



Summit Building Engineering

Commissioning Qualifications

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Commissioning Qualifications

Experience

SBE brings deep experience to every project resulting in efficient and effective delivery of commissioning services. The lead engineers, Karl Stum, P.E. and Scott Nelson, P.E. have over 13 years of direct full time commissioning and design experience. This experience has included a variety of building types, including, universities, schools, office buildings, courthouses, hospital and health care, high rise hotels, research laboratories, clean rooms and retail.

SBE has worked various commissioning approaches and has modified and fine tuned them for a variety of design and construction delivery scenarios. **SBE** engineers have experience with a large number of HVAC system types with a specialization in controls. **SBE** staff have managed the commissioning work of other disciplines, including electrical, plumbing and envelope. Karl and Scott are intimately familiar with sustainable design, having been the commissioning providers on 13 LEED new construction projects and one LEED Existing Building project. Both are LEED accredited professionals.

SBE staff have been the lead day-to-day commissioning authority on 21 new construction projects, totaling 3.7 million sf and commissioning lead on over 15 existing building commissioning projects, totaling 3.5 million sf. **SBE** staff also oversaw or significantly contributed to the commissioning of another 21 commissioning projects totaling over 2.6 million sf. A description of a selection of these projects is found in Exhibit 1.

In total, SBE staff have been the lead commissioning authority on over 36 projects comprising 7 million square feet.

Expertise and Distinguished Qualifications

SBE brings exceptional expertise and qualifications to every commissioning project.

New Construction Commissioning

- Karl Stum is recognized as a national leader in the field of building commissioning receiving the Benner Award for Commissioning Excellence at the 2001 National Conference on Building Commissioning.



- Karl developed the widely distributed *Model Commissioning Plan and Guide Specifications* for the Federal Energy Management Program—a comprehensive suite of specifications, plans, checklists, forms and test procedures.
- **SBE** is a current Building Commissioning Association (BCA) Member. Karl was a member of the founding board of the BCA. Is a current ASHRAE member and was the primary author of the ASHRAE handbook chapter on commissioning, was a member of the ASHRAE guideline committee that rewrote the ASHRAE Building Commissioning Guideline (2005) and was a key member of the committee that developed the commissioning requirements for LEED 2.0 and 2.2.
- **SBE** staff have published and presented over 39 technical papers for professional groups including the American Council for an Energy Efficient Economy's Summer Studies, ASHRAE annual meetings, AIA regional conferences, National Conference on Building Commissioning, and meetings and conferences of the USEPA, USDOE, utility groups and professional trade journals.

The Model Commissioning Plan and Guide Specifications written by Karl Stum have been the base source for many of the commissioning specifications and plans used in the United States today.

Existing Building commissioning (retrocommissioning)

- Developed a complete toolkit for implementing the retrocommissioning process, including building screening, overall plan template, initial assessment procedures, interview instruments and equipment operational and maintenance assessment forms.
- Conducted numerous analyses of energy efficiency improvements identified during retro-commissioning projects. Used spreadsheets, bin analysis, and hourly simulation tools.
- Developed and delivered retro-commissioning training classes at PG&E's training facility.
- Analyzed, wrote and delivered a paper on retrocommissioning in the Federal sector based on his implementation on three actual projects.

Analysis of three Federal RCX projects showed that 40% of findings would likely never to be found, 1/3 of the issues originate with design, 1/3 with installation and 1/3 with the O&M.

Project Management

SBE brings over a decade of commissioning project management experience to very project.



