Vinod Sharma

PE, MS, MBA, CFSE

Senior Managing Consultant

Mr. Vinod Sharma is a licensed professional engineer with over 35 years of experience in mechanical engineering, design analysis, research & development, forensic investigation, and litigation support. He has deep experience with valves/process equipment and mechanical systems that include those used in O&G (up/mid/downstream), Liquefied Natural Gas (LNG) liquefaction/regassification, petro-chemical plants, and gas transmission/distribution pipelines; steam and gas power generation plants; bulk transportation of hazardous chemicals via marine vessels, river/ocean barges, railroad tank cars, tanker trucks; water/wastewater treatment facilities; belt conveyors for aggregate/bulk material handling, and buildings HVAC, plumbing/tubing, appliances/gas service.

He has extensive hands-on experience with piping systems and is intimately familiar with application of valves, pumps, compressors, turbines, steam boilers, heat exchangers, tanks, filters, flanges, gaskets and seals, and instrumentation and control systems. Mr. Sharma has used advanced analytical software and detailed computer-based analysis and testing tools, including those for non-intrusive diagnostics and flow measurements, SCADA, DSP, Computational Fluid Dynamic (CFD) analysis, Finite-Element Analysis (FEA). He also has broad experience with evaluating requirements of Codes & Standards (ASME/API/ANSI/NFPA/ AWWA/ISA/MSS) and evaluating condition monitoring programs at Utilities to enhance safety, integrity, and reliability.

Mr. Sharma draws on this dual background in failure root cause and risk & reliability to holistically characterize components' influence on their system, as well as the system's influence on its components at key life cycles stages, such as specification, selection, design, manufacturing, construction, installation, commissioning, operation, inspection, maintenance, decommissioning. He assists clients with addressing complex and often multidisciplinary investigations involving equipment failures, loss-of-containment accidents, product liability, product recall, construction disputes, intellectual property claims, technology assessments, and business process improvement.

Contact Information

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Areas of Specialization

- Mechanical Engineering
- Valves & Process Equipment
- Industrial Process Systems
- Transportation – Rail, Road, Marine
- Power Generation
- Oil, Gas, Petrochemical – upstream, midstream, downstream, onshore/offshore
- Utilities – Transmission and Distribution Pipelines
- Water/Wastewater Treatment
- Risk and Reliability
- Mechanical Design/Intellectual Property
- Expert Witness Testimony

Education

MBA Executive MBA, The University of Texas. 2002

MS Mechanical Engineering. University of Houston. 1988

BTech Mechanical Engineering. Indian Institute of Technology, Madras. 1985

Licenses & Certifications

State of California P.E. License 33438

State of Texas P.E. License 82758

National Council of Examiners for Engineering & Surveying ID 22-277-38

Languages

- English, Hindi

Positions Held

Engineering Systems Inc., Irvine, CA

- Senior Managing Consultant, Mechanics, September 2021 – present

Exponent Inc., Oakland, CA

- Senior Managing Engineer, Mechanical Engineering, July 2017 – August 2021

Exponent Failure Analysis Associates, Inc., Houston, TX

- Senior Managing Engineer, Mechanics and Materials, January 2006 – July 2017

Kalsi Engineering, Inc., Sugar Land, TX

- Director, Business Development, 2003 – 2005
- Senior Consultant/Specialist, 1999 – 2002
- Project Manager/Consultant, 1996 – 1999
- Project Lead Engineer, 1992 – 1996
- Staff Engineer, 1988 – 1992

Continuing Education

Certified Functional Safety Expert (CFSE) for safety lifecycle per IEC 61511 (process)

Professional Affiliations/Honors

American Society of Mechanical Engineers (ASME)

- Member
- ASME Codes & Standards Verification, Validation and Uncertainty Quantification (VVUQ) Committee — Member
- ASME Codes & Standards VVUQ Sub-committee on Computational Modeling and Simulation of Energy Systems – Member and Former Chair and Vice Chair
- ASME Codes & Standards, Certificate of Recognition, 2009

