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Curriculum Vitae

Michael D. Haughey, P.E., CEM, HBDP, LEED AP. Principal, Silvertip Integrated Engineering Consultants

MichaelH@SilvertipLLC.com

Mr. Haughey has 52 years of experience in mechanical systems design, analysis, consulting, litigation support, energy studies, energy audits, and sustainability consulting in the field of heating, ventilation, air conditioning, plumbing, and fire protection. Specializing in energy conserving systems, Michael has provided design and project management services on a wide variety of projects.

Certifications & Licenses

Registered Professional Engineer, Colorado, Utah, Wyoming, New Mexico, Oklahoma,
ASHRAE High Performance Building Design Professional Certified (HBDP)
AEE Certified Energy Manager (CEM)
LEED ™ 2.0 Accredited Professional
Toastmasters International, ATM April 16, 1997 (member since Sept 1988)

Education

Bachelor of Science in Mechanical Engineering, University of California at Santa Barbara, 1974

Training (partial list)

Professional Development seminars and webinars: about sixteen per year.
California Governor's Office of Emergency Services ATC-20 Post-Earthquake Safety Evaluation of Buildings and Safety Assessment Program (SAP) Training: 1 day training hosted at the University of Colorado at Boulder on January 13, 2019.
Seak, Inc.: Advanced Testifying Skills for Experts: The Masters Program, 2-day, 2017
Seak, Inc.: How to Start, Build, and Run a Successful Expert Witness Practice, 2-day, 2017
ACEC: Applying Expertise as an Engineering Expert Witness, 1-1/2 day, 2015
ACEC/CO: Expert Witness Practices Seminar, 2013
Revit MEP 4-day workshop, 2012, at CAD-1
Attended the international annual winter conference and trade show of ASHRAE, 2011.
Thermal Imaging for Maintenance Best Practices, Fluke, Seminar, 2011
Green Building Design – A Practical Approach, Seminar, Pikes Peak Chapter ASHRAE, 2004
Forensic Estimating, Seminar, Denver Chapter of the American Society of Professional Estimators, 1998
BACnet ASHRAE Standard 135 Seminar, 1995, Setpoint Systems Corporation
The Engineer as Manager, Seminar, The University of Denver, 1985

Measuring and Improving the Efficiency of Commercial and Industrial Boilers, Institute for Boiler Efficiency Improvement, 1984
HVAC Systems, Course, University of Colorado Denver Center, 1977
Numerous professional seminars including Integrated Design, LEED (Leadership in Energy and Environmental Design), Contracts, and Daylighting.
Professional development attending presentations at monthly meetings of The Rocky Mountain Chapter of ASHRAE, attending almost all meetings since late 1970's through the present.
Professional development attending presentations at monthly meetings of the Colorado Renewable Energy Society (CRES), attending most meetings since the late 1990's.
Professional development attending almost all meetings of the Colorado Chapter of the USGBC from March 2003 when I started the programs through about 2008.
Professional development, attending and presenting at the annual technical conference of Rocky Mountain ASHRAE (2003-2024).
Professional development, attending and presenting at the annual technical conferences of CRES, and Colorado USGBC (2003-2008).
Professional Development, attending approximately one seminar annually on contracts, liability, and similar insurance related topics since approximately sometime in the 1980's.
Attendance at International annual conferences of the USGBC in 2002, 2003, 2004, 2005, 2006, 2007.
Attended the International Annual (Winter) Meeting and Conference of ASHRAE in 2011.
Attended the international Summer Conference of ASHRAE in 1993, 2006, 2013.

Publications

HPAC Engineering, February 2012: "Selecting a Mechanical Engineer for Green Projects"

ASHRAE Journal, "Ice Thermal Storage for Colorado School", May 2003

Awards

Silver Sage – Colorado Renewable Energy Society (CRES) 2010 Building Award in the Residential Category. Mechanical and plumbing design for co-housing project with high efficiency condensing boilers to provide heating through baseboard radiation with radiant floors as a unit upgrade option, and split-system DX for optional cooling, fire sprinklers, and kitchen hood ventilation.

Sedalia Residence, Sedalia, Colorado – Radiant and ground-coupled heat pump heating and cooling. Mechanical and plumbing design for residence using ground-coupled heat pumps to provide heating and cooling through radiant floors, energy recovery ventilator for fresh air, whole house fans for moderate weather ventilation, and supplemental fan-coils for dehumidification. Project won a McGraw-Hill Gold Hard Hat award (Sustainable Ranch House in Douglas County) in 2006.

Solar Harvest, Boulder, Colorado - The City of Boulder's First Net-Zero Energy Home, General Housing Category 2006, Colorado Renewable Energy Society. Provided mechanical engineering consulting including ventilation, heat from sunspace, and ground-coupled outside air pre-heating.

Denver Place - LEED for Existing Buildings (EB) pilot project 2004. LEED Accredited Professional for LEED for Existing Buildings (EB) pilot project under sub-contract to E-Cube, Inc. Project comprises a full city block in downtown Denver including two office towers, 34 and 23 stories each, connected by two-six level Terraces, comprising 815,000 gross square feet. Project has been awarded a LEED EB Gold rating and was the first LEED EB, and first LEED Gold, in Colorado.

Poudre School District - Operations Center, Fort Collins, Colorado – Ground-source Heat pumps, heat recovery, natural ventilation, daylighting, and more. Design of ground-source heat pump system, heat-recovery ventilation, daylighting and occupancy sensors integration with mechanical, and demonstration solar photovoltaic system; Excellent Use of Renewable Energy in Buildings award from the Colorado Renewable Energy Society, 2002; Regional ASHRAE Award in 2003 for New Institutional Buildings category.

Lucile Erwin Middle School Ice Thermal Storage System, Loveland, Colorado. Design of chilled water system for a new middle school using ice thermal storage and highly innovative flexible storage and pumping system concepts. This design won the 3rd place society (international) ASHRAE award in 2003 for the New Institutional Buildings category. Evaluated cooling alternatives and local utility incentives for a new Thompson School District middle school. Energy cost savings are optimized with continuous monitoring of building kW demand and modulation and shut-off of the chiller.

Professional Affiliations

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), Rocky Mountain Chapter, Director 2015-2017, 1997-1999; President 1991-1992; and Past Vice President, Secretary, Treasurer, Education Chairperson. Keynote speaker at 2004 Rocky Mountain Chapter ASHRAE Annual Tech Conference.

International Code Council (ICC), member

Colorado Renewable Energy Society, Member, Board of Directors, Secretary

Rocky Mountain Association of Energy Engineers, Member

Toastmasters International, ATM, member since September 1988

Colorado Earthquake Hazard Mitigation Council (a Colorado State policy advisory group), member 2000-present

USGBC – Colorado: USGBC Greenbuild 2006 Colorado Host Committee Chairperson, USGBC-Colorado Board of Directors, Education Director and Programs Coordinator, started and managed the monthly technical programs.

Experience

Engineering consulting including engineering design, project management, construction observations, litigation support, and peer review for commissioning. Areas of expertise include system analysis and troubleshooting, litigation support, energy studies and audits, design projects, and complex remodel projects. Experience includes design of HVAC, fire protection, plumbing, and energy management systems for a wide array of facilities, including institutional, commercial, industrial, and residential. Specialties include energy-conserving projects such as ground-source geothermal, ice thermal storage, indirect-direct evaporative cooling, solar systems, net-zero energy building, displacement ventilation, and design of energy conservation measures. He has also been responsible for design and project coordination for new construction, remodel and maintenance projects while performing facilities engineering in the industrial environment.

Faculty Lecturer/Adjunct Professor, HVAC Design (graduate & undergraduate), CU Boulder; Faculty Lecturer/Adjunct Professor, HVAC Design, CU Denver. He has coordinated the local ASHRAE chapter's HOSO (Hands On Science Outreach) program for kindergartners through sixth-graders and the NEED (National Energy Education Development) "Solar Sprint" program for sixth-grade students.

Litigation support including field testing, code review, design analysis, repair design, expert reports, deposition and trial testimony, and to determine solutions to space heating, cooling, water heating, plumbing, fire protection, and mechanical systems problems.