- Effective project management begins with all parties clearly understanding all of their responsibilities. **SBE** incorporates thorough commissioning specifications, fully coordinated with other specification sections and commissioning plans that ensure the contractor's and designer's responsibilities are clear.
- Managed and implemented small projects where efficient techniques are required to make the process cost effective, such as the Cedar Water Treatment Plant Operations Building, a 5,700 sf building outside Seattle, WA.
- Managed large projects of multi-disciplinary teams (mechanical, electrical, envelope, structural, security, clean-room, etc.) from diverse locations during design reviews and throughout the construction and testing periods. Utilized methods for tracking progress and tasks and the large amount of paperwork required to document the commissioning process. An example is the Seattle Federal Courthouse (630,000 sf; 22 stories), where internal engineering staff and three subconsultants were managed in addition to managing the assistance of operations staff.
- Creatively managed compressed schedules and challenging contracting teams by employing unique weekly look-aheads, test readiness plans, detailed critical path start-up and testing schedules, integrated support from owner staff and appropriate sampling techniques.
- Utilized firm, yet flexible management styles to obtain maximum cooperation from contracting teams. Many years of experience have provided knowledge on when and where to apply firm reminders and instructions so the effectiveness of the process is not compromised.
- Created effective format for Issues Logs and employ proven techniques for keeping the contractor aware of issues and engaged in addressing them.
- Developed database tools for managing and tracking commissioning activities and documentation and utilized web-based tools for working over long distances with multi-discipline teams.

Being experienced in and effective at managing the commissioning process can be as important as having good technical skills.

Design Review

Design review is the most cost effective element of the commissioning process. It provides expert input early when design concepts can be readily altered, generally with no additional design cost.

- **SBE** staff are very experienced in performing design reviews in all major disciplines. A major emphasis is in the HVAC systems and related



controls. We utilize senior staff for our reviews with lengthy histories of experience used to focus their efforts in areas that have been problematic in the past or where issues will result in health concerns, change orders and requests for information.

- We work collaboratively with designers towards the owner's vision. **SBE** recognizes when issues should be brought forward or when they may be too late or inappropriate.
- Our design reviews identify issues where the owner's project requirements may be compromised or not met. Our reviews reduce change orders and requests for information, improve energy efficiency, comfort, system control and maintainability.
- We utilize a clear format for our reviews and track each comment until it is incorporated in the contract documents or resolved.

Controls Verification

For most mechanical systems, controls verification is the heart of commissioning and by far the area that warrants the most attention.

SBE controls expertise applied in design reviews and construction submittal reviews avoids many problems that would otherwise arise later during functional testing.

- Familiar with the industry's primary control systems, including Alerton, Johnson Controls, Siemens, American Automatrix, etc. Working knowledge of sequences that control most types of HVAC equipment and interfaces to packaged controls, lighting and fire-life-safety systems. Conversant in graphical program language (GPL) and line code.
- Experience in reviewing and troubleshooting program code. Extensive experience in evaluating sequences of operation and control drawings for compliance with design intent, good practice, energy efficiency and operations and maintenance needs.
- Conducted performance verification of installed systems for single buildings and multiple building campuses. Extensive experience in verifying proper operation through manual testing of equipment and through trend log graphical analysis.
- Extensive experience in writing detailed step-by-step functional test procedures and trend log plans for verifying proper equipment operation, including intersystem integrated tests.
- Extensive experience with remote monitoring and trouble shooting with multiple control systems. Efficiently monitoring systems in real time and remotely setting up downloading trend information reduces costs to the client while improving final performance.



Field Inspection, Testing and Troubleshooting

The exceptional commissioning provided by **SBE** is founded on a solid understanding of equipment and systems design, operation and troubleshooting and experience and expertise in hands-on field work. **SBE** staff have:

- Solid experience in conducting field construction and start-up inspections on a wide variety of HVAC and electrical equipment.
- Are familiar with HVAC equipment and systems and how they operate and are maintained. They can properly prioritize efforts and only push issues that are needed because they know what is important and what is not.
- Conducted hundreds of hours of hands-on testing of HVAC, electrical systems and controls. Are effective and efficient at test writing, execution and documentation.
- Exceptional expertise in data-logger and trend log installation and in graphical analysis and interpretation.

