers
- Hospitals
- Research Facilities
- Warehouses
- Factories
- Educational Institutions
- Hotel and Restaurant facilities

Building Commissioning Association

- Commissioning Only Professional Organization
- ANSI Certified
- ASHRAE references
- Process Oriented



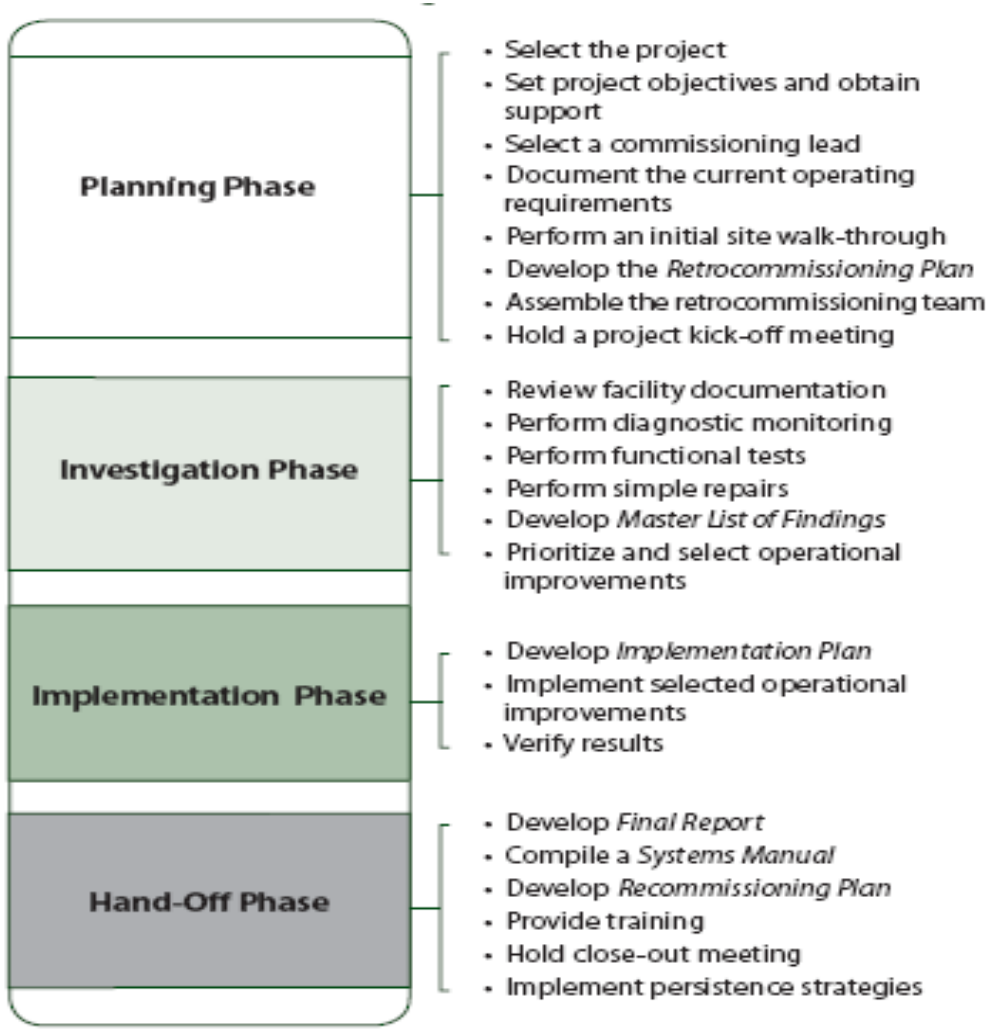
Existing Building Commissioning (EBCx)

Planning/ Initial Assessment Phase

Investigation Phase

Implementation Phase

Hand-Off Phase



Planning Phase

- Select the building (by Owner/FM)
- Define Objectives (by Owner/FM)
- Define (current) facility requirements (CFR)
- Define Scope & Roles

Initial Assessment Phase

- Review building documentation
- Develop initial EBCx Plan
- Analyze Energy Data
- Conduct a kickoff meeting with team
- Perform Initial Walk-through
- Conduct Staff Interviews
- Document Findings
- Define Owner's Focus of Work