Nuclear Industry Check Valve Group

- Award for contributions – 2004
- Award for contributions – 2000

Project Experience

Investigations

Failure Prevention

Mr. Sharma is a Certified Functional Safety Expert (CFSE) for safety lifecycle per IEC 61511 (process) and has facilitated numerous Process Hazard Analyses (PHA), Hazard Identification (HAZID), Hazard and Operability (HAZOP), Job Hazard Analysis (JHA), Failure Mode, Effects, and Criticality Analysis (FMEA/FMECA), Pre-Startup Safety Review (PSSR) evaluations for Floating Production Storage and Off-loading (FPSO), LNG plants and gas transmission and distribution systems. He is a member of ASME Codes and Standards VVUQ 60 subcommittee on Verification and Validation of Computer Modeling in Energy Systems and formerly served as Vice Chair and Chair. He has performed structural and fatigue analysis of down-hole tools and has designed components for the drilling industry. Mr. Sharma has developed procedures, selected instrumentation, managed significant industry research and development (R&D) test programs and taught courses on wear and fatigue analysis and failure prevention.

Failure Analysis

Mr. Sharma has investigated fluid flow control and loss prevention issues in a wide range of applications that span oil & gas onshore and offshore upstream, midstream, and downstream production and processing facilities including Floating Production Storage and Offloading (FPSO) ships, Liquefied Natural Gas (LNG) plants and sub-sea pipelines, domestic and international power plants, refineries, and chemical plants. Also, loading/unloading systems on tank trucks, rail cars and marine vessels; mechanical equipment in manufacturing plants; residential and commercial building plumbing, HVAC, irrigation, water reclamation, and fire protection systems and appliances.

The hydraulic and pneumatic components have included installations in electric power plant turbine steam systems: fire protection, effluent, gas, hot water, hazardous substance distribution, and steam supply systems;

tugs, barges, FPSOs, ships and offshore platforms; railway tank cars and aircraft; LNG pipelines; and at refineries and petrochemical plants.

These evaluations have helped examine observed or expected in-situ fluid-structure interaction-based response and frequently required a comprehensive examination of not only the artifact component, but also the system in which it was installed, interfacing hardware, instrumentation, control software, operating data, procedures, and maintenance records. Artifact components included valves, seals, gaskets, flanges, packing, actuators, bolts, clamps, fittings, tanks, separators, filters, pumps, compressors, heat exchangers, piping, insulation, etc. The evaluations required a consideration of Recognized and Generally Accepted Good Engineering Principles (RAGAGEP), including applicable industry guidance such as the Code of Federal Regulations 10CFR50 Appendix B; Electric Power Research Institute (EPRI) guidelines, and American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA) requirements in the verification and validation of safety related analytical software, and Codes, Standards and recommended practices developed by professional organizations including API, ANSI, ASME, ASTM, ASSE, AWWA, ISA, MSS, NFPA to evaluate operation and maintenance issues, fabrication, and design defects. The following are a few exemplar assignments:

Oil and Gas - Upstream

- LNG pipeline network design assurance equipment reliability peer review
- LNG pipeline monolithic isolation joint technology assessment
- Hydraulic fracturing iron failure - evaluation
- Separator explosion from stuck relief valve at gas well site - examination and testing
- Salvaged jack up drilling rig - examination and condition assessment
- Casing jump-out at gas well - thread examination and condition assessment
- Bottom hole assembly (BHA) reamer design review

Oil and Gas - Midstream

- Gulf of Mexico South Marsh subsea ball valve examination and condition assessment in matter involving an explosion and sinking of a dive support vessel
- Oil terminal API650 tank corrosion investigation
- Gas pipeline compressor station discharge check valves failure investigation
- Pressure regulating ball valve failure at oil terminal - investigation
- Gas pipeline compressor station compressor and turbine unit failure investigation
- Fire at NGL process plant ascribed to leak at valve flange - evaluation

Oil and Gas - Downstream

- Refinery explosion - examination of failed drain valve

- Refinery - examination and condition assessment of failed gas turbine
- Refinery fire attributed to wall thinning - corrosion assessment
- Self-contained breathing apparatus (SCBA) fitting assessment
- PSSR at LNG plant