***SBE** custom tailors the level of testing responsibility between the contractor and the commissioning authority to optimize objectivity, rigor and cost, according to the needs of the project and desires of the owner.*

Sustainable Design

SBE is committed to ensuring appropriate sustainability concepts related to mechanical, electrical and envelope systems are incorporated in design and are operational at turnover. **SBE** is a member of the US Green Building Council and Karl Stum and Scott Nelson are LEED Accredited Professional and have:

- Been the primary author of the commissioning requirements in LEED 2.0 and on the committee revising the requirements for LEED 2.2 and was a member of the committee that developed the Energy and Atmosphere credits. Mr. Stum was research chair of ASHRAE's task group TG2.BIE-Buildings Impact on the Environment.
- Participated as a key technical members of the sustainable design team for 13 new construction projects seeking LEED green building certification and were the lead commissioning authority on 10 of those projects. Were key team members of one LEED Existing Building (EB) project.
- Written papers for and made presentations on commissioning "green" buildings at the international Green Building Challenge Conference in 1998, the USGBC Greenbuild conference in 2006, and the National Conference on Building Commissioning in 2001 and two articles in *HPAC* magazine on the topic (Feb. 2000; Nov 2001).



Energy Analysis

Both new construction commissioning and retrocommissioning require a sound understanding of energy consumption of systems and assemblies. **SBE** staff have:

- Conducted numerous analyses of energy efficiency measures during design phase reviews of new construction and retrofit projects and quantified energy impacts of equipment and operational improvements on commissioning projects of existing buildings.
- Proficient at spreadsheets, bin analysis, and hourly simulation tools..

Building Forensics

- **SBE** staff have demonstrated expertise in identifying root causes of equipment performance failures, poor indoor air quality and moisture problems in buildings.
- HVAC system and envelope interactions and their contribution to microbial contamination are clearly understood.
- Forensic projects completed include multiple hotels in warm humid climates and a high school and court house in a dry cold climate.

Training

Karl Stum developed the curricula for and delivered half-day and full-day workshops on commissioning for the American Institute of Architects' Client Connection Conference, City of Portland, Edmunds Community College, National Environmental Balancing Bureau (NEBB), National Conference on Building Commissioning, Oregon Office of Energy, Washington Water Power, and Pacific Gas and Electric.

Commissioning Approach

SBE utilizes a proven approach to obtain exceptional results. This approach includes:

- **Engagement.** We fully engage with the design and construction teams on all commissioning related issues and stay engaged throughout the delivery process. We are there to assist the design team and the contractor in being successful—in creating a building that is high performance from the start. That requires continuous engagement, not just periodic insertions with to-do lists and audit reports.
- **Centering of Effort.** Our staff's new construction commissioning experience has resulted in a good understanding of where problems most often occur. Our



experience in commissioning existing facilities and working with facility staff has given us an understanding of which issues are most problematic to facility staff during occupancy. Our commissioning staff use this information to prioritize the finite time that can be spent on a project and to focus on issues that are most important.

- ***Communicating Responsibilities.*** SBE has found that the greatest deterrent to contractors fulfilling their commissioning responsibilities in a timely manner is their lack of understanding what their responsibilities are with sufficient lead time. SBE puts in place methods to keep the contractor informed of their responsibilities ahead of time, such as frequent "look-aheads" or analysis of construction progress to identify issues that may (or have) come up that will slow the commissioning process or construction schedule.
- ***Owner Communication.*** SBE considers it crucial to keep the client fully informed of the activities and progress of the commissioning effort. We achieve this by regular progress reports and by keeping the client informed of upcoming commissioning events in which they may want to participate. We will report all findings and issues directly to the project manager.
- ***Dealing With Concerns Early.*** SBE staff have analyzed the commissioning process, the typical construction deficiencies, and where in the process deficiencies are typically identified. We put in place measures that identify issues earlier when they are less costly to properly address.
- ***Firm Management, Yet Flexible and Collaborative Spirit.*** SBE utilizes a highly collaborative approach to projects. We employ communication styles that sustain the autonomy and integrity of the team members by informing them of their responsibilities and needed corrections in a respectful way that supports a collaborative team atmosphere. More firm management is applied tactfully and carefully when necessary to ensure the objectives of the commissioning process are met without affecting relationships and further cooperation.
- ***Timely Follow-up.*** Design and construction team members and the owner's project managers have innumerable issues and tasks to prioritize and deal with. In some cases, commissioning issues can be seen as low priority and can eventually drop off, even the owner's list, if not addressed before the frenzy of move-in. Delaying issue resolution often makes the optimal recommendation difficult to properly address because the window of opportunity has passed. SBE staff use clear issues logs and keep them surfaced in appropriate meetings and communications to ensure that all issues are addressed expeditiously.

