The University of Massachusetts Amherst
North Chiller Plant
Master Planning, System Design
and Construction Approaches
February 2019
Agenda

- Introduction to UMass Amherst
- Project background
- Expectations of the project and project team
- Campus Master Planning influences
- Mechanical challenges & responses
- Plant challenges & responses
- Contingencies
- Lessons Learned
Introduction to UMass

- Research 1 university (ranked 26th)
- Founded in 1863 as a Public University (Mass Ag)
- About 1,500 acres with over 300 buildings (37 built in the last 10 years) with over 12.7M GSF of building space
- Over 30,500 students (grad and undergrad); about 3,000 staff and faculty
- Dubois Library – Tallest academic; 2nd tallest in the world
- CHP facility (presented on at IDEA 2018)
Background and Expectations

- Started as analysis of cooling source for new Physical Sciences Building
- Old plant limitations
- Meet current and known future cooling needs
- Ease of O&M, upgrades, valves & redundancy
- Fits in with 2012 Campus Master Plan
- Completed within a single “off-season”
- Little to no downtime to Research 1 buildings served
- Visual learning tool for the engineering community
Two View Corridors & Campus Grid
Two View Corridors & Campus Grid
View Corridors & Campus Master Plan
Parallelogram plan shape responds to forces outside in & inside out
View of angled chillers
Technology on Display
Technology on Display
Sustainability & Universal Design

Tracking LEED Silver/Gold
Key Topics

- Plant Layout Development
- Plant Construction
- Equipment Locations & Access
- Free Cooling
- Distribution Piping
- Utilization of BIM
Equipment Locations & Access

• Diagonal Chillers
• Roof HVAC Equipment
• Hatches – ground floor to roof
Free Cooling

• Dedicated 200 ton “winter” cooling tower
• Heat exchanger can operate with all cooling towers
Distribution Piping

Polymer Chiller Plant

North Chiller Plant

LGRC Chiller Plant
Pipe Materials, Installation, & Restoration

<table>
<thead>
<tr>
<th>CHW Pipe Materials</th>
<th>Pre-Insulated Welded Steel</th>
<th>Cement Lined Ductile Iron</th>
<th>HDPE SDR 11</th>
<th>PPR SDR 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Size (inches)</td>
<td>20&quot; OD</td>
<td>18&quot; Nom (19.5&quot; OD)</td>
<td>20&quot; OD</td>
<td>20&quot; OD</td>
</tr>
<tr>
<td>(Nominal)</td>
<td>(not standard)</td>
<td></td>
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<tr>
<td>Pipe Wall Thickness</td>
<td>0.375&quot; (Schedule Std)</td>
<td>0.31&quot; (Class 250)</td>
<td>2.12&quot; (Average)</td>
<td>1.16&quot;</td>
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Building Information Modeling
Contingencies

• New Plant in a single off-season for completion was risky, but necessary.
  – Know your buildings… well

• Build-in proper, realistic contingencies
  – Be conservative!

• But still expect the unexpected!
  – Temp 12 kV service to 2 buildings
  – Temp 1,500 T air-cooled chiller plant
  – Active buried storm MH
Lessons Learned

• Extensive testing of controls sequences when combining plants.
  – Differential pressure control points
  – Make up water sources
  – Working pressures

• Project management
  – GC vs. CM
  – Establish milestones to focus work around seasonal efforts
  – Risk (liq damages) vs. reward (early completion incentives)

• How the North Chiller Plant is working today…