Investigation Phase

- Run and Analyze Trends and Monitoring
- More Documentation Review, staff interviews, field inspections.
- Create Functional Performance Test Procedures
- Conduct Functional Testing
- Document your Findings (Issues)
- Resolution / Priority List
- Estimate Savings and Implementation Costs
- Select Items to implement

Implementation Phase

- Complete Additional Investigation
- Complete Engineering Analysis
- Engage Contractors as needed
- Implement Selected Resolutions
- Verify performance of ECMs and FIMs
- Adjust Energy Savings Estimate and Costs

Hand-Off Phase

- Training of Operation Staff
- Update Sequence of Operations
- Update Systems Manual
- Update Preventive Maintenance Procedures
- Implement Performance Tracking
- Develop an Ongoing Commissioning Plan

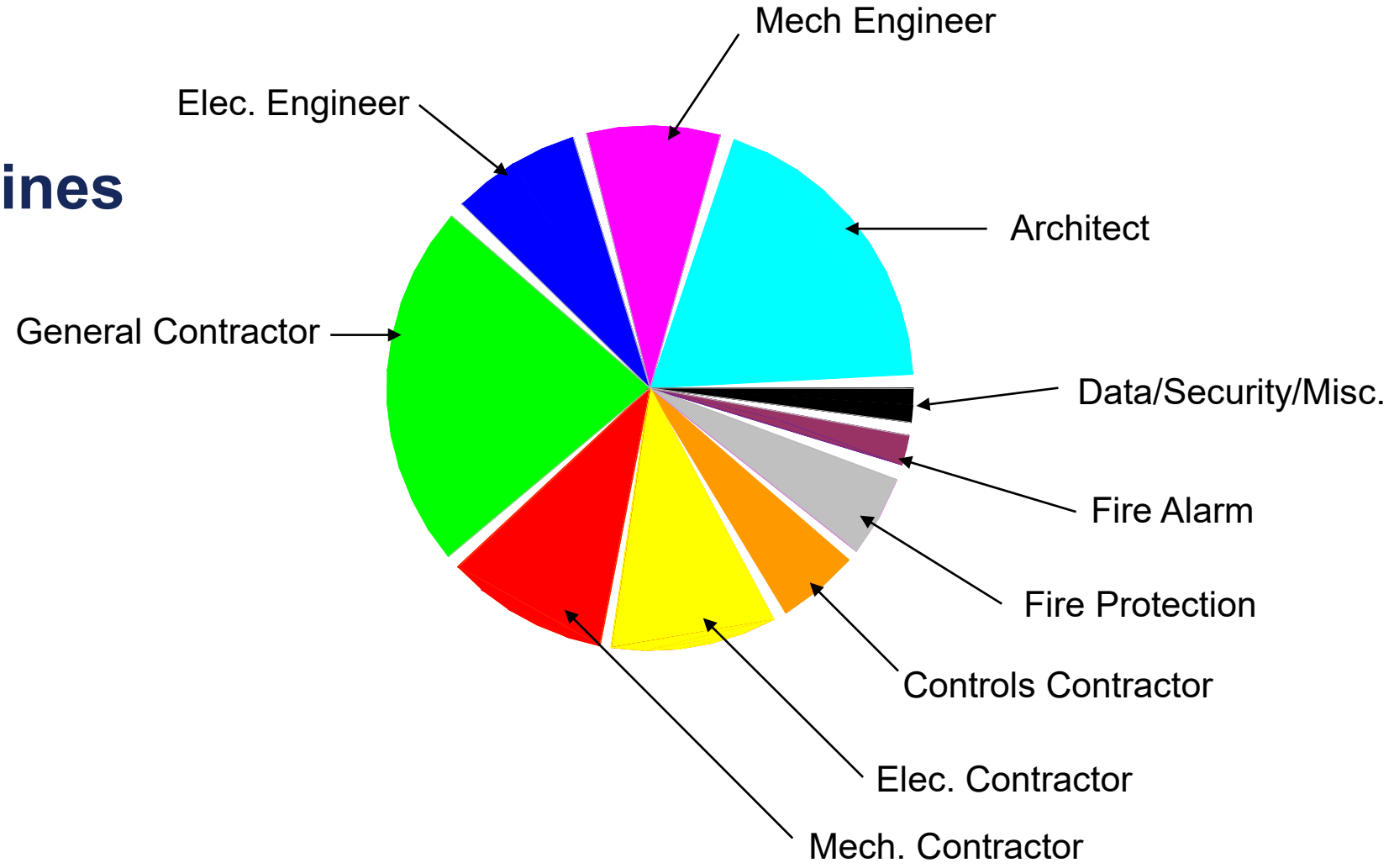
Deliverable

- EBCx or Retro-Cx Plan
- CFR
- Systems / Descriptions
- Sequences of Operation / Diagrams
- Functional Performance Test Procedures
- Functional Testing Observation
- Issues
- Priority List
- Resolution / Estimated Costs
- Report

Typical Project Team Configuration After the Mid 1970's

Gaps between disciplines resulting in:

- Poor coordination
- Lack of documentation
- Rushed Schedule
- Controls are last
- Poor Cx



Fundamental Testing Procedures

Test Steps		Action Items	Location	Observations	Status	Check	Remarks	
M27.2	Operational Test							
		Lower the unit return air temperature set point to 67 degrees F		Verify that the unit is operating to heat.				
		unit return air relative humidity						
		Raise the unit return air temperature set point to 77 degrees F		Verify that the unit is operating to cool.				
		temperature setpoint to 67 degrees F.		Verify that the unit is operating to heat.				