Presentations

Developed and presented seminars and lectures for groups such as the Rocky Mountain Chapter of ASHRAE, Pike Peak Chapter of ASHRAE, The Colorado Renewable Energy Society (CRES), World Renewable Energy Forum (WREF), CEFPI (the Council of Educational Facility Planners International), the US Green Building Council (USGBC) – Colorado Chapter, USGBC Greenbuild 2005 Technical Session, AGC (Colorado), AIA Committee on the Environment (COTE – Colorado), EPA & Denver Mayor's Office, IFMA, BOMA, BOAC, AFEC, SAME, NEBB, Industrial Hemp Research Foundation, to classes at the University of Colorado at Boulder and Colorado State University, and to other professional societies and groups. Presented the Keynote Address to the Rocky Mountain Chapter ASHRAE 2004 Annual Tech Conference. Presents seminars on various topics including Low Energy Mechanical Systems, USGBC-LEED Overview, Ground Source Heat Pumps, LEED EB, High Altitude Design, Ice Thermal Storage, Economizers, Living Buildings, Seismic Risk in Colorado, Living Buildings, Mechanical for Net-Zero Buildings, Efficient HVAC for Indoor Agriculture, Climate Change, and Sustainable Design.

Professional History

2003-Present Silvertip Integrated Engineering Consultants, Westminster, Colorado, Owner, Principal
2001-2003 E-Cube, Inc., Boulder, Colorado, Vice President Engineering - Colorado
1992-2001 The RMH Group, Inc., Project Manager

1990-92	Gordon, Gumeson & Associates, Denver, Colorado, Senior Project Engineer
1979-90	McFall - Konkel & Kimball Consulting Engineers, Denver, Colorado, Associate
1977-79	Storage Technology Corporation, Louisville, Colorado, Facilities Engineer
1976-77	Timpte, Inc, Denver, Colorado, Engineering Designer
1975-76	Independent solar heating design and instruction
1974-75	Applied Magnetics, Inc. Santa Barbara, California, Engineering Technician

Representative Projects

Expert Witness (Retained Expert 2014 through present):

Retained Expert, number of cases: 51
Depositions given: 6
Testimony given at trial: 4
Testimony given at mediation: 1

Residence, consultation on plumbing backup. Golden, Colorado. Settled.

Historically registered retail and office building, Denver, Colorado. Consultation regarding the future impacts of EPA refrigerant regulations. Ongoing.

Apartment building complex, Colorado Springs, Colorado. Investigation and expert report on alleged plumbing defects. Ongoing.

Residence, investigation and expert report of HVAC installation issues and excessive sound levels. Louisville, Colorado. Ongoing.

Residence, investigation and expert report of Plumbing leak. Colorado Springs, Colorado. Ongoing.

Residence, new construction, investigation and expert report of HVAC and Plumbing design and installation issues. Castle Pines, Colorado. Ongoing.

Apartment building complex of 21 residential buildings and a total of 168 units, Lakewood, Colorado. Investigation and report on condition of plumbing and heating piping experiencing leaks. Ongoing.

Five-building multi-family & townhouse complex. Investigation of PEX fitting leaks in plumbing piping, broken heating water meters, and thermostat programming issues. Georgetown, Colorado. Settled. Expert for the Plaintiff.

Condominium. Investigation and report on damage that occurred during maintenance and repair of a residential HVAC unit. Albuquerque, New Mexico. Settled. Expert for the Plaintiff.

Residence, Review and Opinion of Sewer Video. Rocky Ford, Colorado. Expert for the Plaintiff.

Residence, plumbing leak investigation. Santa Fe, New Mexico. Ongoing. Expert for the Plaintiff.

Residence, HVAC investigation of radiant floor heating system installation. Shawnee, Colorado. Ongoing. Expert for the Plaintiff.

Ten-story apartment and retail building, HVAC investigation. Investigation and expert report regarding alleged HVAC defects and project delays in renovation and conversion of existing building into 192 apartments plus retail spaces. Denver, Colorado. Settled. Expert for the Defendant.

Residence, HVAC investigation. Investigation and expert report primarily regarding site water infiltration into underground HVAC ductwork. Aspen, Colorado. Settled. Expert for the Plaintiff.

Food Truck, investigation of gas explosion. Claremore, Oklahoma. Closed. Expert for the Plaintiff.

Residence, buried gas line & grill installation investigation and expert report. Residence has an outdoor grill and an outdoor fire pit. Thornton, Colorado. Abandoned, defendant disappeared. Expert for the Plaintiff.

Condominium building in a 10-building complex, water leak/intrusion investigation. Investigation includes evaluating the possible sources of the leaks/water intrusion. Boulder, Colorado. Settled. Expert for the Defendant.

Residence, investigation and expert report, HVAC issues and representation of same at time of sale. HVAC System is a DIY multi-split. Evergreen, Colorado. Bench trial and verdict. Expert for the Plaintiff.

Residence, investigation and draft expert report, HVAC, code, energy, and insulation issues, and new construction installation of a modular home. Investigation includes IR imagery during blower door testing. Routt County, Colorado. Settled. Expert for the Defendant. Settled pre-arbitration.

Condominium Building, three units in a 12-unit building within an 8-building complex. Aurora, Colorado. Investigation and expert report, sewer line condition and slope. Ongoing. Expert for the Plaintiff.

Residence, investigation and expert report, issues with design and sizing of furnace and AC system and representation of same at time of sale. Denver, Colorado. Ongoing. Expert for the Plaintiff.

Residence, investigation and expert report, issues with cause of furnace and AC failure. Castle Rock, Colorado. Ongoing. Expert for the Plaintiff.

Restaurant, Investigation and expert report, issues with HVAC and plumbing installation, Aspen, Colorado. Issues include quality and weather-resistance of exterior ductwork, code issues, and roof penetrations. Settled. Expert for the Plaintiff.

Residence, Investigation and draft expert report, sewer line condition and slope, Denver, Colorado. Investigation and report includes recommended repairs and replacement. Settled. Expert for the Plaintiff.

Residence, Investigation of water softener installation and reverse osmosis systems installation and bacterial contamination from cross-connection, Brighton, Colorado. Settled. Expert for the Plaintiff.

Residence, Investigation of water softener installation and reverse osmosis systems installation and bacterial contamination from cross-connection, Evans, Colorado. Settled. Expert for the Plaintiff.

Residence, Investigation of water softener installation and reverse osmosis systems installation and bacterial contamination from cross-connection, Colorado Springs, Colorado. Settled. Expert for the Plaintiff.

Detention Center, Colorado. Investigation of HVAC and Plumbing Systems regarding alleged detainee exposure to extreme temperatures that resulted in personal injury. Ongoing. Expert for the Plaintiff.

200 Unit Apartment Building, Tulsa, Oklahoma. Investigation and draft expert report of maintenance performed on chilled water and heating water systems, and causes of excessive centrifugal chiller and fire-tube boiler and underground piping leaks. Ongoing. Expert for the Plaintiff.

Residence, Fort Lupton, Colorado. Investigation and expert report of water and mold damage from plumbing leak and use of mold growth rate to estimate date of leak event. Expert for the Plaintiff. Negotiated settlement.

Office Park, Superior, Colorado. Investigation and expert report of HVAC system smoke damage from the Marshall Fire. Ongoing. Expert for the Plaintiff.

Office Park, Superior, Colorado. Investigation and expert report of irrigation system replacement. Ongoing. Expert for the Plaintiff.

Office Park, Superior, Colorado. Investigation and expert report of fire and soot damage to irrigation piping and HVAC equipment due to wildfire. Ongoing. Expert for the Plaintiff.

Residence, Superior, Colorado. Investigation and expert report of water loss connection to wildfire. Ongoing. Expert for the Plaintiff.

Residence, Investigation and expert report of water softener installation and reverse osmosis systems installation and contamination from cross-connection, Adams County, Colorado. Settled. Expert for the Plaintiff.

Mobile Home Park, Investigation of underground Plumbing and hookup installation issues, expert report. Brighton, Colorado. Settled. Expert for the Defendant.

Mobile Home Park, Investigation of construction administration services for underground Plumbing and hookup installation issues, expert report. Brighton, Colorado. Settled. Expert for the Plaintiff.

Residence, HVAC Boiler Leak Investigation, Westminster, Colorado. Ongoing.

Residence, HVAC Radiant Heat Design, Performance, and Installation Investigation, Boulder County, Colorado. In Mediation.

Hotel, Plumbing Leak Investigation, Santa Fe, New Mexico. Ongoing.

Restaurant, Plumbing Expert Consultation regarding toilet installation in injury case, Denver, Colorado. Settled.

Church, Plumbing Investigation of work installed vs. plans, Arvada, Colorado. Settled.