Utilities

- Palo Verde nuclear station wide review of emergency core cooling system check valves
- Ginna nuclear station residual heat removal pump vibration root cause analysis
- Gas compressor and combustion turbine failures - examination and condition assessment
- Explosion at coal power plant from failure of steam trip and throttle/ valve and governor - investigation
- Investigation of oil spill in river associated with a secondary containment drain valve
- Investigation of a catastrophic structural failure of stacker/reclaimer at a coal fired power station
- Assessment of valve and pump programs at various nuclear power stations
- Evaluation and testing of slam shut devices installed in low pressure gas distribution stations

Municipal Water/Wastewater Treatment

- Investigation of leak past insulating gasket on large diameter butterfly valve at a municipal water distribution facility
- Evaluation of failures of flapper valves installed on residential laterals to LP sewer systems
- Assessment of conveyors, valve/actuator failures at wastewater reclamation facilities
- Inspection of equipment failures at a storm water reclamation, flooding abatement storm water pumping, and combined sewer overflow facilities
- Root cause analysis of flooding at membrane filtration plant

Marine/Transportation

- Tugboat engine room fire caused by diesel spray from duplex filter - root cause analysis
- Hydraulic steering control valve failure in a vessel collision related injury - examination and condition assessment
- Submarine check valve test data assessment to support design and development
- Liquid oxygen (LOX) system ¼" regulator on a medical helicopter - root cause analysis
- Hazardous chemical rail tank car loading and unloading system, valves, and fittings - analyses
- Cargo and ballast system valves on a 260,000 BBLs ocean-going petroleum barge - examination and condition assessment
- Bulk material handling system in a rail car unloading pit - sizing and structural failure analysis

- Acid tank truck unloading system release at mine - hose fitting design analysis, laboratory, and flow loop testing

Industrial

- Chemical process plant manual butterfly valve failure analysis
- Failure of crimped chemical hose during transfer from tanker truck - assessment
- Nitrogen contamination of building air system at a missile manufacturing plant - root cause investigation
- Fouling of steam system in paper mill from valve failure - assessment
- Pigging station caustic release at pig-launcher in soap factory - failure investigation
- Metal seated gate valve on a 96" pipeline to feed water to rocket engine test stands - assessment
- Clear dry air system fire at semiconductor manufacturing site - root cause investigation

Food/Pharmaceutical

- Acid spill from Fiberglass Reinforced Plastic (FRP) pipe joint separation - root cause analysis
- Chemical spill from double walled tank – analysis
- Contamination of infant formula related to failure of a pneumatic butterfly valve - root cause analysis
- Self-priming pump steam release at hog farm - failure investigation
- Solenoid valves used in steam sterilizers and cookers - failure investigation
- Residential icemaker and commercial refrigeration valves - design assessment and testing
- Spill of hazardous chemical from double walled poly tank used for bulk storage at fertilizer plant – assess fitting and system

Commercial Buildings

- Hospital mechanical room equipment damage caused by a safety relief valve - examination and condition assessment
- Fatality at assisted living center attributed to a faulty mixing valve - root cause analysis
- Noisy shower and tub valve in a newly constructed apartment complex - trouble shooting
- Role of dry sprinkler valves in flooding damage to a dormitory - experimental validation
- Scalding injury in hospital hot oil heater thermowell failure - root cause analysis
- Elastomeric expansion joint failure in building emergency hot water system - root cause analysis
- HVAC pump failure in a high-rise building - examination and condition assessment

Residential

- Role of gas appliance stop valves in explosions - root cause analysis

- Effluent contamination at multiple custom homes caused by freezing in septic system - failure analysis
- Gas service head adapter polyethylene pipe separation - root cause analysis
- Water filter casing water hammer related failure - root cause analysis
- Refrigeration system valve freeze failure - testing
- Water treatment system failure related to water damage in high rise - root cause analysis
- Hurricane & windstorm damage to HVAC equipment at apartment complexes - assessment

Mechanical

- Slewing gear failure on crane style rig long boom roof car external building management system – independent investigation and assessment.
- Hydraulic powered flight simulators at Air Force Base - assessment of engineering, procurement, and construction
- Horizontal earth boring machine accident - root cause investigation
- Chiller failure at hydraulic fracturing site - root cause analysis
- Bulk material handling system structural failure at silica sand processing plant- examination and condition assessment
- Dump truck tarp system failure - root cause analysis

