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Commercial Workforce Credentialing Council

Job Task Analysis
Building Operations Professional

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Job Task Analysis

Building Operations Professional

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Executive Summary

This report describes the process for and results of a comprehensive job task analysis (JTA) of Building Operations Professionals. This study was performed by Professional Testing on behalf of the National Renewable Energy Laboratory (NREL). The competency (domains, tasks, and associated knowledge) list, which defines the work performed by practitioners, was initially developed by a representative panel of practitioners during a meeting held February 10–12, 2014, in Orlando, Florida. After the job tasks and associated knowledge and skills were identified, a validation survey was conducted of the finding of the JTA and the results of the validation study were reviewed by a representative panel of practitioners during a conference call held May 30, 2014. The committee finalized the JTA and examination blueprints for the Building Operations Professional credential scheme based on the survey results.

Acronyms

ACM	Asbestos Containing Materials
BAS	Building Automated Systems
CMMS	Computerized Maintenance Management Software
DACUM	Developing a Curriculum
DDC	Direct Digital Controls
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
GHS	Globally Harmonized System
HIPAA	Health Insurance Portability and Accountability Act
HOA	Hand-Off-Auto
IPMVP	International Performance Measurement and Verification Protocols
JTA	Job Task Analysis
NIBS	National Institute of Building Sciences
NREL	National Renewable Energy Laboratory
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
PACM	Presumed Asbestos Containing Materials
PPE	Personal Protective Equipment
SD	Standard deviation
SDS	Safety Data Sheets
SEM	Standard error of the mean
SME	Subject matter expert
SOP(s)	Standard Operating procedure(s)
TDS	Total Dissolved Solids
USGBC	U.S. Green Building Council
VAT	Vinyl Asbestos Tile
VOC	Volatile Organic Compound

Table of Contents

List of Figures

List of Tables

1 Introduction

The National Renewable Energy Laboratory (NREL), in conjunction with the National Institute of Building Sciences (NIBS) and the U.S. Department of Energy (DOE), led a study to identify the critical duties and tasks required of Building Operations Professionals. To facilitate the identification of the competencies, Professional Testing used the DACUM (Developing a Curriculum) process to conduct a Job/Task Analysis (JTA).

A panel of subject matter experts (SMEs) was selected by NIBS and convened by Professional Testing for a 3-day meeting held February 10–12, 2014, in Orlando, Florida. The competencies identified during the meeting were then validated via a survey. This report reflects the completion and results of the study, and is organized with section 2 containing the proposed final content outline, and the later sections containing the details of the JTA development process, including results of the validation survey.

2 Final Building Operations Professional DACUM Job/Task Analysis

2.1 Building Operations Professional Job Description

The Building Operations Professional manages the maintenance and operation of building systems and installed equipment, and performs general maintenance to maintain the building's operability, optimize building performance, and ensure the comfort, productivity and safety of the building occupants.

2.2 Job Task Analysis DACUM Chart for Building Operations Professional

A proposed content outline resulting from this Job/Task Analysis follows.

Table 1. Duties and Tasks of Building Operations Professional

Duties and Tasks			Final Weight	Final Items
A		**Supervising Personnel**	**8%**	**10**
	1	Develop workload analyses	1%	1
	2	Analyze staffing productivity	2%	3
	3	Supervise building staff	4%	5
	4	Secure outside service providers	1%	1
B		**Conduct Planning Activities**	**15%**	**18**
	1	Update procedures (SOPs, BOPs, operating plans, emergency plans, etc.)	3%	4
	2	Develop equipment operations plans	2%	2
	3	Develop planned maintenance schedules	3%	4
	4	Contribute to construction standards and guidelines	2%	2
	5	Contribute to capital renewal plans	3%	4
	6	Conduct data management activities	2%	2
C		**Operating Buildings**	**50%**	**59**
	1	Perform workplace hazard assessments	2%	3
	2	Participate in emergency drills	2%	3
	3	Manage the PPE program	2%	3
	4	Manage third party inspections	2%	2
	5	Respond to building emergencies	2%	2
	6	Manage building securities	2%	2
	7	Coordinate/conduct occupant training	2%	2
	8	Conduct risk management activities	2%	2
	9	Manage responses to inclement weather conditions/issues	2%	3
	10	Respond to tenant requests/issues	2%	2
	11	Conduct equipment checks	2%	2
	12	Conduct daily rounds	2%	2
	13	Coordinate facility operations (normal)	2%	2

Duties and Tasks			Final Weight	Final Items
	14	Coordinate facility operations (other than normal)	2%	2
	15	Manage the work order process	2%	3
	16	Investigate indoor environmental quality	2%	3
	17	Conduct tenant relations activities	2%	2
	18	Manage consumables	2%	2
	19	Manage outside facility contractors/service providers	2%	3
	20	Manage environmental requirements (permits, etc.)	2%	3
	21	Implement an energy management program	3%	4
	22	Maintain the facility and systems	3%	4
	23	Conduct facility repair activities	2%	3
D		**Optimizing the Facility**	**20%**	**24**
	1	Conduct measurement and verification activities	3%	4
	2	Analyze system performance	4%	5
	3	Identify cost saving measures	3%	3
	4	Respond to changing energy costs	3%	3
	5	Optimize system performance	5%	6
	6	Identify sustainability opportunities	2%	3
E		**Contributing to Budgeting Activities**	**7%**	**8**
	1	Contribute to long-term facility budget plan (5 years)	2%	2
	2	Contribute to facility operations budget	3%	4
	3	Contribute to capital improvement budget(s)	2%	2
Total			**100%**	**120**

Table 2. Areas of Specialized Knowledge Required of Building Operations Professional

Areas of Specialized Knowledge	
Adjusting equipment based on readings	Americans with Disabilities Act
Asset inventories	Renewable energy systems
BAS or monitoring systems	Baselines
Basic data architecture	Basic financial terminology
Basic knowledge of contaminant limits	Basic knowledge of insurance policies for equipment and operations
Basic knowledge of tariffs	Basic statistical analyses
Basic utility bill analysis	Benchmarking
Best practices for emergency drills	Biohazards and hazardous chemicals
Break-even analysis	Budget categories
Building certification programs	Building operations and procedures
Building systems (see Table 3) (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations)	Business case development
Chain of custody	Change-management techniques
Common or frequent deficiencies	Communications methods (Skype, Webinar, etc.)
Communications plans	Company labor policies
Comparing alternatives to satisfy demands	Conditions under which a building should be

Areas of Specialized Knowledge	
	evacuated
Consumable logistics	Consumable requirements
Consumable sourcing guidelines	Contaminant containment protocols
Contingency plans/data recovery	Contract knowledge
Contract requirements	Contracts and service providers
Contributors to carbon or environmental footprint	Control systems
Control theory	Costs of systems or improvements
Criticality of various systems and equipment	Customer requirements for business
Decontamination requirements	Deferred issues (deferred maintenance)
Demand management strategies	Distinguishing equivalency between equipment and/or systems
Emergency equipment operation	Emergency procedures including first aid and CPR
Emerging technologies and tools	Energy basics
Energy conservation opportunities	Energy efficiency measures (EEM) and economics
Energy load profiles	EPA regulations
Equipment operations and specifications	Expected life of major building components
Facility knowledge	Failure modes
Familiarity with learning styles	Feasibility studies
Finances	Financial penalties for going above peak demand threshold
First cost versus life cycle costs	First response mitigation techniques (what type of fire extinguisher to use, etc.)
Fluid dynamics	Foot-candles/lumens and lighting concepts
Funding limitations	Funding sources
General knowledge of the authority having jurisdiction	Hazard remediation/cleanup
Hazardous materials disposal	Hazards in the area (earthquakes, etc.)
Hazards management	Health effects of contaminants (including stay times)
Heat transfer	HIPAA requirements
Historical data associated with facility	Human resources
HVAC systems	Impact of change on tenant/occupant space
Impact of facility operations on scheduling	Impact of operational changes (occupancy changes) on performance expectations
Incident command systems (ICS)	Inclement weather escalation plans
Inclement weather local logistics (shelter, food, transportation)	Indicators of problems with equipment
Industry norms for manpower	Infection control procedures
Inspection agencies	Inspection procedures
Insurance requirements	Integrated work management systems structure
Interim life safety measures (fire watch, alternate evacuation routes, etc.)	Interpreting equipment test readings
Inventory control systems	Job responsibilities
Key logic systems (master keys vs. other keys)	Labor contract agreements
Levels of maintenance	Levels of service for various spaces
Licensing requirements	Life cycle assessments
Life cycle accounting practices	Limitations of PPE
Load demand schedules	Local water restrictions and requirements
Local weather issues	Location of facility equipment
Lock-out/tag-outs	Long term goals of the organization
Maintenance costs of existing systems	Management requirements
Manual equipment operation	Material availability
Measured variables to verify system performance	Measurement equipment and techniques

Areas of Specialized Knowledge	
Medical evaluation policies and requirements	Mitigator of carbon or environmental footprint
Monitoring systems and equipment	Municipal requirement for disposal and recycle of consumables
National Incident Management Systems (NIMs)	New technologies
Normal equipment operating parameters/limits	Normal routine operation of the facility
Obtaining measurements	Occupancy types and typical evacuation procedures for various occupancies
Operating baselines	Operation equipment loads
Operational impact of inspections	Operations within the facility
Options for extending the life of equipment and systems	Organizational security requirements (access requirements, levels of security, etc.)
Organizational structures	Organization's budgeting process
Safety Codes and Standards (including OSHA)	Other submetering systems
Outsourcing options	Owner's long-term plan for the facility
Payment policies	Peak demand loads
Performance improvement plans	Permitting requirements
Permitting resources	Personnel performance review processes
Plumbing systems	Potential contaminants
Potential environmental, health and safety (EHS) hazards and risks	PPE and proper usage and maintenance of PPE
Procurement policies and procedures	Procurement regulations
Proper procedures for isolating and removing hazards	Psychrometrics
Rate schedules for utilities	Reclamation techniques
Recommended maintenance schedules	Refrigerant recovery techniques
Regulated consumables	Regulatory record requirements
Relationship between deficiencies and energy efficiency	Remediation activities for contaminants
Remediation procedures	Remote monitoring systems and equipment
Remote system fluency (DDC, etc.)	Reporting capabilities of work order systems
Reporting requirements for emergencies	Resource planning personnel management
Resources required for typical tenant/occupant requests and issues	RFP process
Root cause analysis techniques	Safety codes and standards (including OSHA)
Safety concerns associated with equipment operations	Safety practices
Scope of work	Security equipment (lighting, cameras, etc.)
Security policies and procedures	Sequence of equipment operations
Sequence of operations	Service level agreements
Services to be outsourced	Shelf life of consumables
SOPs related to equipment	Specialized emergency equipment
State and local energy mandates	Storage requirements for consumables
Sustainability options	System documentation requirements
Technical equipment knowledge	Technical knowledge
Tenant/occupant chain of command	Tenant/occupant contracts
Tenant/occupant equipment and requirements	Tenant/occupant hours of operation
Tenant/occupant needs and schedules	Tenant/occupant operations and space uses
Tenant/occupant requirements	Tenant/occupant tolerances in changes to systems
Testing and balancing procedures	Thermodynamics
Trade and union requirements	Trade knowledge for specific equipment and systems
Trade terminology and definitions	Trend analysis
Typical characteristics of facilities and equipment	Typical nonenergy costs

Areas of Specialized Knowledge	
Typical training topics	Understanding of all staff functions carried out in the facility
Understanding of interlocked equipment	Understanding of load shedding and its importance
Understanding of photometric charts	Understanding of staffing models (vacation, sick leave, etc.)
Uninterruptable and critical systems	Utility bill analysis
Utility rate structures and schedules	Utility time of use
Vendors	Ventilation requirements for consumables
Weather impact on the facility	Weather related factors affecting equipment (temperatures, dew points, etc.)
When substitutions of equipment or systems are not allowed	When to conduct IEQ tests
Whole building integration	Work control procedures
Work order processes	

Table 3. Areas of Building Systems Knowledge Required of Building Operations Professional

Areas of Building Systems Knowledge
Air compressor and distribution system
Air distribution system
Building automation system
Building control system
Building envelope
Chilled water system
Combined heat and power system
Communication systems
Condenser water system
Conveyance systems
Cooling generation equipment
District energy systems
Domestic hot water system
Electrical power system
Elevator/escalator systems
Emergency alert systems
Energy metering and monitoring system
Energy recovery system
Fresh air systems
Fuel storage and distribution systems (USTs, ASTs, etc.)
Heat generation equipment
HVAC control system
HVACR system
Irrigation equipment
Life safety systems
Lighting control system
Lighting system
Onsite energy generation system (CHP, PV, wind, thermal, generators, etc.)
Potable cold water system
Primary sewer/gray water systems
Process systems and controls
Pumps and pumping system
Renewable energy system
Specialty exhaust systems
Standpipe/sprinkler systems

Areas of Building Systems Knowledge
Steam and hot water system
Steam distribution system
Thermal energy storage system
Uninterruptible power systems (UPSs)/building energy storage systems (BSS)
Variable drive system
Water distribution and control system

Table 4. Areas of General Knowledge Required of Building Operations Professional

Areas of General Knowledge
Calculations
Perform simple math operations of division
Perform simple math operations of addition
Perform simple math operations of subtraction
Perform simple math operations of multiplication
Use a calculator
Compare numbers
Perform mathematical operations with decimals
Collect information to solve a problem
Perform math operations using single and multiple digit numbers
Make rough estimates
Transfer number sequences from a source into a column
Figure averages
Perform mathematical operations with fractions
Solve percent problems
Solve ratio problems
Perform math operations using signed (positive and negative) numbers
Change numbers from fractions into decimals and back
Change numbers from percentages into decimals and back
Measure angles
Solve problems with graphs
Multiply and factor algebraic expressions
Solve formula calculations with one unknown
Basic Measurement
Read measurements taken with common measuring tools
Measure temperature to within 1 degree Fahrenheit
Measure linear distances (length, width, etc.)
Calculate the perimeter and areas of common figures
Estimate and approximate measurements
Record measurements, using appropriate unit notations (feet, yards, etc.)
Measure area (square inches, square centimeters, etc.)
Measure volume (cubic inches, liters, etc.)
Use tools to measure quantities and solve problems involving measurements

Areas of General Knowledge
Find the dimensions of an object from a scale drawing
Read, interpret, and use size-scale relationships
Read and use the scale of a drawing
Measure length to 1/4 of an inch
Measure length to 1/8 of an inch
Measure length to 1/16 of an inch
Measure weights using devices calibrated in ounces
Measure weights using devices calibrated in pounds
Find distances and directions on land maps
Make simple scale drawings
Convert measurements from one unit to another (English to Metric, etc.)
Measure length to 1/32 of an inch
Read and apply coefficient measurements indicated in a table or chart
Measure accurately to 0.01 inches
Measure board feet
Communications
Ask questions
Communicate using the vocabulary/terminology of a related trade
Follow verbal job instructions
Communicate with co-workers and/or business people verbally (face-to-face)
Listen
Read and follow directions found in equipment manuals and code books
Read and interpret directions found on labels, packages, or instruction sheets
Read drawings and specifications sheets
Communicate with co-workers and/or business people verbally (telephone, radio)
Evaluate options/alternatives
Read codes (building codes, electrical codes, standards, etc.)
Evaluate solutions
Read information from tables and graphs (bar, circle, etc.)
Explain procedures
Read and follow a map, chart, plan, etc.
Write words and numbers legibly
Communicate with co-workers and/or business people in writing (letters, memos)
Find information in catalogs
Find information in references (machinery handbook, tap/drill charts, etc.)
Read flowcharts
Research information
Read statistical data
Participate in brainstorming
Present to others

Areas of General Knowledge
Summarize information
Write reports
Apply assertiveness
Compare names

Table 5. Skills and Abilities Required of Building Operations Professional

Skills and Abilities	
Ability to analyze data	Ability to apply data to protocols
Ability to communicate with non-English speaking individuals	Ability to communication with regulatory authorities/inspectors
Ability to compare costs of technologies	Ability to compare data
Ability to compare products	Ability to conduct a risk assessment
Ability to conduct economic analysis of alternatives	Ability to convert units
Ability to cope with stressful situations	Ability to diagnose equipment and system failures
Ability to distinguish between manual and automatic operations	Ability to evaluate bid proposals
Ability to evaluate facility conditions	Ability to follow written and sequenced directions
Ability to forecast situational resources	Ability to identify alternate work practices
Ability to identify options for extending useful life of equipment and systems	Ability to integrate disparate systems and equipment
Ability to interpret contract documents	Ability to interpret test readings
Ability to manipulate equipment controls	Ability to operate digitizing equipment (scanners, etc.)
Ability to perform equipment checks and tests	Ability to plan for future needs
Ability to prioritize	Ability to read and interpret construction documents
Ability to read gauges	Ability to read technical data
Ability to relate graphic information to real world situations	Ability to remain calm in an emergency
Ability to think clearly in an emergency	Ability to understand contract documents
Ability to utilize a systems or holistic approach to equipment checks	Ability to work in abnormal conditions
Ability to write Key Performance Indicators (KPIs)	Analytical skills
Basic and advanced math skills	Benchmarking skills
Computer skills	Customer service skills
Data interpretation and management skills	Diagnostic skills
Estimating skills	Evaluation skills
Interpersonal skills	Interviewing skills
Inventory control skills	Leadership skills
Listening skills	Locksmith skills
Management skills	Marketing skills
Measurement skills	Meter calibration and verification skills
Negotiation skills	Organizational skills
Physical attributes	Planning skills
Presentation skills	Problem solving skills
Procurement skills	Project management skills
QC skills	Reading ability
Recordkeeping skills	Research skills
Safe	Scheduling skills

