WILLIAM R. ACORN, P.E., FASHRAE

OVERVIEW OF PROFESSIONAL EXPERIENCE

William R. Acorn is principal and founder of Acorn Consulting Services, LLC. A consulting mechanical engineer specializing in the built environment, Bill provides:

- Project Design and Management Consulting
- Forensic Analysis and Litigation Consulting
- Expert Testimony at Legal Proceedings
- Mentoring & Advanced Education

With more than 40 years of experience as a professional engineer, Bill is an internationally recognized authority on assessing, evaluating, conceptualizing and remediating complex project design, construction and operational issues related to the built environment. He has analyzed and designed hundreds of projects including commercial office buildings, healthcare facilities, institutional laboratories, and clean manufacturing facilities for the semiconductor and related advanced technology industries.

Bill has significant experience as an ***expert analyst*** of building system design and construction, environmental system control failures, code compliance issues and cause/effect relationships of performance issues related to the built environment. As a ***forensic engineer***, litigation consultant and expert witness, Bill has represented plaintiffs, defendants and their insurers in a variety of domestic and international venues with litigation values to greater than $250MM US. Forensic assignments have included projects dealing with:

- Heating, Ventilating and Air-conditioning (HVAC) systems,
- Cleanrooms and other critically controlled environments,
- Semiconductor wafer fabrication facilities,
- Data Centers,
- Pharmaceutical and healthcare,
- Institutional laboratories,
- Exposure to hazardous materials in the work environment,
- Industrial ventilation systems,
- Power and Process piping systems,
- Plumbing systems,
- Energy management/control systems,
- Commercial/industrial refrigeration systems,
- Fires and explosions,
- Exposure to carbon monoxide,
- Exposure to Legionella,
- Intellectual property disputes regarding patents or trade secrets,
- Compliance with codes and standards,
- Standard of care for design and construction professionals.

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Bill's experience as an engineer, project manager and design firm principal covers the spectrum including; programming, design, construction, start-up/commissioning, and operational facility evaluation and optimization. Bill and his predecessor firm were responsible for all aspects of design, development of construction documents, start-up and commissioning and construction phase support for new and retrofit projects. Although no longer providing detailed design and construction documents, Bill provides ***project consulting*** services; acting as an owner's agent or extension of the staff of the designer and/or builder of complex projects. Bill's services span the range from ***peer review*** of the design, to code compliance consulting, ***value engineering***, sustainability, energy use evaluation and performance optimization recommendations.

Bill's pragmatic approach to both project consulting and ***forensic/litigation consulting*** is the result of real-world experience and many years as a trainer and mentor in professional and academic settings. His ability to explain complex issues in a manner that is understandable to students, entry level engineers, managers and non-technical audiences is key to his success in the litigation consulting environment.

Professional Mechanical Engineer (P.E.) - Mr. Acorn became licensed as a professional engineer in 1976 in Arizona. Since that time he has become licensed in California, Colorado, Illinois, Iowa, New Hampshire, New Mexico, Nevada, Oregon, Texas, Utah and Washington, and is also registered with the NCEES "National Council of Examiners for Engineering and Surveying" (Certificate No. 6999).

As a visiting lecturer at Arizona State University, he delivers public and private seminars and workshops through their continuing education programs on topics including mechanical system design, project management and code compliance for advanced technology facilities. Bill was the ***"Eminent Scholar"*** in Cleanroom Design at the ASU School of Construction in 1997, the only non-academic ever appointed by the DEWSC to this position. During the period from 2002 – 2011 Bill was responsible for development and presentation of the mechanical engineering and code compliance portions of the curriculum for the graduate level course CON 598 ***"Design and Construction of Cleanrooms"***.

Bill was involved from the inception of CREATE "Construction Research and Education for Advanced Technology Environments" at Arizona State University**.** This organization was charged with research and development related to the design and construction of advanced technology facilities. Bill continues to be involved with ACE "Alliance for Construction Excellence" at ASU.

As a visiting lecturer in the Department of Aerospace and Mechanical Engineering at the University of Arizona, Bill lectures on the analysis and design of environmental control systems (HVAC) for buildings.

The author of **Code Compliance for Advanced Technology Facilities**, Bill is widely recognized as an authority on the subject and regularly delivers seminars and workshops to industry and academia on hazardous occupancy code compliance. Bill also regularly consults with the regulatory community, owner/operators and design professionals concerning issues of life safety in semiconductor and similar hazardous facilities. In addition, Bill was a contributing author to the **Semiconductor Safety Handbook** edited by Richard A. Bolmen, Jr.

Bill has been recognized for technical achievements, innovation and foresight by peers, associates and clients. He was elected in 2007 to the status of ***Fellow*** in the HVAC industry-leading professional organization the American Society of Heating, Refrigerating and Air-Conditioning Engineers ASHRAE; a position that recognizes "unusual distinction and contributions to the art and science of the HVAC industry." This recognition is achieved by fewer than 1% of the members of ASHRAE world-wide.

Bill has also attained the status of ***Board Certified Diplomate in Forensic Engineering*** granted by the National Academy of Forensic Engineers (http://www.nafe.org), a Chartered Affinity Group of the National Society of Professional Engineers (https://www.nspe.org/).

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PROFESSIONAL ACHIEVEMENTS AND QUALIFICATIONS

TECHNICAL/LARGE COMPLEX FORENSIC CASES – *representative projects*

- **Wafer Fab Fire – Taiwan:** This confidential project involved the forensic evaluation and expert representation of an A/E firm accused of having improperly designed a wafer fabrication facility that was involved in a catastrophic fire in Taiwan, ROC that resulted in over $400 MM in damages. Insurance company filed subrogation claims for $256 MM. ACS conducted site visits, interviewed fact witnesses in Japan and Taiwan, conducted laboratory testing and reconstruction of the events. Utilizing surveillance video, photographs and legacy conditions, ACS reconstructed the cause and origin of the fire more than two years after the event, in spite of the fact that the facility had been completely reconstructed. ACS reviewed and rebutted the reports of opposing experts and investigators. ACS prepared extensive reports, demonstrative drawings and presentation for mediation. This complex litigation (subrogation action) involved a Japanese A/E firm, a Taiwanese manufacturer and an international group of insurers. The matter was settled to the satisfaction of our client in mediation in California. Represented defendant.

- **Chemical Spill and Alleged Airborne Exposure (NM):** In this matter, a contractor inadvertently cut an active chemical line that was pressurized with a corrosive liquid chemical. The chemical spilled onto the floor of a manufacturing facility. The chemical was alleged to have volatized and spread by the ventilation system to remote areas of the facility where it allegedly was inhaled by the plaintiff. Plaintiffs' chemical expert erroneously utilized an outdoor air dispersion model to opine on the probable level of concentration of the chemical in the work environment of the plaintiff. Following extensive evaluation of the complex HVAC systems in the facility and the dynamics of the chemical discharge, an air dispersion model was prepared that proved the plaintiffs' exposure could not have been at a harmful level. Settled in mediation for a small portion of the original claim. Represented defendant/owner.