	M27.2.3	Raise the unit return air temperature setpoint to 77 degrees F.	Unit	Verify that the unit is operating to cool.				

Fundamental Testing Procedures

Test Steps					ck	Remarks
M27.3	Al					
	M		temperature alarm registers.			
			Verify at the BAS workstation that a high return air temperature alarm is logged.			

Lower the unit high return air temperature alarm setpoint 5 degrees F below the actual return air temperature

Verify at the CRAC unit that a high return air temperature alarm registers

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Retro-Commissioning Issues Log

Project:	Building Example

Building Owner:	Building's Owner	**Updated By:**	WFW
Building Name:	Building's Name	**CxA Firm:**	Wick Fisher White
Building Address:		**Address:**	111 S. Independence Mall East, Suite 400 Philadelphia, PA 19106
Copy To:		**Phone:**	(215) 627-0200
		E-Mail:	

Finding Number	Date Noted	Finding / Issue Description	Recommended Action or Action Taken	Implement-ation	Date Resolved
Implementation: C = Completed during investigation; I = To be completed during Implementation Phase; D = Deferred Capital Improvement					
1	8/1/08	Per Dennis Larkin, the NCC did not run the boilers during the peak cooling season due to recent high fuel costs.	Hot water must be available during the cooling season to provide active temperature control in zones served by constant volume reheat systems. Consider installing dedicated, summer reheat boiler.	I D	
2	8/20/08	Per Dennis Larkin, a recent glitch in the ATC software program was discovered and corrected. The face and bypass dampers in all of the air handling units were commanded closed to the heating coil during normal unit operation. 2/19/09 - Face and bypass dampers are in operator overide open to the hot water coil.	-	C	2/19/09