Skills and Abilities	
Spreadsheet skills	Strong control system skills
Systems thinking	Teaching skills
Team management skills	Teambuilding skills
Teamwork skills	Technical aptitude
Technical reading ability	Technical writing skills
Troubleshooting skills	Verbal communication skills
Written communication skills	

Table 6. Attitudes Required of Building Operations Professionals

Attitudes
Safety conscious
Adaptable/flexible
Analytic
Accurate/precise
Common sense
Cooperative
Critical thinker
Dependable
Ethical/ fair
Honest
Trustworthy
Integrity/tactful
Conscientious
Free of substance abuse
Customer-oriented
Detail-oriented/attention to detail
Manage stress/pressure
Organized
Professional
Work efficiently (resources)
Focused
Quality focused
Self-discipline
Team player
Punctual
Responsible/accountable
Work efficiently (time)
Confident
Good listener
Good time manager
Multi-tasker
Non-aggressive/patient

Positive attitude
Self-control
Eager to learn new things
Goal-oriented
Industrious
Self-motivated
Mechanical aptitude

Table 7. Physical Conditions Required of Building Operations Professional

Physical Conditions
Position - How important is it that one can. . .
Stand part of the time
Stoop kneel or crouch
Stand at all (could the work be performed from a sitting position?)
Bend forward frequently
Sit part of the time
Work in a squatting position for more than five (5) minutes per hour
Stand all of the time
Lay on back
Mobility - How important is it that one can. . .
Climb ladders, stairs, poles, etc. using legs and/or arms
Walk
Crawl or creep
Lifting - How important is it that one can. . .
Carry objects of up to 25 lbs.
Lift 50 lbs. maximum
Lift objects from ground to waist level
Lift objects from waist to overhead level
Lift objects from ground to overhead level
Arm/Hand Use - How important is it that one can. . .
Reach with arms and hands in any direction
Feel size, shape and temperature or texture of objects with the hands
Hold or move objects using the fingers
Push objects with arms or hands
Pull objects with arms or hands
Hold or move objects using the hands but not the fingers
Work with hands and arms over head level
Senses - How important is it that one can. . .
Talk
Hear speech
Detect abnormal noises

Physical Conditions
See clearly at 20 inches or less (with/without optical assistance)
Judge depth (the position and distance of objects) with the eyes
See and discriminate colors
See clearly at 20 feet or more (with/without optical assistance)
Working Conditions - How important is it that one can. . .
Work while wearing protective equipment (respirators, hoods, etc.)
Work inside
Work while standing on portable ladders
Work outside
Work while standing on scaffolding
Work in changing temperatures (in and out of buildings repeatedly)
Work at heights of 1 to 25 feet above ground or floor level
Work around or near high voltage power sources or equipment
Work in high temperatures (85 to 130 degrees F)
Work in low temperatures (0 to 45 degrees F)
Work in noisy places (85 DB or higher with ear protection)
Work while sitting or standing on high roofs, overhangs, or I-beams
Work in damp places (high humidity, some standing water)
Work in one place (no change of work location)
Handle hot or cold objects
Work in dry places (lacking any natural moisture or humidity)
Work in dust, oils, fumes, or smells
Work around or near magnetic equipment or materials
Work in confined spaces
Work on slippery surfaces
Work in stale air (with some oxygen depletion)
Work with or near fiberglass or asbestos materials
Work at heights of 26 to 75 feet above ground or floor level
Handle toxic materials
Work in sub-zero temperatures (0 and lower)

Table 8. Tools, Equipment, and Resources Required by Building Operations Professional

Tools, Equipment, and Resources	
Access control systems	Adequate consumable storage devices
Analysis data	As-built drawings and documents
AV equipment	Backlogs and deferred activities list
Balancing reports	Basis of design
Better Buildings Resources	Better buildings website
Budgets	Building data
Building plans and related documents	Calculator

Tools, Equipment, and Resources	
Case studies	Certifications
Certifications and licenses as required (EPA refrigerant handling certification - EPA rule 608, etc.)	Certified payroll rules
Chemical analysis kit (See Table 9)	Codes, standards, regulations and guidelines (See Table10)
Commissioning reports	Communication devices
Communications methods (Skype, Webinar, etc.)	Computer, peripherals and pertinent software (See Table 11)
Computerized maintenance management system (CMMS)	Construction documents (drawings and specifications)
Contingency services and resources	Contracts
Corporate diversity procurement policies	Corporate policies
Corporate social responsibility policies	Dashboard and remote monitoring systems
Data loggers	Data storage policies
Davis-Bacon Act (prevailing wages)	DDC system
Department of Labor wage information	Documentation tools (note recording, etc.)
DOT regulations (for shipping and transport)	Emergency certifications (first aid, CPR, etc.)
Emergency plans	Energy market data
Energy modeling software	Energy Star
EPA and state regulations	Equipment and system information (historical information, parts list, maintenance information, etc.)
Equipment and system warranties	Equipment energy consumption
Equipment lists	Equipment manuals
Evacuation plans	Existing system information
External agencies (fire department, police department, etc.)	External resources for emergencies (Ammonia response team, confined space rescue team, etc.)
Facility information	Facility management plan
Facility strategic plan	Financial calculator
Fire extinguishers	Fire hoses
Flammable storage cabinets	Foot-candles/light meters
Hand tools (See Table 12)	HIPAA
Historical staffing level data	HR policies
HR Resources	Inclement weather resources (deicer, chain saw, PPE, etc.)
Industry and association reference materials	Industry expense references
Industry resources (BBB, etc.)	Inspection reports
Insurance policies	Insurance requirements
Inventory management system	IPMVP
ISO/IEC 50001	IT Resources
Labor and service provider contracts	Labor contracts
Lifecycle cost analysis reports and tools	Local jurisdiction vulnerability analysis

Tools, Equipment, and Resources	
Locksmith tools	Logs and plans
Logs of previous inspections	Maintenance records
Metering	Modeling software
Monitoring systems	O&M manuals
Onsite logistic support resources	Operating manuals and documents
Operating references	Organizational standards
Owner's project requirements	Payroll system
Personnel scheduling system	Phase 1 or other historical documents
Plans and facility documentation	PM guides
Policies and procedures for the stakeholders	Potential new system information
PPE (See Table 13)	Previous year's budgets
Prior phase 1 reports	Procurement policies and procedures
Product manuals	Project schedules
Projected data	Projections versus actual
Projections versus actual for past projects	Property condition report
Property documents	Psychrometric charts
Real time energy dashboard	Recovery equipment
Reference and guidance materials pertaining to staffing	Remote monitoring systems
Resources (Energy Star, FEMP, trade magazines, etc.)	Riser diagrams
Risk management data	Safety materials (spill kits, absorbable, etc.)
Safety tracking system	Sample containers
Schematics	SDS
Sequence of operations	Service logs and historical equipment data
SOPs	Specialized emergency equipment
Specialized insurance policies	Specialized testing resources (consultants, etc.)
Specialized tools (See Table 14)	Strategic plan
Submetering systems	Submittals
Systems data and information	Technology tools (See Table 15)
Tenant/occupant lease or contract	Test equipment
Third party experts	Time management system
Training materials	Training plans
USGBC	Utility cost information
Utility interval data	Video management and monitoring systems
Warranty maintenance requirements	Waste removal guidelines
Work orders	

Table 9. Chemical Analysis Kit Required by Building Operations Professional

Chemical Analysis Kit
pH strips
pH/conductivity meter
TDS meters
non-chemically reactive tubing, pumps and flow meters

Table 10. Codes, Standards, Regulations, and Guidelines for Building Operations Professional

Codes, Standards, Regulations and Guidelines
Sources of information
Most current editions of:
AEE -- Handbook of Energy Audits
AEE Reference Books
American Institute of Architects -- Guideline for the Construction of Hospital and Health Care Facilities
ASHRAE -- Building Performance Metrics Best Practices
ASHRAE -- Handbooks: Fundamentals, Systems, Applications, Refrigeration
ASHRAE -- Procedures for Commercial Building Energy Audits; 2nd Edition
ASHRAE/ASPE/AWW -- Water Condition Standards
Cost Estimating Guides
NFPA Codes
EERE (Air Master, Motor Master, etc.)
General OSHA Guidelines
Illuminating Engineering Society -- The Lighting Handbook
International Performance Measurement and Verification Protocol
FEMP M&V Guidelines
MICA -- National Mechanical Insulation Standards
NIST -- Handbook 135 Life Cycle Costing Manual for Federal Energy Management Program
EPA Regulations regarding environmental hazards such as asbestos and lead paint
EPA Section 608 – Refrigerant handling
ISO/IEC 50001: NEED title
Department of Transportation 39
Department of Transportation 49
ASHRAE Guides, Etc.
ASHRAE Guide 10 -- Interactions Affecting the Achievement of Acceptable Indoor Environments
ASHRAE Guide 11 -- Field Testing of HVAC Controls Performance
ASHRAE Guide 12 -- Minimizing the Risk of Legionellosis with Building Water Systems
ASHRAE Guide 14 -- Measurement of Energy and Demand Savings
ASHRAE Guide 22 -- Instrumentation for Monitoring of Chilled Water Plant Efficiency
ASHRAE Guide 32 -- Sustainable High Performance Operation and Maintenance

Codes, Standards, Regulations and Guidelines
ASHRAE Guide -- Energy Efficiency Guides for Existing Commercial Buildings: Business Case
ASHRAE Guide -- Energy Efficiency Guides for Existing Commercial Buildings: Technical Case
ASHRAE Standards
ASHRAE Standards 15 -- Safety Standards for Refrigeration Systems
ASHRAE Standards 34 -- Designation and Safety Classifications of Refrigerants
ASHRAE Standards 41.1 -- Standard Method for Temperature Measurement
ASHRAE Standards 41.7 -- Method Test for Measurement of Flow of Gas
ASHRAE Standards 55 -- Thermal Environmental Conditions for Human Occupancy
ASHRAE Standards 62.1 -- Ventilation and Acceptable Indoor Air Quality
ASHRAE Standards 90.1 -- Energy Standard for Buildings Except Low Rise Residential Buildings
ASHRAE Standards 100 -- Energy Conservation in Existing Buildings
ASHRAE Standards 105 -- Standard Method of Measuring and Expressing Building Energy Performance
ASHRAE Standards 134 -- Graphic Symbols for Heating, Ventilating, Air Conditioning and Refrigeration Systems
ASHRAE Standards 154 -- Ventilation for Cooking Operations
ASHRAE Standards 169 -- Weather Data for Building Design Standards
ASHRAE Standards 170 -- Ventilation for Health Care Facilities
ASHRAE Standards 180 -- Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
ASHRAE Standards 189.1 -- Standard for Design of High Performance Green Buildings
ASHRAE Standards 211 (P) -- Standard for Conducting commercial Building Audits
BSR/ASHRAE/USGBC/ASPE/AWWA Standard 191(P) -- Standard for the Efficient Use of Water in Building, Site, and Mechanical Systems
ASTM Standards
ASTM Standard E1934-10 -- Standard Guide for Examining Electrical and Mechanical Equipment with Infrared Thermograph
ASTM Standard E1311-2010 -- Standard Test Methods for Minimum Temperature Detection Difference for Thermal Imaging Systems
ANSI Standards
ANSI/ASSE Z87.1: Occupational and Educational Personal Eye and Face Protection
ANSI/ISEA Z89.1: Industrial Head Protection

Table 11. Software Required for Building Operations Professional

Software
Computerized maintenance management system (CMMS)
BIM Viewer
Building energy modeling software
CAD Viewer
Computer aided facility management (CAFM)
ECAM (Energy Charting and Metrics)
Energy Star Portfolio manager
eQuest

FEMP BLCC (Federal Energy Management Program, Building Life Cycle Costing)
Geospacial information systems (GIS)
Integrated work management system (IWMS)
MotorMaster
Spreadsheets

Table 12. Hand Tools Required for Building Operations Professional

Hand Tools	
Adjustable pliers	Adjustable wrench
Allen wrenches	Amp Probe
Ball-peen hammer	Chisel
Clamps	Cleaning brushes
Combination wrenches	Deburring tool
Extension magnet	File
Flashlight	Fuse puller
Hacksaw	Hammers
Inspection mirror	Lock-out/tag-out equipment
Locking pliers	Measuring devices
Multimeter	Nut drivers
Pipe wrenches	Pliers
Pocket knife	Pocket level
Ratchets	Rubber mallet
Screw drivers	Small power tools (hand electric drill)
Socket sets	Strap wrench
Tape measure	Toilet plunger
Torque wrench	Tube bender
Tubing cutters	Vises
Water key	

Table 13. PPE Required for Building Operations Professional

PPE
Arc flash protection (NFPA 70e)
Back protection
Dust masks
Eye protection/safety glasses
Face shield
Fall protection
Gloves
Hardhat
Hearing protection (plugs and muffs)
Level C suit (Tyvek, etc.)
Respirator
Rubber boots
Safety harnesses
Vests
Welding jacket
Work shoes (toe and shank protection)

Table 14. Specialized Tools Required for Building Operation Professionals

Specialized Tools	
Anemometer	Borescope
Circuit tracer	Combustion analyzing instruments
Digital thermometer (surface and air)	Dosimeter
Flow meters	Gas Analyzers
Hydrometer	Infrared thermometer
Light meters	Manometer
Megohmmeter	Moisture meter
Plumbing snakes	Power analyzer
Psychrometers	Refractometer
Refrigeration tools	RPM Meter
Shaft alignment tools	Smoke stick
Sound meters	Tachometers
Temperature meters	Thermal imaging camera
Torch	Tube brushing machines
Velometer	Vibration analysis instrument

Table 15. Technology Tools Required for Building Operations Professional

Technology Tools	
Smart phone with	Camera
	WiFi access
	Internet access
	Two-way communications
	Video recording/transmitting
Computer with	Spreadsheet applications
	Internet access
	Word processing applications
	Data storage
	Graphics software
	External data storage/backup
Data gathering	Data loggers with sensors (t/h/kw/on-off)
	Utility tariffs
	Real time pricing data stream
	DDC
	BEMS/BIMS

Table 16. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Supervising Personnel

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Develop Workload Analyses			
Develop scopes of work for responsibilities Review data for operating and maintaining the building systems* (*See separate list) Evaluate the equipment to determine multipliers Perform a summation of hours Segregate hours by trade Compare staffing benchmarks	• Building systems (See Table 3) • Criticality of various systems and equipment • Labor contract agreements • Levels of service for various spaces • Recommended maintenance schedules • Tenant/occupant contracts • Understanding of staffing models (vacation, sick leave, etc.)	• Ability to evaluate bid proposals • Ability to read and interpret construction documents • Ability to write Key Performance Indicators (KPIs) • Analytical skills • Basic and advanced math skills • Computer skills • Estimating skills • Technical reading ability	• Building data • Calculator • Computer, peripherals and pertinent software (See Table 11) • Contracts • Department of Labor wage information • Equipment lists • Historical staffing level data • O&M manuals • Reference and guidance materials pertaining to staffing • Technology tools * (see list)
Analyze Staffing Productivity			
Compare work orders completed to total staff hours Benchmark productivity Baseline staff productivity Compare actual work order hours to estimated work order hours Review quality of staff work Track and reduce incidences of rework Survey/validate work completion Review productivity to operations plan Analyze reasons for rework and callbacks Analyze deferred maintenance backlogs Track and benchmark overtime	• Building operations and procedures • Building systems* (See Table 3) • Industry norms for manpower • Outsourcing options • Reporting capabilities of work order systems • Trade terminology and definitions	• Ability to analyze data • Ability to identify alternate work practices • QC skills	• Computerized maintenance management system (CMMS) • Technology tools (See Table 15)
Supervise Building Staff			
Delegate work to staff			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Assign tasks to staff Review staff performance Create work schedules for staff Train facility staff Develop staff training programs Document staff training Manage conflicts among staff Approve time sheets Coordinate schedules (vacation, sick days, personal time off, etc.) Discipline staff Motivate staff Manage on call and after work hours schedule Mentor staff	styles • Human resources • Job responsibilities • Performance improvement plans • Personnel performance review processes • Technical knowledge • Trade and Union requirements	• Assertive • Fair • Interpersonal skills • Interviewing skills • Leadership skills • Management skills • Patience • Safe • Tactful • Teambuilding skills • Verbal communication skills • Written communication skills	• HR policies • Labor contracts • Payroll system • Personnel scheduling system • Safety tracking system • Technology tools (See Table 15) • Time management system • Training plans • Training tools
Secure Outside Service Providers			
Create the Request for Proposals (RFPs) and scope of work (SOW) Determine requirements for outside services (skills, resources, service levels, etc.) Determine type of contract (prescriptive or performance) Interview service providers Review proposals or RFP responses Develop a contractor/service provider handbook Conduct orientation for service providers Determine criteria for selection of service providers Secure the services of outside service providers (sign contracts, etc.)	• Building operations and procedures • Building systems (See Table 3) • Contract knowledge • Funding limitations • Licensing requirements • Procurement policies and procedures • RFP Process • Services to be outsourced • Trade and Union requirements	• Analytical skills • Interviewing skills • Technical writing skills • Written communication skills	• Certified payroll rules • Codes, standards, regulations and guidelines (See Table 10) • Corporate diversity procurement policies • Davis-Bacon Act (prevailing wages) • Facility information • Industry resources (BBB, etc.) • Insurance requirements • Systems data and information • Technology tools (See Table 15)