SBE incorporates ASHRAE's Commissioning Process guideline as appropriate for the project and follows the Building Commissioning Association's Essential Attributes.



Scalable Resources

SBE has in place relationships and agreements with experienced and skilled associates and subconsultants in the areas of mechanical, HVAC, controls, energy, electrical, architectural and sustainable design. This ensures every project receives proper attention and is staffed with qualified engineers and professionals, with sufficient backup; all managed by **SBE**.



Exhibit 1. Project Listing

10-04-06

	Project Name, Date Bldg Size & Type	Building Use & New or Existing Const	Contact and Phone City & State	Name & Role of Persons(s) Assigned to Project by Firm	Systems Commissioned	Tasks Completed By SBE Staff									
						Design Review	Cx Plan	Cx Specifications	Test Forms	Directed Testing	Hands-on Testing	Trending & Logging	Training Verification	Review O&Ms	
1.	Potomac Yard. 577,000 sf (two 12 story towers) office buildings. Complete in early 2006.	Large office. New	Loran Adams, Crescent Resources, 703-418-7702, Arlington, VA	Karl Stum, at Summit: Lead controls and test engineer for the commissioning team, subcontracted to the Advanced Building Performance-Paul Tseng, 240-888-5860. Wrote commissioning plan, test procedures and conducted field tests.	--Cooling towers, self contained DX air handlers, variable speed drives, CO2 ventilation control, humidifiers, rigorous LEED M&V program, building automation system, terminal units, daylight dimming, occupancy sensors; LEED features.	X	X	X	X	X	X	X	X	X	X
2.	Kelley Engineering Building Oregon State University. 146,000 sf. Complete 2005.	University; mid-size office. New.	John Gremmels, OSU PM, 541-737-9692, Corvallis, OR	Scott Nelson, at CH2MHILL: Commissioning project manager; lead CA throughout project. Managed commissioning team of mechanical and electrical engineers. Developed enhanced language for controls, balancing, training and O&M manuals. Managed balancing contract. LEED	Chiller, cooling towers, boiler system, under floor air distribution, atrium ventilation system, air handlers, computer room units, controls, daylight dimming, occupancy sensors, emergency generator; electrical equipment.	X	X	X	X	X	X	X	X	X	X
3.	Lawrence Berkeley Laboratory Molecular Foundry Lab. 146,000 sf. Cx complete Sept. 2006.	Dry labs and clean room. New.	Joe Harkins, LBNL PM, 510-486-7486, Berkeley, California	Karl Stum, at CH2MHILL: Lead CA. Managed commissioning team of HVAC, mechanical, clean room and electrical engineers and facility staff during design and construction phases. Developed enhanced language for controls, balancing, training and O&M manuals. LEED.	--Chillers, cooling towers, boilers, air handlers, exhaust fans, clean room makeup and fan filter units, laboratory controls and fume hoods, terminal units, cold rooms, autoclaves and sterilizers, lighting controls, emergency power, treated water; LEED features.	X	X	X	X	X	X	X	X	X	X

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4.	Seattle Federal Court House, USGSA. 630,000 sf, \$190M new federal courthouse design and construction. Complete in summer 2005.	Court-house; large office. New.	Rick Thomas GSA Project Manager, 253-931-7343, Auburn, WA	Karl Stum, at CH2MHILL: Lead CA. Managed the commissioning team of mechanical and electrical engineers and facility staff during the design and construction commissioning, startup and occupancy phases of the project. Subconsultants: PECI-mechanical support; Power Systems-electrical.	--Chillers, cooling towers, pumps, boiler system, air handlers, variable speed drives, terminal units, unit heaters, building automation system --Emergency generator, fire alarms, all electrical equipment, lighting controls, electrical --LEED features	X	X	X	X	X	X	X	X	X	X
5.	GSA Auburn Social Security Call Center. Complete early 2006. New / gut renovation.	Mid-size office. New.	Mike Neumberger, GSA PM, 253-931-7306 Auburn, WA	Scott Nelson, at CH2MHILL: Commissioning project manager; lead CA throughout project. Managed commissioning team of mechanical and electrical engineers. Developed enhanced language for controls, balancing, training and O&M manuals. Managed balancing contract (NWESI). LEED.	--All HVAC, controls and emergency power, including under floor air distribution.	X	X	X	X	X	X	X	X	X	X
6.	Kaiser Center for Health Research. 36,000 sf. 2006. Portland, OR.	Mid-size office. Existing.	Tony Mosio, Kaiser Permanente, 503-813-3400, Portland, OR	Karl Stum and Scott Nelson (at Summit). Performed retrocommissioning including plan development, field investigations, manual testing, datalogging and trend analysis and design of corrections.	--All HVAC—chillers, boilers, air handlers, variable speed drives, building automation system and lighting controls.	X	X		X	X	X	X	X	X	X