- **Failure of Cleanroom Design (NH):** This project involved the evaluation of cleanrooms designed by an international engineering firm and constructed for a manufacturer of precision/high definition printing equipment. The plaintiff-owner found that the HVAC systems were unreliable (had multiple single points of failure) and could not properly control the manufacturing environment in terms of temperature, relative humidity or particulates (i.e. cleanliness classification). In addition, the overall design of the cleanrooms failed to meet the plaintiff's requirements for flexibility and sustainability. Upon forensic evaluation, the facility was deemed unsuitable for retrofit for a variety of technical and financial reasons. Represented plaintiff/owner, settled favorably for client upon mediation in 2017.

- **Evaluation of Code and Design Deficiencies, University Laboratory Building (AZ):** The issues involved in this matter were code compliance and HVAC system design deficiencies of a multi-story science and chemistry laboratory building (approx. 70,000 SF). Technical analysis included evaluation of the improper design of the egress system (lack of sufficient stair towers) and improper design of the HVAC system in terms of pressure control, especially during a fire or smoke event. In addition, the standard of care of an architect/engineer involved in the design of sophisticated technical buildings was evaluated and found to be lacking. The project was delivered with a CMAR contract and the evaluation found that in addition to the failure of the A/E, the CMAR failed to meet its contractual obligations with regard to constructability review, code compliance evaluation and value analysis. Representing plaintiff/owner, matter settled prior to mediation in 2017.

- **IBM Workers Litigation – New York, Vermont and California:** Multiple plaintiffs alleged health issues as result of employment in IBM semiconductor facilities and alleged resultant exposure to hazardous chemicals. Conducted field investigations, forensic reconstruction of historical

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facilities, research into relevant period standard of care and consulted with the litigation team concerning cleanroom design and industrial ventilation systems. Particular emphasis on potential exposure of workers to chemicals as a result of allegedly improper industrial ventilation and local exhaust systems. In addition, issues related to improper construction, operational practices and non-compliance with codes and ordinances were alleged, therefore these were evaluated. Plaintiff claims were resolved on the basis of a unanimous jury verdict for IBM at trial in San Jose California. Represented defendants.

- **Hospital Contamination (KS):** This project involved forensic and litigation consulting, on-site observations, research and preparation of expert report and testimony at deposition. The plaintiff alleged infection caused by a defective HVAC system serving the operating room in which open heart surgery was performed. Evaluated the design and construction of the HVAC systems, pressure hierarchies, filtration systems and maintenance protocols. Determined that the alleged pathogens could not have been transmitted through the HVAC systems. Settled prior to trial. Represented defendant, private settlement.

- **Evaluation of Cleanroom and HVAC Systems - National Ignition Facility, Livermore, CA:** This project involved the evaluation of the HVAC systems serving the high bay cleanrooms and special laser target environment. This is the largest laser facility in the world and is to be used for weapons development and other fundamental research. Recommendations for retrofit of the HVAC systems were provided based upon in-situ performance testing and quantitative analysis/review of the design. Prioritized recommendations for cost effective retrofit strategies to ensure compliance with critical environmental control criteria were provided recognizing the need to minimize impact on budget, operations and R&D mission of this DOE facility. Non-litigation, forensic consulting.

- **Failure of HVAC Systems at College Campus (AZ):** ACS was retained by plaintiff/owner to evaluate problems with various air handling and central plant HVAC systems at this community college campus. The heating water boilers began failing within one year of installation, requiring replacement and a complete re-design of the central heating water plant. Various air handling systems for instructional buildings performed poorly and required remediation. The issues involved evaluation of HVAC and piping system design and construction and the standard of care of the A/E and the contractors. On-going mediations.

- **Workers Litigation – Confidential Semiconductor Manufacturer (TX):** ACS was retained by the legal defense team of a major semiconductor manufacturer accused of operating unsafe clean manufacturing facilities alleged to have excessive levels of chemicals in the indoor environment, resulting in exposures that allegedly resulted in a variety of health issues for personnel that worked in various wafer fabs. ACS conducted site surveys, reviewed original design documents (when available) and evaluated the efficacy of the various ventilation systems in support of the legal team. In many situations, ACS had to forensically reconstruct the likely configuration and ventilation rates from incomplete documentation. Case was settled prior to trial, 2011.

- **Industrial Workers Exposure Claims (AZ, TX):** Confidential evaluation of allegations of improper design, construction and operation of various wafer fabrication facilities in Arizona and Texas that are alleged to have caused illnesses and injury to workers and children thereof. Investigation of facilities, ventilation systems and operational documentation. Represented defendants, private settlement.

- **Failed Air-to-Air Heat Exchanger University Laboratory (TX):** Evaluation of the cause of catastrophic failure of air to air heat exchangers associated with research laboratory HVAC systems. This assignment involved review of design documents, on-site observation and evaluation of failed components and technical evaluation of the aerodynamic forces (turbulent flow) associated with the installation of the heat exchangers in field built air handling units (approximately 50,000

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CFM/each). An engineering report and recommendations were issued prior to litigation, resulting in a definitive plan of remedial action and resolution. Non-litigation, forensic evaluation.

- **Fire in Compressed Air System in Flat Panel Manufacturing Facility (Taiwan):** Evaluation of the improper actions of an insurance consortium in the denial of payment of reasonable amount of loss related to a fire in a flat panel display manufacturing facility in Taiwan. Fire in the compressed air system of the plant damaged the facility and the production tools. Remediation efforts of insurers' contractor were inadequate. Estimated value of property damages >$40MM with business interruption loss in excess of property damages. Preparation of testing plan, supervision of analytical testing and preparation of expert report for presentation to arbitration tribunal. Represented plaintiff in insurance claim. Represented plaintiff, private insurance settlement.

- **Legionnaires Disease Litigation (LA):** Litigation consulting re: causation of legionnaires disease that led to the death of 16 people. Refrigeration systems in grocery store were alleged source of Legionella organisms. Site investigation and evaluation of products in question resulted in location of various other plausible sources of bacteria and potential exposure of plaintiffs. Testimony at trial in Bogalusa, LA. Represented defendant.

- **Chemical Spill at Manufacturing Plant (CA):** Research and litigation consulting re: damages to semiconductor facility and production tools resultant from hydrofluoric (HF) acid spill. A contractor performing demolition work in the utility area of the plant inadvertently cut an active (50 psig) HF line believing it was an inactive line. Plaintiff alleged improper design and construction of piping, cleanroom HVAC, exhaust ventilation and control systems resulting in more than $50MM in property damages and several times that amount in business interruption losses. Discovered that HF fumes were circulated by the HVAC systems into the manufacturing cleanroom and exhausted through the process tools, resulting in corrosion damage to the tools that required extensive remediation and in some cases replacement. Preparation of preliminary report, field investigation, interviews with knowledgeable persons and research concerning standard of care and relevant codes and standards. Represented plaintiff owner and insurance carrier in subrogation matter. Settled favorably prior to trial.

- **Failure of Utility Water Distribution System (AZ):** This project involved the failure of joints in a large underground water transmission system for a major city. The HDPE piping system was more than 3-miles in length and ranged in size from 12" to 54" with flanged joints containing up to (44) – 1-3/4" stainless steel bolts. The original contractor failed to properly assemble the flanged joints and failed to properly torque the bolts (required to be torqued to over 1,200 Ft-lbs.). As a result of the construction defects, the joints leaked upon testing and had to be reconstructed using new gaskets and other components. Consultation by ACS included auditing the original installation to determine the extent of the failures and design of a remediation strategy. The project was settled favorably on behalf of the city through a series of mediations. Represented city as plaintiff.