Reverse Osmosis System Leak Investigation, Colorado. Investigation of the cause of a residential RO System failure and leak. Ongoing. Expert for a Defendant.

19-Building, 264 unit Apartment Complex, Evans, Colorado. Investigation, documentation, and Expert Report of hail damage to HVAC equipment. Settled. Expert for the Plaintiff.

Indoor agricultural grow facility in Colorado Springs, Colorado. Investigation and expert report of the HVAC systems design, capacity, and suitability. Detailed analysis of dehumidification and cooling capability and recommendations for correction. Completed concept design for repairs and system modifications. Jury verdict. Expert for the Plaintiff.

6-Unit Housing Development, Boulder, Colorado. Investigation and Expert Report of HVAC equipment, code, and sound ordinance alleged installation issues; Trial Testimony. Jurist Decision in favor of Client. Expert for the Defendant.

9-Building, 19-unit Condominium Complex, Salida, Colorado. Investigation and Expert Report of plumbing issues/allegations. Case exit settlement in favor of client. Expert for a Defendant.

Single family residence in Steamboat Springs, Colorado. Research, Expert Report, and Deposition Testimony, related to PEX piping issues. Settled. Expert for the Defendant.

Multi-family Air B & B in Moffat County, Colorado: Investigation of alleged issues with mini-split HVAC systems. Ongoing. Expert for the Defendant.

Fridgewize v. Oribi Manufacturing, Colorado. Consultation and development of test protocol regarding refrigeration condensing unit fan blade failures. Case settled. Expert for the Plaintiff.

Resort in Telluride, Colorado. Water damage from broken pipes after a freeze event. Consultation to attorney for owner regarding strength of litigation case.

Expert Witness/Litigation Support Consultation

Sub-consultant to Engineering Expert Witness - multiple projects (2003 through present, 54 cases):

Courthouse VRF Investigation, Ouray, Colorado. Investigation of multiple compressor failures.
52 unit condominium building water loss investigation. HVAC system is combo space conditioning and domestic water heating.
Commercial Building Plumbing Investigation, Denver Tech Center, Colorado. Site visit to document sanitary sewer and grease waste piping connections in food facility crawlspace.
Residence Partial Explosion Investigation, Rye, Colorado. Site visit to observe post-explosion conditions, pipe testing, and collection and preservation of equipment for further testing.
Apartment project, Boulder, Colorado. Load calculations for 5 building project.
Ski Area Snow Melt Investigation, Vail, Colorado. Site investigation of snow melt system leaks.
Condominium project, Broomfield, Colorado. Site investigations of plumbing deficiency allegations.
Condominium project, Superior, Colorado. Performed load calculations for a variety of building orientations.
Condominium project, Colorado. Develop graph of VRF equipment capacities vs. various parameters.
University Hockey Team Locker Room Investigation, Denver, Colorado. Performed calculations and analysis of heat and dehumidification required to dry protective pads and equipment. Review of existing system and recommendations for modifications to resolve issues. Ongoing.
Doctor's office in 3-story office building, Highlands Ranch, Colorado. Performed HVAC load calculations.
Multi-family 4-story condominium building in Denver, Colorado. Development of a scope of work and scope drawings, including investigation of piping locations, in response to case settlement requiring repair and mitigation of future failures of HVAC condensate piping.
Single Family Residence, Colorado Springs, Colorado. Observation of testing and input into test procedure regarding damage from a pipe fitting leak.
Multi-building, multi-family townhome project, Denver, Colorado. Project consists of 36 buildings containing a total of 144 townhomes. Provided site visits and photo-documentation, field ductwork sketches, heating and cooling load calculations, consultation, and draft report in response to Plaintiff report that alleged HVAC deficiencies.
Single Family Custom Residence, Aspen, Colorado. Site visit, photo-documentation, and boroscope observations as part of an investigation into Owner's claimed HVAC deficiencies. Heating and cooling load calculations and evaluation of existing systems capacity and air distribution. Write Plaintiff report.
Single Family Residence, Peyton, Colorado. Site visit, photo-documentation, Infrared Camera documentation, and consultation in response to Plaintiff Report alleging HVAC defects. Review Plaintiff report and documentation, and write

report in response.
Single Family Residence, Frederick, Colorado. Site visit, photo-documentation, and consultation in response to Plaintiff Report alleging HVAC defects.
Medical manufacturing Laboratory, Palmer Lake, Colorado. Site visits with photo documentation, investigation, and consultation regarding cooling and humidity control and capacity in response to report claiming damages.
Residence in Avon, Colorado. Review Plaintiff report and disclosures regarding pipe freeze-burst damage. Assist with report in response to Plaintiff report.
Office Building, Centennial, Colorado. Provided cost opinions for fire sprinkler modifications for uses in expert report.
Office building, Eagle, Colorado. Provided cost opinion for RTU replacement options for use in expert report.
Four-building residential complex of about 100 units, Boulder, Colorado. Provided site visits and photo-documentation, plumbing research, drawings review, report, and consultation regarding response to Plaintiff expert report.
Hotel investigation. Provided minor assistance with drawings.
Four-building lofts residential complex with about 100 units, Boulder, Colorado. Review documents, drawings, specifications, photographs, and reports. Write report in response to Plaintiff's expert report regarding alleged plumbing defects and code violations.
Four-building residential complex of about 100 units, Boulder, Colorado. Report regarding plumbing in response to Plaintiff report. K-12 School HVAC Investigation, San Luis, Colorado. Document and cost estimate reviews relative to system capacities and other issues.
Hospital Central Heating Plant Investigation, Santa Clarita, California. Field investigation, documentation, and document review.
Luxury Condominium Complex, San Diego, California. Field investigation and testing of HVAC and plumbing systems for 233 unit high rise condominium building.
Natatorium Hydrostatic Relief Valves Investigation, Pueblo, Colorado. Field investigation, test observations, and documentation.
Residential water loss investigation. Witness and document testing of an HVAC zone valve.
Residential high-rise building pool ventilation replacement, Denver, Colorado. Investigate ventilation options subsequent to moisture damage. Provide mechanical design for selected option.
Assisted Living Facility Fire Protection Leak Investigation, Casper, Wyoming. Field investigation and document review.
Aspen Residence HVAC Leak Investigation. Field investigation and subsequent research to determine cause of HVAC leak. Write response to opposing expert opinion.
College Classroom and Office Building. Review documents and edit document list and timeline.
Office Building Water Heater Investigation. Observe destructive testing of expansion tank.
Condominium Complex, Boulder, Colorado. Field investigation, systems testing using data-loggers, data analysis, and report writing for 34 unit complex. Investigation included freeze issues with fan-coils and control ussies with make-

up air units.

Assisted Living Facility, Centennial, Colorado. Field investigation, data logger data collection, and building exterior infrared photography and documentation.

Condominiums Complex, Colorado Springs, Colorado. Investigation and response to opposing expert report regarding portions of a five building, 40 unit complex. Field observations of report issues. Investigation of HVAC, plumbing, and fire protection issues including furnace flue, OSA, and CA plus various code issues.

Office & Retail building, Golden, Colorado. Investigate overheating condensing units.

Residential high-rise building make-up air unit replacement, Denver, Colorado. Investigate make-up air unit replacement options subsequent to moisture damage. Provide mechanical design for selected option.

Residence water damage, Aspen, Colorado. Review documentation and research contributing factors to fire sprinkler system leak.

96 unit condominium project. Investigation and documentation of HVAC, fire protection, and plumbing leaks and issues.

Restaurant in shopping mall. Water leaking into space below. Investigation and report writing services regarding of source of leaks and recommendation for resolution.

Ten-story 474,525 sq. ft. hotel that included guest rooms, condominiums, employee housing, banquet facilities, restaurant, spa, laundry, retail, children's center, and support areas. Expert witness research, analysis, documentation, and report writing services.

Engineering analysis, document review, and investigation of compressed air system design and performance issues for a 176,000 sq. ft. multi-story university medical teaching facility.

Mid-rise 112 unit Condominium, Denver, Colorado - Forensics/Litigation Support. Field investigation and engineering analysis of heating and plumbing system problems. Site testing and data logging of systems temperatures and pressures. Thermal imaging of building envelope specific to frozen pipe investigation.

Middle School explosion investigation, Erie, Colorado - Forensics/Litigation Support. Field investigation, photo-documentation, testing witnessing, and engineering analysis of damage from water heater explosion.

Twelve building Townhouse Complex, Denver, Colorado - Forensics/Litigation Support. Field investigation, photo-documentation of existing conditions and code compliance issues of HVAC and plumbing systems.