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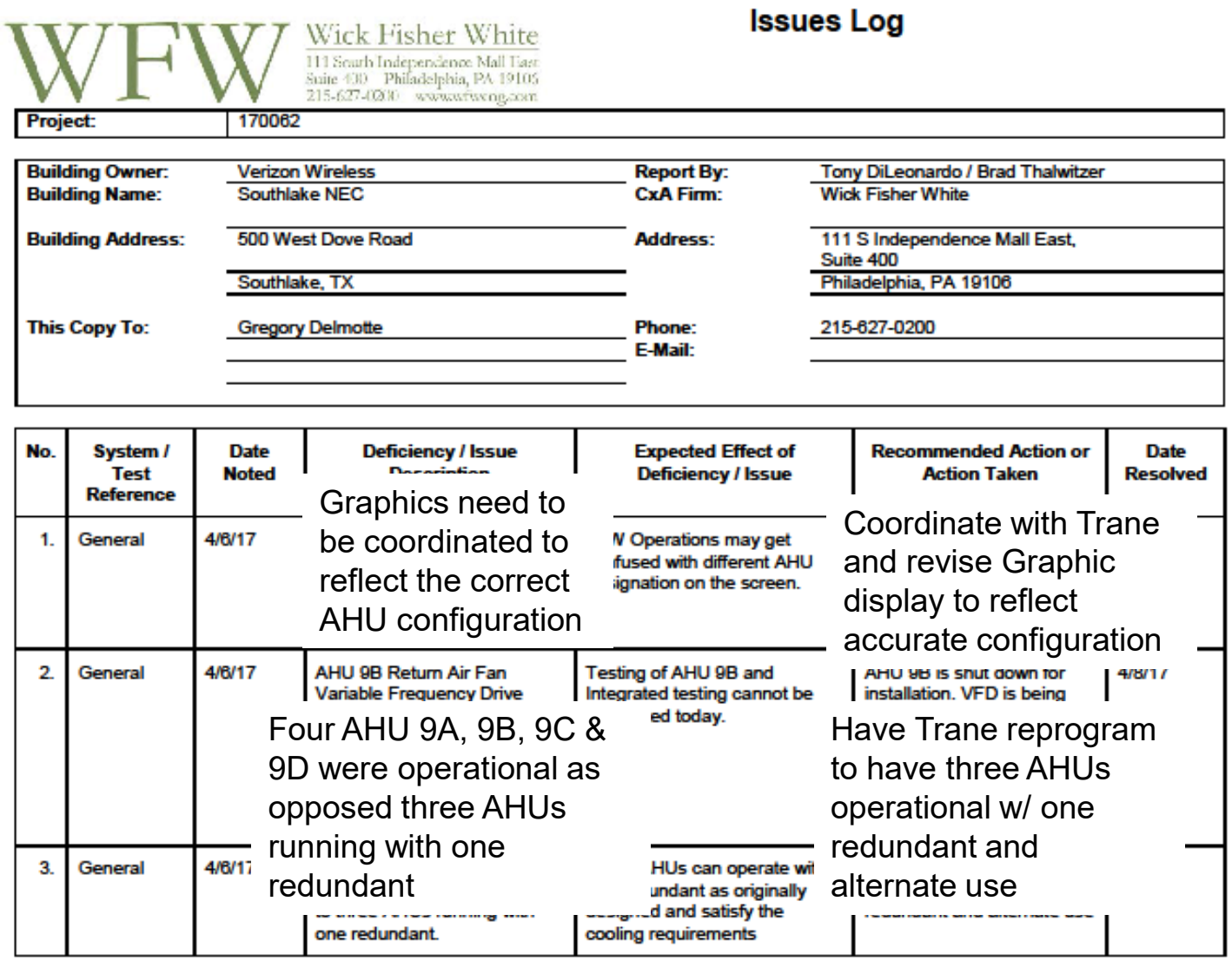
3	9/29/08	The archive vault, served by AHU-3 does not adequately maintain design temperature and relative humidity.	Further investigation is required.		
4	9/29/08	AHU-5's face and bypass damper position results in a 3,000 CFM change in supply airflow. 11/30/08 – face and bypass dampers are damaged.	Further investigation is required.		
5	9/29/08				10/8/08
6	9/29/08	9 is not lined or insulated within the mechanical room.	Insulate ductwork to improve thermal efficiency.	D	
7	9/29/08	Two chilled water pumps continuously operate to maintain required flow through lead chiller.	Chilled water bypass valve has been repaired to eliminate blockage. System flow has improved. 2nd pump is no longer required.		2/19/09
8	9/29/08	maintain required flow through lead chiller.	eliminate blockage. System flow has improved. 2nd pump is no longer required.	C	3/19/09
9	9/29/08	Leaks observed in the chilled water and hot water bypass valves.	Hot Water Bypass Valve has been repaired. Chilled Water bypass valve requires additional repairs. Replace damaged insulation.		2/19/09