COMMERCIAL FORENSIC ENGINEERING CASES – *representative projects*

- **Failure of Underground Hydronic Piping Systems (NV):** This matter involves the failure of several miles of underground chilled and heating water piping serving the HVAC systems in thousands of units of a luxury "condotel" facility. The pre-insulated piping ranged in size from 4" to 16" and involved many branch and isolation valve stations that failed within a short time of initial installation, as a result of; improper installation, improper component selection and improper insulation and water proofing techniques. The plaintiff owner had claims against the installing general and mechanical contractors. Represented plaintiff in this matter – settled favorably after multiple mediation sessions in 2017.

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- **Alleged Carbon Monoxide Poisoning (TX):** A family is alleged to have suffered injury as a result of exposure to CO in their home. The evaluation involved testing of the gas fired appliances, evaluation of the overall arrangement of the appliances with respect to the venting system, and computational evaluation and modeling of the potential for CO generated within the combustion processes of the appliances to enter the breathing zone and accumulate to an injurious level. On-going matter.
- **Failure of Medical Product Manufacturing Cleanroom (CA):** This matter involved the failure of a medical products manufacturing cleanroom as designed and installed, to perform in accordance with the design. Prior to engaging ACS, the owner made modifications to the HVAC systems to achieve the required air flow rates. These changes required excessive fan power that resulted in significant operating energy cost penalty for the owner. In addition, we identified a number of fundamental design flaws that compromised the performance of the facility. ACS designed an alternative cleanroom HVAC system as a proposed "standard of care" design. ACS prepared estimates of the lifetime excessive operating energy costs as a portion of the alleged damages of the owner. The standard of care of the design professional was called to question in this matter. Settled in mediation favorably for the plaintiff client in 2013.
- **Failure of HVAC Systems in Federal Facility (NM):** The federal agency operating this new "state-of-the-art" laboratory and office building filed claims against the mechanical contractor for improper construction. Upon field survey, review of the design and performance trend logs, proved that the original design was flawed and that the system was installed in accordance with the contract documents. Represented mechanical contractor/defendant. Private settlement.
- **Failure of Piping Systems at College Campus (AZ):** This project involves the systemic failure of chilled water and domestic water piping within this student residence and activity center at a major university in Arizona. The facility houses approximately 1,700 students in seven buildings serviced by water sources in the central plant. The chilled water piping system began experiencing failures within two years of installation and had to be completely removed and replaced. Accelerated corrosion was linked to improper commissioning and water treatment, improper fabrication of the piping, low quality Asian sourced pipe with defective welds, inadequate insulation and vapor barrier, among other design and construction issues. The domestic hot and cold water piping experienced numerous leaks and upon evaluation was found to be fatally flawed as the result of design and construction issues including; use of non-code-compliant materials, improper fabrication of fittings, improper welding of the stainless steel pipe and general design defects related to the overall arrangement of the systems. This is an on-going matter – representing plaintiff/owner-developer.
- **Failure of HVAC Systems in Outpatient Surgery Center (AZ):** Evaluation of the allegation of design and construction defects related to the improper environmental control within a cosmetic surgery center. The owner alleged the HVAC system had inadequate capacity, improper control of relative humidity and poor reliability. Upon technical analysis, it was determined that the capacity and control were indeed inadequate. Evaluation of the maintenance history revealed the package chiller was poorly designed and manufactured. The matter was settled in a series of mediations with a favorable finding for the owner. Designed remediation retrofit for the systems that were successfully implemented by a mechanical contractor. Represented plaintiff, settled in mediation.
- **Failure of PEX Domestic Water System (AZ):** This matter involves the failure of PEX (cross-linked high density polyethylene) domestic water piping system. This piping system was installed in a 100 unit luxury condominium project and began to fail approximately five years after installation. The domestic water system is chlorinated by the local utility and contains some microbiological matter that is known to attack metallic piping components. Both the brass fittings and the stainless steel clamp bands failed. The failure mechanisms were determined to include

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problems with the design and metallurgy of the components, installation deficiencies and the corrosive nature of the water supply. Representing defendant in this on-going matter.

- **Failure of Underground Ductile Iron Piping (TX):** This matter involved the failure of "bell and spigot" joints in pre-insulated DIP utilized in chilled and heating water service for a college campus. The installing contractor alleged defects in the pipe fittings and gaskets were the cause of the leaks and made financial demands for restitution by the manufacturer. Forensic investigation showed the contractor failed to properly pressure test the piping before foaming-in-place insulation at the joints, in contradiction to the manufacturer's requirements and industry standards. Quantitative evaluation of the joints and gaskets confirmed they met the manufacturer's specifications, in spite of plaintiff's experts' allegations to the contrary. Represented manufacturer/defendant – settled successfully prior to trial.

- **Fire and Explosion in Fire Station (NM):** In this case, a fire and explosion resulted in the death of an occupant of the recently constructed rural fire station. The piping system was not adequately protected from snow and ice accumulation. That snow and ice accumulation ultimately caused the pipe riser to deflect, fracturing a valve that caused release of LPG into the fire station; where an electrical spark caused ignition of the gas and a massive explosion that destroyed the building. Represented plaintiff in action naming design team and contractor. Settled prior to trial in 2012.

- **Evaluation of Failure of Energy Performance Contract:** This project involved the failure of a "performance contract" that replace cooling systems in several schools with new "energy efficient" equipment that was supposed to be paid for with savings in utility consumption. After several years of operation with energy use in excess of the rate of the original HVAC systems the owner invoked the contractual right to have the contractor pay for the savings shortfall. After much negotiation, the contractor recognized the errors in its analysis and has been making annual payments to the school district to make it whole. Represented owner/plaintiff, contractor is making payments to supplement underperforming energy cost reduction, in accord with performance contract.

- **Failed Refrigeration System – Loss of Equity (CA):** Alleged refrigeration system deficiencies caused massive leak of refrigerant from the ammonia piping system that led to significant loss of commercial frozen food products. Engagement included the review of documents concerning the condition of the facility prior to the failure, design and maintenance practices with respect to industry standards and opinions about the respective liability of the parties. Private civil matter. Represented plaintiff.

- **Failed Chilled Water System at Medical Center (CA):** Litigation consulting and testimony at mediation involving the failure of a large absorption chilling plant to perform as specified by the owner. The issues required the analysis of the design and specifications of the engineer, the proposals of the contractor and performance claims by the manufacturer not substantiated by field testing. Mediation resulted in a settlement favorable to the plaintiff owner. Represented plaintiff.

- **Structural Collapse – Manufacturing Facility (CA):** Evaluation of claims of improper compensation by insurance company following collapse of building structure related to HVAC equipment on roof of manufacturing building. Technical and project management evaluations prepared, no expert report, no testimony. Insurance subrogation matter, private settlement.

- **Fire and Explosion in Home (AZ):** This matter involved the failure of a natural gas line in the attic of a home that led to an explosion and fire, resulting in the death of a resident. Upon forensic evaluation of the evidence remaining in the fire debris it was determined the HVAC equipment was improperly installed. The installation caused condensate from the evaporator coil to leak onto the steel gas line that was installed below the furnace/coil unit; resulting in through-corrosion of the line

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and the subsequent release of natural gas into the attic space. Represented plaintiffs, private settlement prior to trial in 2016.