Fourteen building Condominium Complex (128 units), Broomfield, Colorado - Forensics/Litigation Support. Field investigation, flue draft testing, photo-documentation of existing conditions and code compliance issues of HVAC and plumbing systems.

Eighteen building, 408 unit Condominium Complex, Erie, Colorado - Field investigation, photo-documentation of existing conditions and code compliance issues of HVAC and plumbing systems, and fire protection sprinkler freeze-burst issues.

Forty building, 120 unit Townhouse Complex, Greenwood Village, Colorado - Forensics/Litigation Support. Field investigation, building envelope thermography, photo-documentation of existing conditions and code compliance

issues of HVAC and plumbing systems.

Twenty-seven building, approx. 102 unit Townhouse Complex, Loveland, Colorado - Field investigation, photo-documentation of existing conditions and code compliance issues of HVAC and plumbing systems, report of findings. Flue draft and combustion testing of water heaters and furnaces.

136,000 square foot Mixed-Use Commercial and Residential Complex, Durango, Colorado - Field investigation, photo-documentation of existing conditions and code compliance issues of HVAC, fire protection, and plumbing systems, including acoustic issues involving sound transmission and hydronic turbulence-generated sound, balcony drain leaks, snowmelt leaks, and report of findings.

Sixteen Building, 58-unit, Low-Income Townhouse, Duplex, and Single Family Flat Complex, Denver, Colorado - Forensics/Litigation Support. Field investigation and engineering analysis of heating and water heater system problems. Site testing and data logging of systems temperatures, water heater flow rates and limits, CO2 and CO levels. Drawings for repairs, and report of findings.

Design, Consultation, Investigation, and Other Projects (representative list)

Historical Condominium, 42-units, Denver, Colorado. Investigate alternative systems to replace failed one-pipe steam system. Provide investigation report with concept designs and cost opinions for six options including central ground source heat pumps and central VRF (variable refrigerant flow) systems.

Residential Complex Radon/Methane Fan, Broomfield, Colorado. Write specification for spark-resistant fan to exhaust radon in an area that might contain methane.

Condominium, Denver, Colorado. Investigation of frequent HVAC condensate piping overflows and schematic design of recommended upgrades. Ongoing.

Pavek Residence, Jefferson County, Colorado. Design services for boiler replacement and investigation of heating shortage in specific rooms. Schematic design and load calculations complete. Design ongoing.

Investigation into water temperature and pressure fluctuations, Denver, CO. Project is a retail salon. Initial report and recommended repair sketch (schematic design) are complete. Repairs and system modifications completed.

Condominium, Belmar, Colorado. Provide DHW tank research in support of investigation of alleged defects.

Grow Facility, Denver, Colorado. Provide conceptual design and cost opinions for replacements, additions, and modifications to HVAC systems for use in expert investigation.

Hampden East Fire Pump Study, Denver, Colorado. Prime consultant for the conceptual design and cost opinions of options for the addition of fire pumps and associated building addition or space remodel.

Hampden East Boiler Replacement, Denver, Colorado. Prime consultant for the design of replacement and reconfiguration of heating and DHW boilers and storage tanks for a two-tower residential complex of approximately 200 units and a common area with a swimming pool. The design included trailer-mounted temporary heat boiler, brick chimney repairs, pumps, heat exchangers, flue fan, and building backflow preventer.

Market Square Reserve Study, Beaver Creek, Colorado. Sub-consultant to B2CE, Inc. Review and update of energy cost allocation for condos, restaurant, central boiler plant, central chiller plant, parking garage make-up air, sidewalk heating, snowmelt systems,

Ice rink melt system, Zamboni heat system, performing arts center heating and cooling, common areas heating and cooling. Conceptual budget development for long-term and annual maintenance and capital improvements. Mechanical concept design and cost opinion for pony boiler and summer DHW boiler installation.

Snowbird Hidden Peak HVAC Investigation, Snowbird, Utah. Investigation of multiple design and construction issues including flue leaks, snow intrusion, and heating and cooling capacity and distribution issues, and boiler stability and chiller failure issues at a ski resort building housing cafeteria, private dining room, ski patrol, kitchen, and other customer services on top of an 11,000 ft mountain. Provided report with recommended repairs, system modifications, and redesign requirements.

USDA Human Nutrition Research Laboratory Energy Study, Grand Forks, ND. Performed site investigation, testing, energy analyses, and documentation and report as a sub-consultant to E-Cube, Inc. This 79,806 gsf facility houses laboratory, office, vivarium, and volunteer studies spaces. The value of the recommended measures exceeded $1,000,000 with a return on investment (ROI) of 14.9% per year (simple payback of 6.7 years). Low / no cost measures recommended exceeded a value of sum of $280,000 with a return on investment (ROI) of 38.3% per year (simple payback of 2.6 years).

Palmer Ridge High School, Monument, Colorado – Peer review, troubleshooting, and design consultation services for 230,000 square feet, 2,600 students ground-coupled heat pump project.

Schriever Data Center troubleshooting, Colorado Springs, Colorado - Peer review and analysis of mechanical design and commissioning results of chilled water system and development of remediation design to increase capacity and reliability of a high-criticality facility.

Teller County Courthouse Boiler Replacement, Cripple Creek, Colorado. Investigation of replacement options for 110 year old steam boiler serving a 32,000 sq. ft. historic courthouse. Prime consultant and mechanical design for selected replacement option.

Teller County Jail DHW Investigation and DHW Boiler Replacement Design, Divide, Colorado.

Teller County Jail Systems Investigation and Upgrade Design, Divide, Colorado. Investigation of control and ventilation systems; design of upgrade of HVAC control, smoke pressurization, and fire alarm interface systems; construction in-progress.

Centennial Building System Investigation, Cripple Creek, Colorado – investigation and analysis of heating, ventilation, and controls system to improve performance, troubleshoot system problems, and provide short and long-term recommendations.

Infinite Harvest, Denver, Colorado. Analysis and design for indoor multi-level salad greens grow facility. Design included irrigation system, HVAC with liquid desiccant dehumidification, plumbing, and controls sequence. Separate designs for 296 sq. ft. prototype and 7,350 sq. ft. prototype. Performed monitoring and analysis in first phase for verification of plant and irrigation moisture loads.

BotanaCare, Northglenn, Colorado. Design of HVAC and plumbing for indoor grow facility. Design included analysis of lighting and plant expiration and irrigation moisture loads; provisions for dehumidification and carbon filtering of exhaust air; ventilation of under-roof space to mitigate moisture issues.

Avalon Grow Facility, Boulder, Colorado. Systems consultation to Owner.

Pinnacle Eye Care, Colorado Springs, Colorado. Sub-consultant to Owner's engineer. Field investigation of eye surgery center temperature and humidity design and control

issues. Research and analysis of options. Conceptual design and report for repairs and improvements.

Osteopathic Integrative Medicine Doctor's Office remodel: design for remodel of existing space into a multiple doctor office.

Park Towers, Residential High-Rise Building, Denver, Colorado. Sub-consultant to Owner's engineer. Field investigation and analysis of existing systems including piping capacities. Review of contractor pump and control replacement proposal. Recommendations for condenser water systems modification.

Hotel, Glenwood Springs, Colorado. Sub-consultant to Owner's engineer. Investigate options for heating and snow melt systems replacement utilizing water from hot spring. Schematic design of system replacement.

Urban Thai Restaurant, Boulder, Colorado. Mechanical and plumbing design for restaurant tenant finish at the Hyatt in Boulder, Colorado.

Edible Arrangements – Brighton, Colorado. Mechanical and plumbing design for restaurant facility.

Yogurt Shop, Denver, Colorado. Mechanical and plumbing design for downtown yogurt shop.

Cornerstone Montessori School Sunroom. HVAC design for sunroom addition to school.

Silver Sage Consultation, Boulder, Colorado. Consultation regarding boiler replacement and systems upgrades.

Coors Field Reserve Study, Denver, Colorado. Sub-consultant to Owner's engineer. Field investigation, documentation, cost opinions, and conceptual budget development for mechanical, HVAC, plumbing, and fire protection systems for long-term and annual maintenance and capital improvements.