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7.	Crown Plaza Office Building, 250,000 sf. 2006. Portland, OR.	Large office. Existing.	Dave Raybon, Melvin-Mark. 503-223-4777, Portland, OR	Karl Stum and Scott Nelson (at Summit). Performed retrocommissioning including plan development, field investigations, manual testing, datalogging and trend analysis, design of corrections and energy impacts estimates.	--All HVAC—chillers, boilers, air handlers, variable speed drives, building automation system and lighting controls.		X		X		X		X		X		X		X
8.	Oregon State University Veterinary Medicine Facility. 108,000 sf. Complete 2005.	University; mid-size office. New.	Larrie Easterly, OSU PM, 541 230 0802 Corvallis, OR	Scott Nelson, at CH2MHILL: Commissioning project manager; lead CA throughout project. Managed commissioning team of mechanical and electrical engineers. Developed enhanced language for controls, balancing, training and O&M manuals. Managed balancing contract (NWESI).	Chiller, heating water, air handlers, laboratories, hoods, exhaust fans, cold rooms, controls, electrical equipment.		X		X		X		X		X		X		X
9.	Oregon Safety Training Academy, Oregon Department of Safety Standards and Training, 10 building complex. Complete 2006.	Mid-size office. New.	Richard Ross, DAS PM, 503-378-8834 x207 Salem, OR	Scott Nelson, at CH2MHILL: Commissioning project manager; lead CA throughout construction, verification and warranty. Managed commissioning team of mechanical and electrical engineers. Developed enhanced language for controls, balancing, training and O&M manuals.	Boilers, roof top units, air handlers, controls, electrical equipment, lighting controls		X		X		X		X		X		X		X

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10.	North Mall Office Building. 115,000 sf. Complete Fall 2003.	Mid-size office. New.	Ed Wales, Oregon DAS, PM. 503-378-2865, Salem, OR	Karl Stum, at CH2MHILL: Commissioning project manager; lead CA during design; commissioning oversight and quality control during construction. Managed commissioning team of mechanical and electrical engineers. Developed enhanced language for controls, balancing, training and O&M manuals. Managed balancing contract (NWESI). LEED.	--All HVAC, including chillers, boilers, air handlers, under floor air distribution, perimeter radiant heat, all electrical, plumbing, envelope, LEED.	X	X	X	X	X	X	X	X	X	X
11.	University of Texas Health Science Center at Houston Nursing Center. 190,000 sf. Completion 2004.	University; mid-size office and dry labs. New.	Paul Zider UTHSC PM, 713-794-4333, Houston, TX	Karl Stum, at CH2MHILL: Lead CA. Scott Nelson commissioning engineer. Managed commissioning team of mechanical and electrical engineers. Developed enhanced language for controls, balancing, training and O&M manuals. State-of-the-art LEED design concepts. Functional testing and balancing by Engineered Air Balance.	--Pumps, boiler system, air handlers, variable speed drives, terminal units, building automation system, under floor distribution, fume hoods, atrium ventilation, gray water recovery, domestic hot water. --Emerg gen, fire alarms, all electrical equipment, lighting controls. --LEED.	X	X	X	X	Sc	Sc	X			
12.	Eugene Federal Courthouse, USGS A. 234,000 sf, \$75M federal courthouse design. Construction complete late 2006.	Court-house; large office. New.	Richard Broderick, GSA PM, 253-931-7165, Auburn, WA	Karl Stum, at CH2MHILL: Lead CA. Managed the commissioning team of mechanical and electrical engineers during the design phase commissioning. LEED.	--Chillers, cooling towers, boilers, air handlers, under floor air distribution, etc. --LEED.	X		X							