- **Evaluation of Hail Damage to HVAC Equipment (AZ):** A charter school with more than twenty rooftop packaged air conditioning units was subjected to a hail and wind storm event that left the school uninhabitable. The insurance company retained an expert that opined that many (virtually all) of the units could simply be repaired and offered an unsatisfactory financial settlement. Site investigation and evaluation of the units and related duct systems revealed that not only was there external damage to the units (condenser fins, etc.) but many of the casing access panels had been displaced by the wind (in excess of 70 mph) and as a result many of the units had become infested with pigeons since the initial incident. As a result of not only the physical damage, but the pest infestation, recommendations for remediation included replacement of many of the units that had previously been slated for repair. An estimate of the damage was prepared and accepted by the insurance carrier resulting in a substantially higher recovery than originally offered.
- **Excessive Noise and Vibration from HVAC System (AZ):** In this matter, a new multi-story Class A office building was designed and constructed as designed for the plaintiff client. Client had advised the engineer and the contractor that they were particularly sensitive to noise and vibration in their work environment. The roof mounted units transmitted both high levels of acoustical and vibration energy through the structural system such that many areas of the building were not acceptable to the owner/client. The remedy proposed and ultimately accepted by the contractor and engineer was to provide vibration isolation roof curbs for the AC units and to insulate the roof structure under the units to create a sound barrier.
- **Alleged Construction Defects in School Construction (AZ):** The rural school district alleged the contractor was responsible for losses associated with hydronic piping that froze and caused flooding in several school buildings following a unique ultra-low temperature event. It was determined that the owner had not properly maintained glycol anti-freeze in the various piping systems and had not maintained proper water flow balance at the various fan coil and water source heat pump units. Represented contractor/defendant, private settlement.
- **Improper Design and Construction of HVAC System in Religious Facility (AZ):** This involved the improper design and poor construction of various HVAC systems retrofitted to in a large existing religious school, sanctuary and meeting facilities. The design was marginal in terms of meeting the needs of the owner, then the contractor substituted AC units of a different manufacturer than the basis for design, resulting in the need to rearrange the layout. In revising the layout, the contractor fabricated and installed improper duct fittings that resulted in unsightly appearance, excessive noise and air pressure drop and overall poor performance. After a protracted mediation process the contractor provided funding for the remedial construction. Represented plaintiff.
- **Electrocution of Service Technician in Air Handling Unit:** This matter was the result of the electrocution death of a service technician working in an air handling unit with an electric resistance heater. The technician came into contact with a live portion of the resistor section of the heater, even though the heater was "off". The manufacturer utilized a heater in the air handler that did not have 3-phase disconnecting contactors, thus allowing one phase of the heating element to be energized, in spite of the appearance that it was off. Product liability and code compliance matter, represented plaintiff, settled prior to trial in 2017.
- **Failure of Domestic Water Piping Systems in High Rise (AZ):** This matter involved the failure of significant portions of the domestic hot water system in a high rise luxury condominium project. Both copper and cast iron fittings in the system experienced accelerated failure as a result of microbiologically induced corrosion (MIC). The biological colonies were generally active in the entire water system, but were most prevalent in sections of the piping (including water storage tanks)

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that operated at low velocities. Remedial design involved replacement of the affected components with more corrosion resistant materials and treatment of the water supply to eliminate biological contaminants at the source. Represented plaintiff in this matter. Settled privately.

- **Carbon Monoxide Exposure (CA):** Evaluation of alleged CO exposure of plaintiff in apartment. Provided calculations of natural ventilation and evaluation of potential CO generation of wall furnace. Evaluated probable concentration of CO feasible as a result of operation of the furnace. Represented defendant owner.
- **Scalding in Hotel Spa (AZ):** Evaluation of cause of failure of spa heater controls that lead to scalding injury of plaintiff. Determined the design of the boiler safety controls (high-limits) were inadequate. Preparation of testing protocols and expert report. Successfully settled in private mediation. Represented plaintiff.
- **Evaluation of Normal Wear and Tear on HVAC Systems (AZ):** This civil litigation involved the allegation of the owner of a manufacturing facility that the former tenant owed a duty to pay for the replacement of HVAC multiple systems due to alleged excessive wear and tear. At trial it was shown that the terms of the lease provided for restoration of the HVAC systems in first class condition, subject to normal wear and tear. Mr. Acorn showed that given the age and use of the facility, the HVAC systems were in such condition. The directed verdict was favorable to the defendant client.
- **Scalding in Therapeutic Tub (AZ):** This matter involved the scalding of the user of a handicap accessible (walk-in) tub in which the user perished. Evaluation of the circumstances of the design of the tub and the installation revealed that the tub did not have a tempering valve to prevent the introduction of excessive hot water temperature into the pool as required by applicable codes. Matter was resolved in favor of plaintiff's heirs in civil mediation. Represented plaintiff.
- **Failed HVAC System – Surgery Center (AZ):** Evaluation of the cause of improper performance of the HVAC systems associated with a gastroenterology procedure facility including inadequate temperature and humidity control. The evaluation included field observations, direction of testing agency, review of test reports, preparation of a summary report and recommendations for remediation. Deposition and testimony at mediation resolved with award to plaintiff client.
- **Failed HVAC Systems in Restaurant (AZ):** This involved the installation of new HVAC systems (split system air cooled condensing units and direct expansion fan coil units) in a high-end restaurant with an adjacent parking structure. The owner/client had experienced the inability of the HVAC systems to adequately cool the occupied spaces, a complaint that had been lodged with both the contractor and the architect/engineer to no avail. Upon site inspection it was determined that the air cooled condensing units had been installed on a lower level of the parking structure, resulting in recirculation of the condenser air and overheating of the units. When confronted with this situation, the engineer recognized the improper nature of the design and installation; however his professional liability insurance carrier did not offer to pay for correction of the problem. After mediation the insurance carrier and the design team paid for the remedial work required to relocate the condensing units.

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INTELLECTUAL PROPERTY DISPUTES – recent projects

- **Data Center Design Trade Secret Violations** (Various US and European venues): This matter involves allegations of breach of trade secret confidentiality by a European plaintiff firm involved in the design and construction of warehouse-scale data centers. The plaintiff complaint alleges several defendants breached confidentiality agreements concerning design and construction processes they allege to be trade secrets including, but not limited to: modular components utilized therein, HVAC air handling systems, temperature and humidity control systems, as well as the method of delivery of the data center. I represent one of the major defendants in this international matter with venue in California. ACS researched prior art with respect to the "Reasonable Ascertainability" of plaintiff's alleged trade secrets. In addition to preparation of an expert report that sought to prove the claimed trade secrets and combinations of trade secrets were both generally known and "readily ascertainable" to practitioners of the art, ACS prepared a rebuttal report. The rebuttal report sought to show that plaintiff's expert's opinions as to the validity of trade secrets lacked merit, in that the subject matter was well documented in trade journals, reference books, or other publications readily available to persons in the design and construction industry. Claims for damages are in the nine-figure range. ACS represents the defendant in this matter. Discovery and investigation is on-going.
- **Air-handling Equipment Patent Infringement:** This matter involves allegations that a large nationally known manufacturer of commercial and industrial HVAC equipment violated patents owned by another manufacture of similar air-handling units designed to dehumidify ventilation air required for a variety of applications. ACS evaluated the claims of the plaintiff and the elements of its patents with respect to prior art and the ability of a person of ordinary skill in the art (POSITA) to either infer from information in the public domain or be obvious to such a POSITA. In preparing an affidavit for presentation to the United States Patent and Trademark Office Patent Trial and Appeal Board, ACS researched prior patents and researched the claims presented in plaintiff's patent and compared those to readily known and previously disclosed. My disclosure showed the challenged claims simply and ordinarily involve combining common air-handling system components used in typical HVAC systems; components long-known in the prior art and that each of the features, configurations and functionality disclosed in the Challenged Claims are found in one or more prior art references and would have been obvious to, or anticipated by, one of skill in the art as of the relevant date. ACS represents the defendant in this matter. Discovery and investigation is on-going.

