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Customer Information

Customer Name	Pennsylvania Department of General Services
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Location	Harrisburg, PA
ProjectType	Laboratory Facility

Project Information

Project Name	Pennsylvania State Laboratory Facility
Location	Harrisburg, PA
Start Date	2023-05-12
Completion Date	2025-12-31
Budget	Not specified in documentation
Scope	Construction of a new state laboratory facility including mechanical, electrical, plumbing, fire protection, and laboratory equipment systems
Project ID	1050-1 PHASE 1
Project URL	N/A
ProjectPhase	Documentation Phase 1
LastUpdated	2024-11-25

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Date: 2025-05-14

Project Equipment

Air Handling Units

Equipment Tag	Manufacturer	Model
AHU-1	VENTROL	
AHU-2	VENTROL	
AHU-3	VENTROL	
AHU-4	VENTROL	
AHU-5	VENTROL	
AHU-6	VENTROL	
AHU-7	VENTROL	
AHU-8	VENTROL	

Notes

Multiple AHUs serving different building areas. Units include supply fans, coils, filters, and energy recovery systems.

Cooling Towers

Equipment Tag	Manufacturer	Model
CT-1	EVAPCO	AXS-12-9M22
CT-2	EVAPCO	AXS-12-9M22
CT-3	EVAPCO	AXS-12-9M22
CT-4	EVAPCO	AXS-12-9M22
CT-5 (Future)	EVAPCO	AXS-12-9M22

Notes

Evaporative cooling towers with VFD control for hot water rejection

Hot Water Boilers

Equipment Tag	Manufacturer	Model
B-1	PATTERSON-KELLY	
B-2	PATTERSON-KELLY	
B-3	PATTERSON-KELLY	

Notes

Gas-fired condensing boilers with high efficiency ratings

Pumps

Equipment Tag	Manufacturer	Model
HWP-1	B and G	E-1510 5EB
HWP-2	B and G	E-1510 5EB
GHP-1	B and G	E-1510 6E
GHP-2	B and G	E-1510 6E
ERP-1	B and G	E-1510 6G
ERP-2	B and G	E-1510 6G

Notes

End suction centrifugal pumps for various hydronic systems

Fans

Equipment Tag	Manufacturer	Model
EF-1	STROBIC	Tri-Stack
EF-2	STROBIC	Tri-Stack
EF-3	STROBIC	Tri-Stack
EF-4	STROBIC	Tri-Stack

Notes

Lab exhaust and general ventilation fans

Electrical Distribution

Equipment Tag	Manufacturer	Model
MDS-J1		
MDS-J2		
UPS-A		
UPS-B		

Notes

Power distribution system includes medium voltage switchgear, transformers, and low voltage distribution

Emergency Power

Equipment Tag	Manufacturer	Model
JG1		
JG2		

Notes

Emergency power generation system with generator paralleling capability

Grilles, Registers & Diffusers

Equipment Tag	Manufacturer	Model
CD-1	TITUS	OMNI
CD-2	TITUS	TLF
LD-1	TITUS	FL-10HT

Notes

Various air distribution devices throughout the facility

Hydronic Specialties

Equipment Tag	Manufacturer	Model
AS-1	B and G	
AS-2	B and G	
AS-3	B and G	
ET-1	B and G	
ET-2	B and G	
ET-3	B and G	

Notes

Support components for hydronic systems

HEPA Filter Housings

Equipment Tag	Manufacturer	Model
FHE-1	AAF	TSI-2H3W-4GG-304-D1
FHE-2	AAF	TSI-1H2W-4GG-304-D1

Notes

Bag-in Bag-out filter housings for laboratory exhaust

Suppliers

Air Handling Units

Manufacturer	Model	Representativ	Compatibility Notes	BoD
VENTROL	Custom	N/A	Basis of Design	**Yes**
VENTROL	Custom	H.C. Nye Company	Custom units designed specifically for laboratory applications with high filtration requirements and energy recovery capabilities.	No
Trane	Custom	Trane U.S. Inc.	Compatible with design specifications but may require modifications to coil and fan arrangements. Different control interface.	No
York	Custom	Johnson Controls	Compatible option with similar energy recovery system. Would require different BAS integration approach.	No

Cooling Towers

Manufacturer	Model	Representativ	Compatibility Notes	BoD
EVAPCO	AXS-12-9M22	N/A	Basis of Design	**Yes**
EVAPCO	AXS-12-9M22	Cummins-Wagner	Factory-assembled, induced draft, counterflow design with VFD control	No
Baltimore Aircoil Company (BAC)	Series 3000	Thermal Products, Inc.	Similar performance characteristics. May require modifications to piping connections.	No
SPX Cooling Technologies (Marley)	NC Series	Potomac Sales Group	Premium option with enhanced water conservation features and low sound options. May require additional controls integration.	No

Hot Water Boilers

Manufacturer	Model	Representativ	Compatibility Notes	BoD
PATTERSON-KELLY	SONIC SC	N/A	Basis of Design	**Yes**
PATTERSON-KELLY	SONIC SC	TabCo Sales Associates, Inc.	High-efficiency condensing boilers with integrated controls	No