Table 17. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Conducting Planning Activities

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Update Procedures (SOPs, BOPs, Operating Plans, Emergency Plans, etc.)			
Evaluate existing procedures Evaluate building use changes Conduct gap analyses Document new procedures Update and test new/revised procedures Implement revised procedures Train staff on new/revised procedures Evaluate new/revised procedures Update emergency operating procedures Update disaster recovery plans	• Building operations and procedures • Building systems* (See Table 3) • Company labor policies • National Incident Management Systems (NIMs) • Organizational structures	• Adaptable • Analytical skills • Leadership skills • Organizational skills • Problem solving skills • Teaching skills • Technical writing skills	• Codes, standards, regulations and guidelines (See Table 10) • External agencies (fire department, police department, etc.) • Technology tools (See Table 15)
Develop Equipment Operations Plans			
Determine required start/stop times based on tenant occupancies Review O&M manuals and extract equipment specific information Develop system specific operation procedures (steps in operation) Train staff on system operations Develop operating logs	• Building systems (See Table 3) (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations) • Equipment operations and specifications • Rate schedules for utilities	• Ability to distinguish between manual and automatic operations • Presentation skills • Teaching skills • Technical reading ability • Verbal communication skills	• O&M manuals • Technology tools (See Table 15) • Tenant/occupant lease or contract
Develop Planned Maintenance Schedules			
Conduct equipment inventories Identify equipment specifications Identify O&M requirements Rank equipment in terms of priority Determine level of service to be performed on equipment based on criticality of system	• Criticality of various systems and equipment • Equipment operations and specifications • Facility knowledge • Failure modes • Levels of maintenance	• Ability to follow written and sequenced directions • Ability to read and interpret construction documents • Analytical skills • Mechanical aptitude • Organizational skills	• Codes, standards, regulations and guidelines (See Table 10) • Hand tools (See Table 12) • Resources (Energy Star, FEMP, trade magazines, etc.) • Specialized tools (See Table 14) • Technology tools (See Table 15)

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Update Procedures (SOPs, BOPs, Operating Plans, Emergency Plans, etc.)			
Identify tasks to be outsourced Identify skill level of staff Identify required tools Identify opportunities for predictive maintenance Identify opportunities for reliability centered maintenance Identify appropriate timing for maintenance (when can it be done to eliminate interference with operations) identify frequency of maintenance Compare needs to available budget Prioritize maintenance tasks Document maintenance procedures Create the maintenance programs Document any deviations from OEM standards Plan for third party inspections/maintenance	• Resource planning personnel management • Tenant/occupant needs and schedules	• Reading ability • Verbal communication skills	• Warranty maintenance requirements
Contribute to Construction Standards and Guidelines			
Participate in construction meetings Review construction specifications prior to construction design and bid Review designs to actual building requirements Provide input based on existing systems Review submittals Contribute to commissioning planning Participate in commissioning Contribute to maintainability	• Customer requirements for business • Distinguishing equivalency between equipment and/or systems • Equipment operations and specifications • Equipment operations and specifications • Management requirements • Scope of work • When substitutions of	• Ability to read and interpret construction documents • Reading ability • Verbal communication skills	• Basis of design • Certifications and licenses as required (EPA refrigerant handling certification - EPA rule 608, etc.) • Codes, standards, regulations and guidelines (See Table 10) • Construction documents (drawings and specifications) • Owner's project requirements • Project schedules • Submittals • Technology tools (See Table 15)

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Update Procedures (SOPs, BOPs, Operating Plans, Emergency Plans, etc.)			
analysis prior to construction	equipment or systems are not allowed		
Conduct a surrounding site assessment			
Contribute to Capital Renewal Plans			
Review existing capital renewal plans	• Emerging technologies and tools • Expected life of major building components • Facility knowledge • Impact of change on tenant/occupant space • Options for extending the life of equipment and systems • Organization's budgeting process • Owner's long-term plan for the facility	• Ability to forecast situational resources • Ability to identify options for extending useful life of equipment and systems • Computer skills • Data interpretation and management skills • Verbal communication skills	• Codes, standards, regulations and guidelines (See Table 10) • Computer, peripherals and pertinent software (See Table 11) • Industry and association reference materials • Maintenance records • Technology tools (See Table 15)
Review organizational strategic plans			
Develop and review facility condition indexes			
Advise on new conditions within the facility and property			
Identify timeline for system and equipment replacements			
Promote sustainable materials and practices for renewal			
Analyze ROI			
Conduct a project failure analysis			
Review system lifecycle assessments			
Review ongoing maintenance requirements			
Review schedule for capital renewal to level capital requirements			
Provide input into the facility strategic plan			
Conduct Data Management Activities			
Develop facility/equipment/system data acquisition and management plans	• Basic data architecture • Building systems (See Table 3) • Contingency plans/data recovery • Facility knowledge • Integrated work	• Ability to operate digitizing equipment (scanners, etc.) • Computer skills • Organizational skills • Reading ability • Written communication skills	• Budgets • Codes, standards, regulations and guidelines (See Table 10)Computerized maintenance management system (CMMS) • Computer, peripherals and pertinent software (See Table 11)
Maintain asset inventories			
Maintain handwritten logs			
Maintain updated building as-built plans			
Maintain updated OEMs			
Maintain inspection records			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Update Procedures (SOPs, BOPs, Operating Plans, Emergency Plans, etc.)			
Develop data retention policies	management systems structure • Regulatory record requirements		• Data storage policies • HR Resources • IT Resources • Logs and plans • Technology tools (See Table 15)
Determine data storage capabilities and needs			
Determine offsite data storage requirements			
Determine data interoperability levels			
Determine data access levels			

Table 18. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Operating Buildings

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Perform Workplace Hazard Assessments			
Conduct daily building inspections	• Biohazards and hazardous chemicals • Chain of custody • Limitations of PPE • Operations within the facility • Safety Codes and Standards (including OSHA) • Safety practices • Understanding of all staff functions carried out in the facility	• Analytical skills • Attention to detail • Organizational skills • Technical reading ability • Verbal communication skills • Written communication skills	• Certifications • Codes, standards, regulations and guidelines (See Table 10)Organizational standards • PPE(See Table 13) • SDS • SOPs • Specialized testing resources (consultants, etc.) • Technology tools (See Table 15)
Conduct monthly building inspections			
Conduct quarterly building inspections			
Identify confined workspaces			
Identify hazardous building components			
Review workplace injury records			
Review workplace biohazards and chemicals			
Obtain OSHA training			
Identify building obsolescence			
Create job hazard analyses reports			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Identify required PPE			
Participate in Emergency Drills			
Schedule fire drills	• Best practices for emergency drills • Conditions under which a building should be evacuated • Emergency procedures including first aid and CPR • Emergency procedures including first aid and CPR • First response mitigation techniques (what type of fire extinguisher to use, etc.) • Incident command systems (ICS) • National Incident Management Systems (NIMs) • Occupancy types and typical evacuation procedures for various occupancies • Specialized emergency equipment	• Ability to remain calm in an emergency • Critical thinker • Leadership skills • Team management skills • Verbal communication skills • Written communication skills	• Codes, standards, regulations and guidelines (See Table 10) • Emergency certifications (first aid, CPR, etc.) • Emergency plans • Evacuation plans • Fire extinguishers • Fire hoses • Technology tools (See Table 15)
Schedule emergency evacuation drills (earthquakes, fires, etc.)			
Develop the EAPs (Emergency Action Plans)			
Coordinate with regional emergency agencies			
Coordinate with local emergency services			
Monitor fire panels			
Monitor emergency generators			
Track and record evacuation times			
Create evacuation results reports			
Coordinate with building tenants/occupants regarding drills			
Coordinate with building tenants/occupants with disabilities and needing assistance in evacuating			
Maintain emergency equipment (radios, communication devices, etc.)			
Develop communication protocol (ICS)			
Manage the PPE Program			
Identify the hazards	• Decontamination requirements • Hazards management • HIPAA requirements • Job responsibilities • Medical evaluation policies and requirements	• Evaluation skills • Teaching skills • Technical reading ability • Technical writing skills • Verbal communication skills • Written communication skills	• Codes, standards, regulations and guidelines (See Table 10) • HIPAA • PPE (See Table 13) • Prior phase 1 reports • Technology tools (See Table 15) • Test equipment
Train staff on hazards and PPE requirements			
Train staff on limitations of PPE			
Label hazards and rooms with hazards			
Test staff on use of PPE for			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
correct usage	• PPE and proper usage and maintenance of PPE • Proper procedures for isolating and removing hazards		• Training materials
Set up medical evaluations for some PPE (Respirators, etc.)			
Conduct a fit test of PPE			
Document training			
Document use compliance			
Document PPE testing			
Procure required PPE			
Verify required PPE is available			
Conduct audiometric testing (loudness)			
Enforce use of PPE			
Certify the PPE equipment on an annual basis			
Document the PPE program			
Manage Third Party Inspections			
Determine types of inspection needed	• Equipment operations and specifications • Facility knowledge • General knowledge of the authority having jurisdiction • Inspection agencies • Inspection procedures • Operational impact of inspections	• Ability to communication with regulatory authorities/inspectors • Interpersonal skills • Mechanical aptitude • Teaching skills • Verbal communication skills	• Codes, standards, regulations and guidelines (See Table 10) • Communication devices • Construction documents (drawings and specifications) • Hand tools (See Table 12) • Logs of previous inspections • Maintenance records • O&M manuals • Specialized tools (See Table 14) • Technology tools (See Table 15)
Schedule third party inspections			
Prepare equipment for inspections (shut down, etc.)			
Operate equipment for inspections (elevator recall, etc.)			
Participate in inspections (escort the inspector, etc.)			
Schedule inspections with internal staff affected			
Verify safety for inspectors (hazards, etc.)			
Communicate with building tenants regarding inspection requirements			
Communicate results with parties			
Schedule inspections with tenants/occupants affected			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Review results of inspections			
Address identified deficiencies			
Coordinate re-inspections			
Respond to Building Emergencies			
Identify emergencies	• Building systems (See Table 3) • Hazard remediation/clean up • Hazardous materials disposal • Hazards in the area (earthquakes, etc.) • Potential environmental, health and safety (EHS) hazards and risks • Normal routine operation of the facility • Reporting requirements for emergencies • Uninterruptable and critical systems	• Ability to communicate with non-English speaking individuals • Ability to think clearly in an emergency • Leadership skills • Verbal communication skills	• External resources for emergencies (Ammonia response team, confined space rescue team, etc.) • Riser diagrams • SDS • Technology tools (See Table 15)
Initiate emergency procedures			
Communicate with internal stakeholders and staff			
Secure impacted equipment and/or affected areas			
Respond to emergencies with no established procedures by isolating and mitigating the emergency			
Escalate for additional emergency support			
Communicate with external stakeholders			
Clean up after emergencies			
Conduct "lessons learned" activities			
Document emergencies			
Restock emergency supplies			
Make emergency/temporary repairs to stabilize problems			
Make permanent repairs			
Conduct root cause analyses			
Coordinate outside special services			
Plan for/accommodate non-English speaking building tenants/occupants and staff			
Managing Building Securities			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Update access requirements or permissions	• Key logic systems (master keys vs. other keys) • Organizational security requirements (access requirements, levels of security, etc.) • Security equipment (lighting, cameras, etc.) • Security policies and procedures	• Attention to detail • Computer skills • Locksmith skills • Recordkeeping skills	• Access control systems • Locksmith tools • Technology tools (See Table 15) • Video management and monitoring systems
Issue access cards and keys			
Verify security of access (door locks, self closing door operation, etc.)			
Maintain chain of custody of access cards and keys			
Maintain security lighting (exterior lights, etc.)			
Maintain security equipment (camera system, etc.)			
Maintain key logic system and distribution			
Provide temporary access to secured areas			
Develop policies for temporary access for outside vendors			
Maintain egress/access documentation (doors and window counts)			
Perform security functions (monitor for potential unauthorized access)			
Respond to unauthorized access			
Complete certificates and compliance forms regarding access			
Maintain access (rekey locks, cut new keys, etc.)			
Maintain security and access records (video, written logs, etc.)			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Coordinate Tenant/Occupant Training			
Identify training topics	• Change management techniques • Communications methods (Skype, Webinar, etc.) • Typical training topics	• Organizational skills • Presentation skills • Teaching skills • Technical reading ability	• AV equipment • Communications methods (Skype, Webinar, etc.) • Policies and procedures for the stakeholders • Specialized tools (See Table 14) • Technology tools (See Table 15)
Identify knowledge levels of tenants/occupants			
Develop and update training programs			
Distribute training materials			
Schedule and conduct training			
Identify appropriate personnel for training			
Coordinate training with tenant/occupant management			
Document completed training			
Evaluate success of training			
Conduct Risk Management Activities			
Define risks associated with building operations	• Basic knowledge of insurance policies for equipment and operations • Hazards in the area (earthquakes, etc.) • Operations within the facility • Root cause analysis techniques • Typical characteristics of facilities and equipment	• Analytical skills • Interpersonal skills • Recordkeeping skills • Verbal communication skills • Written communication skills	• Codes, standards, regulations and guidelines (See Table 10) • Hand tools (See Table 12) • Industry and association reference materials • Inspection reports • Local jurisdiction vulnerability analysis • Specialized insurance policies • Specialized tools (See Table 14) • \Technology tools (See Table 15)
Assess risks associated with building operations			
Participate in development of hazard vulnerability analysis			
Manage utility system risk and vulnerability			
Examine interoperability of systems			
Develop action plan for hazard risks			
Identify external resources required			
Coordinate management of external resources			
Review hazard vulnerability analyses and update			
Manage Responses to Inclement Weather Conditions/Issues			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Create inclement weather action plans Identify areas that are vulnerable to inclement weather Redirect resources Prepare and stock for inclement weather incidents Restock following inclement weather incidents Maintain inclement weather response resources Plan for processes/services that cannot be disrupted Communicate inclement weather activities with tenants/occupants and stakeholders Manage and schedule staff to address inclement weather conditions/issues Train staff on the inclement weather action plans Monitor inclement weather forecasts	• Communications plans • Emergency equipment operation • Equipment operations and specifications • Facility knowledge • HVAC systems • Inclement weather escalation plans • Inclement weather local logistics (shelter, food, transportation) • Local weather issues • Plumbing systems • Safety codes and standards (including OSHA)	• Ability to forecast situational resources • Ability to cope with stressful situations • Ability to prioritize • Ability to work in abnormal conditions • Leadership skills • Project management skills • Verbal communication skills • Written communication skills	• Inclement weather resources (deicer, chain saw, PPE, etc.) • Onsite logistic support resources • SDS • Specialized emergency equipment • Specialized tools (See Table 14) • Third party experts • Technology tools (See Table 15)
Respond to Tenant/Occupant Requests and Issues			
Identify core issues of tenant/occupant requests Document tenant/occupant issues or requests Prioritize responses to tenant/occupant requests Identify staff to address tenant/occupant issues Communicate actions throughout the response to tenant/occupant	• Building systems (See Table 3) • Infection control procedures • Remediation procedures • Resources required for typical tenant/occupant requests and issues • Tenant/occupant chain of command	• Ability to evaluate facility conditions • Critical thinker • Diagnostic skills • Listening skills • Patience • Verbal communication skills • Written communication skills	• Hand tools (See Table 12) • Plans and facility documentation • PPE (See Table 13) • Specialized tools (See Table 14) • Technology tools (See Table 15) • Work orders