Equinix LA4 Data Center, Los Angeles, California – review of LEED submittal documents

Lucille Erwin Middle School Chilled Water Plant, Loveland, Colorado - chilled water/ice thermal storage system serving a large middle school (honors (3rd place) society (international) ASHRAE award, 2003 for New Institutional Buildings category)

Poudre School District, Facility Service Center, Ft. Collins, Colorado – design of ground-source heat pump system, heat-recovery ventilation, daylighting and occupancy sensors integration with mechanical, and demonstration solar photovoltaic system (Excellent Use of Renewable Energy in Buildings award from the Colorado Renewable Energy Society, 2002); Regional ASHRAE Award in 2003 for New Institutional Buildings category.

Lakeside Animal Hospital, Golden, Colorado – mechanical and plumbing design for a full-service veterinary clinic.

Woody's Pizza, Golden, Colorado – mechanical and plumbing design for kitchen remodel and expansion.

Net-Zero Existing Residences Renovation Studies – Co-authored two studies for Golden, Colorado. The first detailed a road map for attaining net-zero energy in existing residences in Golden. The Second study produced a guide for Golden homeowners considering energy upgrades and used two fictional families to illustrate the choices.

Golden Cemetery Sustainable, Historical Office – Golden, Colorado. Mechanical and plumbing design for small office including ground-source heat pumps system that we tested and verified performance at 18.7 EER and 6.1 COP in October, 4.6 COP in April, 23.5 EER in July.

Sedalia Residence, Sedalia, Colorado – Project won 2006 McGraw-Hill Gold Hard Hat Award for Sustainable Design. Radiant and ground-coupled heat pump heating and

cooling. Mechanical and plumbing design for residence using ground-coupled heat pumps to provide heating and cooling through radiant floors, energy recovery ventilator for fresh air, whole house fans for moderate weather ventilation, and supplemental fan-coils for dehumidification.

Silver Sage Village, Boulder, Colorado – Radiant heating, domestic solar hot water, and DX cooling. Mechanical and plumbing design for co-housing project with high efficiency condensing boilers to provide heating through baseboard radiation with radiant floors as a unit upgrade option, and split-system DX for optional cooling. 2010 Colorado Renewable Energy Society Building Award in the Residential Building category.

Shambhala Mountain Center – Rigden Lodge, Red Feather Lakes, Colorado – Radiant heating and domestic solar hot water. Mechanical and plumbing design for meditation, dormitory, and multi-purpose project with high efficiency condensing boilers to provide heating through baseboard radiation with radiant floors in specific areas.

Century Elementary School, Aurora, Colorado – Renovation of HVAC system. Mechanical design for 50,000 sq. ft. elementary school HVAC system renovation and upgrade.

Harvest House, Boulder, Colorado – Net Zero Energy Home Consultation. Mechanical consultation for a net-zero energy home in Boulder Colorado. Mechanical and plumbing design for residence using ground-coupled heat pumps to provide heating and cooling through radiant floors, energy recovery ventilator for fresh air, whole house fans for moderate weather ventilation, and supplemental fan-coils for dehumidification.

Denver Place, Denver, Colorado - LEED Accredited Professional for LEED for Existing Buildings (EB) pilot project. Denver place achieved the first LEED EB in Colorado as well as the difficult-to-achieve Gold Certification. Project comprises a full city block in downtown Denver including two office towers, 34 and 23 stories each, connected by two-six level Terraces, comprising 815,000 gross square feet plus underground parking for a total of 1.3 million sq. ft.

Araj Courthouse, Denver, Colorado – troubleshooting consultation of the displacement ventilation system during construction for this new US GSA courthouse, designed to achieve at least a Silver LEED certification. Building systems include displacement ventilation, high-efficiency lighting/controls, photovoltaics, and district heating and cooling.

Memorial Sloan-Kettering Cancer Center, New Research Building, New York, New York – a new 692,000 sq. ft., three-phase, 23 story, biomedical and chemistry research facility. Provided design review and commissioning planning services toward LEED rating including additional commissioning as defined by the USGBC

Energy Efficiency Training – provided seminars to contractors as part of the New York State Energy Research and Development Authority (NYSERDA) project to transform key elements of the market for commercial heating, ventilation, and air conditioning (HVAC) equipment and related energy-efficiency services.

Northwestern Memorial Hospital, Galter/Feinberg Pavilion, central chilled water optimization study, with the intention of discovering areas in which the current operation of the central plant could be streamlined in terms of reduction in annual energy costs and improved environmental conditions, and to help NMH staff address concerns and issues with plant performance.

New Prentice Women's Hospital (NPWH), Chicago, Illinois – peer review of the mechanical systems in this 910,000 square foot, 17 story growth project for the Northwestern Memorial Hospital Women's Program

Sandia National Labs JCEL and Central Utility Plant Design Review
USDA Grand Forks, ND – Facility evaluation, troubleshooting, and energy audit/analysis report
Bacon Elementary School, Ft. Collins, Colorado – peer review and commissioning consultation for this 93,000 square foot sustainable design school. The systems include ice thermal storage.
Eaton Elementary School, Eaton, Colorado - peer review and commissioning consultation for new elementary school. The systems include ice thermal storage.
Windsor High School, Windsor, Colorado - peer review and commissioning consultation for remodel and expansion to 98,000 sq. ft. of existing high school
Centennial High School, Ft. Collins, Colorado - peer review and commissioning consultation for remodel and expansion of existing high school with 16,376 GSF Activities Building and 25,717 GSF Administration Building
City of Denver Recreation Centers and Police Stations – peer review for Rude, Montclair, and Ashland Recreation Centers and Police Stations #2 and #3. Systems included displacement ventilation.
KUTV, Salt Lake City, Utah – energy audit for PacifiCorp of TV station and studios
Key Bank, Salt Lake City, Utah – energy audit for PacifiCorp of high-rise bank building in downtown salt Lake City
Crossroads Plaza, Salt Lake City, Utah - energy audit for PacifiCorp of regional shopping mall
Numerous energy audits for PacifiCorp including BYU-salt Lake Center; Honeywell manufacturing plant; QC review of Matson Fruit energy audit
Design assistance, energy analysis, and commissioning services for numerous schools including Poudre School District - Zach Elementary School, 2003 elementary School, Centennial High School, Weld County School District, Windsor High School; Eaton School District, Eaton Elementary School
Plaza Tower, Denver, Colorado – energy analysis and systems design for energy conserving measures, downtown high-rise building
Plaza Tower and Denver Place, Denver, Colorado – Re-Commissioning and energy analysis for two downtown high-rise buildings
David Skaggs Research Center, Boulder, Colorado – chilled water systems analysis and concept designs for improvement and remediation; hydronic economizer (flat plate) system design
Poudre School District Prototype Elementary School, Fort Collins, Colorado - energy-efficient HVAC concepts for design competition
Naropa University, Nalanda Hall, Boulder, Colorado - project management and mechanical design for three-story, 20,000 sf classroom/administrative building using a combination of passive and sustainable design features for heating, cooling, and ventilation
Fairview High School Remodel/Addition, Boulder, Colorado - mechanical design for upgrade of 25,000 sf plus 28,000 sf addition using indirect evaporative cooling in a VAV system coupled with a DX second stage to serve a new library, gym, and renovated science lab area, integrated daylighting with mechanical design
Heritage and Sunset Middle Schools Energy Improvements, Longmont, Colorado - engineering support services for design and construction administration of energy conservation measures including refurbishment of existing rooftop units (replacement of

existing motors and addition of VFDs to the supply fan motors) and revision of the temperature control sequence

Loveland High School, Ventilation System Upgrade, Colorado - design for new rooftop ventilation system using custom equipment to replace existing interior unit ventilator system, including roof-mounted ductwork in weathertight enclosures due to lack of interior space for ductwork

Oak Creek High School Addition and Remodel, Colorado - HVAC, plumbing, and fire protection design of new addition including expansion and conversion of coal-fired boiler plant to steam from hot water

Thompson Valley High School Air Conditioning Addition, Loveland, Colorado - chilled water/ice thermal energy storage system for cooling of classrooms, library, cafeteria, and shop areas

Numerous Energy Audits following State of Colorado Guidelines - Juchem Elementary School, Lawrence Elementary School, Lakewood Senior High School, Columbine Senior High School, Fremont Elementary School, Sierra Elementary School, Green Mountain Elementary School, and the Science and Industrial Arts Building and Richardson Hall, both at Adams State College

Clayton College Remodel, Denver, Colorado - project management and design for HVAC and plumbing as part of complete kitchen remodel to add ventilation hoods, make-up air, and plumbing to meet codes and demands of expanded use