Intellectual Property

- Home appliance patent infringement claim review
- Misappropriation of trade secrets and false advertising related to fast depressurization systems used on power transformers – assessment of technology and competing prototype
- Misappropriation of trade secrets related to luminaire support system - review of product lines, production, and marketing techniques
- Validity of patent on polymeric seal for hydraulic fracturing pumps - review of technology, product lines, and production technique

Risk and Reliability

- Facilitated numerous Hazard Identification (HAZID) and Hazard and Operability (HAZOP) analyses in the Pre-Front End Engineering Design (FEED), FEED, execution readiness and detailed engineering and decommissioning phases of projects associated Floating Production Storage and Off-loading/Floating Production Unit (FPSO/FPU) conversions and retrofits:
    - HAZID/HAZOP studies of FPSO marine systems, disconnectable turret operations, topsides process modules
    - HAZID study for FPSO turret disconnection reconnection

- HAZID/HAZOP study Hydrogen Sulfide (H2S) Removal Flooded Tower Package
- HAZID/HAZOP studies for subsea well tieback to offshore production platform and MOC closeout
- HAZID/HAZOP studies for subsea well cleanup/flowback
- Hazard Identification and Risk Assessment (HIRA) for critical lift(s) to and from offshore production platform
- HIRA for subsea flowline pre-commissioning
- HAZID for boarding shut down valve (BDSV) replacement peer review/HAZID
- Simultaneous Operations (SIMOPS) planning and HIRA for offshore production platform shut-in/turnaround
- HAZOP study for ethylene vinyl acetate/low density polyethylene plant mechanical utilities
- FMEAs for regulating stations, valves and slam shuts used for gas transmission and distribution
- Detailed system- and component-level failure-mode-and effect analysis (FMEA) evaluations of over 3,700 valves to screen operating systems and valves based on role in assuring personnel safety and nuclear plant reliability

Multidisciplinary Assessments

- Managed and contributed to a third-party independent assessment of cracking of a bilge keel on an FPSO. This project comprised of integrating assessments and inputs from several disciplines including naval architecture, structural engineering, metallurgy, fatigue, fracture mechanics, risk and reliability.
- Managed an independent review of the capability of a fabrication shop to simultaneously construct an extra module, in addition to the one planned for an offshore drilling platform. This study examined the production risks, scheduler risks and safety risks associated with the side-by-side construction of two modules on a critical path to meet a weather dictated module deployment window. Inherent constraints considered included those imposed on account of sharing fabrication, quality control, material handling and human resources within the available indoor production space and ramping up production at a brown field idled facility with the need to hire suitable production crews.
- Served as the Project Manager for an independent evaluation of various internal apparent-cause and root-cause analyses for determining the source of unreliability in reactor recirculation pump seals installed at various boiling water reactors in the Exelon Corporation's nuclear plant fleet. The results of this study, presented to senior corporate management, provided feedback on the root-cause analysis results and suggested process and equipment improvements.
- Served on a design assurance team assigned to perform a peer review of design documents for a West African natural gas pipeline being developed by a consortium of major oil companies. The work included performing an independent third-party review of documents related to the Pre-FEED/FEED trunkline design activities and nearshore and onshore sections, as requested by the team, on a range of topics, such as the fatigue demand report, the Gas Export Regulating Manifold, and geotechnical assessments. The final report

provided comments based on an integrated look at a project's underlying assumptions, decision logic, alternatives, and forward plans. This evaluation, performed on behalf of an entity representing the investors, provided assurance of the design and suggestions for improvement to the oil companies. For example, evaluated design contractor's update of requirements to be placed on monolithic isolation joint manufacturers to fatigue test their joints to ensure physical integrity under the specified loading conditions expected in an LNG pipeline network. The effects considered included metal fatigue, corrosion, degradation of elastomeric seals, and the cumulative impact of pressure transients on the joint's structural integrity over its 30-year design life. This study included a review of the Monolithic Isolation Joint Specification, Data Sheet, and Supplier Data Requirements List (SDRL) to assess the impact of aging-related loss of strength and loss of corrosion barriers.