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
requests	• Work control procedures		
Provide a lead-time for responses to tenant/occupant requests			
Manage tenant/occupant expectations			
Document resolution of responses to tenant/occupant requests and issues			
Track resources required for responses to tenant/occupant requests and issues			
Assess area for other issues			
Identify tenant/occupant request responsibilities			
Review prior requests (trend analysis, historical data)			
Identify opportunities for improvement			
Identify PPE need for response to tenant/occupant requests and issues			
Conduct Equipment Checks			
Identify staff responsibilities	• Adjusting equipment based on readings • Building systems (See Table 3) • (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations) • Interpreting equipment test readings • Normal equipment operating	• Ability to convert units • Ability to perform equipment checks and tests • Ability to read gauges Ability to utilize a systems or holistic approach to equipment checks	• Analysis data • Codes, standards, regulations and guidelines (See Table 10) • Dashboard and remote monitoring systems • DDC system • Hand tools (See Table 12) • Operating references • PPE (See Table 13) • Schematics Technology tools (See Table 15)
Identify equipment/systems that require daily check			
Record equipment check readings			
Collect equipment operating data			
Respond to equipment anomalies			
Conduct necessary equipment tests			
Determine frequency of equipment checks			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
	parameters/limits • SOPs related to equipment • Whole building integration		
Conduct Daily Rounds			
Physically tour facilities	• Building systems (See Table 3) (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations) • Common or frequent deficiencies • Control systems • Indicators of problems with equipment • Location of facility equipment • Relationship between deficiencies and energy efficiency • Remote monitoring systems and equipment • Sequence of operations • Tenant/occupant equipment and requirements Weather impact on the facility	• Ability to relate graphic information to real world situations • Analytical skills • Attention to detail • Data interpretation and management skills • Listening skills • Verbal communication skills Written communication skills	• Documentation tools (note recording, etc.) • Hand tools (See Table 12) • PPE (See Table 13) • Remote monitoring systems • Specialized tools (See Table 14)Technology tools (See Table 15)
Identify areas requiring efficiency upgrades or needing improvements			
Identify deficiencies			
Communicate with building tenants/occupants regarding concerns			
Identify energy conservation opportunities (lights on in unoccupied areas, ventilation issues, HOA switches, etc.)			
Listen for potential problems (bad bearings, loose belts, etc.)			
Observe for other indicators of issues (odd smells, etc.)			
Check remote and other automated monitoring systems			
Check for common or known issues			
Document deficiencies noted			
Coordinate Facility Operations (Normal)			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Verify occupied, unoccupied and standby schedules Compile equipment schedules Validate equipment availability Optimize equipment start ups Obtain peak demand loads Start equipment Stop equipment Verify equipment is operating within normal seasonal parameters Verify systems availability Evaluate alternative scheduling needs (holidays, inclement weather, etc.) Document building operations Operate renewable technologies (solar, wind, energy storage systems, distributed generation, water recovery systems, etc.) Maintain the BAS system Maintain the BAS system database Complete activity reports	• Emerging technologies and tools • Historical data associated with facility • Impact of facility operations on scheduling • Impact of facility operations on scheduling • Normal equipment operating parameters/limits • Peak demand loads • Renewable energy systems • Sequence of operations • Understanding of interlocked equipment • Utility time of use • Weather related factors affecting equipment (temperatures, dew points, etc.)	• Ability to manipulate equipment controls	• Certifications and licenses as required (EPA refrigerant handling certification - EPA rule 608, etc.) • Technology tools (See Table 15)
Coordinate Facility Operations (Other Than Normal)			
Perform equipment shut downs for maintenances Perform equipment load shedding Perform equipment lock-out/tag-out Shut down equipment for smoke control Schedule and notify tenants/occupants of shut downs Adjust to utility shut downs Verify equipment is ready for normal operations	• Basic knowledge of tariffs • Building systems (See Table 3) • (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations) • Lock-out/tag-outs	• Ability to follow written and sequenced directions • Computer skills • Project management skills • Scheduling skills	• Building plans and related documents • Contingency services and resources • Equipment manuals • Hand tools (See Table 12) • Sequence of operations • Specialized tools (See Table 14) • Technology tools (See Table 15)

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Return to normal operations	• Manual equipment operation • Normal equipment operating parameters/limits • Remote system fluency (DDC, etc.) • Safety concerns associated with equipment operations • Sequence of equipment operations • Technical equipment knowledge Understanding of load shedding and its importance		
Document building operations			
Manage the Work Order Process			
Obtain work orders	• Asset inventories • Facility knowledge • Work order processes	• Analytical skills • Computer skills • Customer service skills • Data interpretation and management skills • Diagnostic skills • Organizational skills • Patience • Procurement skills • Troubleshooting skills • Verbal communication skills • Written communication skills	• Technology tools (See Table 15)
Build/maintain asset inventory			
Establish work order priorities			
Establish response times			
Establish whether work order is open or closed			
Document activities associated with work order (including completion verification)			
Identify responsible party for work order			
Track labor hours			
Assign nominal value to work order			
Identify if work order is recoverable (charge back, etc.)			
Track resolution of the work order foundation problem			
Identify the date of the work order			
Identify the time of the work order			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Verify quality of work associated with the work order			
Evaluate the efficiency of the work order process			
Train tenants/occupants regarding work order process			
Track and compile feedback on work order outcomes			
Investigate Indoor Environmental Quality			
Monitor remote monitoring systems	• Basic knowledge of contaminant limits • Building systems (See Table 3) • Contaminant containment protocols • Hazards management • Health effects of contaminants (including stay times) • Monitoring systems and equipment • Potential contaminants • Remediation activities for contaminants • Remote monitoring systems and equipment • When to conduct IEQ tests	• Ability to prioritize • Ability to read technical data • Analytical skills • Attention to detail • Data interpretation and management skills • Verbal communication skills • Written communication skills	• Codes, standards, regulations and guidelines (See Table 10) • Hand tools (See Table 12) • Industry and association reference materials • Phase 1 or other historical documents • PPE (See Table 13) • SDS • Specialized tools (See Table 14) • Technology tools (See Table 15) • Third party experts • Waste removal guidelines
Conduct indoor air quality checks			
Address drafts			
Investigate CO_2 alarms			
Survey tenants/occupants			
Identify chemicals in the workplace			
Investigate indoor air quality issues			
Investigate CO alarms			
Conduct random testing to verify building automation systems			
Control chemicals brought into the workplace			
Verify air exchange (fresh air, exhaust fans) meets requirements			
Investigate and respond to moisture issues			
Investigate gas smells (sewers, etc.)			
Follow protocols for IAQ testing (mold, etc.)			
Promote the use of low VOC paints			
Schedule construction remodeling work			
Manage ACM programs			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Manage PACM programs			
Develop IEQ plans			
Conduct Tenant/Occupant Relations Activities			
Check in with tenants/occupants	• Tenant/occupant contracts • Tenant/occupant hours of operation • Tenant/occupant operations and space uses	• Interpersonal skills • Verbal communication skills • Written communication skills	• Codes, standards, regulations and guidelines (See Table 10) • Technology tools (See Table 15)
Manage tenant/occupant expectations			
Train tenants/occupants in efficiency measures and protocols			
Communicate on a proactive basis with tenants/occupants			
Confirm building protocols (acids not dumped in drains, etc.)			
Introduce new initiatives			
Solicit tenant/occupant feedback and initiatives			
Communicate and manage about tenant/occupant equipment (space heaters, etc.)			
Check in with tenants/occupants about improvement activities			
Communicate with tenants/occupants about space uses			
Manage Consumables			
Maintain consumable inventories	• Chain of custody • Consumable logistics • Consumable requirements • Consumable sourcing guidelines • Inventory control systems • Municipal requirement for disposal and recycle of consumables • Procurement policies and procedures	• Interpersonal skills • Verbal communication skills • Written communication skills	• Codes, standards, regulations and guidelines (See Table 10) • Technology tools (See Table 15)
Track consumable usage			
Establish restock levels			
Conduct inventory control activities (fuel, parts, chemicals, etc.)			
Identify vendors for consumables			
Identify vendors using sustainable supplies			
Procure consumables in accordance with purchasing policy			
Manage recyclables			
Dispose of regulated consumables			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
(batteries, paint, computers, etc.)	• Regulated consumables • Safety practices • Shelf life of consumables • Shelf life of consumables • Storage requirements for consumables • Storage requirements for consumables • Vendors • Vendors • Ventilation requirements for consumables		
Manage chain of custody on disposal of regulated consumables (batteries, paint, computers, etc.)			
Schedule consumable deliveries			
Accept delivery of consumables			
Store consumables			
Manage Outside Facility Contractors/Service Providers			
Verify contractor/service providers licenses	• Contract requirements • Facility knowledge • Insurance requirements • Licensing requirements • Permitting requirements • Scope of work • Service level agreements	• Leadership skills • Management skills • Verbal communication skills	• As-built drawings and documents • Codes, standards, regulations and guidelines (See Table 10) • Construction documents (drawings and specifications) • Contracts • Hand tools (See Table 12) • Insurance policies • O&M manuals • SOPs • Submittals • Technology tools (See Table 15) • Third party experts
Verify contractor/service providers permits			
Verify contractor/service providers insurance			
Verify contractor/service providers compliance with company policies and contract documents			
Verify contractor/service providers compliance with local codes			
Distribute facility rules and regulations to contractor/service providers			
Ensure training is provided to contractor/service providers			
Enforce facility rules and regulations with contractor/service providers			
Check contractor/service providers work			
Verify contractor/service providers PPE			
Communicate environmental			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
hazards to contractor/service providers			
Validate contractor/service providers work has been completed prior to payment (progress billing)			
Obtain lien waivers			
Obtain close-out documents (submittals, as-builts, etc.) or ongoing service documents			
Provide access to contractors/service providers			
Check actual performance against contracted service at periodic intervals			
Provide site specific orientation to contractors/service providers			
Manage Environmental Requirements (Permits, etc.)			
Identify permit parameters for systems (refrigerant logs, etc.)	• Building systems (See Table 3) (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations) • Measurement equipment and techniques • Monitoring systems and equipment • Payment policies • Permitting requirements • Permitting resources • Reclamation techniques • Refrigerant recovery techniques • Reporting requirements for	• Ability to interpret contract documents • Ability to interpret test readings • Interpersonal skills • Mechanical aptitude • Organizational skills • Planning skills • Verbal communication skills • Written communication skills	• Certifications and licenses as required (EPA refrigerant handling certification - EPA rule 608, etc.) • Codes, standards, regulations and guidelines (See Table 10) • DOT regulations (for shipping and transport) • EPA and state regulations • Recovery equipment • Sample containers • Technology tools (See Table 15)
Measure and record parameters			
Report parameters			
Manage readings outside of permit parameters			
Coordinate outside resources and services			
Coordinate reclamation processes			
Identify appropriate permits required			
Maintain documentation			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
	emergencies • System documentation requirements		
Implement an Energy Management Program			
Assist in the development of energy management programs Assist in the development of strategic energy plans Create baselines Set goals for energy improvement Maintain energy-related operating improvements Implement recommissioning or ongoing commissioning energy programs Determine targets for reductions Benchmark internally and externally Develop opportunities for energy improvement initiatives Obtain buy-in from building tenants/occupants Support outreach and marketing activities Evaluate utility bills Investigate opportunities for rebates Identify code requirements Document results Measure and verify savings Identify KPIs	• Break-even analysis • Building certification programs • Building systems (See Table 3) (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations) • Business case development • Energy conservation opportunities • Financial knowledge • First cost vs. lifecycle costs • Lifecycle accounting practices • State and local energy mandates Utility bill analysis	• Ability to analyze data • Ability to compare costs of technologies • Ability to compare data • Analytical skills • Leadership skills • Marketing skills • Verbal communication skills • Written communication skills	• Better Buildings Resources • Codes, standards, regulations and guidelines (See Table 10) • Corporate policies • Corporate social responsibility policies • Energy market data • Energy modeling software • Energy Star • Industry and association reference materials • ISO/IEC 50001 • Lifecycle cost analysis reports and tools • Real time energy dashboard • Risk management data • Specialized tools (See Table 14) • Systems data and information • Technology tools (See Table 15) • USGBC
Maintain the Facility and Systems			
Perform emergency maintenance Perform preventive/predictive maintenance Perform scheduled maintenance Ensure maintenance of life safety	• Americans with Disabilities Act • Building systems (See	• Ability to follow written and sequenced directions • Management skills	• Chemical analysis kit (See Table 9) • Codes, standards, regulations and guidelines (See Table 10

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
systems Test emergency power systems Maintain water/wastewater systems Maintain plumbing systems Maintain irrigation systems Ensure maintenance of security systems Maintain the building envelope Ensure maintenance of electrical systems Maintain lighting systems Maintain mechanical systems Maintain other non-facility equipment (food service, laundry, etc.) Ensure maintenance of elevator/escalator and other conveyance systems Maintain access systems (locks, keys, etc.) Ensure maintenance of communications systems Inspect structural systems Ensure maintenance of medical and laboratory gas systems Maintain wall systems and finishes (paint, drywall, picture frames, etc.) Ensure maintenance of firewall penetration integrity Oversee cleanliness of facility Oversee building improvements Oversee tenant/occupant improvements Oversee storm drainage system maintenance	Table 3) (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations) • EPA regulations • Equipment operations and specifications • Facility knowledge • Funding sources • Interim life safety measures (fire watch, alternate evacuation routes, etc.) • Procurement policies and procedures • Refrigerant recovery techniques • Safety Codes and Standards (including OSHA) • Trade knowledge for specific equipment and systems	• Mechanical aptitude • Organizational skills • Physical attributes • Planning skills • Recordkeeping skills • Scheduling skills • Technical aptitude	• Equipment and system information (historical information, parts list, maintenance information, etc.) • Facility information • Hand tools (See Table 12) • PM guides • Specialized tools (See Table 14) • Technology tools (See Table 15)

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Oversee landscaping maintenance			
Manage pest management operations			
Ensure maintenance of air compressor and compressed air systems			
Ensure the maintenance of HVACR systems			
Ensure maintenance of building control systems (BAS, DDC, EMS, BMS, pneumatics, etc.)			
Ensure maintenance of hot water and steam systems			
Maintain utility submetering systems			
Maintain the onsite power generation systems			
Maintain the primary sewage and gray water systems			
Ensure maintenance of other building systems* (*See separate list)			
Maintain other facility use systems (operational systems such as package tracking, etc.)			
Conduct Facility Repair Activities			
Ensure fire and life safety systems are monitored throughout the repair	• Americans with Disabilities Act • Building systems (See Table 3) (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations)	• Ability to diagnose equipment and system failures • Scheduling skills	• As-built drawings and documents • Certifications and licenses as required (EPA refrigerant handling certification - EPA rule 608, etc.) • Codes, standards, regulations and guidelines (See Table 10) • Equipment and system warranties • Hand tools (See Table 12) • Specialized tools (See Table 14)
Comply with safety regulations			
Make improvements and repairs to comply with ADA			
Troubleshoot systems			
Identify and manage needed repairs			
Identify repair options or			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
alternatives	• EPA regulations • Facility knowledge • Interim life safety measures (fire watch, alternate evacuation routes, etc.) • Procurement policies and procedures • Refrigerant recovery techniques • Safety Codes and Standards (including OSHA)		• Technology tools (See Table 15)
Comply with infection control risk assessments			
Identify environmental issues (asbestos, VAT, ACMs, lead paint, etc.)			
Identify equipment/source suppliers			
Order repair parts			
Coordinate permitting			
Ensure business continuity			
Communicate repair status to stakeholders			
Schedule repairs			
Repair equipment			
Identify sustainable materials (low VOC, etc.)			
Conduct repair verification and follow-up activities			
Dispose of waste			
Document repairs			
Update as-builts if equipment or systems change			

Table 19. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources for Optimizing the Facility