Priority List



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Issues Log

Project:	170062

Building Owner:	Verizon Wireless	**Report By:**	Tony DiLeonardo / Brad Thalwitzer
Building Name:	Southlake NEC	**CxA Firm:**	Wick Fisher White
Building Address:	500 West Dove Road	**Address:**	111 S Independence Mall East, Suite 400
	Southlake, TX		Philadelphia, PA 19106
This Copy To:	Gregory Delmotte	**Phone:**	215-627-0200
		E-Mail:	

No.	System / Test Reference	Date Noted	Deficiency / Issue Description	Expected Effect of Deficiency / Issue	Recommended Action or Action Taken	Date Resolved
1.	General	4/6/17		M Operations may get fused with different AHU signation on the screen.		
2.	General	4/6/17	AHU 9B Return Air Fan Variable Frequency Drive	Testing of AHU 9B and Integrated testing cannot be ed today.	AHU 9B is shut down for installation. VFD is being	4/6/17
3.	General	4/6/17	one redundant.	HUs can operate wi undant as originally d and satisfy the cooling requirements		

Graphics need to be coordinated to reflect the correct AHU configuration

Coordinate with Trane and revise Graphic display to reflect accurate configuration

Four AHU 9A, 9B, 9C & 9D were operational as opposed three AHUs running with one redundant

Have Trane reprogram to have three AHUs operational w/ one redundant and alternate use

Issues Log Page 1 of 7

Priority List

(AHU) Air Handling Units:

1. Provide an “AHU” programmed shutdown in the case of power failure by allowing Johnson Controls to monitor the power loss through the actual switch gear relays (in Building 7 and 3). There is an existing NAE-55 in Building 07 with space and one per floor in Building 03. It is desirable to monitor both buildings because the chiller and boiler plants are in Building 07 and the servicing units are in Building 03. Action: Have JCI submit a proposal to monitor the switch gear (so the system knows the shutdown was caused by loss of power) and to program a slow ramp up during re-starting of the fans.

2. A list of added alarms for the air handing units (AHU’s) that are specific to the unit are

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ISSUES LOG REPORT

ISSUE DATE:	April 12, 2017
PROJECT:	Verizon Wireless Southlake NEC AHU 9A, 9B, 9C & 9D Commissioning
TESTING DATE:	April 6, 2017
COMMISSIONING AUTHORITY:	WICK FISHER WHITE
COMMISSION NUMBER:	170022

Issues Log No. 14
System Test Reference B 1.7

During our testing of individual air handling unit AHU-9A, item B1.7 we noticed that Humidifier drain was not working properly. When reviewing the drain time of the humidifier drain pan, it did not appear to drain when we physically checked the drain pan. We noticed that water was stagnate in the pan, the humidifier element appeared contain scale, rust, algae and uneven distribution of water. We tested the float operation and it was inoperable, calcified and unable to move after trying to lift the float. In addition, the graphics indicates a spray type humidifier but it is a wet media type. See pictures of pan, float and element below.

We checked AHU 9B, 9C and 9D humidifiers with the following points of concern:

AHU 9B – Humidifier operational with but with similar deficiencies to AHU 9A with drain pan of water, rust, algae, scale and uneven distribution of water. Also, drain valve was stuck with float calcified and not working properly.

AHU 9C - Humidifier was de-energized for over a year, drain pans were dry with rust, algae and float not working. In addition, this unit has ultra violet lamps mounted in the air stream in front of the humidifier.

AHU 9D - Humidifier was de-energized for over a year, drain pans were dry with rust, algae and float not working. In addition, this unit has ultra-violet lamps mounted in the air stream in front of the humidifier.

See Pictures below of AHU 9C and 9D

Recommendation: A study should be completed to investigate the need for humidification in the spaces the air handling units serve. The systems were designed for mobile switching equipment back in 2001. Humidification was a requirement. The spaces served by AHU 9A thru 9D has changed. Humidifiers are 15 years old and need to be replaced in kind or another humidification type if needed.