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13.	Ada County Court House. 2002. 337,000 sf, county courthouse construction. Complete in Dec. 2001.	Court-house; large office. New.	Dave Logan, Ada County Operations Director, 208-364-2345 Boise, ID	Karl Stum, at CH2MHILL. Lead CA. Managed the commissioning team of mechanical, electrical, structural engineers and architects and facility and operations staff in the construction commissioning, startup and occupancy phases of the project.	--Chillers, cooling towers, pumps, boiler system, air handler, variable speed drives, terminal units, unit heaters, building automation system --Emergency generator, fire alarms, CCTV, lighting controls, electrical, envelope	X	X	X	X	X	X	X	X	X	X
14.	Saint Alphonsus Regional Medical Center (hospital). 440,000 sf 9 story, \$92M. Complete 2006.	Hospital. New.	Darrell Fugate, 208-367-2703, Boise, ID	Karl Stum, at CH2MHILL: Lead CA developing commissioning specifications. Commissioning advisor during early construction.	Chillers, boilers, steam system, air handlers, humidifiers, variable speed drives, controls, room pressurizations, electrical equipment, lighting controls.	X	X	X							
15.	OHSU Bio-Medical Research Building. 26,000 sf. Complete late 2005.	Medical research, wet and dry labs. New.	Brad Wellstead, Ethos, 503-241-8099, Portland, OR	Karl Stum, at CH2MHILL: Coordinated a commissioning design review of mechanical and HVAC systems, including BSL-2 labs and vivariums.	Heating water, chilled water, air handlers, variable speed drives, fume hoods; room pressurizations	X									
16.	Pioneer Court House, USGSA. 47,000 sf, \$13M design. Design complete in summer 2002.	Court-house; large office. Renovation.	Kit Meith GSA Energy Coordinator, 253-931-7315, Auburn, WA	Karl Stum, at CH2MHILL: Managed the commissioning team of mechanical and controls engineers in the design reviews and development of commissioning specifications. Subconsultants: PECCI-HVAC.	--Chillers, cooling towers, pumps, boiler system, air handler, variable speed drives, terminal units, unit heaters, building automation system	X	X	X							

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17.	Hatfield Federal Court House, US GSA. 530,000 sf, \$125M federal courthouse. Complete in spring 1999.	Courthouse; large office. New.	Rick Thomas GSA Project Manager, 253-931-7343, Auburn, WA	Karl Stum, at PECI: Provided commissioning consulting services to GSA and to the general contractor. Developed the commissioning plan and major test plans and oversaw the functional testing of primary systems.	--Chillers, cooling towers, pumps, boiler system, air handler, variable speed drives, terminal units, unit heaters, building automation system. --Emergency generator, fire alarms, lighting controls, electrical	X	X	X	X	X	X	X			
18.	Portland Int'l Airport Expansion, Port. Design in Fall 2001, \$25M Gut renovation and enlargement of the main concessions and terminals.	Airport. New.	Bruce Fellows Facilities Engineer, 503-460-4091, Portland, OR	Karl Stum, at CH2MHILL: Lead CA. Managed mechanical and electrical design reviews and developed the commissioning specifications.	-Chiller system, cooling tower, boiler system, pumps, variable speed drives, piping and controls	X	X	X							
19.	SeaTac International Airport Emergency Command Center C-4, Port of Seattle. Design in 2002. \$20M state-of-the-art multi-agency emergency command center.	Airport. New.	Teresa Eckard, 206-248-7130, Seattle, WA	Karl Stum, at CH2MHILL: Lead CA. Conducted a commissioning review on the construction documents identifying functional, operational, maintenance, verification problems and likely change orders and time delay issues.	--All mechanical, electrical and communications.	X		X							
20.	SeaTac International Airport S. Terminal Expansion, Port of Seattle. Design in fall 2001. Full addition of a new terminal, 900,000 sf; \$240M.	Airport. Renovation	Sam Wright Program Leader, 206-444-6718 Seattle, WA	Karl Stum, at CH2MHILL: Lead CA. Key contributor to the commissioning and facility staff training specifications and performed a review on the control system specifications. Conducted a commissioning review on the new emergency command center.	--All mechanical, electrical and communications.	X									