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Conduct Measurement and Verification Activities			
Obtain equipment and system performance baselines	• BAS or monitoring systems • Basic statistical analyses • Building systems (See Table 3) (including interdependencies,	• Ability to apply data to protocols • Ability to compare data • Basic and advanced math skills	• Computer, peripherals and pertinent software (See Table 11) • Contracts • Data loggers • Financial calculator
Identify expectations from basis of design			
Obtain measurements validating performance against basis of design			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Revise basis of design based on new conditions	interoperability, limitations, operating plans, operations, and performance expectations) • Impact of operational changes (occupancy changes) on performance expectations • Measured variables to verify system performance • New technologies • Obtaining measurements • Other submetering systems • Trend analysis	• Data interpretation and management skills • Measurement skills	• IPMVP • Monitoring systems • Submetering systems • Systems data and information • Technology tools (See Table 15)
Obtain M&V plan			
Analyze System Performance			
Conduct an energy audit (ASHRAE Level 1 or 2)	• Baselines • Benchmarking • Building systems* (See Table 3) • Control theory • Energy basics • Testing and balancing procedures	• Ability to integrate disparate systems and equipment • Analytical skills • Strong control system skills • Systems thinking	• Balancing reports • Commissioning reports • Computer, peripherals and pertinent software (See Table 11) • Construction documents (drawings and specifications) • Hand tools (See Table 12) • Modeling software • Monitoring systems • Sequence of operations • Service logs and historical equipment data • Specialized tools (See Table 14) • Submetering systems • Systems data and information • Third party experts • Technology tools (See Table 15)
Establish system performance baselines			
Gather information regarding system performance			
Determine if facility is being used the way the system was designed for it to be used			
Determine if adequate monitoring equipment exists			
Compare baselines to measured information			
Verify facility's needs are being met			
Validate current sequence of operations			
Select measuring equipment			
Obtain key measurements			
Estimate changing use and/or loads			
Look for non-performers (systems that are not performing)			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Compare system performance to internal and external benchmarks			
Identify equipment or system upgrade opportunities			
Develop a facility/equipment/ system digital data acquisition plan			
Identify Cost Saving Measures			
Select cost saving equipment (operations)	• Basic utility bill analysis • Energy efficiency measures (EEM) and economics • Financial knowledge • New technologies • Utility rate structures and schedules	• Ability to conduct a risk assessment • Spreadsheet skills	• Better buildings website • Case studies • Computer, peripherals and pertinent software (See Table 11) • Existing system information • Hand tools (See Table 12) • Industry and association reference materials • Potential new system information • Projected data • Specialized tools (See Table 14) • Technology tools (See Table 15) Third party experts
Compare old equipment to new technologies			
Calculate total cost of ownership of equipment (capital costs, ownership costs, maintenance costs, etc.)			
Identify recoverable costs			
Identify rebates and incentives			
Develop a business case for upgrade measures			
Set a schedule for implementation			
Identify productivity improvements in the environment			
Identify asset value increases			
Identify negative impacts of change			
Respond to Changing Energy Costs			
Analyze utility costs	• Comparing alternatives to satisfy demands • Demand management strategies • Financial penalties for going above peak demand threshold • Load demand schedules • Operating baselines • Operation equipment loads	• Analytical skills • Meter calibration and verification skills • Organizational skills	• Contracts • Equipment energy consumption • Metering • Systems data and information • Technology tools (See Table 15)Third party experts • Utility cost information • Utility interval data

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
	• Tenant/occupant tolerances in changes to systems Utility rate structures and schedules		
Obtain baselines			
Manage utility interval data (i.e. hourly consumption top establish use patterns)			
Develop contingency plans for energy reduction			
Develop communication plan for tenants/occupants			
Respond to real-time prices			
Change utility rates			
Implement demand management programs			
Perform meter analysis			
Optimize System Performance			
Verify the optimal stop/start routine	• Building systems(See Table 3) (including interdependencies, interoperability, limitations, operating plans, operations, and performance expectations) • Control theory • Energy load profiles • Equipment operations and specifications • Fluid dynamics • Heat transfer • Psychrometrics • Sequence of operations • Tenant/occupant requirements • Thermodynamics • Typical non-energy costs	• Analytical skills	• Computer, peripherals and pertinent software (See Table 11) • DDC system • Hand tools (See Table 12) • Industry and association reference materials • Psychrometric charts • SOPs • Specialized tools (See Table 14) • Technology tools (See Table 15)* • Third party experts
Implement reset schedules (hot and cold water systems, static pressure, discharge temperature, etc.)			
Implement demand control strategies			
Verify existing sensors and add new as needed			
Research demand control ventilation			
Verify critical tenant/occupant schedules and reduce where possible			
Optimize pressure, flow and temperatures in all central systems			
Verify costs savings and			

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
optimization			
Adjust set point to eliminate simultaneous heating and cooling			
Ensure all capacity controls are operational			
Compare air balance to baseline			
Manage seasonal use of equipment			
Maintain integration of access with user systems			
Contribute to the development of the energy management program			
Identify Sustainability Opportunities			
Participate in the waste management program	• Building systems (See Table 3) • Contributors to carbon or environmental footprint • Facility knowledge • Foot-candles/lumens and lighting concepts • Local water restrictions and requirements • Mitigator of carbon or environmental footprint • Procurement policies and procedures • Sustainability options • Understanding of photometric charts	• Ability to conduct economic analysis of alternatives • Leadership skills • Leadership skills • Research skills	• Codes, standards, regulations and guidelines (See Table 10) • Foot-candles/light meters • Technology tools (See Table 15)
Participate in water conservation programs			
Participate in sustainable procurement programs			
Participate in integrated pest management programs			
Participate in green cleaning programs			
Participate in recycling programs			
Implement refrigerant management programs (reduction in CFCs etc.)			
Identify alternative sustainable systems			
Contribute to business case for alternatives			
Participate in "green teams" with facility tenants/occupants			
Conduct gap analysis to identify sustainability options			
Participate in heat island reduction (roof and non-roof)			

Table 20. Duties, Tasks, Steps, Specialized Knowledge, Skills, Abilities, Tools, Equipment, and Resources Required for Contributing to Budgeting Activities

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Contribute to Long Term Facility Budgets Plan (5 Years)			
Review long term/strategic facility plans Provide recommendations on repairs or replacements List out deferred maintenances Conduct feasibility studies Create "wish list" of items to be repaired/replaced Conduct life cycle assessments Forecast staffing, utilities, and other contributory costs	• Deferred issues (deferred maintenance) • Facility knowledge • Feasibility studies • Life cycle assessments • Long term goals of the organization	• Ability to forecast situational resources • Ability to identify alternate work practices • Teamwork skills • Ability to work with cross functional teams • Organizational skills • Planning skills	• Codes, standards, regulations and guidelines (See Table 10) • Industry resources (BBB, etc.) • Property condition report • Property documents • Strategic plan • Technology tools (See Table 15)
Contribute to Facility Operations Budget			
Review previous budgets and performance against budgets Identify future changes in operations or occupancy usage projections Benchmark operations budgets (RS means) Evaluate equipment and potential failures Identify contractors/service providers requirements Identify staffing requirements for future service activities Identify special maintenance needs Identify potential code changes affecting operations Review maintenance backlog and deferred activities Identify rate increases Review non-normal operating categories (snow removal, etc.)	• Basic financial terminology • Budget categories • Contracts and service providers • Financial knowledge • Material availability	• Ability to understand contract documents • Benchmarking skills • Computer skills • Negotiation skills • Reading ability • Teamwork skills • Verbal communication skills • Written communication skills	• Backlogs and deferred activities list • Codes, standards, regulations and guidelines (See Table 10) • Department of Labor wage information • Facility management plan • Industry expense references • Labor and service provider contracts • Previous year's budgets • Projections versus actual • Technology tools (See Table 15)

Duties, Tasks, and Steps	Specialized Knowledge	Skills and Abilities	Tools, Equipment, and Resources
Review contingencies			
Review existing contracts			
Manage actual expenditures to budgets			
Contribute to Capital Improvement Budget(s)			
Review expected life of systems and facilities	• Basic financial terminology • Budget categories • Contracts and service providers • Costs of systems or improvements • Emerging technologies and tools • Financial knowledge • Maintenance costs of existing systems • Organization's budgeting process • Procurement regulations • Technical knowledge	• Teamwork skills • Benchmarking skills • Computer skills • Estimating skills • Negotiation skills • Reading ability • Verbal communication skills • Written communication skills	• Backlogs and deferred activities list • Codes, standards, regulations and guidelines (See Table 10) • Department of Labor wage information • Facility strategic plan • Industry expense references • Labor and service provider contracts • Previous year's budgets • Projections versus actual for past projects • Technology tools (See Table 15)
Review previous budgets			
Identify future changes in operations or occupancy usage projections			
Evaluate equipment and potential failures			
Identify special maintenance needs			
Identify potential code changes affecting operations			
Review maintenance backlog and deferred activities			
Review contingencies			
Provide input into the development of the capital improvement budget			
Manage actual expenditures to budgets			

3 Examination Blueprint

The Final Proposed Examination Blueprint for Building Operations Professional is shown below in Table 21. The exam blueprint identifies subject matter areas covered on a certification exam. Table 21 column headings are defined as follows:

Duties and Tasks: Description of the work

Analytical Weights: The weights calculated by taking the average of the tabulated individual ratings on frequency and importance (2 times importance plus frequency). See Section 6.2.

Holistic Weights: These are the weights calculated by taking the average the individual responses regarding the overall percentage that should be in each of the Duties and Tasks. See Section 6.2.

Final Weight: These are the weights agreed upon by the JTA committee during the post-validation study webinar. See Section 6.

Final Items: These are the quantity of items (i.e., test questions) that should be on each examination in each of the categories as agreed to by the JTA committee during the post-validation study webinar.

Table 21. Final Proposed Examination Blueprint for Building Operations Professional

Duties and Tasks	Analytical Weights	Holistic Weights	Final Weight	Final Items
Supervising Personnel	9%	14%	8%	10
Develop workload analyses	2%		1%	1
Analyze staffing productivity	2%		2%	3
Supervise building staff	3%		4%	5
Secure outside service providers	2%		1%	1
Conducting Planning Activities	13%	15%	15%	18
Update procedures (standard operating procedures, building operating procedures, operating plans, emergency plans, etc.)	2%		3%	4
Develop equipment operations plans	2%		2%	2
Develop planned maintenance schedules	3%		3%	4
Contribute to construction standards and guidelines	2%		2%	2
Contribute to capital renewal plans	2%		3%	4
Conduct data management activities	2%		2%	2
Operating Buildings	55%	40%	50%	59
Perform workplace hazard assessments	2%		2%	3
Participate in emergency drills	2%		2%	3
Manage the personal protection equipment program	2%		2%	3
Manage third party inspections	2%		2%	2
Respond to building emergencies	3%		2%	2

Manage building securities	2%		2%	2
Coordinate/conduct occupant training	2%		2%	2
Conduct risk management activities	2%		2%	2
Manage responses to inclement weather conditions/issues	2%		2%	3
Respond to tenant requests/issues	3%		2%	2
Conduct equipment checks	3%		2%	2
Conduct daily rounds	3%		2%	2
Coordinate facility operations (normal)	3%		2%	2
Coordinate facility operations (other than normal)	3%		2%	2
Manage the work order process	2%		2%	3
Investigate indoor environmental quality	2%		2%	3
Conduct tenant relations activities	2%		2%	2
Manage consumables	2%		2%	2
Manage outside facility contractors/service providers	2%		2%	3
Manage environmental requirements (permits, etc.)	2%		2%	3
Implement an energy management program	3%		3%	4
Maintain the facility and systems	3%		3%	4
Conduct facility repair activities	3%		2%	3
Optimizing the Facility	15%	21%	20%	24
Conduct measurement and verification activities	2%		3%	4
Analyze system performance	3%		4%	5
Identify cost saving measures	3%		3%	3
Respond to changing energy costs	2%		3%	3
Optimize system performance	3%		5%	6
Identify sustainability opportunities	2%		2%	3
Contributing to Budgeting Activities	8%	10%	7%	8
Contribute to long term facility budget plan (5 years)	2%		2%	2
Contribute to facility operations budget	3%		3%	4
Contribute to capital improvement budget(s)	3%		2%	2
	100%	100%	100%	120

To arrive at the final blueprint, the JTA committee was asked to consider the tabulated frequency and importance scales together with the holistic weights.

Respondents were asked to provide a holistic weighting to the domain areas. Based on the responses, an examination blueprint was calculated for each domain. This information appears in Table 22.

Table 22. Summary of Respondent Holistic Ratings

Domain	%
Supervising Personnel	14.15%
Conduct Planning Activities	15.13%
Operating Buildings	40.00%
Optimizing the Facility	20.85%
Contributing to Budgeting Activities	10.94%

The remainder of this document describes the process for conducting the job task analysis and administering the validation survey.

4 Job Task Analysis and Survey Validation

NIBS and NREL organized a group of panelists consisting of 15 SMEs representing Building Operations Professionals to conduct a JTA using the DACUM methodology. The 15 experts are listed in Table 23.

Table 23. List of DACUM JTA Participants

Mohamed Amin, LEED AP, EIT **Project Engineer**	U.S. Environmental Protection Agency (EPA) Edison, NJ
Terry M. Bickham, CEM, LEED AP, CSDP **Director , Energy Services and Solutions**	Ingersoll Rand/Trane Lees Summit, MO
Robert Blakey **Sr. Manager - Operations**	CBRE – Group Health Seattle, WA
Christine C. Maurer, PE, CEM **Energy Engineer**	Advanced Energy Raleigh, NC
Mike McBee **Capital Mechanical Coordinator**	Seattle Public Schools / IUOE Local 609 Seattle, WA
Carlos Santamaria, MBA, RPA, LEED AP **Vice President, Engineering Services**	Glenborough LLC / CEES-Advisors - Principal Napa, CA
James Coates, BS, CEM, LEED AP **Training Fund Administrator**	International Union of Operating Engineers Local 399 ETF, Chicago, IL
Rick Dames, MSAE, CFM, CEM, OPMP, CEA **Director of Facility Management**	Boone County Schools Florence, KY
Howard (Mike) Day **Director of Operations**	ProSource Consulting Gainesville, VA
Charles Frost **Energy Manager**	UC Berkeley Berkeley, CA
Hadley Hartshorn **Instructor**	Laney College Oakland, CA
Daniel Sexton, RPA **Director, Tampa Service Center**	U.S. General Services Administration (GSA), PBS Tampa, FL
Daryl R. Walker **Instructor**	Renton Technical College Renton, WA
Rod Weiss **Director of Development – Smart Energy Programs**	Coleman University San Diego, CA
Anthony Zotto **Operating Engineer, LEED G.A.** **Industry Skills Coordinator**	Thomas Shortman Fund Local 32BJ/Training Fund New York, NY

The DACUM JTA meeting was facilitated by Dr. Cynthia Woodley, psychometrician, and Ms. Tracey Paschal, project manager with Professional Testing, Inc. The 3-day meeting developed a list of five domains or duties and 42 tasks through group discussions.

4.1 Survey Development

The task list was used to build a survey that was delivered using an online mechanism. The survey consisted of two major sections: Demographic Information and Building Operations Professional Tasks. The draft survey was shared with NREL/NIBS/DOE staff for initial review and then NIBS volunteered to send out the survey to appropriate respondents. Appendix A includes a copy of the survey.

4.2 Survey Dissemination

NIBS sent the survey to several Building Operations Professionals. The survey was open for approximately 30 days in the spring of 2014 for data collection, during which time email reminders were sent. The final dataset included 122 respondents, some of whom did not complete the survey.

5 Results

All data were included in the analyses, as people who skipped a question or task rating may have done so either accidentally or because they felt that the item was not applicable to their position. The sample size is large enough (122) to allow reasonable confidence in the results. Results from the demographics questions will be presented first.

5.1 State of Primary Employment

The largest number of respondents reported working in some "other" (14.2%, n = 15) location for which they wrote in responses. The locations with the largest number of respondents included California (10.4%, n = 11), New York (9.4%, n = 10), multiple states (8.5%, n = 9), and Washington State (7.5%, n = 8). Table 24 provides the summary.

Table 24. State of Employment of Respondents

State	%	#	State	%	#
Other (please specify)	14.2%	15	Rhode Island	0.9%	1
California	10.4%	11	Tennessee	0.9%	1
New York	9.4%	10	Alabama	0.0%	0
Multiple States	8.5%	9	Alaska	0.0%	0
Washington	7.5%	8	Arkansas	0.0%	0
North Carolina	6.6%	7	Delaware	0.0%	0
Texas	6.6%	7	Georgia	0.0%	0
Virginia	5.7%	6	Idaho	0.0%	0
Colorado	3.8%	4	Indiana	0.0%	0
Maryland	3.8%	4	Iowa	0.0%	0
Pennsylvania	3.8%	4	Kansas	0.0%	0
Connecticut	2.8%	3	Minnesota	0.0%	0
Florida	2.8%	3	Mississippi	0.0%	0
Illinois	2.8%	3	Montana	0.0%	0
Massachusetts	2.8%	3	Nebraska	0.0%	0
Missouri	2.8%	3	Nevada	0.0%	0
New Jersey	2.8%	3	New Hampshire	0.0%	0
Hawaii	1.9%	2	Oklahoma	0.0%	0
Michigan	1.9%	2	South Dakota	0.0%	0
South Carolina	1.9%	2	Utah	0.0%	0
Wisconsin	1.9%	2	Vermont	0.0%	0
Arizona	0.9%	1	West Virginia	0.0%	0
Kentucky	0.9%	1	Wyoming	0.0%	0
Louisiana	0.9%	1	**Answered question**	**106**	
Maine	0.9%	1			
New Mexico	0.9%	1			
North Dakota	0.9%	1			
Ohio	0.9%	1			
Oregon	0.9%	1			

Table 25 contains a list of the write-in comments associated with "other." Several of the write-in comments were states where the respondent could have checked a participant state. However, Table 25 highlights international locations where respondents work (yellow highlight).