Cleaver-Brooks	ClearFire	Cate Equipment Company	Higher cost but includes enhanced control package with remote monitoring capabilities. Similar footprint.	No
Lochinvar	CREST	Harry M. Stevens, Inc.	Slightly different piping configuration required. Good turndown ratio but different control interface.	No

Pumps

Manufacturer	Model	Representativ	Compatibility Notes	BoD
B and G	E-1510 Series	N/A	Basis of Design	**Yes**
B and G	E-1510 Series	Wallace Eannace Associates	End suction centrifugal pumps with high efficiency motors and VFD compatibility	No
Armstrong	4300 Series	Flow Control Equipment	Similar performance characteristics with slightly different mounting arrangements. Compatible with specified VFDs.	No
Taco	FI Series	United Electric Supply	Lower cost option but may have slightly different performance curves. Would require reselection to match flow requirements.	No

Fans

Manufacturer	Model	Representativ	Compatibility Notes	BoD
STROBIC	Tri-Stack	N/A	Basis of Design	**Yes**
STROBIC	Tri-Stack	Gunn & Pegelow	Specialized laboratory exhaust fans designed for effective plume dispersion and entrainment	No
Greenheck	Vektor	Pittsburgh Air Systems/Air Industrial, Inc.	Lower cost option with similar plume height performance. May require different mounting arrangement and control interface.	No
Twin City Fan	Laboratory Exhaust System	Tom Barrow Company	Good alternative with similar performance. May require reconfiguration of discharge plenum and different structural support.	No

Air Distribution Products

Manufacturer	Model	Representativ	Compatibility Notes	BoD
Titus	Various	N/A	Basis of Design	**Yes**
Titus	Various	H.C. Nye Company	Complete line of grilles, registers, diffusers and air terminal units for laboratory applications	No
Krueger	Various	Air Distribution Products	Comparable performance with slightly different aesthetic options	No

Electrical Distribution Equipment

Manufacturer	Model	Representativ	Compatibility Notes	BoD
Schneider	Electric/Squar D PowerPact Series	N/A	Basis of Design	**Yes**
Schneider Electric/Square D	PowerPact Series	Graybar Electric Company	Full range of distribution equipment with integrated monitoring capabilities	No
Eaton	Power Defense Series	Fromm Electric Supply	Compatible alternative with similar performance specifications. Different interface for power monitoring system.	No
ABB	SACE Tmax Series	Rumsey Electric Company	Premium option with enhanced power quality monitoring. Requires additional coordination with BAS integration.	No

Design Notes

HVAC

Technical Observations:

- The design incorporates a mix of centralized air handling systems for laboratory areas and more conventional systems for office/administrative areas.
- Multiple AHUs provide redundancy for critical laboratory spaces.
- Energy recovery is incorporated into exhaust systems to improve efficiency.
- Geothermal system is integrated with conventional cooling systems.

Concerns:

- Coordination of ductwork in congested ceiling spaces may present challenges during construction.
- Maintaining pressurization relationships between laboratory spaces requires careful balancing and commissioning.
- Laboratory exhaust fans must be carefully coordinated with architectural features to ensure proper plume dispersion.
- Noise levels from high static pressure fans and equipment must be carefully controlled especially near occupied spaces.

Opportunities:

- Enhanced monitoring and control systems could provide better energy use visibility and optimization potential.
- Additional heat recovery opportunities may exist between exhaust air streams and incoming air.
- Variable air volume strategies could be further optimized for laboratory spaces with intermittent occupancy.
- Demand-controlled ventilation could be implemented in non-laboratory spaces to reduce energy consumption.

Electrical

Technical Observations:

- Robust electrical distribution system with redundant utility feeds and emergency power generation.
- UPS systems provide critical power for laboratory equipment and controls.
- Advanced generator paralleling system allows for flexible load shedding and priority-based power restoration.
- Comprehensive grounding and lightning protection systems are included.

Concerns:

- The complex generator paralleling control system requires careful programming and testing.

- Power quality must be maintained for sensitive laboratory equipment.
- Physical space requirements for electrical equipment is substantial.
- Coordination of emergency power distribution with mechanical system priorities requires careful planning.

Opportunities:

- Integration of power monitoring system with laboratory management systems could improve energy visibility.
- Load shedding strategies could be further refined based on actual laboratory operations.
- Additional selective coordination studies may identify opportunities to improve system reliability.
- Power quality monitoring could be enhanced to protect sensitive equipment.

Plumbing

Technical Observations:

- Laboratory waste systems include provisions for neutralization and treatment as required.
- Separate laboratory and domestic water systems are provided.
- Emergency fixture water systems are provided for laboratory safety showers and eyewash stations.

Concerns:

- Chemical waste systems must be carefully coordinated with laboratory equipment layouts.
- Emergency fixture water supplies must be maintained at appropriate temperatures.
- Cross-contamination prevention between laboratory and domestic water systems is critical.

Opportunities:

- Water usage monitoring could be implemented to identify conservation opportunities.
- Additional water reclamation systems could reduce overall water consumption.
- Point-of-use water heating could potentially reduce energy consumption compared to centralized systems.