Colorado Mountain College Multipurpose Building, Steamboat Springs - HVAC design involving VAV air handling system with direct evaporative cooling and compact high-efficiency boilers, as well as plumbing and fire protection for 44,000 sf building housing classrooms, offices, laboratory, and auditorium spaces

University of Northern Colorado Ross Hall Addition and Remodel, Greeley - renovation and upgrade of 84,000 sf science building and 15,000 laboratory addition; project included VAV indirect-direct evaporative cooling system, heat recovery and VAV exhaust system, VAV hood exhaust, and room pressurization control; heat provided by high-temperature hot water converted to low-temperature water distributed via fan-powered VAV boxes

Colorado School of Mines, Ben Parker Student Center Retrofit, Golden - kitchen HVAC, plumbing, and fire protection design and student annex ventilation troubleshooting

Colorado School of Mines, Stratton Hall Renovation, Golden - steam-to-heat hot water conversion, baseboard radiation, and VAV air conditioning in conjunction with air-cooled chiller for 23,000 sf building

Community College of Aurora, Colorado - HVAC, plumbing, and fire protection for administrative, lecture, and arts buildings, including computer and science laboratories, faculty and administrative space, student lounge, cafeteria, lecture hall, classrooms, music, drama, and art spaces, student greenhouse, medical center, and smoking lounge

UCHSC Fitzsimons Campus Redevelopment, Steam and Chilled Water Study, Aurora, Colorado – life cycle study of steam plant, chilled water plant, and distribution alternatives for redevelopment of the Army Medical Center including 5,000,000 sf of relocated and new University of Colorado Health Sciences Center facilities

Denver Athletic Club Addition, Colorado - plumbing and fire protection design for addition comprised of 100-meter pool, game courts, lockers, exercise room, and snack bar; project included an air-cooled chiller and a boiler plant

Fort Logan Mental Health Center, Children's Cottages Heating System Replacement, Denver, Colorado - hot water radiant heating system

University of Southern Colorado Library Building, Colorado Springs - energy retrofit design including EMCS upgrades and lighting modifications

University of Denver Campus Energy Audit, Colorado - review of utility systems serving 12 campus buildings with design recommendations

Auraria Higher Education Center Energy Audit, Denver, Colorado - identification and development of energy conservation measures including central chilled water campus distribution

LDS Temple Complex Expansion New Central Plant, Salt Lake City, Utah - cost analysis, systems alternatives study, and chiller system design for 4,800 ton central plant, plus future ice storage (3,000 tons)

Church of Jesus Christ of Latter-day Saints, Central Steam and Chilled Water Plant, Salt Lake City, Utah – design of the chilled water system and development of seismic restraint requirements

Church of Jesus Christ of Latter-day Saints, Library and Museum Chilled Water Tie-in, Salt Lake City, Utah – replacement of existing chillers with heat exchangers and pumps with VFDs, and design for interconnecting piping to the new central chilled water loop.

Great West Life; Central Chiller Plant Expansion and Tower III Design; Englewood, Colorado - Project Manager of HVAC, Plumbing, Fire Protection and Electrical design and Project HVAC Engineer. The total project budget is 24 million dollars with a mechanical and electrical budget of 8.8 million dollars. The project included redesign and expansion of the existing chiller plant from 1200 tons to 2400 tons to accommodate Tower III and provide back-up capacity. Tower III is a 248,000 square foot design with ten stories above grade an one below grade. The design was changed from the first two towers to low e windows and to a blow through fan system to provide added capacity for substantially increased personal computer loads within previously determined structural constraints. Mechanical systems included chilled water storage, hydronic economizer, back-up systems, temperature control system replacement and upgrade and fire and life safety smoke control systems.

Great West Life; Mechanical And Electrical Systems Evaluation; Englewood, Colorado - Project Manager of HVAC and Electrical and Project Mechanical Engineer for systems analysis project. The basic mechanical task was to evaluate apparent central chilled water plant capacity shortages and to recommend a the size for an additional chiller. There were a number of unexpected findings which led to additional requirements for the Tower III design. The air handling systems were short of capacity for the owners current and projected needs. The chillers were used to create tenant condenser water which drained much needed capacity. The chiller and air handling unit cooling coil design temperatures were mismatched resulting in capacity loss. The automatic emergency mode for depletion of chilled water storage had no provision for loads less than full chiller output. The cooling coils were not pumped and chilled water was returning to the central plant with only a fraction of the capacity having been used. This rapidly depleted the chilled water storage. A heat exchanger with glycol had been added to solve a freeze-up problem but reduced the supply air temperature a few degrees in the Fall and Spring. Alternative solutions to these and other problems were recommended and solutions were agreed upon with the owner.

Colorado Mountain College; Multipurpose Building; Steamboat Springs, Colorado - Project Manager for HVAC, Plumbing, Fire Protection and Electrical design and Project HVAC Engineer. This is a 44,000 square foot three story building with classroom, multipurpose (auditorium), faculty office and science laboratory space. The mechanical system is VAV air handling system with direct evaporative cooling, compact high-efficiency boilers, and hot water baseboard heating.

Community College Of Aurora; Administrative, Lecture And Arts Buildings; Aurora, Colorado - Project Manager for HVAC, Plumbing, Fire Protection and Electrical design and Project HVAC Engineer. This project was a new campus with three buildings which total to 91,000 square feet. Mechanical designs included faculty and administrative space, student lounge, cafeteria, science laboratories, multipurpose lecture hall, classrooms, music, drama and art spaces, student greenhouse, media center, computer laboratories and smoking lounge. Most of the mechanical systems were large rooftop VAV systems with fan powered VAV boxes with electrical heat for the perimeter. The Arts building has small packaged DX cooling and gas heating rooftop units. Make-up air is provided for selected areas. The smoking lounge uses a combination of package charcoal filtration units, dedicated air supply from the main system and 100% exhaust to make the space negative.

Great West Life; Demand Side Management Proposal; Englewood, Colorado - Project Manager for preparation and submittal of a successful demand side management proposal to Public Service Company of Colorado. The project involves conversion to a hybrid gas and electric heating system and the use of high efficiency compact gas boilers.

Fort Carson; Vehicle Maintenance Facility Upgrade; Colorado Springs, Colorado - Project Manager and Prime Consultant for HVAC, Plumbing, Fire Protection and Electrical design, coordination of Architectural, Soils and Structural Consultants and Project HVAC Engineer. The project included an addition and a paint booth to accommodate large military vehicles and battery room ventilation. Mechanical systems included the paint booth with make-up air, exhaust and filtration systems and ancillary room conditioning.

Marathon Oil; C.T. Scanner Addition; Littleton, Colorado - Project Manager for HVAC, Plumbing, Fire Protection and Electrical design and Project HVAC Engineer. This project included an addition to house a C.T.Scanner, control room and relocated fire protection equipment for an adjacent oil storage tank farm.

Great West Life; Tower I and II Cooling Retrofit; Alternatives, Schedule and Cost Evaluation; Englewood, Colorado - Project Manager for HVAC, Plumbing, Fire Protection, Electrical, Architectural and Structural evaluation and Project HVAC Engineer. The project scope was to evaluate alternatives for increasing existing system capacities to accommodate substantially increased internal gains from personal computers and lower indoor design temperatures than the 78 degree energy code design. Cost estimate verification was obtained through system schematic sketches and contractor pricing input.

Great West Life; Tower II Balancing Consultation; Englewood, Colorado - Project Manager and Project HVAC Engineer for system troubleshooting consultation. Evaluation of apparent stack effect problems and HVAC system imbalances. During

the project, discovered numerous contributing problems including substantial ductwork and plenum leakage and damper control problems.

Lincoln Center; Stack Effect Study; Denver, Colorado - Project Manager and Project Engineer for HVAC system evaluation. During the evaluation, discovered numerous related problems including fan tracking control problems and apparent stack effect problems due to modifications made to counteract freeze-up problems.

Quebec Centre; Boiler Addition, Balancing and Crawlspace Ventilation; Englewood, Colorado - Project Manager for HVAC, Electrical, Architectural and Structural design and HVAC Project Engineer. The project included the evaluation of heating capacity shortages and excessive Radon levels and the design for the recommended solutions. Additional boiler capacity and scheduling of heat pump morning warm-up were provided to alleviate capacity shortages. Existing heat pipe heat recovery devices were discovered to be installed backwards. This was corrected to eliminate the need for additional electrical reheat capacity.

Oak Creek High School; Addition And Remodel; Oak Creek, Colorado - Project Engineer for HVAC, Plumbing and Fire Protection design of new addition. The project included the expansion and conversion of a coal fired boiler plant from hot water to steam.