Table 25. List of "Other" Write-In Comments

"Other" Write-in Comments
China
Canada
Texas
India
Canada BC
District of Columbia
Israel
All US
Portugal
Greece
Czech
Asia/Taiwan
Jamaica
Guam USA
MU

5.2 Highest Level of Education

Respondents were asked about the highest level of education reached. The majority of respondents indicated completing a Bachelor's degree (30.2%, n = 38) followed by a graduate degree (27.8%, n = 35). The result is that 58% (n = 73) have a Bachelor's degree or higher. Table 26 and Figure 1 depict this information.

Table 26. Highest Level of Education

What is your highest level of education?		
Answer Options	**Response Percent**	**Response Count**
Less than High School	0.8%	1
High School or Equivalent	7.9%	10
Some College	10.3%	13
Two Years of College/Technical School/Community College	23.0%	29
Bachelor's Degree	30.2%	38
Graduate Degree	27.8%	35
Answered question		**126**

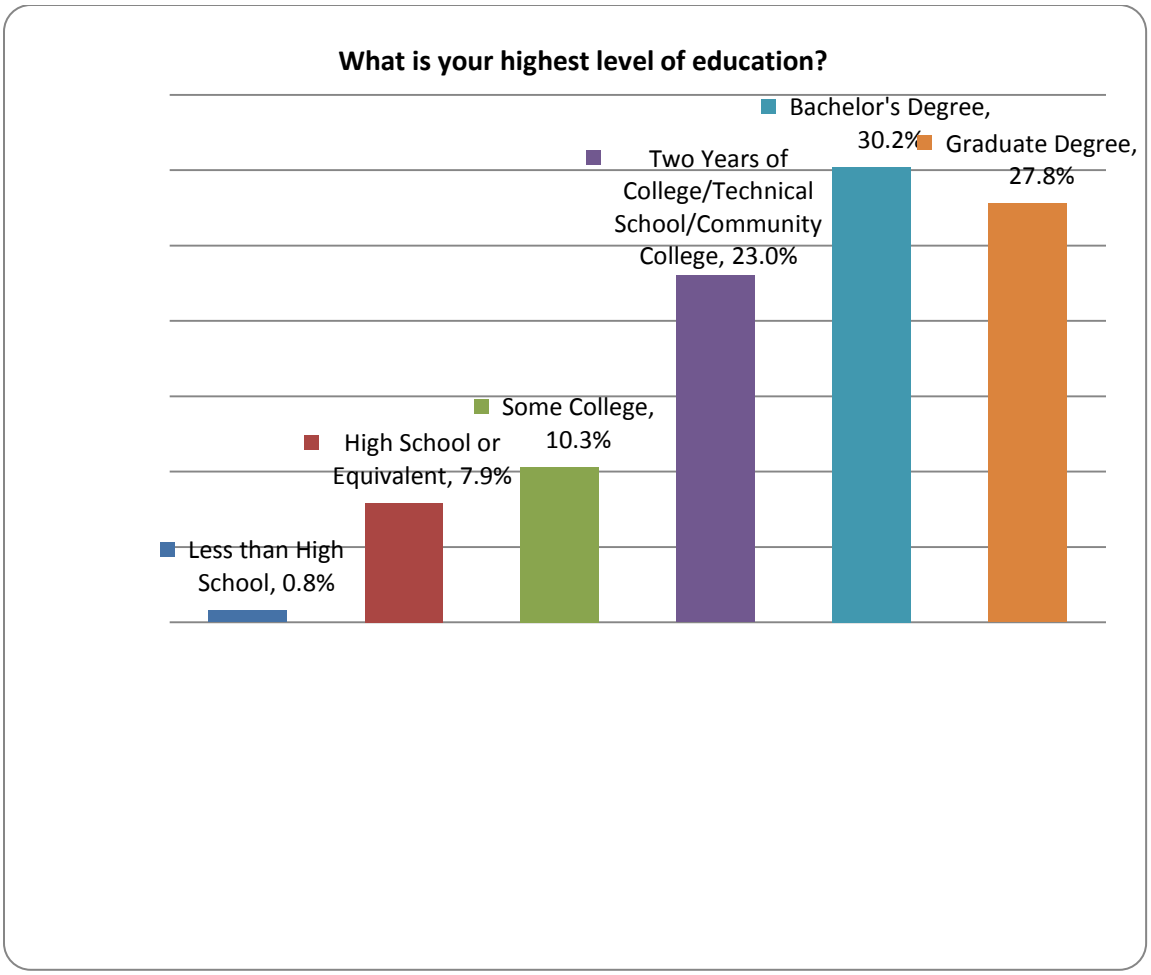

Figure 1. Highest level of education

5.3 Years of Energy Experience

Respondents were asked to identify the number of years of experience they have in an energy-related industry (all jobs combined) and not necessarily specifically as Building Operations Professionals. The majority of respondents (51.6%, n = 65) have more than 21 years of experience. Table 27 and Figure 2 depict this information.

Table 27. Years of Energy Experience

How many years of experience do you have in an energy related industry (all jobs combined)?		
Answer Options	**Response Percent**	**Response Count**
5 years or less	6.3%	8
6–10 years	20.6%	26
11–15 years	11.9%	15
16–20 years	9.5%	12
21 or more years	51.6%	65
Answered question		**126**

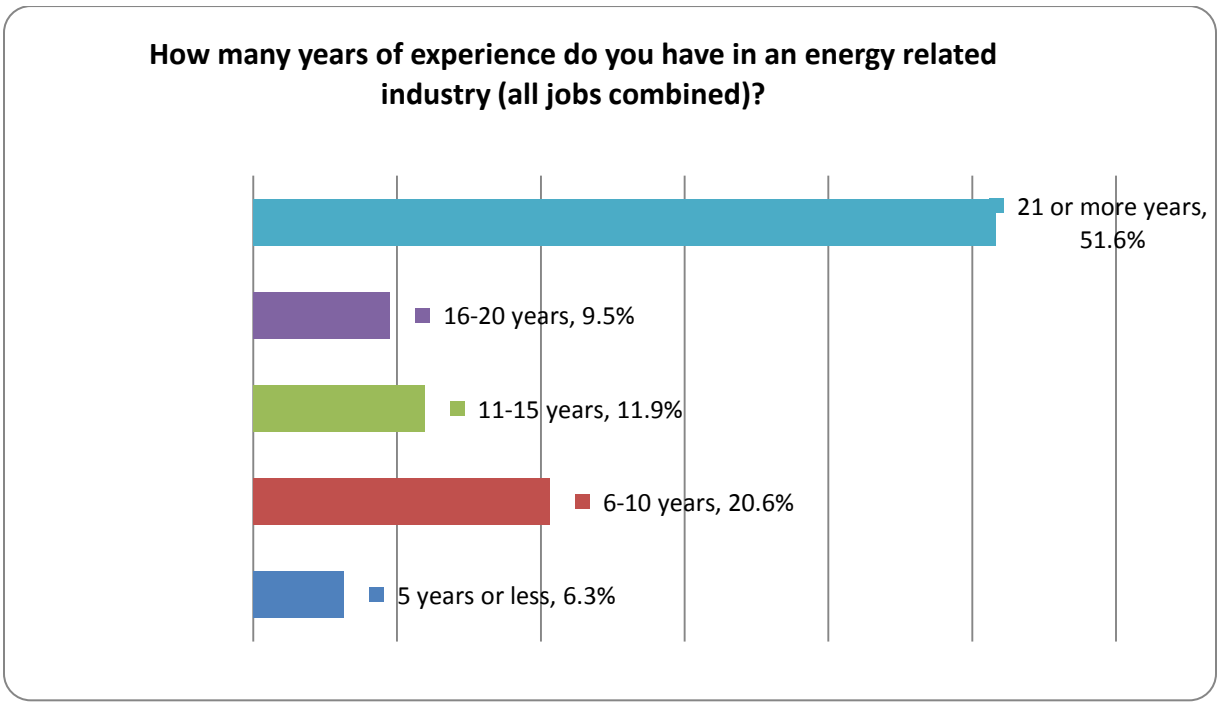

Figure 2. Years of energy experience

5.4 Years of Building Operations Experience

The majority of respondents (37.6%, n = 47) had 21 years or more of experience as Building Operations Professionals. The JTA Committee felt that this result was representative of the Building Operations field. Table 28 and Figure 3 reflect this information.

Table 28. Years of Experience Specifically as a Building Operations Professional

How many years of experience do you have specifically as a Building Operations Professional?		
Answer Options	**Response Percent**	**Response Count**
none	3.2%	4
5 years or less	14.4%	18
6–10 years	17.6%	22
11–15 years	10.4%	13
16–20 years	16.8%	21
21 or more years	37.6%	47
Answered question		**125**

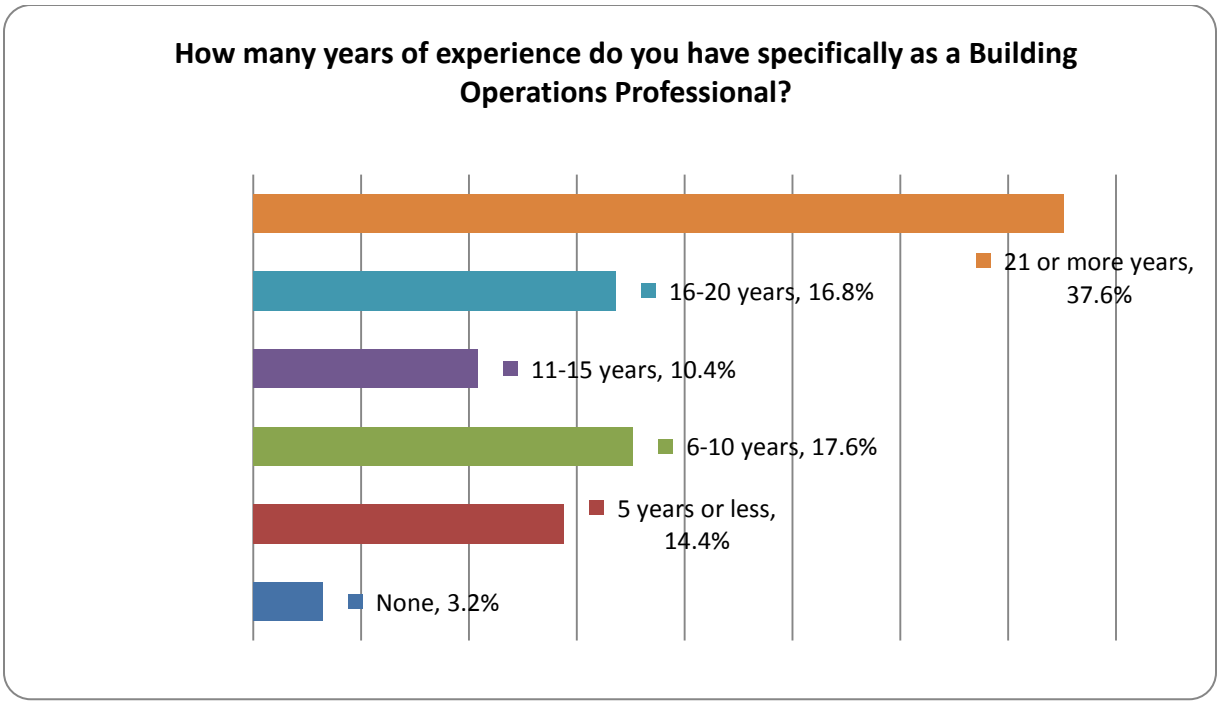

Figure 3. Years of experience specifically as a building operations professional

5.5 Work Sector

Respondents were asked whether they worked in a private or public (government) work sector. A majority (62.3%, n = 76) indicated they worked in a private sector. Table 29 and Figure 4 reflect this information.

Table 29. Sector in Which Respondent Works

In which sector do you currently work?		
Answer Options	**Response Percent**	**Response Count**
Public (government at any level)	37.7%	46
Private	62.3%	76
Answered question		**122**

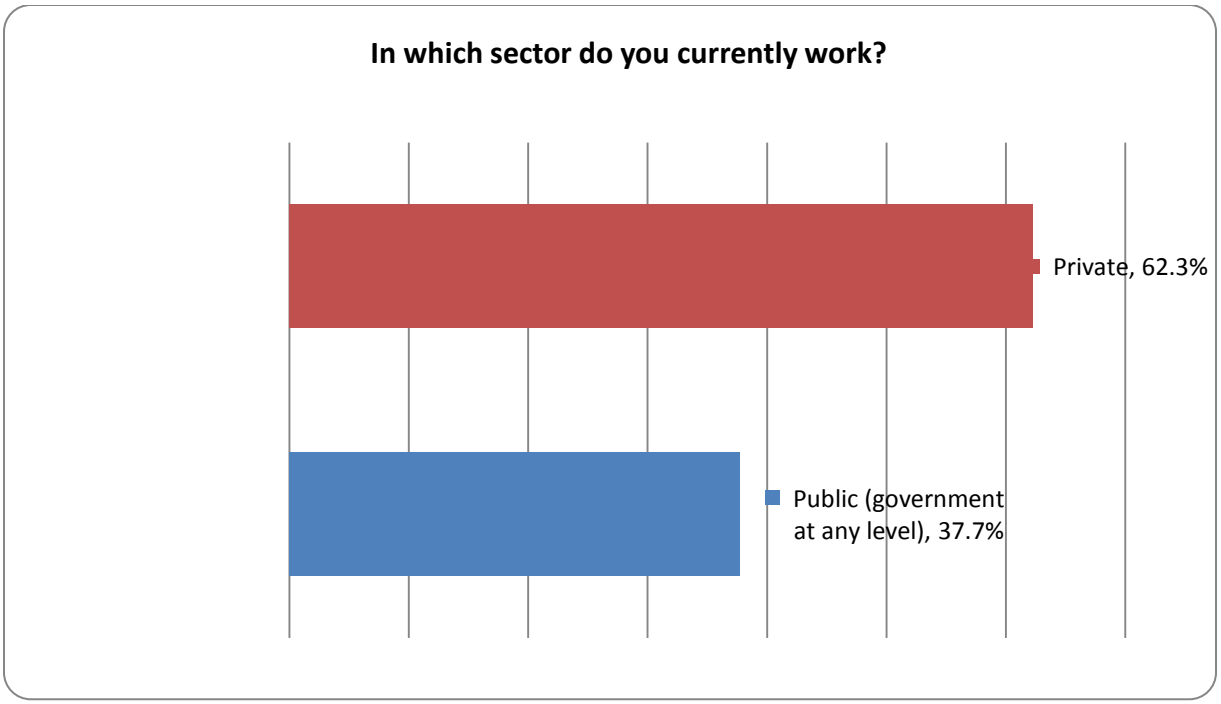

Figure 4. Sector in which respondent works

6 Post-Survey Conference Call/Webinar

Based on this information, Professional Testing facilitated a conference call facilitated on May 30, 2014, to review and discuss the survey results. The meeting began by reviewing the demographic question results to confirm that the sample appeared to be representative of the industry. The attending Building Operations SMEs agreed that the group of respondents was representative of the industry. They then reviewed the tasks that were flagged for potential elimination. The resolution of this conference call was to remove none of the competency statements.

6.1 Adequacy of Respondent Demographics

Based on the results of the demographic data, the expert panel felt that the respondents were demographically representative and in fact the correct target population was reached.

6.2 Job Task Ratings

Forty-two tasks were included in the final version of the validation survey. These tasks were grouped based on the five content domains to be covered by the Building Operations Professional examination scheme. The survey used a 4-point rating scale for importance of task performance, using the following scale:

1 Not important
2 Somewhat important
3 Important
4 Very Important

In addition to the rating scale for task importance, a 6-point rating scale for the frequency of the task, using the following scale:

1 Never
2 1% to 25% of the time
3 26% to 50% of the time
4 51% to 75% of the time
5 76% to 99% of the time
6 100% of the time

Responses were tabulated, and means, standard deviations (SDs), and standard errors of mean (SEMs) were calculated for both the frequency scale and the importance scale. This information appears in Table 28.

In Table 28, tasks in red represent tasks with less than 2.0 on frequency AND importance. The SMEs considered these tasks during the follow-up webinar to determine whether they should be dropped. The SMEs determined all tasks were needed.