DESIGN and CODE CONSULTING PROJECTS – representative projects

- **Design and Code Consulting Wafer Fab, Malta NY:** Design and code consulting to the design/build firm and the owner of this world-class greenfield semiconductor manufacturing facility – one of the largest in the U.S. The project involves the main fabrication facility (more than 250,000 SF of cleanrooms), a central utility building, HPM chemical warehouse and other support functions. Code consulting involves the negotiation of alternative method and means (AMM) strategies with the authority having jurisdiction and its third party code and permitting consultant. In addition, the proprietary hazardous materials analysis software of ACS was used to determine compliance with building and fire code limitations on such inventory. Non-litigation, project consultation. 2010.
- **Medical Product Manufacturing Facility (CA):** This project involved evaluation of the design of a large (>200,000 SF) medical product manufacturing facility as proposed by an engineering firm retained by the owner prior to involvement by ACS. Upon technical evaluation, ACS determined the design was inappropriate in terms of its ability to reliably and cost effectively deliver the performance required by the owner. ACS assisted the owner in retaining a replacement engineering firm to redesign the HVAC and process piping systems. ACS acted as the owner's agent to

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collaborate with the new engineering firm to redesign the manufacturing facility and the central utility plant (including cogeneration) that served that facility.

- **Code Consulting - Photovoltaic Manufacturing Facility, Mesa AZ:** this project involved the design and construction of a manufacturing plant of approximately 1,400,000 SF. Challenges from a code compliance perspective included the occupancy classification – a variety of chemicals are used that exceed the aggregate quantity allowed in a non-H occupancy, yet the density of these chemicals was low. The construction type of the building was at issue given the vast size (essentially unlimited area). In addition, fire sprinkler and smoke control systems were at issue as a result of the un-subdivided size of the manufacturing floor (approx. 1,000,000 SF). The project required the development and negotiation of a series of alternative method and means (AMM) strategies that had to be proven viable and code compliant by engineering analysis of the alternatives. The successful development, negotiation and ultimate approval of all proposed AMMs saved this owner many millions of dollars in construction cost.

- **Code and Design Consulting - Sandia National Laboratories – MESA Project, Albuquerque, NM:** Acting as the owner's agent, reviewed the design concepts and proposals of an internationally recognized engineering firm for the MEMS fabrication facility. This assignment involved value engineering, conceptual design, HPM analysis, development of code compliance strategies and overall evaluation of the optimum conceptual design for this project with a total budget in excess of $200 MM. Non-litigation, project consultation.

- **HVAC System Deficiencies in High Schools (AZ):** This engagement was the result of improper design of HVAC system retrofits by a national energy conservation (performance contracting) company. After the retrofits the client had numerous complaints of inadequate cooling as a result of the improper evaluation of the air distribution systems. ACS acted as the owner's agent to address the concerns with the performance contractor and develop and oversee the installation of remedial designs that resulted in dramatic improvement of performance and comfort. Represented school district as owner's agent.

- **ETEC Systems Inc.** (now Applied Materials)**, Hayward, CA and Hillsboro, OR:** The Hayward project involves a 156,000 SF expansion of existing semiconductor mask writing tools manufacturing facility. HVAC systems were designed to provide "exquisite" temperature control ($\pm$0.1 F). The Hillsboro project is a 177,000 SF facility on a green field site with all new utilities and infrastructure. Both projects include tool hook-up and were designed and constructed simultaneously. Projects were delivered utilizing a fast track design/build approach. The approximate total value is $85 million.

- **Code and Design Consulting - Micron Technology Inc., Lehi Utah:** Acting as owner's agent, provided design guidance, value engineering, project delivery consulting and oversight for the design of a 300mm wafer fab. Approximate value of base bid - $150 MM. Non-litigation, project consultation.

- **Code and Design Consulting - Hyundai, Eugene OR: Wafer Fab;** As the liaison between Hyundai and the City of Eugene, negotiated code compliance strategies for this 107,00 SF Class 1 cleanroom with approximately 1,000,000 SF of total area. Acorn also reviewed proposals of the owner's design/build contractor on behalf of Hyundai.

- **Motorola Inc., Mesa, AZ: MOS 21 Wafer Fab** including more than 30,000 SF of Class 10 cleanrooms. Approximately 150,000 SF total project. Team approach allowed customer's First Silicon 10 days ahead of schedule and in record time for a 200mm wafer fab start-up. Some tools installed in new industry benchmark timeframes. Project also involved the design and construction

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of a new central chilled water and steam plant, upgrade of RO/DI water plant, upgrade of wastewater treatment plant and upgrade of campus electrical substation. Approximate project value $80 million.

- **Code and Design Consulting - University of Maryland College Park, Engineering and Applied Sciences Building:** This project involved the design of a semiconductor R&D facility within this new engineering classroom/laboratory building. ACS developed strategies to cost effectively integrate state of the art wafer fabrication facilities into this University teaching and research project with a very tight budget. Non-litigation, project consultation.
- **Facility Life Safety Systems Analysis, Confidential Client, Santa Clara, CA:** This study for a manufacturing client in the Santa Clara area was conducted as a pro-active approach to assess the proposed design of a new facility with respect to compliance with industry standards for environmental, health and safety matters. The proposed facility will utilize a wide variety of potentially hazardous materials (liquids and compressed gases). The study compared the proposed facility design to national building and fire codes as well as to industry standards for such facilities. Recommendations for improvements were provided.
- **Micron Technology Inc., Lehi Utah:** Owner's agent providing design guidance, conceptual design services and value engineering for the design and construction of a prototypical test facility for semiconductor products. Approximate value of base bid - $45 MM.
- **Medtronic, MicroRel, Wafer Fab Expansion, Tempe, AZ.:** Owner's agent developing conceptual design strategies and cost estimates for the phased expansion of wafer fab capacity.
- **Evaluation of Manufacturing Facility Humidity Control Failure, Confidential Client, Phoenix AZ:** Evaluation of the cause or humidity control failure of this new wafer fabrication facility designed by an international engineering firm. The evaluation included field investigation of the existing facility and HVAC systems for the cleanroom, development and supervision of in-situ field testing and quantitative analysis of a variety of potential retrofit opportunities. Evaluation of potential remediation options conducted from the perspective of implementation cost, feasibility of retrofit in an operational factory and energy cost implications of each option.
- **SGS-THOMSON Microelectronics**, Inc., Rancho Bernardo, CA: 6" Wafer Fab Expansion and Upgrade, including project management for a 25,000 SF Class 10 fabrication area, 10,000 SF Class 10,000 test area, 30,000 SF Class 10,000 subfab, and a 10,000 SF central utility and HPM Support Facility. Approx. value $30 million**.**
- **Motorola Inc., Phoenix, AZ: Wafer Fab Expansion Feasibility Study and Facility Audit**; Code Compliance Strategies Evaluation. These studies preceded the COM 1 wafer fab constructed at the 52nd Street plant.
- **Motorola Inc., Chandler, AZ: MOS 12 Wafer Fab** with over 200,000 SF of Cleanroom Spaces, Chemical and Gas Storage Areas, Central Utility Plant and Large Office Building. AEC responsible for HVAC systems and coordination of all infrastructure systems. Approx. value of systems designed $25 million.
- **Motorola Inc., Tempe, AZ: CS-1 Gallium Arsenide Wafer Fab** Pilot / R&D Facility. This project was developed in two phases and includes a total of 20,000 SF of class 10 Cleanroom. Approx. value $40 million.
- **IBM Corporation, Tucson, AZ:** Cleanrooms and Laboratories for a variety of R & D and manufacturing operations. Facilities and infrastructure upgrades.
- **Silicon Systems, Inc., Santa Cruz, CA:** Design and Construction Management for 6" Process Tool Hook-up for Wafer Fab. Approx. value $12 million.