RETRO- COMMISSIONING Master List of Findings (MLOF)

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Update Issued : January 18, 2017

VZW COSP Retro-Commissioning
WFW Project No. 161210

RETRo-COMMISSIONING - PHASE I FINDINGS

#	Des	System	Finding	"Next-Step" Recommendations	INVESTIGATIVE Test/Pre-Test	DIAGNOSTIC Trend/Measure	ENGINEERING Analysis	OTHER	Date	VzW Priority
1	FP	Fire smoke dampers (FSD)	Smoke control area isolation commands may not be match correctly to which FSDs close/operate.	1. Site Survey **(Complete)** 2. Engineering analysis of damper sequences. 3. Engineering analysis of zoning. 4. Test **smoke control area isolation commands** versus which **FSDs close/operate**, **include w/ Fire Alarm/FM-200 Integrated System Test (IST)	●				11/8/16	
2	ELEC	Generator Exhaust System - Dampers	Current damper and exhaust sequencing may not be set up according to the latest best practices.	1. Site Survey **(Complete)** 2. Engineering verification of best practices for damper/exhaust sequence and fire event, UVIR, smoke det. best practices. When generator is off, should exhaust dampers open or close? In fire event? The current sequence and mode of control (BAS points/logic?) is unverified. 3. Test exhaust dampers via local controls and BAS to determine current sequence that is in place.	●		●		11/8/16	

Energy Conservation Methods (ECM)

Controlling data center cooling from equipment inlet air temperatures increases the efficiency of the mechanical systems

Note: For every megawatt that is used to power a data center IT equipment, another 0.5 to 1 megawatt is consumed in maintaining the proper temperature

Example: 4 Degree change = 6.0% electrical cost savings

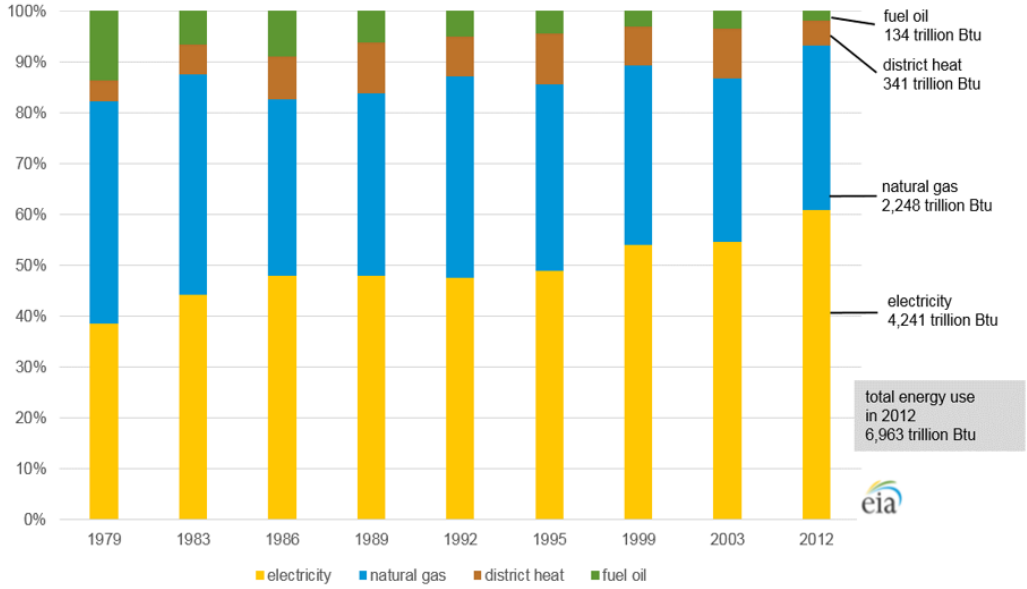
Result: (2015) : Entire data center portfolio electrical ~ $15M

Utility Bill Analysis

- Provide utility bills for one year
- Determine if one utility has a higher average rate (Gas vs Electric)
- Check if there are any anomalies

  (i.e. high gas rates in the summer time – can we shed load?)
- Confirm if different rates are applied to different times of the day (Ie: Higher Electric Rates from 1:00PM to 5:00PM)

Figure 2. Electricity now accounts for 61% of all energy consumed in commercial buildings