Table 30. Means, SDs, and SEM of Rating Scale Responses

Duties and Tasks	Frequency			Importance		
	Means	SD	SEM	Means	SD	SEM
Supervising Personnel						
Develop workload analyses	1.61	1.16	0.12	1.88	0.90	0.11
Analyze staffing productivity	1.87	1.35	0.13	2.08	0.86	0.11
Supervise building staff	2.64	1.46	0.14	2.29	0.82	0.11
Secure outside service providers	1.60	1.07	0.12	1.81	0.91	0.11
Conducting Planning Activities						
Update procedures (SOPs, BOPs, operating plans, emergency plans, etc.)	1.68	1.12	0.12	2.06	0.71	0.10
Develop equipment operations plans	1.67	1.14	0.13	2.01	0.75	0.10
Develop planned maintenance schedules	2.15	1.50	0.14	2.40	0.74	0.10
Contribute to construction standards and guidelines	1.45	0.94	0.11	1.83	0.79	0.10
Contribute to capital renewal plans	1.65	1.16	0.13	1.99	0.78	0.10
Conduct data management activities	1.65	1.25	0.13	1.68	0.78	0.10
Operating Buildings						
Perform workplace hazard assessments	1.95	1.54	0.15	2.14	0.82	0.11
Participate in emergency drills	1.93	1.62	0.15	2.01	0.83	0.11
Manage the PPE program	1.82	1.55	0.15	2.07	0.84	0.11
Manage third party inspections	1.49	1.19	0.13	1.59	0.80	0.11
Respond to building emergencies	2.66	1.79	0.16	2.65	0.63	0.09
Manage building securities	1.40	1.43	0.14	1.71	0.82	0.11
Coordinate/conduct occupant training	1.11	1.15	0.13	1.46	0.90	0.11
Conduct risk management activities	1.42	1.17	0.13	1.70	0.79	0.11
Manage responses to inclement weather conditions/issues	2.10	1.63	0.15	2.08	0.79	0.11
Respond to tenant requests/issues	2.79	1.62	0.15	2.32	0.67	0.10
Conduct equipment checks	2.44	1.64	0.15	2.27	0.70	0.10
Conduct daily rounds	2.47	1.85	0.16	2.07	0.83	0.11
Coordinate facility operations (normal)	2.77	1.75	0.15	2.27	0.70	0.10
Coordinate facility operations (other than normal)	2.27	1.71	0.15	2.23	0.83	0.11
Manage the work order process	2.19	1.48	0.14	2.03	0.72	0.10
Investigate indoor environmental quality	2.00	1.62	0.15	2.21	0.83	0.11
Conduct tenant relations activities	1.73	1.58	0.15	1.70	0.90	0.11
Manage consumables	1.74	1.55	0.15	1.41	0.85	0.11
Manage outside facility contractors/service providers	2.12	1.56	0.15	1.93	0.83	0.11
Manage environmental requirements (permits, etc.)	1.88	1.62	0.15	2.03	0.73	0.10
Implement an energy management program	2.34	1.57	0.15	2.37	0.78	0.10
Maintain the facility and systems	3.33	1.58	0.15	2.65	0.56	0.09

Duties and Tasks	Frequency			Importance		
	Means	SD	SEM	Means	SD	SEM
Conduct facility repair activities	2.82	1.70	0.15	2.44	0.73	0.10
Optimizing the Facility						
Conduct measurement and verification activities	2.00	1.45	0.14	2.00	0.81	0.11
Analyze system performance	2.42	1.51	0.14	2.28	0.72	0.10
Identify cost saving measures	2.45	1.46	0.14	2.37	0.74	0.10
Respond to changing energy costs	1.93	1.54	0.14	1.87	0.86	0.11
Optimize system performance	2.53	1.57	0.15	2.45	0.73	0.10
Identify sustainability opportunities	2.03	1.53	0.14	1.86	0.96	0.12
Contributing to Budgeting Activities						
Contribute to long term facility budget plan (5 years)	2.00	1.56	0.15	2.17	0.71	0.10
Contribute to facility operations budget	2.57	1.70	0.15	2.49	0.60	0.09
Contribute to capital improvement budget(s)	2.19	1.53	0.14	2.28	0.75	0.10

Responses to frequency and importance rankings were combined by doubling the importance and adding the frequency to arrive at a single scale. Table 29 shows the tabulated results.

Table 31. Combined Frequency and Importance Scales

Duties and Tasks	Frequency			Importance			Combined Ratings	Overall Weights
	Means	SD	SEM	Means	SD	SEM		
Supervising Personnel								
Develop workload analyses	1.61	1.16	0.12	1.88	0.90	0.11	5.37	2.06%
Analyze staffing productivity	1.87	1.35	0.13	2.08	0.86	0.11	6.03	2.31%
Supervise building staff	2.64	1.46	0.14	2.29	0.82	0.11	7.22	2.76%
Secure outside service providers	1.60	1.07	0.12	1.81	0.91	0.11	5.21	2.00%
Conducting Planning Activities								
Update procedures (SOPs, BOPs, operating plans, emergency plans, etc.)	1.68	1.12	0.12	2.06	0.71	0.10	5.79	2.22%
Develop equipment operations plans	1.67	1.14	0.13	2.01	0.75	0.10	5.70	2.18%
Develop planned maintenance schedules	2.15	1.50	0.14	2.40	0.74	0.10	6.95	2.66%
Contribute to construction standards and guidelines	1.45	0.94	0.11	1.83	0.79	0.10	5.11	1.96%
Contribute to capital renewal plans	1.65	1.16	0.13	1.99	0.78	0.10	5.62	2.15%
Conduct data management activities	1.65	1.25	0.13	1.68	0.78	0.10	5.01	1.92%
Operating Buildings								
Perform workplace hazard assessments	1.95	1.54	0.15	2.14	0.82	0.11	6.23	2.39%
Participate in emergency drills	1.93	1.62	0.15	2.01	0.83	0.11	5.96	2.28%
Manage the PPE program	1.82	1.55	0.15	2.07	0.84	0.11	5.96	2.28%
Manage third party inspections	1.49	1.19	0.13	1.59	0.80	0.11	4.68	1.79%
Respond to building emergencies	2.66	1.79	0.16	2.65	0.63	0.09	7.95	3.05%
Manage building securities	1.40	1.43	0.14	1.71	0.82	0.11	4.83	1.85%
Coordinate/conduct occupant training	1.11	1.15	0.13	1.46	0.90	0.11	4.02	1.54%
Conduct risk management activities	1.42	1.17	0.13	1.70	0.79	0.11	4.82	1.85%
Manage responses to inclement weather conditions/issues	2.10	1.63	0.15	2.08	0.79	0.11	6.26	2.40%
Respond to tenant requests/issues	2.79	1.62	0.15	2.32	0.67	0.10	7.44	2.85%
Conduct equipment checks	2.44	1.64	0.15	2.27	0.70	0.10	6.97	2.67%
Conduct daily rounds	2.47	1.85	0.16	2.07	0.83	0.11	6.61	2.53%

Duties and Tasks	Frequency			Importance			Combined Ratings	Overall Weights
	Means	SD	SEM	Means	SD	SEM		
Coordinate facility operations (normal)	2.77	1.75	0.15	2.27	0.70	0.10	7.30	2.80%
Coordinate facility operations (other than normal)	2.27	1.71	0.15	2.23	0.83	0.11	6.72	2.58%
Manage the work order process	2.19	1.48	0.14	2.03	0.72	0.10	6.25	2.39%
Investigate indoor environmental quality	2.00	1.62	0.15	2.21	0.83	0.11	6.42	2.46%
Conduct tenant relations activities	1.73	1.58	0.15	1.70	0.90	0.11	5.13	1.97%
Manage consumables	1.74	1.55	0.15	1.41	0.85	0.11	4.56	1.75%
Manage outside facility contractors/service providers	2.12	1.56	0.15	1.93	0.83	0.11	5.98	2.29%
Manage environmental requirements (permits, etc.)	1.88	1.62	0.15	2.03	0.73	0.10	5.93	2.27%
Implement an energy management program	2.34	1.57	0.15	2.37	0.78	0.10	7.07	2.71%
Maintain the facility and systems	3.33	1.58	0.15	2.65	0.56	0.09	8.62	3.30%
Conduct facility repair activities	2.82	1.70	0.15	2.44	0.73	0.10	7.70	2.95%
Optimizing the Facility								
Conduct measurement and verification activities	2.00	1.45	0.14	2.00	0.81	0.11	6.00	2.30%
Analyze system performance	2.42	1.51	0.14	2.28	0.72	0.10	6.98	2.67%
Identify cost saving measures	2.45	1.46	0.14	2.37	0.74	0.10	7.18	2.75%
Respond to changing energy costs	1.93	1.54	0.14	1.87	0.86	0.11	5.68	2.18%
Optimize system performance	2.53	1.57	0.15	2.45	0.73	0.10	7.43	2.85%
Identify sustainability opportunities	2.03	1.53	0.14	1.86	0.96	0.12	5.75	2.20%
Contributing to Budgeting Activities								
Contribute to long term facility budget plan (5 years)	2.00	1.56	0.15	2.17	0.71	0.10	6.33	2.43%
Contribute to facility operations budget	2.57	1.70	0.15	2.49	0.60	0.09	7.54	2.89%
Contribute to capital improvement budget(s)	2.19	1.53	0.14	2.28	0.75	0.10	6.74	2.58%
							261.08	100.00%

6.3 Tasks or Knowledge Missing

Survey respondents were asked if they felt any tasks or knowledge were missing from the JTA. Appendix B lists all write-in responses. The JTA Committee reviewed all the comments and determined that no content was missing from the JTA.

6.4 Discussion of Assessment

7 Conclusions and Next Steps

The JTA is the first step in the test development process, serving as the primary source of evidence for validity of the examination. The final DACUM JTA is now validated and may be used by training organizations to develop training programs and by a certification body or scheme committee to develop a certification scheme. The final DACUM JTA for Building Operations Professionals appears in Table 23.

Appendix A: Building Operations Professional Validation Study Survey

Commercial Workforce Credentialing Council Job Task Analysis Validation

Welcome!

The National Institute of Building Sciences Commercial Workforce Credentialing Council and industry stakeholders have a project to improve the quality and consistency of commercial buildings workforce training and certification programs for four key energy-related jobs.

In support of this project, the National Institute of Building Sciences (NIBS), and Professional Testing, Inc. are seeking members of the commercial buildings industry to participate in a nationwide research study validating job task analyses (JTAs) of four key energy-related jobs in the commercial buildings sector. The JTA is a procedure for analyzing the tasks performed by individuals in a specific job, as well as the knowledge, skills, and abilities necessary to perform those tasks. JTAs are critical elements of quality training programs and professional certifications.

Current industry practitioners whose work falls into one or more of the following job categories may complete a validation study by **April 25, 2014**. Each energy-related job area survey is nine pages. For each survey you will rate the frequency and importance of the work activities associated with each area of responsibility. Participation should take approximately 30–45 minutes and individuals may complete more than one validation study, if applicable. When determining applicability, practitioners should focus on the details of the job descriptions rather than on the job title, as job titles frequently vary from one employer to another.

You do not have to respond to all surveys however we ask you to please finish any survey you start.

If you do not have time to complete the survey in one sitting, you can stop and complete the survey later (provided you use the same computer and have cookies enabled on that computer). The survey will resume where you stopped. If you do not have cookies enabled, the survey will start over from the beginning again.

Your responses will be kept confidential, and we appreciate your assistance. If you have any difficulty responding to this survey, please contact NIBS at dsmith@nibs.org.

On the next page you will be given the opportunity to select the energy-related job survey you are interested in responding to.

Commercial Workforce Credentialing Council Job Task Analysis Validation

*** Following is a description of the remaining surveys you may respond to. Please review the job descriptions and select the survey for which you feel most qualified. Please select the survey for which you wish to respond:**

◯ Energy Manager - Responsible for managing and continually improving energy performance in commercial buildings by establishing and maintaining an energy program management system that supports the mission and goals of the organization.

◯ Building Operations Professional - Manages the maintenance and operation of building systems and installed equipment, and performs general maintenance to maintain the building's operability, optimize building performance, and ensure the comfort, productivity and safety of the building occupants.

◯ Building Commissioning Professional - Leads, plans, coordinates and manages a commissioning team to implement commissioning processes in new and existing buildings.

Commercial Workforce Credentialing Council Job Task Analysis Validation

Please answer the following background questions. Your responses will be kept confidential and this information will only be used for statistical purposes.

In which state do you primarily work?

Other (please specify)

What is your highest level of education?

- Less than High School
- High School or Equivalent
- Some College
- Two Years of College/Technical School/Community College
- Bachelor's Degree
- Graduate Degree

How many years of experience do you have in an energy related industry (all jobs combined)?

- 5 years or less
- 6-10 years
- 11-15 years
- 16-20 years
- 21 or more years

How many years of experience do you have specifically as a Building Operations Professional?

- none
- 5 years or less
- 6-10 years
- 11-15 years
- 16-20 years
- 21 or more years

Commercial Workforce Credentialing Council Job Task Analysis Validation

In which sector do you currently work?

- ◯ Public (government at any level)
- ◯ Private

Commercial Workforce Credentialing Council Job Task Analysis Validation

Instruction Page

In the following pages, you will be asked to think about tasks that a Building Operations Professional does and to indicate the frequency with which a Building Operations Professional performs each task on a job. Then, considering the same task statement, you will be asked to indicate how important it is that a Building Operations Professional knows how to do each of these tasks. To respond click the drop down menu and select your response.

Commercial Workforce Credentialing Council Job Task Analysis Validation

When a Building Operations Professional is Managing Human Resources, please indicate how frequently this task is performed on the job and how important this task is to a Building Operations Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Operations Professional?
Develop workload analyses		
Analyze staffing productivity		
Supervise building staff		
Secure outside service providers		

When a Building Operations Professional is Conducting Planning Activities, please indicate how frequently this task is performed on the job and how important this task is to a Building Operations Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Operations Professional?
Update procedures (SOPs, BOPs, operating plans, emergency plans, etc.)		
Develop equipment operations plans		
Develop planned maintenance schedules		
Contribute to construction standards and guidelines		
Contribute to capital renewal plans		
Conduct data management activities		

Commercial Workforce Credentialing Council Job Task Analysis Validation

When a Building Operations Professional is Operating Buildings, please indicate how frequently this task is performed on the job and how important this task is to a Building Operations Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Operations Professional?
Perform workplace hazard assessments		
Participate in emergency drills		
Manage the PPE program		
Manage third party inspections		
Respond to building emergencies		
Manage building securities		
Coordinate/conduct occupant training		
Conduct risk management activities		
Manage responses to inclement weather conditions/issues		
Respond to tenant requests/issues		
Conduct equipment checks		
Conduct daily rounds		
Coordinate facility operations (normal)		
Coordinate facility operations (other than normal)		
Manage the work order process		
Investigate indoor environmental quality		
Conduct tenant relations activities		
Manage consumables		
Manage outside facility contractors/service providers		
Manage environmental requirements (permits, etc.)		
Implement an energy management program		
Maintain the facility and systems		
Conduct facility repair activities		

Commercial Workforce Credentialing Council Job Task Analysis Validation

When a Building Operations Professional is Optimizing the Facility, please indicate how frequently this task is performed on the job and how important this task is to a Building Operations Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Operations Professional?
Conduct measurement and verification activities		
Analyze system performance		
Identify cost saving measures		
Respond to changing energy costs		
Optimize system performance		
Identify sustainability opportunities		

When a Building Operations Professional is Conducting Budgeting Activities, please indicate how frequently this task is performed on the job and how important this task is to a Building Operations Professional.

	Frequency - How often is this task performed on the job?	Importance - How important is this task to the overall successful performance of a Building Operations Professional?
Contribute to long term facility budget plan (5 years)		
Contribute to facility operations budget		
Contribute to capital improvement budget(s)		

Commercial Workforce Credentialing Council Job Task Analysis Validation

Review the specialized knowledge below and indicate the depth of knowledge that is required of a Building Operations Professional.