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21.	Columbia Blvd Waste Water Treatment Plant Operations Building. 2,100 sf, complete late 2001.	Small office. New.	Dan Bush, PM, 503-823-2669, Portland, OR	Karl Stum, at CH2MHILL: Lead CA. Performed LEED design reviews and developed commissioning specifications and conducted construction phase commissioning.	--All HVAC and LEED	X	X	X	X	X	X	X	X	X	X
22.	Riverside High School, Indoor Air Quality Investigation, complete early 2002.	High school. Existing.	Jake Larsen, Attny, (206) 447-8986, Seattle, WA	Karl Stum, at CH2MHILL: Performed an HVAC and controls assessment to determine the cause and ramifications of moisture, mold, mildew and IAQ problems.	--HVAC—air handlers, outside air control, exhaust fans, terminal units, balancing and controls			X							
23.	National Marine Fisheries Laboratory. 112,000 sf, \$28M, design complete late 2001.	Wet and dry labs and office. New.	Bob Gries, PM, NOAA, 808-983-5735, Honolulu, HI	Karl Stum, at CH2MHILL: Developed commissioning specifications and provided enhanced language for controls, balancing, training and O&M manuals.	--All HVAC including chilled beams, daylighting,	X	X	X							
24.	Tualatin Medical Building. 56,000 sf. Complete 2000.	Medical office. New.	Bob Bowyer, Kaiser Permanente, 503-571-6509 Portland, OR	Karl Stum, at PECCI: Lead CA. Performed commissioning review of construction documents, wrote commissioning specifications and plans and conducted construction phase commissioning.	--All HVAC-rooftop DX air handlers, boilers, terminals, DHW, controls and emergency power	X	X	X	X	X	X	X	X	X	X
25.	Shriner's Hospital. 300,000 sf, 2000.	Hospital. Existing.	Jim Parks, Sacramento Municipal Utility District, 916-732-6609	Karl Stum, at PECCI: Lead CA. Performed retrocommissioning including plan development, field investigations, manual testing, trend and logger analysis, design of corrections and energy impacts.	--All HVAC—chillers, boilers, refrigeration, air handlers, variable speed drives, building automation system and lighting controls	X	X	X	X	X	X	X	X	X	X

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26.	Sacramento County Coroner's Laboratory 115,000 sf, 2000. Sacramento, CA..	Wet labs and office. Existing.	Jim Parks, Sacramento Municipal Utility District, 916-732-6609	Karl Stum, at PECI: Lead CA. Performed retrocommissioning including plan development, field investigations, manual testing, trend analysis, design of corrections and energy impacts estimates.	--All HVAC--makeup and AC air handlers, boilers, chiller, cooling towers and controls and lighting controls; pressure and temperature controls of laboratories.	X	X	X	X	X	X	X			
27.	Interstate South Medical (Hospital). 120,000 sf. Complete 1999.	Hospital. New.	Bob Bowyer, Kaiser Permanente ,503-571-6509 Portland, OR	Karl Stum, at PECI: Lead CA. Performed commissioning review of construction documents, wrote commissioning specifications and plans and conducted construction phase commissioning.	--All HVAC--chillers, boilers, pumps, drives, garage CO, controls, and emergency power, including operating room and other critical room pressurization and testing.	X	X	X	X	X	X	X	X		X
28.	Salmon Creek Medical / Dental Building. 80,000 sf. Complete 1998.	Medical office. New.	Bob Bowyer, Kaiser Permanente, 503-571-6509 Portland, OR	Karl Stum, at PECI: Lead CA. Performed commissioning review of construction documents, wrote commissioning specifications and plans and conducted construction phase commissioning.	--All HVAC--roof top DX air handlers, boilers, pumps, terminals, controls, emergency power and lighting controls.	X	X	X	X	X	X	X	X		X
29.	Hotel Tower 1. Confidential Client. 25 story, 480 rooms. Complete 2003.	High-rise hotel. Renovation.	Confidential Client, Hawaii	Karl Stum, at CH2MHILL: Lead CA. Renovation and replacement of the entire HVAC system. Developed commissioning specifications and plan and supervised execution and testing.	Boilers, air handlers, chilled water, fan coil units and exhaust fans, pressure mapping for moisture control.	X	X	X	X	X	X	X	X		X