BuildVision Recommendations

1. Implement enhanced energy monitoring and dashboard system integrated with BAS

Rationale: The complex systems in this laboratory facility would benefit from detailed energy monitoring. Current design includes basic monitoring, but an enhanced system would provide better visibility into energy use patterns and identify optimization opportunities.
Estimated Impact: Potential 5-10% energy savings through identification of inefficiencies and operational improvements. Better data for future facility planning and optimization.
Implementation: Specify additional power metering points, especially on laboratory equipment circuits. Implement dashboard system accessible to facility management team. Include trending and analysis capabilities.
Priority: Medium

2. Evaluate potential for additional variable frequency drives on secondary pumping systems

Rationale: While VFDs are included on primary equipment, some secondary distribution systems use constant speed pumping. Adding VFDs to these systems would allow for better pressure control and energy savings during partial load operation.
Estimated Impact: Estimated 15-20% pump energy savings for affected systems. Improved system control and potential for extended equipment life due to reduced cycling and wear.
Implementation: Review secondary pumping systems, particularly for non-critical applications. Evaluate control strategies and implement VFDs where beneficial.
Priority: Medium-High

3. Review and enhance arc flash mitigation strategies

Rationale: The complex electrical distribution system presents potential arc flash hazards. While basic protection is included, additional mitigation strategies could improve safety for maintenance personnel.
Estimated Impact: Improved safety for maintenance personnel. Potential reduction in arc flash incident energy levels at key maintenance points. Reduced risk of equipment damage during fault conditions.
Implementation: Conduct detailed arc flash study during design. Consider zone-selective interlocking and maintenance-mode settings for circuit breakers. Review panel locations and maintenance access points.
Priority: High

4. Implement lab exhaust fan optimization system

Rationale: The current design includes constant volume exhaust for laboratory spaces, which is energy-intensive. A wind-responsive, variable volume exhaust system could maintain safe plume dispersion while reducing energy consumption.
Estimated Impact: Potential 30-40% reduction in exhaust fan energy. Significant heating and cooling energy savings from reduced exhaust air volumes. Typical payback period of

2-3 years for similar systems.
Implementation: Add wind speed/direction sensors and control system integration. Modify exhaust fan control sequences to respond to wind conditions. Ensure fail-safe operation for safety-critical spaces.
Priority: High

5. Consider alternative suppliers for specified Strobic exhaust fans

Rationale: Strobic Tri-Stack fans are specified as basis of design but have long lead times and are typically high cost. Alternatives from Greenheck or Twin City Fan could provide similar performance at lower cost.
Estimated Impact: Potential 5-8% cost savings on exhaust fan package. Improved schedule flexibility with potentially shorter lead times.
Implementation: Review alternative manufacturers and confirm performance requirements. Verify plume dispersion modeling with alternative equipment. Confirm structural and dimensional compatibility.
Priority: Medium

6. Enhance emergency power system testing capabilities

Rationale: The current emergency power system includes basic testing provisions, but enhanced capabilities would simplify regular testing and reduce disruption to facility operations.
Estimated Impact: Reduced facility disruption during testing. More thorough testing capability leading to improved system reliability. Simplified compliance with regulatory testing requirements.
Implementation: Add dedicated load bank connection points. Enhance generator control system to facilitate testing sequences. Implement automated test reporting system.
Priority: Medium

7. Review redundancy requirements for critical laboratory systems

Rationale: The current design includes some redundancy for critical systems, but a comprehensive review could identify additional areas where enhanced redundancy would be beneficial based on criticality of laboratory functions.
Estimated Impact: Improved reliability for critical laboratory functions. Reduced risk of experiment disruption or sample loss during equipment failures.
Implementation: Conduct criticality assessment for laboratory spaces and systems. Identify single points of failure in current design. Develop targeted redundancy enhancements based on criticality.
Priority: Medium-High

Conclusion

Key Findings

- The HVAC system design balances the need for precise environmental control with energy efficiency considerations, though additional optimization is possible.
- Electrical systems are robust with multiple layers of redundancy appropriate for a critical laboratory facility.
- Equipment selections generally favor reliability and performance over first cost, which is appropriate for this type of facility.
- Several alternative equipment suppliers could provide similar performance with potential cost savings.
- Enhanced monitoring and control systems would provide valuable operational data and optimization potential.

Highest Priority Actions

- Implement lab exhaust fan optimization system to significantly reduce energy consumption while maintaining safety (Recommendation #4)
- Review and enhance arc flash mitigation strategies to improve maintenance safety (Recommendation #3)
- Review redundancy requirements for critical laboratory systems to identify potential vulnerabilities (Recommendation #7)

Summary

The Pennsylvania State Laboratory Facility design represents a comprehensive approach to laboratory infrastructure with robust mechanical, electrical, and plumbing systems. The design incorporates high-efficiency equipment, redundancy for critical systems, and flexibility for future modifications. While the fundamental design is sound, there are several opportunities for enhancement that could improve energy efficiency, operational flexibility, and maintenance accessibility while potentially reducing first costs through selective value engineering of non-critical systems.

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Date: 2025-05-14