Clayton College; Kitchen And Restroom Remodel; Denver, Colorado - Project Manager for HVAC and Plumbing design of complete kitchen remodel to add ventilation, hoods, make-up air and plumbing to upgrade for code compliance and expanded use.

Denver Athletic Club; Athletic Addition; Denver, Colorado - Project Manager of HVAC, Plumbing and Fire Protection design. The addition included a 100 meter pool, Racquet Ball and Squash courts, lockers, exercise room and snack bar. The system design utilized outside air control for dehumidification and included run-around loop heat recovery. The systems were constant volume air handling units with chilled water cooling and hot water heating coils. The project included an air cooled chiller and a boiler plant. Mechanical cost: $658,000.

Colorado School Of Mines; Ben Parker Student Center Retrofit; Golden, Colorado - Project Manager of HVAC, Plumbing and Fire Protection design for kitchen and student annex ventilation troubleshooting, system redesign and absorption chiller replacement.

Singletree Golf Clubhouse; Clubhouse And Maintenance Buildings; Avon, Colorado- - Project Engineer for HVAC and Plumbing design. The project included a restaurant, lounge, lockers, outdoor pool, indoor golf cart storage, battery ventilation systems, maintenance building, and fuel storage and dispensing systems. Systems design included propane storage and piping for kitchen use and pool heating.

Chateau D'Mont; Building D and Phase I Humidity Consultation And Redesign; Keystone, Colorado - Project Engineer for HVAC, Plumbing and Fire Protection design. Consultation and repair design services were provided to remedy moisture damage in existing buildings. Ventilation and humidity control were provided for the existing buildings and for the new building.

Andiamo's Restaurant; Aspen, Colorado - Project Manager for HVAC, Plumbing and Fire Protection design. The project was to convert the basement level of an existing three story building into a restaurant.

Vail Post Office; Vail, Colorado - Project Manager for HVAC, Plumbing and Fire Protection design of a two story post office built into a steep site. Systems included constant volume air handling units with modular gas heat and VAV distribution for control in selected zones.

Breckenridge Post Office; Breckenridge Colorado - Project Manager for HVAC, Plumbing and Fire Protection design of new postal facility.

UEPH Housing; Peterson Field, Colorado - Project Manager for HVAC and Plumbing design for new Air Force dormitory including controls and interface for EMCS System.

University Of Northern Colorado; Ross Hall Addition And Remodel; Greeley, Colorado - Project Mechanical Engineer for renovation and upgrade of existing 84,000 square foot science building and the addition of a 15,000 square foot science laboratory addition. Mechanical systems included a VAV indirect-direct evaporative cooling system, heat recovery and VAV exhaust system. VAV hood exhaust and room pressurization control was also provided. Heat was provided from high temperature hot water converted to low temperature distribution to fan powered VAV boxes.

American Association Of Railroads; Mechanical Systems Survey And Report; Pueblo, Colorado - Project Engineer for evaluation of mechanical equipment condition and life safety survey for large multibuilding campus. The project included providing coordination assistance for the discharge test of a large carbon dioxide fire suppression system serving a hydraulic test equipment building.

Air Force Academy; Hospital Master Plan Update; Colorado Springs, Colorado - Project Engineer for HVAC, Plumbing and Fire Protection evaluation and report for the update of the facility master plan.

State Of Colorado; Energy Audits - Project Engineer for numerous energy audits following State of Colorado guidelines including Juchem Elementary School, Lawrence Elementary School, Lakewood Senior High School, Columbine Senior High School, Fremont Elementary School, Sierra Elementary School, Green Mountain Elementary School, and Adams State College Science And Industrial Arts Buiding and Richardson Hall.

State Of Wyoming; Rawlins High School; Energy Audit - Project Engineer for facility energy audit.

University Of Southern Colorado; Library Building Energy Retrofit; Colorado Springs, Colorado - Project Engineer for energy retrofit design involving EMCS control upgrades and lighting modifications. The project included the addition of new cards to an existing Honeywell Delta system using cards from another manufacturer.

Colorado School Of Mines; Phase I Master Plan; Golden, Colorado - Project Engineer for mechanical equipment condition, tunnel piping systems, life safety survey and master plan report.

Buckley Air National Guard Base; Master Plan; Denver, Colorado - Project Manager for master plan report of existing mechanical systems including central steam equipment and campus natural gas distribution piping.

Lowry Air Force Base; Steam Distribution And Central Boiler Plant Master Plan - Project Manager for energy study, field survey and preparation of steam distribution record drawings and master plan report. The project included evaluation and alternatives analysis for tunnel systems and central boiler systems. Systems included high temperature hot water, high and low pressure steam and coal, gas and oil fired

boilers. The analysis included expansion of the existing facility and relocation to a new site. Field survey included making record drawings of valving and piping in hazardous vaults requiring cooled suits for entry. Report included an evaluation of safety equipment for entering the hot vaults and the purchase and use of the equipment for our survey work.

Fort Logan Mental Health Center; MS-G Building Retrofit; Denver, Colorado - Project Engineer as prime consultant for controls and energy retrofit design. The project included troubleshooting and redesign for correction of existing control problems, the addition of a heat recovery system and control modifications to save energy. Construction cost: $55,500.

Colorado State Hospital; Building 20 Energy Study And Retrofit; Pueblo, Colorado - Project Engineer for energy study and retrofit design. The project included controls and EMCS retrofit and the addition of a hydronic economizer to a chilled water system. Control schemes included zone temperature set back, fan control and make-up air unit reset controls.

Colorado School Of Mines; Main Steam Valve Replacement; Golden, Colorado - Project Engineer for the evaluation and replacement of the main steam valve serving one half of the campus. The valve was inaccessible due to a dangerous leak and close coordination was needed to accommodate a limited shutdown allowance. Redesign included improved access, provisions for isolation and improvement of pipe guiding and expansion design.

Castlewood Fire Station; Arapahoe County - Project Manager for HVAC, Plumbing and Fire Protection design. This project included a vehicle maintenance bay, CO sensing and ventilation, hose drying tower and fuel storage and dispensing equipment.

Lakewood Post Office; Lakewood, Colorado - Project Manager for HVAC, Plumbing and Fire Protection design of new 42,000 square foot postal facility. The design included fuel storage and dispensing.

Federal Correctional Institute; Englewood Plant And Office Building - Project Manager for HVAC, Plumbing and Fire Protection design of 30,000 square foot light manufacturing facility which uses inmate workers.

E470 Administration Building; Arapahoe County, Colorado - Project Manager for HVAC, Plumbing and Fire Protection design of the Administration Building, Toll Booths and underground access tunnel. The project included tunnel ventilation to mitigate fume migration and a DDC control system.

RTD; Term Contract; 1987 to 1989; Denver, Colorado - Project Manager for mechanical projects including heat recovery ventilation for bus garage ventilation systems, bus vault unloading area ventilation, decorative fountain troubleshooting and redesign, computer facility cooling, office HVAC system troubleshooting and redesign and tenant finish design.

Kraft Foods; Office And Warehouse; Arapahoe County, Colorado - Project Manager for mechanical design of 261,000 square foot warehouse and office building which includes 100,000 square feet of refrigerated storage, 35,000 square feet of office and 126,000 square feet of dry storage, and conditioned ripening rooms. Seven freezer and cooler compartments require a total of 700 tons of cooling, with each being maintained at a different temperature. Design included vehicle wash facility and

vehicle maintenance facility and drafting and checking service for the two stage liquid overfeed ammonia refrigeration systems design by Tolin Mechanical.

United Foods; Warehouse And Office Building; Commerce City, Colorado - Project Engineer for the design of HVAC, Plumbing and Fire Protection systems of a 178,000 square foot warehouse and office building. The office portion is 26,000 square feet. The project included computer rooms, demonstration kitchen, meeting rooms, display room, general office space, dry storage, battery charging room and ventilation system, acid drainage systems, freezer and seven separate coolers. Mechanical systems included VAV rooftop and single zone rooftop units, electric radiant heat in the office areas, gas fired radiant heat and make-up air units in the warehouse and computer room units. Mechanical cost: $1,262,400.

Shamrock Foods; Warehouse Expansion; Commerce City, Colorado - Project Manager of HVAC, Plumbing and Fire Protection design of a 117,000 square foot expansion of the former United Foods Warehouse. The addition included 59,000 square feet of dry storage and 45,000 square feet of -10 degree freezer. Design services included consultation for smoke removal alternatives, freezer floor ventilation, DX refrigeration systems design and drafting and checking service for ammonia systems design to Tolin Mechanical.