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- **Symbios Logic Wafer Fab Renovation and Expansion, Colorado Springs:** This project was developed in support of a new technology manufacturing operation. The renovation included upgrade of central utility capabilities (chilled water, scrubbed exhaust, power distribution, etc.) while the adjacent wafer processing facility continued to operate. Mini-environment technology utilized to accommodate process tools. Project was accomplished by AEC under a fast track, design/build approach. Approx. value $16 million.
- **Motorola Inc., Mesa, AZ: MOS 6 Class 10 Wafer Fab** renovation and expansion. This total renovation of the existing fab involved the reconstruction of the building shell and complete re-construction of the fab for early DRAM manufacturing. Completed in an expedited manner utilizing partnered contractors and advanced construction management techniques. Approx. value $30 million.
- **Motorola Inc., Mesa, AZ: BP-3 Wafer Fab** renovation and upgrade to improve product yield and facility reliability. Involved the renovation of HVAC, process piping and electrical systems. In addition, a new submicron, photolithography facility was created. Approx. value $15 million.
- **Motorola Inc., Mesa, AZ: Chilled Water Plant** - analysis and design of complete renovation of 12,000 ton central chilled water generation plant. Primary/secondary pumping and substantial energy conservation were achieved. The renovation and re-piping of the plant was accomplished while the cooling loads continued to be served, without interruption of delivery to all critical loads. Approx. value $5 million.
- **Motorola Inc., Austin, TX: MOS 3 Stepper Expansion and HPM Facility** - design and construction of critical manufacturing space including submicron advanced lithography process. Code compliance evaluation and subsequent development of HPM storage and dispense facility for liquids and gases. Approx. value $15 million.
- **Northern Telecom, Rancho Bernardo, CA:** Wafer Fab Analysis, Master Planning and renovations of operating wafer fab facility. Included the development of Implantation facility in a former storage facility. Approx. value $18 million.
- **W.L. Gore Associates - Medical Products Division, Flagstaff, AZ:** Design of facility upgrades and expansions including renovations and upgrades to the manufacturing and support operations over a period of more than 10 years. Facilities included cleanrooms and other manufacturing and R&D operations for specialty medical products and devices.
- **St. Joseph's Hospital, Phoenix, AZ:** Energy Analysis; Retrofit Design; Master Planning of HVAC, Electrical and Utility System Capital Expenditures, etc. This comprehensive evaluation involved the engineering analysis of more than 50 air handling units and the related chilled water and steam central plant for a large hospital in Phoenix, AZ. The purpose of the study was to determine the optimum means to retrofit or replace the various air handling and central plant components to enhance reliability and reduce energy costs. The study evaluated a variety of options ranging from low cost "quick fix" to complete replacement. Evaluation of alternatives was based on their ability to meet the functional requirements of the hospital, enhance reliability and reduce energy cost. All options were simulated with software programs developed by Acorn Engineering. The results of this study were utilized by the hospital to obtain matching energy grant funding and as a roadmap for the refurbishment of the HVAC systems, some of which were more than 30 years old.
- **Agricultural Research Laboratory - University of Arizona, Tucson, AZ:** 121,000 SF Agricultural Research Lab and Training Facility on eight levels. Design of the HVAC, process piping and fire protection systems for this cutting edge research facility. Systems included extensive fume hood exhaust, energy recovery, adiabatic cooling assist and variable volume temperature and pressure control schemes. Approx. value $25 million.

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WORKSHOPS, SEMINARS AND ACADEMIC COURSES:

Mr. Acorn has presented numerous seminars and workshops (varying in length from two hours to three days) including the subjects of Forensic Engineering, Hazardous Occupancy Code Compliance, technical subjects (such as thermodynamics, air handling and distribution, environmental control systems, hydraulics, etc.) related to the design of advanced technology manufacturing and research and development facilities. Representative activities and presentations include:

- ***Purdue University***, West Lafayette, IN: Invited lecturer presented seminar "Forensic Analysis of Design and Construction of HVAC Systems by a Consulting Engineer", 2018.
- ***Arizona State University***, Tempe, AZ: Adjunct Instructor associated with the development of curriculum for graduate level course Con 598 ***"Design and Construction of Cleanrooms"*** in the Del E. Webb School of Construction, College of Engineering. Instructs in the area of cleanroom design, contamination control theory and strategies for HVAC systems and overall facility organization. In addition, Bill teaches the module "Code Compliance for Hazardous Occupancies". 2002- 2011.
- ***Intel Project Manager Development Program (PMDP)*** – 2006 – 2014. Through association with ASU, instruction and team development leader for facilities design and construction project managers for Intel. This is a combined distance learning and one week hands-on workshop to develop the analytical and problem solving skills of new project managers for advanced technology facilities worldwide.
- ***University of Arizona, Tucson, AZ:*** Adjunct Instructor in a team teaching program for AME 442 – Fundamentals of Environmental Control Systems. This course has been delivered in the AME department by the team since 2008.
- ***SESHA 2015*** – International High Technology ESH Symposium & Exposition, May 2015 – ***Keynote Speaker*** – Litigation of Worker Health Issues – Lessons Learned.
- ***Forensic Engineering Analysis of HVAC Systems – Why HVAC Systems Go Wrong*** – presented at the National Academy of Forensic Engineers Summer Seminar, Arizona. 2011.
- ***SESHA/IHTESH 2011 Symposium*** – **Disaster Preparedness Roundtable** – presented discussion of several large losses incurred by semiconductor and similar advanced manufacturing clients that resulted not only in business interruption, but significant out-of-pocket expenses. Case studies addressed: 1. Fire in wafer fab – catastrophic losses, business interruption, lengthy litigation, 2. Fire in flat panel display manufacturing facility catastrophic losses, business interruption, lengthy litigation, 3. Chemical leak in wafer fab -catastrophic losses, business interruption, lengthy litigation, 4. Alleged unsafe environments in wafer fabs result in employee claims and protracted lawsuits.
- ***Peer Review vs. Litigation Consultant Services for Your Project*** – Seminar presented by Mesch Clark Rothschild to construction industry attendees – owner, contractors and design professionals. 2010.
- ***Intel Code Compliance Workshop 2010*** – conducted under the auspices of ASU Del E. Webb School of Construction and CREATE, this two day workshop provided insight into the current International Codes and practical applications in large modern wafer fabs and similar facilities that frequently require alternative methods and means (AMM) compliance strategies.