	No knowledge needed	Some knowledge needed	Moderate knowledge needed	Extensive knowledge needed
Access requirements for maintenance	◯	◯	◯	◯
Adjusting equipment based on readings	◯	◯	◯	◯
Americans with Disabilities Act	◯	◯	◯	◯
Asset inventories	◯	◯	◯	◯
Available renewable energy systems	◯	◯	◯	◯
BAS or monitoring systems	◯	◯	◯	◯
Baselines	◯	◯	◯	◯
Basic data architecture	◯	◯	◯	◯
Basic financial terminology	◯	◯	◯	◯
Basic knowledge of contaminant limits	◯	◯	◯	◯
Basic knowledge of insurance policies for equipment and operations	◯	◯	◯	◯
Basic knowledge of tariffs	◯	◯	◯	◯
Basic statistical analyses	◯	◯	◯	◯
Basic utility bill analysis	◯	◯	◯	◯
Benchmarks for system performance	◯	◯	◯	◯
Best practices for emergency drills	◯	◯	◯	◯
Biohazards and hazardous chemicals	◯	◯	◯	◯
Break-even analysis	◯	◯	◯	◯
Budget categories	◯	◯	◯	◯
Building certification programs	◯	◯	◯	◯
Building operations and procedures	◯	◯	◯	◯
Building systems	◯	◯	◯	◯
Building Systems interdependencies	◯	◯	◯	◯
Building Systems interoperability	◯	◯	◯	◯
Building Systems limitations	◯	◯	◯	◯
	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

Building Systems operating plan	◯	◯	◯	◯
Building Systems operations	◯	◯	◯	◯
Building Systems performance expectations	◯	◯	◯	◯
Business case development	◯	◯	◯	◯
Chain of custody	◯	◯	◯	◯
Change management techniques	◯	◯	◯	◯
Common or frequent deficiencies	◯	◯	◯	◯
Communications methods (Skype, Webinar, etc.)	◯	◯	◯	◯
Communications plans	◯	◯	◯	◯
Company labor policies	◯	◯	◯	◯
Comparing alternatives to satisfy demands	◯	◯	◯	◯
Conditions under which a building should be evacuated	◯	◯	◯	◯
Consumable logistics	◯	◯	◯	◯
Consumable requirements	◯	◯	◯	◯
Consumable sourcing guidelines	◯	◯	◯	◯
Contaminant containment protocols	◯	◯	◯	◯
Contingency plans/data recovery	◯	◯	◯	◯
Contract knowledge	◯	◯	◯	◯
Contract requirements	◯	◯	◯	◯
Contracts and service providers	◯	◯	◯	◯
Contributors to carbon or environmental footprint	◯	◯	◯	◯
Control systems	◯	◯	◯	◯
Control theory	◯	◯	◯	◯
Costs of systems or improvements	◯	◯	◯	◯
Criticality of various systems and equipment	◯	◯	◯	◯
Customer requirements for business	◯	◯	◯	◯
Decontamination	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

requirements				
Deferred issues (deferred maintenance)	◯	◯	◯	◯
Demand management strategies	◯	◯	◯	◯
Distinguishing equivalency between equipment and/or systems	◯	◯	◯	◯
Emergency equipment operation	◯	◯	◯	◯
Emergency procedures including first aid and CPR	◯	◯	◯	◯
Emerging technologies and tools	◯	◯	◯	◯
Energy basics	◯	◯	◯	◯
Energy conservation opportunities	◯	◯	◯	◯
Energy cost savings measures	◯	◯	◯	◯
Energy load profiles	◯	◯	◯	◯
EPA regulations	◯	◯	◯	◯
Equipment operations and specifications	◯	◯	◯	◯
Expected life of major building components	◯	◯	◯	◯
Facility knowledge	◯	◯	◯	◯
Failure modes	◯	◯	◯	◯
Familiarity with learning styles	◯	◯	◯	◯
Feasibility studies	◯	◯	◯	◯
Financial knowledge	◯	◯	◯	◯
Financial penalties for going above peak demand threshold	◯	◯	◯	◯
First cost vs. lifecycle costs	◯	◯	◯	◯
First response mitigation techniques (what type of fire extinguisher to use, etc.)	◯	◯	◯	◯
Fluid dynamics	◯	◯	◯	◯
Foot-candles/lumens and lighting concepts	◯	◯	◯	◯
Funding limitations	◯	◯	◯	◯
Funding sources	◯	◯	◯	◯
	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

General knowledge of the authority having jurisdiction	◯	◯	◯	◯
Hazard remediation/clean up	◯	◯	◯	◯
Hazardous materials disposal	◯	◯	◯	◯
Hazardous materials that may be onsite	◯	◯	◯	◯
Hazards in the area (earthquakes, etc.)	◯	◯	◯	◯
Hazards in the building	◯	◯	◯	◯
Hazards management	◯	◯	◯	◯
Health effects of contaminants (including stay times)	◯	◯	◯	◯
Heat transfer	◯	◯	◯	◯
HIPAA requirements	◯	◯	◯	◯
Historical data associated with facility	◯	◯	◯	◯
Human resources	◯	◯	◯	◯
HVAC systems	◯	◯	◯	◯
Impact of change on tenant/occupant space	◯	◯	◯	◯
Impact of facility operations on scheduling	◯	◯	◯	◯
Impact of operational changes (occupancy changes) on performance expectations	◯	◯	◯	◯
Incident command systems (ICS)	◯	◯	◯	◯
Inclement weather escalation plans	◯	◯	◯	◯
Inclement weather local logistics (shelter, food, transportation)	◯	◯	◯	◯
Indicators of problems with equipment	◯	◯	◯	◯
Industry norms for manpower	◯	◯	◯	◯
Infection control procedures	◯	◯	◯	◯
Inspection agencies	◯	◯	◯	◯
Inspection procedures	◯	◯	◯	◯
Insurance requirements	◯	◯	◯	◯
Integrated work	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

management systems structure				
Interim life safety measures (fire watch, alternate evacuation routes, etc.)	◯	◯	◯	◯
Interpreting equipment test readings	◯	◯	◯	◯
Inventory control systems	◯	◯	◯	◯
Job responsibilities	◯	◯	◯	◯
Key logic systems (master keys vs. other keys)	◯	◯	◯	◯
Labor contract agreements	◯	◯	◯	◯
Levels of maintenance	◯	◯	◯	◯
Levels of service for various spaces	◯	◯	◯	◯
Licensing requirements	◯	◯	◯	◯
Life cycle assessments	◯	◯	◯	◯
Lifecycle accounting practices	◯	◯	◯	◯
Limitations of PPE	◯	◯	◯	◯
Load demand schedules	◯	◯	◯	◯
Local water restrictions and requirements	◯	◯	◯	◯
Local weather issues	◯	◯	◯	◯
Location of facility equipment	◯	◯	◯	◯
Lock-out/tag-outs	◯	◯	◯	◯
Long term goals of the organization	◯	◯	◯	◯
Maintenance costs of existing systems	◯	◯	◯	◯
Management requirements	◯	◯	◯	◯
Manual equipment operation	◯	◯	◯	◯
Markets for rate increases	◯	◯	◯	◯
Material availability	◯	◯	◯	◯
Measured variables to verify system performance	◯	◯	◯	◯
Measurement techniques	◯	◯	◯	◯
Medical evaluation policies and requirements	◯	◯	◯	◯
Mitigation of carbon or environmental footprint	◯	◯	◯	◯
	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

Monitoring systems and equipment	◯	◯	◯	◯
Municipal requirement for disposal and recycle of consumables	◯	◯	◯	◯
National Incident Management Systems (NIMs)	◯	◯	◯	◯
New technologies	◯	◯	◯	◯
Normal equipment operating parameters/limits	◯	◯	◯	◯
Normal routine operation of the facility	◯	◯	◯	◯
Obtaining measurements	◯	◯	◯	◯
Occupancy types and typical evacuation procedures for various occupancies	◯	◯	◯	◯
Operating baselines	◯	◯	◯	◯
Operation equipment loads	◯	◯	◯	◯
Operational impact of inspections	◯	◯	◯	◯
Operations within the facility	◯	◯	◯	◯
Options for extending the life of equipment and systems	◯	◯	◯	◯
Organizational security requirements (access requirements, levels of security, etc.)	◯	◯	◯	◯
Organizational structures	◯	◯	◯	◯
Organization's budgeting process	◯	◯	◯	◯
OSHA workplace safety standards	◯	◯	◯	◯
Other submetering systems	◯	◯	◯	◯
Outsourcing options	◯	◯	◯	◯
Owner's long-term plan for the facility	◯	◯	◯	◯
Payment policies	◯	◯	◯	◯
Peak demand loads	◯	◯	◯	◯
Performance improvement plans	◯	◯	◯	◯
Permitting requirements	◯	◯	◯	◯
	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

Permitting resources	◯	◯	◯	◯
Personnel performance review processes	◯	◯	◯	◯
Plumbing systems	◯	◯	◯	◯
Potential contaminants	◯	◯	◯	◯
PPE and proper usage and maintenance of PPE	◯	◯	◯	◯
Process or operations the facility supports	◯	◯	◯	◯
Procurement policies and procedures	◯	◯	◯	◯
Procurement regulations	◯	◯	◯	◯
Proper procedures for isolating and removing hazards	◯	◯	◯	◯
Psychrometrics	◯	◯	◯	◯
Rate schedules for utilities	◯	◯	◯	◯
Reclamation techniques	◯	◯	◯	◯
Recommended maintenance schedules	◯	◯	◯	◯
Refrigerant recovery techniques	◯	◯	◯	◯
Regulated consumables	◯	◯	◯	◯
Regulatory record requirements	◯	◯	◯	◯
Relationship between deficiencies and energy efficiency	◯	◯	◯	◯
Remediation activities for contaminants	◯	◯	◯	◯
Remediation procedures	◯	◯	◯	◯
Remote monitoring systems and equipment	◯	◯	◯	◯
Remote system fluency (DDC, etc.)	◯	◯	◯	◯
Reporting capabilities of work order systems	◯	◯	◯	◯
Reporting requirements	◯	◯	◯	◯
Reporting requirements for emergencies	◯	◯	◯	◯
Resource planning personnel management	◯	◯	◯	◯
Resources required for typical tenant/occupant requests and issues	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

RFP Process	◯	◯	◯	◯
Root cause analysis techniques	◯	◯	◯	◯
Safety codes and standards	◯	◯	◯	◯
Safety concerns associated with equipment operations	◯	◯	◯	◯
Safety handling requirements for consumables	◯	◯	◯	◯
Safety recordkeeping requirements	◯	◯	◯	◯
Scope of work	◯	◯	◯	◯
Security equipment (lighting, cameras, etc.)	◯	◯	◯	◯
Security policies and procedures	◯	◯	◯	◯
Sequence of equipment operations	◯	◯	◯	◯
Sequence of operations	◯	◯	◯	◯
Service level agreements	◯	◯	◯	◯
Services to be outsourced	◯	◯	◯	◯
Shelf life of consumables	◯	◯	◯	◯
SOPs related to equipment	◯	◯	◯	◯
Specialized emergency equipment	◯	◯	◯	◯
State and local energy mandates	◯	◯	◯	◯
Storage requirements for consumables	◯	◯	◯	◯
Sustainability options	◯	◯	◯	◯
System documentation requirements	◯	◯	◯	◯
Technical equipment knowledge	◯	◯	◯	◯
Technical knowledge	◯	◯	◯	◯
Tenant/occupant chain of command	◯	◯	◯	◯
Tenant/occupant contracts	◯	◯	◯	◯
Tenant/occupant equipment and requirements	◯	◯	◯	◯
Tenant/occupant hours of operation	◯	◯	◯	◯
Tenant/occupant needs	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

and schedules				
Tenant/occupant operations and space uses	◯	◯	◯	◯
Tenant/occupant requirements	◯	◯	◯	◯
Tenant/occupant tolerances in changes to systems	◯	◯	◯	◯
Testing and balancing procedures	◯	◯	◯	◯
Thermodynamics	◯	◯	◯	◯
Trade and Union requirements	◯	◯	◯	◯
Trade knowledge for specific equipment and systems	◯	◯	◯	◯
Trade terminology and definitions	◯	◯	◯	◯
Trend analysis	◯	◯	◯	◯
Typical characteristics of facilities and equipment	◯	◯	◯	◯
Typical non-energy costs	◯	◯	◯	◯
Typical training topics	◯	◯	◯	◯
Understanding of all staff functions carried out in the facility	◯	◯	◯	◯
Understanding of interlocked equipment	◯	◯	◯	◯
Understanding of load shedding and its importance	◯	◯	◯	◯
Understanding of photometric charts	◯	◯	◯	◯
Understanding of staffing models (vacation, sick leave, etc.)	◯	◯	◯	◯
Uninterruptable and critical systems	◯	◯	◯	◯
Utility bill analysis	◯	◯	◯	◯
Utility rate structures	◯	◯	◯	◯
Utility time of use	◯	◯	◯	◯
Vendors	◯	◯	◯	◯
Ventilation requirements for consumables	◯	◯	◯	◯
Weather impact on the facility	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

Weather related factors affecting equipment (temperatures, dew points, etc.)	◯	◯	◯	◯
When substitutions of equipment or systems are not allowed	◯	◯	◯	◯
When to conduct IEQ tests	◯	◯	◯	◯
Whole building integration	◯	◯	◯	◯
Work control procedures	◯	◯	◯	◯
Work order processes	◯	◯	◯	◯

Commercial Workforce Credentialing Council Job Task Analysis Validation

Are there any job related tasks that are missing from this survey?

- ◯ No
- ◯ Yes

If yes, what?

Is there any knowledge that we did not include in this survey that should have been included?

- ◯ No
- ◯ Yes

If yes, what?

Commercial Workforce Credentialing Council Job Task Analysis Validation

If a certification examination were to be developed based on this information, please enter the percentage of the exam that should be devoted to each of the content areas listed below.

(Note: Your responses should add up to 100.)

Managing Human Resources	
Conduct Planning Activities	
Operating Buildings	
Optimizing the Facility	
Conducting Budgeting Activities	

Commercial Workforce Credentialing Council Job Task Analysis Validation

* **Do you wish to respond to another survey?**

- ◯ Yes
- ◯ No

Appendix B: Tasks or Knowledge Missing: List of Written Comments

- 1. Actually recovering and / or charging of refrigerant 2. Do you routinely test and or work on live equipment
- Building engineers often replace lighting ballasts. Typically at least one dies every year in greater Los Angeles because they don't understand 277 volt lighting systems & ballast wiring. If the building is a 480/277 building with 277 v lighting (common here), that is an important training consideration. Coil cleaning requires knowledge. Many coil cleaners (particularly those designed for condenser coils) are either extremely acidic or extremely basic. They have to be applied and rinsed off in a particular manner, and timing is critical...you can't leave them on the coil too long. They also remove fin material, so you have to evaluate when they are appropriate vs. evaporator coil cleaner (soap) used for the same purpose. Most building engineers do coil cleaning, and most don't really know what they are doing.
- Building fire suppression systems- testing, locating, code, etc. Plc/ and building automation systems - environmental criticality based on tenants needs.
- Client communication property managers budgetary controls review limitations.
- Consideration and development of a self-sustainable business community, formed from tenants and occupants of the facility. Our facility is a Historic Landmark in Asheville known as the Flatiron and we are that self-sustainable business community.http://renewabilities.org
- Fire alarms
- Homeland Preparedness as it relates to facility and crisis management. Variable Frequency Drive Knowledge Emergency Generators Transfer Switch Infrared Testing Back-flow Prevention Water Sampling and Testing Low Voltage Systems Vertical Transportation Systems
- I suggest that Building Operators have the appropriate certifications - Electrician, Stationary Engineer, Refrigeration, HVAC etc. Building Managers should take the Building Owners and Managers Association (BOMA) Systems Maintenance Administrator (SMA) series not the RPA. Property and Building Managers should be very knowledgeable in how building equipment operates, and have an good understanding of energy management. Every O&M contractor should have an ANSI Certified Energy Manager (CEM or an ANSI Certified Certified Practitioner in Energy Management Systems (EnMS) for every million square feet. Every Government Property Management Organization should have someone with the same qualifications over seeing the O&M contractor and Monitoring Building Energy Use for every million square feet.
- Importance of testing and training staff of critical equipment. Rules and Regulations (local, state and federal). Mitigating environmental risks (air pollution, hazardous spills).
- load shedding, occupied and off hour set backs, economizer mode
- Negotiating contracts for services

- The real issue is the job description is too broad.
- Too many overlapping responsibilities that should be combined or dropped
- Best practices, full energy isolation - lototo lock/tag/try. Varied sources of energy - I. E. Pneumatic, hydraulic, chemical, electrical, mechanical.
- emergency fire suppression and/or containment
- Jurisdictional Certification Requirements
- Knowing the safety requirements for working on live equipment
- Most facilities require constant operational training with review.
- quality systems such as ISO9000
- Rare is the building engineer who understands the comfort and total building energy implications of either raising AHU leaving air temp to avoid drafts in the winter (then leaving it that way as summer comes) or raising leaving chilled water temp to minimize chiller power while then increasing their VAV airside power consumption by far more than they "saved" at the chiller. The specific relationships therein are a good "break out" training session. A simple discussion of air filter efficiencies and MERV ratings is directly relevant to building engineers. Basic operation of a conventional open tower chemical treatment system (TDS sensors, what the conductivity readings mean, how the bleed valve reacts, how chemicals are injected, why a make up water flow meter is good, how to control biocide, etc.) is very good knowledge for a building engineer. Elevator equipment room cooling has a whole host of code restrictions regarding where the equipment may be located, how it can be accessed for service, etc. A building engineer at a minimum should know that there are code requirements and roughly what they mean.
- Renewable energy, quality assurance skills.
- Too many overlapping responsibilities that should be combined or dropped
- Understanding of Fire systems and water back flow prevention
- Variable Frequency Drive Knowledge Emergency Generators Transfer Switch Infrared Testing Back-flow Prevention Water Sampling and Testing Low Voltage Systems Vertical Transportation Systems
- Yes level of experience and education. I current have a bachelors in mechanical engineering developing the basics of HVAC required to operate facilities, a masters in engineering and technology management, a PE license and CEM certification. All of these have been instrumental. In addition BAS use, design and operation is a must.

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