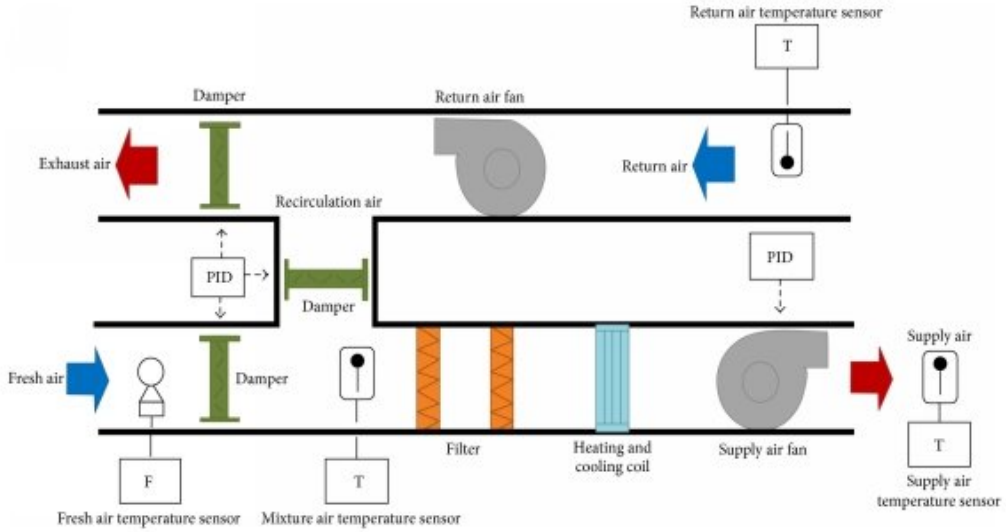
Source: U.S. Energy Information Administration, Commercial Buildings Energy Consumption Survey.

Energy Savings Calculations

- Excel Spreadsheets
  - Utilizes Weather Data and Utility Rates to calculate savings
- Online Saving Calculators
  - Typically shows energy savings for specific equipment (i.e. air curtains, wind turbines, solar arrays etc.)
- Energy Modeling
  - Several programs can be used such as Equest, Energy Plus & Trane Trace.
  - Ability to incorporate the building's geometry along with weather data and utility rates to calculate energy savings.

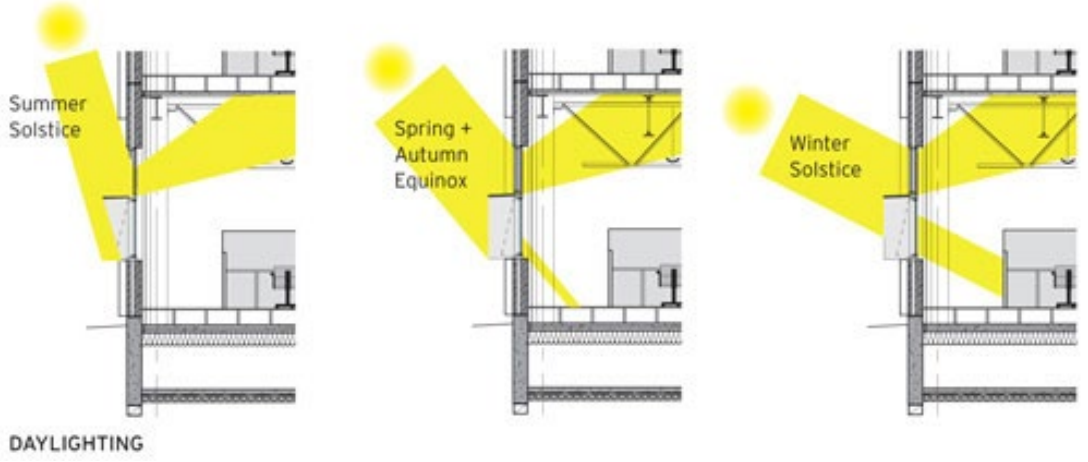
Energy Conservation Measures

- Implement Supply Air Temperature Reset Control on Air Handling Units
  - Lightens loads on AHU compressors and reduces fan energy consumption
  - Electrical Savings: 87,955 kWh/year
  - Gas Savings: 5,808 MMBTU/year
  - Overall Annual Cost Savings: $134,970/year
  - Simple Payback: 2.6 years