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- ***Avoiding Litigation in Design and Construction*** – presented to ASHRAE Tucson Chapter in conjunction with Mel Cohen, Esq. Discussion of teaming and contractual methods of preventing design and construction disputes that lead to litigation. 2007.
- ***Project Management for Advanced Technology Facilities*** – via ASU and CREATE, July, 2004 - on site lectures and web based continuing education workshop.
- ***Eminent Scholar in Cleanroom Design,*** 1997 - "Expediting the Delivery of Advanced Technology Factories". Arizona State University, Tempe, AZ - graduate course on cleanroom design and construction in the Del E. Webb School of Construction, College of Engineering.
- ***University of Wisconsin, Milwaukee***: Course Leader for ***"Code Compliance for Advanced Technology Facilities"*** seminar based upon his textbook of the same name. This two-day course was held several times a year between 1995 and 1998 at locations around the country and was attended by designers, builders and owners of advanced technology facilities. Mr. Acorn was an Adjunct Professor through the UWM Center for Continuing Engineering Education.
- ***Texas Instruments*** (Dallas Texas) – "Code Compliance for Hazardous Occupancies" May and June, 2000.
- ***Arizona State University*** – Cleanroom Construction Workshop – featured lecturer in this one week workshop for industry and academia, sessions presented are "Environmental Systems (HVAC)" and "Code Compliant Design of Hazardous Cleanroom Facilities" – presented twice a year – 1996 through spring 2000.
- ***Micron Technology Inc.*** – Project Management and Delivery Systems Workshop – four day workshop for private client at Lehi Utah site. July 2001.
- ***Semiconductor Safety Association*** International Symposium – professional development course – "Building Codes and Standards for Environmental Health and Safety Professionals" – New Orleans, April 2001.
- ***"Creating a Safer Working Environment in Clean Manufacturing Facilities"*** - Cleanrooms East 2000.
- ***Decommissioning an Advanced Technology Manufacturing Facility, Concepts for Demolition of Re–use*** - Cleanrooms East 2000
- ***Cleanrooms West 1998*** – Environments for Tool Manufacturing – "How to design and build more effective environments for the manufacturing of process tools".
- ***"A New Project Delivery Paradigm - Getting to Market Faster through Rational Teaming"***- CleanRooms West '98.
- ***"What we Need to Do Now - A New Paradigm in Capacity Enhancement Strategies"***- CleanRooms West '97.
- ***Intel Corporation (Albuquerque, Chandler and Hillsboro)*** – "Code Compliance for Hazardous Occupancies". Several sessions 1995 to 1998.
- ***Motorola, Austin, Mesa and Phoenix*** – "Code Compliance for Hazardous Occupancies". Several sessions 1992 to 1995.
- ***Motorola***, Mesa, AZ - HVAC System Design Considerations – 1990.
- ***Hewlett-Packard (San Jose, Corvallis Oregon)*** – "Code Compliance for Hazardous Occupancies". Several sessions 1996.

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- ***Atmel*** (Colorado Springs) – "Code Compliance for Hazardous Occupancies". Several sessions 1995 to 1998.
- ***IESH***, International Conference presentation of paper on "Energy Conservation Opportunities in Advanced Technology Factories" – May 1996.
- ***Northern Telecom (Rancho Bernardo and Ottawa)*** – "Code Compliance for Hazardous Occupancies" - 1993.
- ***Austin Major Facilities Users Group - SEMATECH***, Advanced Micro Devices, Motorola, IBM, MCC, Texas Instruments- "Code Compliance for Hazardous Occupancies" - 1994.
- ***San Diego County Fire Prevention Officers Section*** – "Code Compliance for Hazardous Occupancies".
- ***University of Arizona***, Tucson, AZ: Visiting Lecturer in the College of Architecture. Developed and presented curriculum and studies in the field of fundamentals and design strategies for ***HVAC Systems*** in buildings. Taught senior-level class part-time from 1974 to 1983. Approximately 100 students per semester.
- ***American Society for Heating, Refrigerating & Air Conditioning (ASHRAE)*** - Numerous technical seminars including duct design, acoustics, energy conservation, automation and controls, thermodynamics, psychometrics, hydraulics, air distribution, etc.
- ***Energy Conservation in HVAC System Design and Operation*** - National Society of Professional Engineers (NSPE) Tucson, AZ chapter.
- ***"Evaluation of Failed HVAC Systems"*** - National Academy of Forensic Engineers (NAFE) – annual conference.
- ***"How To Build Cleanrooms Fast"*** - CleanRooms West '95.
- ***"Code Compliant Design of Hazardous Occupancy Facilities"*** - CleanRooms West '93.

PROFESSIONAL ORGANIZATIONS:

- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) – ***Fellow*** (status reached by less than 1% of members), Past Treasurer College of Fellows, past President of Tucson Chapter
- National Society of Professional Engineers (NSPE)
- National Academy of Forensic Engineers (NAFE) ***Board Certified Diplomate***
- Forensic Expert Witness Association (FEWA)
- Tau Beta Pi, National Engineering Honorary Society
- National Association of Corrosion Engineers (NACE International)
- Alliance for Construction Excellence (ACE) – Arizona State University, Tempe, AZ.
- American Consulting Engineers Council (ACEC)

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AWARDS AND PATENT:

- Mr. Acorn holds a U.S. patent for a unique, linear control damper widely used in the cleanroom industry for the management of process air flow.
- Valley Forward "Award of Merit" for Environmental Excellence - Motorola MOS 21 wafer fab, Mesa Arizona. 1998
- Arizona Consulting Engineers Association's "Outstanding Technological Achievement Award" for Design of AFC 1000 Flow Control Damper, 1992
- Arizona Consulting Engineers Association's "Technical Excellence Award for Mechanical Engineering" for Motorola's MOS 12 Wafer Fab Facility in Chandler, AZ, 1991
- Arizona Consulting Engineers Association's "Technical Excellence Award for Mechanical Engineering" for Motorola's MOS 6 Wafer Fab Facility in Mesa, AZ, 1988
- Electric League's "Energy Efficient Building Award" for Motorola's Wafer Fab Facility in Mesa, AZ, 1988
- Electric League's "Energy Efficient Building Award" for AEC's office building, 1987

PUBLICATIONS:

- **Code Compliance for Advanced Technology Facilities** - A Comprehensive Guide for Semiconductor and Other Hazardous Occupancies. 1993, Noyes Publications – considered the pre-eminent text used by industry worldwide. Library of Congress catalogue number: 93-28549. ISBN: 0-8155-1338-0.
- **Semiconductor Safety Handbook - Chapter 9**, "Building and Fire Codes Impacting the Semiconductor Industry" - edited by Richard A. Bolmen, Jr., 1998, Noyes Publications. Library of Congress catalogue number: 97-24032. ISBN: 0-8155-1418-2.
- "Environmental Controls for Tool Mfg. - Environmental Control Strategies for Production Tool Manufacturing Environments", Proceedings - CleanRooms West, '98
- "A New Project Delivery Paradigm - Getting to Market Faster through Rational Teaming", Proceedings - CleanRooms West, '98
- "Total Energy Management for Wafer Fabs", Visions 1997
- "Total Energy Management Strategies for Wafer Fabs", 1996, IESH
- "Commitment - The Key to Growth and Prosperity," 1996, Visions
- "Facilities System Start-Up & Commissioning - How to get the most of your investment", Visions 1996
- "How Do You Build Cleanrooms Fast," Proceedings - CleanRooms West '95
- "Forensic Engineering Evaluation of Failed HVAC Systems," Journal of the National Academy of Forensic Engineers, December 1990

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EDUCATION AND PROFESSIONAL QUALIFICATIONS:

University of Arizona - Bachelor of Science "With Distinction" in Mechanical Engineering, 1971. Inductee to Tau Beta Pi National Engineering Honorary Society.

Bill is a visiting lecturer at the Arizona State University Del E. Webb School of Construction in Tempe, AZ. In addition, he is an advisor to CREATE, ACE the Alliance for Construction Excellence and the IAB – Industry Advisory Board all affiliated with ASU.

As a visiting lecturer in the Department of Mechanical Engineering at the University of Arizona, Bill lectures on the analysis and design of environmental control systems (HVAC) for buildings.

In addition to teaching, he remains current and hones his skills by attending a wide range of technical and managerial seminars and workshops to update his technical expertise.

Professional Mechanical Engineer; registered in the States of Arizona, California, Colorado, Illinois, New Mexico, New Hampshire, Nevada, Oregon, Texas, Utah and Washington. Bill is also registered with the National Council of Examiners for Engineering and Surveying NCEES (Certificate No. 6999).

He has been recognized for technical achievements, innovation and foresight by peers, associates and clients, and has achieved the status of ***Fellow*** in the industry-leading professional organization, ASHRAE.

Board Certified Diplomate in Forensic Engineering granted by the National Academy of Forensic Engineers (NAFE).

EMPLOYMENT HISTORY:

- **Acorn Consulting Services, LLC** – 1999 to Present – Founder and Principal Engineer. Consulting practice involves the evaluation of new and existing facilities with respect to adaptive reuse, strategic planning, conceptual design and design/peer review as owner's agent. Training services include seminars, workshops and short courses for Arizona State University, University of Arizona and private clients on the subjects of code compliance for hazardous occupancies, HVAC system and cleanroom design for advanced technology facilities and expediting project delivery. Forensic engineering and litigation consulting services include the evaluation and consultation with respect to failed or marginally performing facility systems, compliance with codes and standards and standard of care of design and construction professionals. Clients include; AMD, American Campus Communities, Applied Materials, Applied Medical Resources, Arizona State University, Department of Defense, Emerson, Etec Systems, Factory Mutual, Foster Wheeler International, Freescale Semiconductor, FUJIFILM USA, GLOBALFOUNDRIES, Intel Corp., International Rectifier, Lawrence Livermore National Laboratories, M+W USA, Medtronic Micro-Rel, Micron Technology, Motorola, Northrup Grumman, Northern Arizona University, NXP Semiconductor, On Semiconductor, Raytheon, Sandia National Laboratory, Texas Instruments, Trane, University of Arizona, University of Maryland, University of Texas, various school districts and various national defense and plaintiff attorneys including; Bingham McCutchen, Clausen Miller, Dickenson Wright, Fennemore Craig, Greenberg Traurig, Jones Day, Lewis Roca Rothgerber Christie, Norton Rose Fulbright, Polsinelli, Procopio, Primmer, Snell & Wilmer, among many others.

- **Arizona State University** – 1996 to 2011 – Visiting Lecturer, College of Engineering, Del E. Webb School of Construction. Lecture on HVAC system design, cleanroom design and contamination control, code compliance and project delivery approaches for advanced technology facilities. Also

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provide short courses to industry engineers and project managers in the same subject areas. Served as ***Eminent Scholar*** in Cleanroom Design, 1997, a graduate level summer seminar.

- **University of Arizona** – 2007 to 2012 – Visiting Lecturer, College of Engineering, Mechanical Engineering Department – HVAC Systems. Team teach introduction to Environmental Control Systems – AME 442 – senior level, approximately 25 students per semester.

- **Acorn Engineering and Consulting** – 1980 to 1999 – Founder and Principal Engineer. Consulting Engineering firm that grew to two offices (Tucson and Phoenix) with satellite offices in Austin, TX and San Diego, CA. Firm began as a mechanical engineering practice involved in HVAC and Plumbing system design for commercial, institutional and industrial projects. Firm evolved to add electrical engineering and for a brief period architectural services. Practice from approximately 1984 to 1999 almost exclusively involved in the analysis and design of manufacturing and related facilities for semiconductor and other advanced technology companies as a prime professional wherein AEC was responsible for all aspects of the project design and development of construction documents, including limited construction management services. Clients included; Allied Signal, Atmel, Etec Systems (Applied Materials), Hyundai, IBM, Intel, Medtronic Micro-Rel, Microchip Technologies, Micron Technology, Motorola, National Semiconductor, Northern Telecom, SGS Thompson, Symbios Logic, Universities, Hospitals, among others.

- **RGA Consulting Engineers** – 1978 to 1980 – Chief Mechanical Engineer and Vice President. Started mechanical engineering department in a civil and structural engineering firm. Responsible for all aspects of the department from hiring and training of technical staff to development of technical standards. Developed or consulted with design staff on conceptual designs, development of construction documents through construction administration services including final acceptance and start-up. Clients included Corps of Engineers, Department of Navy, Department of Energy, IBM, Burr Brown Research Corp., W.L. Gore Manufacturing, Universities, local architectural firms, mining companies, etc.

- **University of Arizona** – 1974 to 1983 – Visiting Lecturer, College of Architecture. Retained to teach the HVAC segment of the building systems course to 3rd year architecture students. Developed course curriculum. Approximately 100 students per semester.

- **Shipley & Associates Engineers** – 1973 to 1978 – HVAC Engineer and Vice President. As a design engineer, was responsible for calculations, selection of systems and components and development of control strategies for HVAC systems for a variety of commercial, institutional and industrial projects. Registered as a Professional Mechanical (by examination) July 1976. Progressed to the position of Vice President responsible for technically challenging design projects from concept development through project start-up. Clients included Corps of Engineers, Department of the Navy, local architects, Universities, semiconductor and other advanced technology companies.

- **Texaco Incorporated** – 1971 to 1972 – Power Engineering Department, Wilmington California Refinery. Mr. Acorn's first position post-graduation from the University of Arizona as an Engineer-in-Training, involved the evaluation of process units at the Wilmington refinery including heat exchanger and pump applications for viscous hydrocarbon materials, energy conservation projects, pollution abatement projects and application of industrial control systems.

- **University of Arizona** – 1970/71 – Engineering Experiment Station, as a student Engineer-in-Training, Mr. Acorn was responsible for a contract with Krueger Manufacturing Company. This was a part time position while a full time student in the College of Engineering.

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