- Served as the Project Manager to determine the root cause of pump vibration at the Ginna Nuclear Station. This study provided the nuclear plant with the root cause, and suggestions for design improvement and validation, prior to equipment replacement.
- Supported the initial economic evaluation and due diligence of a proposed integrated polyethylene terephthalate (PET) and purified terephthalic acid (PTA) complex for an overseas investment firm.

Analysis/Design Component Capability Calculations

- Contributed as a member of Failure Root Cause teams for several nuclear stations, including Ginna, H.B. Robinson, San Onofre, Grand Gulf, Millstone Unit 3, Catawba, Comanche Peak, Susquehanna, Nine Mile Point, Davis Besse, Pickering, Kori, Yeonggwang, Turkey Point, Shearon Harris, Laguna Verde, and Sizewell. These projects enhanced improved equipment reliability and plant availability. For example: Applied Computational Fluid Dynamic (CFD) methods to determine the root cause of valve failure by simulating non-testable conditions for a 24-inch feedwater lift check valve that was experiencing excessive wear. Analysis validated the hypothesis that the internal flow geometry was creating an unfavorable pressure distribution within the valve. An optimal disc position was then determined to ensure disc stability and closure on reverse flow without introducing excessive pressure drop during forward flow.
- Served as a Project Lead/Projects Specialist for check valve program development at San Onofre, Cooper, River Bend, Waterford 3, D.C. Cook, Callaway, and Wolf Creek. Contributor to INPO SOER 86-03 check valve application reviews for ANO 1, Clinton, Comanche Peak, South Texas, Davis Besse, St. Lucie, and Turkey Point. These projects generated technically rigorous and well-documented bases that facilitated the prioritization of the components for maintenance and condition monitoring programs. For example: Collected component-level and system-level data including valve drawings; installation details; operating flow rate, pressure, and temperature data for all modes of plant operation; and valve maintenance histories. Comprehensive valve analyses were then performed on 1,100 check valves to quantify the rate of internal degradation, using the Check Valve and Analysis Prioritization (CVAP) methodology. Analysis results were used to prioritize valve maintenance, select condition monitoring methods, and schedule inspection intervals. Inspection recommendations included acceptance criteria for valve internals and use of non-intrusive diagnostic technologies.
- Served as a Project Lead for GL 89-10 Analysis of motor operated valves (MOV) design-basis calculations for all non-testable gate valves at Millstone Power Station Units 1, 2, 3, and gate and globe valves for Palo

Verde, to determine thrust requirements and fulfill the requirements of NRC Generic Letter 89 10. This included the procurement of valve internal dimensions from valve vendors; the integration of operating temperature, pressure, and flow data; and the analysis of MOVs using the Electric Power Research Institute (EPRI) Genetic Algorithm Template-Matching (GATM) methodology to determine thrust requirements. For valves that fell outside the technical specification, justification was developed to support designating the valve either "operable, but out of design" or "unpredictable/inoperable." These projects enabled plants to develop data required to fulfill the regulatory requirement of ensuring sufficient operating margin.

- Performed Limitorque actuator fatigue life analyses for actuators loaded beyond their specified ratings, using the proprietary Limitorque Actuator Fatigue Life Analysis (LTAFLA) software for Carolina Power and Light. This evaluation enabled the utility to estimate the remaining fatigue life of motorized valve actuators.
- Performed detailed thermal stress analysis on a high-temperature, high-pressure steam throttle valve for the Department of Defense. This effort contributed to the design of a valve for a proprietary naval system.
- Contributed to the revision of EPRI/Nuclear Maintenance Applications Center (NMAC) Application Guide for Check Valves in Nuclear Power Stations and provided sections on check valve hinge-pin wear and disc stud fatigue degradation. This document provided plant engineers with state-of-the-art guidance on the proper application of check valves.
- Responsible for all aspects of data gathering, verification, and document control supporting the 86-03 check valve application review for Florida Power and Light Company's St. Lucie Units 1 and 2 and Turkey Point Units 3 and 4. This project enabled the identification of potential bad actors from the valve population, and a basis to plan their maintenance.
- Responsible for all aspects of compilation and analysis of main steam safety valve (MSSV) operating history data used to study the dependence of MSSV degradation on duration of plant operation at diverse power levels for Toledo Edison's Davis Besse Nuclear Power Station. This effort supported the evaluation of the root-cause analysis of in-service degradation.
- Performed finite-element analyses of down-hole drilling mud motor sealed bearing assemblies of various sizes, and elastomeric hydrodynamically lubricated rotary shaft seals. Also performed structural and fatigue analyses of down-hole subs and bottom-hole assemblies. These projects supported the design of mechanical systems used in oil and gas exploration and production.