Energy Conservation Measures

- Add daylighting controls to a 2 Story Medical Office Building
  - Located in Indianapolis, IN
  - Daylighting Controls – control that dims the lighting as daylight comes through the windows.
  - 19% Energy Reduction
  - Electrical Annual Cost Savings: $16,041/year



Energy Conservation Measures

- Fix and optimize air handling units' economizer operation
  - Involves six air handling units
  - Electrical Savings: 230,470 kwh/year
  - Fuel Savings: 1443 MMBTU/year
  - Overall Annual Cost Savings: $55,842/year
  - Simple Payback: 0.23 years

Energy Conservation Measures

- Apply Night Setback to Air Handling Units that don't require 24/7 operation
  - One rooftop unit serving a small office space
  - Increase cooling temperature setpoint and decrease heating temperature during unoccupied hours
  - Electrical Savings: 8090 kwh/year
  - Fuel Savings: 7 MMBTU/year
  - Overall Annual Cost Savings: $800/year
  - Simple Payback: 2 years

Energy Conservation Measures

- Convert building from electric heat to gas heat
  - High rise office building in Philadelphia
  - Install condensing hot water boilers (96 ~ 98% Efficient)
  - Increase in energy consumption: 30 MMBTU/year
  - Overall Annual Cost Savings: $1963/year
  - Monetary savings comes from the gas utility rate being less than electrical rate
  - PECO utility offers rebate/tax incentive for conversion to natural gas utility

Energy Conservation Measures

- Peak Demand Load Shedding
  - In certain regions of the country, the utility charges more during peak demand hours
  - Reducing the electrical load during this peak hours will reduced your monthly electrical bill
  - Energy meters or intelligent load shedding controllers are installed to monitor the energy consumption and limit consumption during these peak hours
  - Load shedding would include reduction in lighting load, temperature setback and other electrical loads.
  - Programs are offered through many utilities. The utilities offer discounted electrical rates with participation in these programs further reducing monthly utility costs.
  - Load Shedding Equipment payback ranges from 6 months to 3 years depending on the building size and age.

Energy Rebates & Tax Incentives

- Energy savings measures' implementation cost money can be offset tax incentives or rebates offered by local utilities
- Specific Rebates
  - Rebates that are offered for specific measures (i.e. installation of variable frequency drives, equipment upgrade with increased energy efficiency rating)
  - Rebates are in increments $/hp, $/ton etc.
- Custom Rebates
  - Covers energy conservation measures rebates not listed by the utility. (i.e. HVAC control measures)
  - Rebates are in increments $/kwh saved.
- There are rebates available for whole building and cooling system retrocommissioning
  - Rebates are in increments of $/sq. ft.

Energy Rebates & Tax Incentives

Other HVAC Measures	Incentive	Unit
Hotel Guest Room Occupancy Sensors (Electric Resistance Heat and Air Conditioning)	$20	Room
Integrated Dual Enthalpy Economizer Controls	$15	Ton
Circulation Fan: High-Volume, Low-Speed	$30	Unit
Electronically Commutated Motor (ECM) Circulation Fan	$15	Fan
ECM Circulation Pump	$50	Pump
CHANGED Retrocommissioning, Cooling Systems	***$1.00–$10****	Ton
CHANGED Retrocommissioning, Whole Building for Large Commercial Customers	***$0.06–$0.20****	Sq. Ft.
CHANGED Retrocommissioning, Whole Building for Small Commercial Customers	***$0.05–$0.15****	Sq. Ft.
CHANGED Energy Management System	***$2.25–$40****	Ton
CHANGED Demand Controlled Ventilation	***$30–$100****	Ton

How Do I Know What I Want or Need?

- Consult with Several Firms your issues or needs
- Request For Proposal needs to be issued to “recommended” Cx Firms
- Most CxP will be willing to prepare the RFP for you
- Different types of CxPs
  - Cx only firms (Some one to five persons)
  - Large Engineering firms with Cx department
  - Consulting Engineering Firms with persons who do commissioning
  - Firms who say they do Commissioning

Questions and Complaints

Thank You

Tony DiLeonardo

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