Martin Marietta; Laser Laboratory; Denver, Colorado - Project Manager for HVAC and Plumbing design of a class 10,000 clean room as a design build project with Economy Mechanical. Mechanical systems included pressurization control, filtration, compressed air and vacuum. Project budget: $170,000.

Wyoming State Training School; Pool Renovation - Project Engineer for HVAC troubleshooting and redesign of ventilation systems to mitigate moisture damage.

Sullivan Post Office; Sullivan, Colorado - Project Manager for HVAC, Plumbing and Fire Protection design of new postal facility.

Columbine Hills Post Office; Littleton, Colorado - Project Manager for HVAC, Plumbing and Fire Protection design of new 20,000 square foot post office annex.

Castle Rock Post Office; Castle Rock, Colorado - Project Manager for HVAC, Plumbing and Fire Protection design of new 16,300 square foot postal facility annex. Engineering services included life cycle analysis of system alternatives. Mechanical systems included split system air handling units, high efficiency compact boilers and hot water baseboard radiation.

Morrison Post Office; Morrison, Colorado - Project Manager for HVAC, Plumbing and Fire Protection design of new 12,000 square foot post office annex.

Delta Post Office; Heating System Evaluation; Delta, Colorado - Project Manager of study to evaluate heating system replacement alternatives. The project included supervision of service company boiler inspection and life cycle analysis of repair and replacement alternatives with various types of boilers and systems.

Delta Post Office; Boiler Replacement; Delta, Colorado - Project Manager of project to replace a steam boiler with a hot water boiler. Construction cost: $97,500.

La Junta, Rocky Ford And Las Animas Post Offices - Project Manager of boiler condition evaluation survey and report including life cycle comparison of repair and replacement.

Mary Jane Ski Resort; Rathskeller Remodel; Winter Park, Colorado - Project Manager for HVAC, Plumbing and Electrical design of the remodel of this ski resort restaurant.

Colorado School Of Mines; Student Center Chiller Replacement, Golden, Colorado - Project Engineer for life cycle analysis of alternatives and design for the replacement of an absorption chiller with an electric chiller. Construction cost: $104,500.

Fort Logan Mental Health Center; Main Building Complex Chiller Replacement and Energy Retrofit, Denver, Colorado - Project Engineer for evaluation of alternatives and design for chiller replacement and energy retrofit project. The project included the life cycle evaluation of alternatives and design for replacement of two absorption chillers. Evaluation included free cooling, indirect-direct conversion, air and water cooled chillers and centrifugal, reciprocating and rotary screw types. The selected design was a rotary screw chiller and the project included asbestos removal.

Colorado School Of Mines; Condensate System Evaluation And Schematic Design, Golden, Colorado - Project Engineer for the evaluation of piping corrosion problems in system provided with steam from Coors Brewery which cannot accept condensate return that has been treated. Project included coordination of coupon testing, evaluation and design of air elimination systems, steam powered condensate pumping systems, replacement of an open condensate tank and deaeration.

Fort Logan Mental Health Center; Steam Line Break Evaluation, Denver, Colorado - Project Manager for the evaluation of replacement alternatives for a broken underground steam main. The project included an evaluation of corrosion problems related to the break.

ACME Warehouse; Warehouse Addition; Aurora, Colorado - Project Engineer for the 100,000 square foot addition to accommodate candy storage. The DX refrigeration (R-502) system capacity is 150 tons and included 40 and 60 degree compartments. Mechanical services included design assistance, pipe sizing and drafting and checking services as part of a design build team with Tolin Mechanical. Mechanical cost: $368,000.

United Bank Of Denver; Motor Bank, Denver, Colorado - Project Engineer for Mechanical design of motor bank facility. Design included filtration and treatment system for decorative fountain.

Valley Federal Saving And Loan; Boiler Evaluation; Grand Junction, Colorado - Project Manager for the evaluation of a premature boiler failure. Services included retention of a metallurgical testing company to determine the failure mode. Determined that a leaking expansion tank and resultant excessive water make-up overpowered the treatment program.

Fort Logan Mental Health Center; Childrens Cottages Heating System Replacement; Denver, Colorado - Project Engineer as prime consultant for the evaluation of alternatives and design of replacement for a failed underfloor radiant heating system. The new system design was for a hot water radiant ceiling system and included asbestos removal for four buildings. Construction cost: $216,000.

Village Shopping Center; Due Diligence Evaluation; Boulder, Colorado - Project Engineer for the evaluation of mechanical systems condition, code compliance, and anticipated replacement and maintenance costs for prospective buyer of 197,600 square foot shopping center.

Cherry Hills Marketplace; Due Diligence Evaluation; Cherry Hills, Colorado - Project Engineer for the evaluation of mechanical systems condition, code compliance and

anticipated replacement and maintenance costs for prospective buyer of 157,400 square foot shopping center.

Fort Logan Mental Health Center; Childrens Treatment Center; Underground Piping Evaluation, Denver, Colorado - Project Manager for the evaluation of failures of underground heating and domestic water piping systems. The project included review of contract documents and coordination of exploratory excavation. Determination was made that problems resulted primarily from galvanic corrosion at copper joints with improper solder and corrosion of poorly protected steel piping.

The Victoria Condominiums; Aspen, Colorado - Project Engineer for the design of 18 unit luxury condominium complex with 10 different floor plans. The project included underground parking, snow melt systems, recreation building and an outdoor pool. Mechanical systems included high efficiency compact boilers for each unit.

2300 Riverside Building; Renovation Alternatives Analysis; Tulsa, Oklahoma - Project Engineer for troubleshooting and life cycle analysis of alternative solutions for 17 story luxury apartment building. The project recommendations included replacement of corroded piping, conversion of the three pipe system to a four pipe system, and chiller and boiler replacements. Additional improvements for an upgrade to code compliance included revisions to exhaust and make-up air systems. Each apartment had individual air handling units which needed coil cleaning and testing with a few needing replacement. Other alternative improvements included pump replacements, the addition of a hydronic free cooling cycle and a computerized control system for submetering and central control of mechanical equipment.

Government General Computer Center; Energy Conservation Study; Denver, Colorado - Colorado - Project Engineer for a study to analyze alternatives for reducing energy consumption at the Government General Computer Center. Alternatives evaluated included the addition of dry coolers and cooling towers coupled with pre-cooling coils.

Colorado Bureau Of Investigation; Laboratory Upgrade; Denver, Colorado - Project Engineer for a troubleshooting and upgrade design project. Improvements included upgrade of ventilation, hood exhaust and filtration, retrofit of unit ventilator and interlocked exhaust system controls and ventilation and particulate control at the indoor shooting range.

Colorado School Of Mines; Stratton Hall Renovation; Golden, Colorado - Project Engineer for complete mechanical system replacement concurrent with complete Architectural restoration of the 23,000 square foot building. Mechanical systems included steam to heating hot water conversion, baseboard radiation, variable air volume air conditioning in conjunction with an air cooled chiller.

Cobe Laboratories; Clean Room Facilities; Tijuana, Mexico - Project Engineer for the mechanical design of 13,600 square feet of laboratory and research facilities with an additional 17,000 square feet of office and warehouse area. The laboratory and research portion was a class 10,000 clean room with air conditioning, pressurization and humidity control.

Federal Detention Center; Englewood, Colorado - Project Engineer for the mechanical systems design of a 44,200 square foot, 72 bed pre-trial detention center. The project included counseling and administrative services and a kitchen facility. Construction cost: $5,000,000.

Swimming Pool Projects - Project Engineer for ventilation troubleshooting and design and pool system piping and pumping systems for various projects. Projects include: Wyoming State Training School Pool; Denver Athletic Club; Morgan Residence Trout Pond; Colony Recreation Center Pool; Grynberg Residence Pool; Coors Residence Pool; Stevenson Residence Pool; Turner Residence Pool; Wilde Residence Pool.

Willie Nelson Residence; Addition; Bear Creek, Colorado - Project Engineer for Mechanical design of bedroom and whirlpool addition.

Eastgate Apartments; Due Diligence Report; Denver, Colorado - Project Engineer for troubleshooting, mechanical systems condition survey and evaluation of equipment replacement and maintenance costs.

Bill Walters Residence; Due Diligence Report; Denver, Colorado - Project Engineer for mechanical systems condition survey and report for prospective buyers.