Laboratory and Flow Testing

- Served as the Principal Investigator on the EPRI MOV PPM (Performance Prediction Methodology) butterfly valve design, elbows, and scaling effect 10CFR50 Appendix B incompressible flow testing of butterfly valves, to quantify the effects of an upstream elbow on torque requirements, and to verify torque prediction and scaling equations used by the nuclear industry, published in EPRI TR-103257. This project culminated in the compilation of a comprehensive database on hydrodynamic torque coefficients of quarter-turn valves that is used by nuclear power plants to calculate the valve torque requirements.

- Served as Project Lead for the EPRI MOV PPM Borg-Warner gate valves performance validation dynamic flow testing, to determine the root cause of high stem thrust requirements, published in EPRI TR-1032229V1. This project helped explain the cause of the gate valves' anomalously high thrust requirements.
- Served as Project Lead for the Kalsi Valve & Actuator Program (KVAP) model validation 10CFR50 Appendix B testing of quarter-turn valves to verify torque prediction and scaling equations, and to quantify the effects of upstream elbows on torque requirements. These incompressible and compressible flow tests were performed on a variety of valve types, including butterfly valves with symmetric, single-offset, and double-offset discs; ball valves of the full spherical and segmented type; and plug valves. This testing resulted in improved models to perform quarter-turn valve capability calculations for Air Operated Valves Joint Owners Group (AOV JOG) Program/RIS 2000-3 and GL 89-05 MOV JOG Periodic Verification programs.
- Served as the Program Manager for the Nuclear Industry Check (NIC) valve trending program, to identify parameters that can be trended reliably to assess check valve internal wear and predict incipient failure. In consultation with the Nonintrusive Examination Committee Technical Advisory Group (NEC-TAG), developed a test plan, facilitated the flow-loop testing, and worked with TAG to prepare a final report for industry-wide distribution. This test program involved compressible and incompressible flow tests on swing, tilt, double disk, and piston check valves. This industry study helped nuclear power plant engineers develop plant condition monitoring programs.
- Served on the project team responsible for Small Business Innovation Research/Nuclear Regulatory Commission's (SBIR/NRC) check valve internal wear rate quantification Phase 2 test program. Performed tests and evaluated data gathered during the 18-month Phase 1 study of performance and prediction of degradation in swing check valves. The results formed the basis for the wear and fatigue methodologies provided in NUREG/CR-5583 and the NMAC Check Valve Application Guide, 5479 Rev. 1. This industry study resulted in the validation of first principal's models and their use to prioritize the maintenance of check valves at several nuclear power stations.
- Served on the project team for the EPRI Valve Design Separate Effects Test Program, with responsibility for the design and implementation of a closed-loop servo-hydraulic data acquisition and control system to simulate hydraulic loads on gate valve discs tested on the Kalsi Engineering Inc. (KEI) gate valve design effects test fixture, described in EPRI TR-1032229V2. The test fixture developed under this study was used to evaluate key design features of gate valves in relation to their propensity to result in the unpredictable behavior of gate valves. The results of this study formed the basis of evaluation and modification of gate valves used in nuclear power stations.
- Served as the Project Lead for several flow-loop tests that enabled clients to better quantify the performance of their valves and make better design choices, such as tests for Carolina Power and Light Company on 4- and 10-inch Westinghouse check valves to determine Vmin and disc stability. Designed special valve weld end adapters to mount 4- and 10-inch Westinghouse check valves on a KEI test flow loop. Additional tests to simulate the suitability of 18-inch Atwood and Morrill and Anchor Darling feed-water swing check valves. Tests to evaluate performance of commercial-grade check valves, butterfly valves, nozzle checks, excess flow checks, and other items made by several manufacturers, including Velan, Stockham, Walworth, Crane, Powell, Bray, Noble Alloy, PGI, GariTech, GSI, and others.