	Project Name, Date Bldg Size & Type	Building Use & New or Existing Const	Contact and Phone City & State	Name & Role of Persons(s) Assigned to Project by Firm	Systems Commissioned	Tasks Completed By SBE Staff													
						Design Review	Cx Plan	Cx Specifications	Test Forms	Directed Testing	Hands-on Testing	Trending & Logging	Training Verification	Review O&Ms					
30.	Hotel Tower 2. Confidential Client. 24 story, 250 rooms. Complete 2004.	High-rise hotel. Renovation.	Confidential Client, Hawaii	Karl Stum, at CH2MHILL: Lead CA. Assisted in moisture and building pressurization evaluation. All room fan coil units, exhaust fans, chiller and makeup air handler units were replaced. Developed commissioning specifications and plan and supervised execution and testing.	Air handler, chiller, fan coil and exhaust fan units, pressure mapping for moisture control.		X	X	X	X	X	X	X	X	X	X	X	X	X
31.	Five-chiller, 4,000 ton chilled water plant, servicing a hotel campus of six towers and two conference centers. Complete 2005.	Large central plant. Renovation.	Confidential Client, Honolulu, HI	Karl Stum, at CH2MHILL: Lead CA investigating chilled water plant sequence of operation and capacity issues and after replacement of three chillers and cooling towers and 10 primary pumps and 16 secondary / booster pumps, developed commissioning and test plans and executed tests.	Five chillers and cooling towers, 10 primary pumps and 10 secondary pumps, primary and secondary loops.		X	X	X	X	X	X	X	X	X	X	X	X	X
32.	Cedar Water Treatment Plant Operations Building. 5,700 sf. Complete 2005.	Small office. New.	Scott Trussler, design PM, 425- 453-5000, Seattle, WA	Karl Stum, at CH2MHILL: Lead CA. Performed LEED design reviews and developed commissioning specifications. Will be conducting construction commissioning.	--All HVAC including heat pumps, daylighting, natural ventilation controls	X	X	X	X	X	X	X	X	X	X	X	X	X	X
33.	Green / Wyatt Federal Office Building. 500,000 sf. 1999. Portland, OR.	Large office. Existing.	Michael Okoro, 253-931-7945. Auburn, WA	Karl Stum, at PECI: Lead CA. Performed retrocommissioning including plan development, field investigations, manual testing, data logging and trend analysis, design of corrections and energy impacts estimates.	--All HVAC—chillers, boilers, air handlers, variable speed drives, building automation system and lighting controls.		X		X										X

	Project Name, Date Bldg Size & Type	Building Use & New or Existing Const	Contact and Phone City & State	Name & Role of Persons(s) Assigned to Project by Firm	Systems Commissioned	Tasks Completed By SBE Staff									
						Design Review	Cx Plan	Cx Specifications	Test Forms	Directed Testing	Hands-on Testing	Trending & Logging	Training Verification	Review O&Ms	
34.	Citizen's Plaza State Office Building. 250,000 sf. 1998.	Large office. Existing.	Herb Stonebrook, 615-532-8215, State of Tennessee, Nashville, TN	Karl Stum, at PECl: Lead CA. Performed retrocommissioning including plan development, field investigations, manual testing, datalogging and trend analysis, design of corrections and energy impacts estimates.	--All HVAC—chillers, boilers, air handlers, variable speed drives, building automation system and lighting controls.		X		X	X	X	X	X	X	X

Sc = by subconsultant