- Performed error analyses for various measurement systems in ANSI/ASME PTC 19.1-1985 Measurement Uncertainty supplement to the ASME Performance Test Code. This was a key requirement for safety-related testing performed in accordance with the requirements of 10CFR50, Appendix B.
- Responsible for many laboratory and field tests, to support client research and development projects and enable the investigation of the root cause of component failure.
    - Implemented data acquisition systems and processing systems for an industry sponsored Limitorque actuator housing cover thrust overload increase test program
    - Department of Energy air motor performance characterization tests (progressive cavity)
    - Impact loading tests on proprietary threaded connection used in sub-sea piles
    - Product development testing for hydrodynamically lubricated rotary shaft seals used in oil and gas drilling applications.
- Performed many tests on mechanical equipment and structures, including studies of side loading induced by free-floating backup, and temperature effects on integrity of fiberglass piping. Evaluated the effect of component design on bursting during a freeze, unintentional operation/ fluid discharge, failure, etc.

Software Development

- Contributed to the development, verification and validation, upgrades and implementation of advanced engineering analysis software packages used by US nuclear power plants to perform safety related calculations for improving equipment reliability. These software products were designed, developed, and maintained under the requirements of the 10CFR50 Appendix B Quality Assurance Criteria, ASME NQA-1 Requirements for Computer Software used in Nuclear Facilities, and 10CFR Part 21 for the reporting of defects and noncompliance:
- Check Valve Analysis and Prioritization (CVAP) Software (1990-2005) used to improve valve reliability at 22+ nuclear power plants. As Product Manager, was responsible for quality assurance, training, technical support, sales, and marketing.
    - Kalsi Valve & Actuator Program (KVAP) advanced engineering analysis software to calculate the design based operability margin of safety-related valves in nuclear power generation stations.
    - The KEIGATE software for analysis of MOV gate and globe valves installed in nuclear power generation stations.
    - Marketed various other analytical software products: Limitorque Actuator Fatigue Life Analysis/Limitorque Life Evaluation (LTAFLA/LiFE) Software, Kalsi Pressure Locking and Thermal Binding (KPLTB) program.

Industry Involvement

- Mr. Sharma has served as project manager for several plant-wide valve program development projects and was a key contributor in the development of industry-leading methodologies for performing component capability calculations and modeling wear degradation. These projects involved system and component-level

evaluations, design basis calculations, detailed reviews of numerous valve applications, testing of a wide variety of nuclear and commercial valves, and leading self-assessment/audit teams and expert panels. Mr. Sharma has contributed to many R&D projects, including those sponsored by the Small Business Innovation Research/Nuclear Regulatory Commission (SBIR/NRC), Nuclear Industry Check Valve Group (NIC), Electric Power Research Institute (EPRI), U.S. Department of Defense (DOD), and U.S. Department of Energy (DOE). The following are examples of participation in industry forums and trade groups to stay current on ongoing and emergent industry issues related to the reliability of flow systems:

- Presentation to Valve Manufacturers Association of America – Valve Repair Council in 2022.
- Active member of NIC, 1990-2005; honored by the NIC group for contributions to the improvement of check valve reliability industry wide.
    - Program Manager for the Non-intrusive Examination Committee of NIC, and project lead for NIC-sponsored test program.
    - Lead Assessor on check valve program self-assessment teams at Wolf Creek, Waterford 3, Columbia, and Cooper. Example: served on expert panel that assessed the Wolf Creek check valve condition-monitoring program.
    - Developed course material for and presented the following courses: CVAP Software Training, Advanced Check Valve Failure Analysis course, Seminar on Computational Fluid Dynamics Applications to Valve Analysis and contributed to the NIC/ISTOG Check Valve Condition Monitoring Workshop: Courses provided at the EPRI Valve Symposium, NIC 2004 Winter Meeting, NIC/ISTOG 2005 Summer Meeting, and to the following plants and engineering companies: Davis Besse, Duke Power (Oconee, McGuire and Catawba), San Onofre, Cooper, Wolf Creek, Callaway, D.C. Cook, Nine Mile Point, Pilgrim, South Texas, Bruce Power, Korea Power Engineering Company (KOPEC), Korea Plant Services (KPS), Framatome ANP, UltraCheck Users Group.
    - Facilitated EPRI/NMAC Advanced Check Valve Non-Intrusive Diagnostic Technology Class and EPRI/NMAC Advanced AOV Non-Intrusive Diagnostic Technology Class at flow-loop facility.

Publications

“Protecting Process Hazard Assessments from Becoming Compliance-Only Exercises,” **Sharma, V.**, Exponent Oil & Gas Insight, Volume 2, 2015.

Presentations

“Have COVID Disruptions Stifled Your Flows – Assessing risks to valves and process equipment from atypical plant operations,” **Sharma, V.**, Exponent Inc., Thought Leadership, March 18, 2021.

“Deriving Value from Near-Misses & Failure Analyses,” **Sharma, V.**, Plant Maintenance, Inspection and Engineering Society, ASME Plant Engineering and Maintenance Technical Chapter, May 2016.

“Leveraging Experience to Reduce Business Risks and Brand Liability,” **Sharma V.**, Valve Repair Council Annual Meeting and Exhibition, November 2012.

“Swing Check Valve Performance Improvement,**”** **Sharma V.**, Domingo Cruz. Borg Warner,. Nuclear Industry Check Valve Group, June 2011.

“Workshop for Palo Verde Nuclear Station Check Valve Inspector Qualification,**”** **Sharma V.**, Arizona Public Service Company, February 11-13, 2009.

“Equipment replacement - How Rigorous is your Due Diligence?,**”** **Sharma V.**, Nuclear Industry Check Valve Group, June 2008.

“Check Valve Program Self-Assessment at Columbia and Cooper - Benefits and Critical Success Factors,**”** **Sharma V.**, Simon A., Stuhr D. Nuclear Industry Check Valve Group, January 2008.

“Enhancing Check Valve Programs by Invoking Appendix II Condition Monitoring,” Masters D., **Sharma V.**, Dixon B., Maanavi T. Nuclear Industry Check Valve Group and Inservice Test Owners Group (ISTOG), June 2005 and December 2005.

“Case study - Analysis and Testing of Small Size Piston Check Valve w/ Air Flow,**”** **Sharma V.**, Leutwyler Z., Sicking R. Nuclear Industry Check Valve Group, June 2005.

“Advancements in Valve Technology and Industry Lessons lead to Improved Valve Reliability,**”** **Sharma V.**, Kalsi M.S., Wang J.K. 13th International Conference on Nuclear Engineering, ICONE 13-50286, Beijing, China, May 2005.

“Role of quantitative analysis in check valve condition monitoring programs,**”** **Sharma V.**, Nuclear Industry Check Valve Group, Winter Meeting, December 2004.

“Industry issues and lessons learned for improved valve reliability and competitiveness,**”** **Sharma V.**, Kalsi M.S., Wang J.K. Workshop on Valve Selection, Valve World, Maastricht, November 2004.

“AOV/MOV design basis evaluation and margin improvement methodologies,” Kalsi M.S., **Sharma V.**, Annual Korea Institute of Nuclear Safety Workshop on AOVs/MOVs, KINS/PR-056 Vol. 1, July 2004.

“Check Valve Condition Monitoring and Software for Improved Plant Reliability,**”** **Sharma V.**, Annual Korea Institute of Nuclear Safety Workshop on AOVs/MOVs, KINS/PR-056, Vol. 1 July 2004.

“Safety Injection Check Valve Evaluation to Eliminate Premature Seat Degradation Problem,.” Wang J.K., **Sharma V.**, Kalsi M.S., KHNP, Yeonggwang Nuclear Station, June 2004.

“Industry issues, initiatives, and technology to improve valve and actuator reliability,” Kalsi M.S., **Sharma V.**, British Energy - Sizewell Power Station, April 2004.

“Evaluation of Non-intrusive Diagnostic Examination Technologies for Check Valve Trending,**”** **Sharma V.**, Domingo Cruz et al. of the Non-Intrusive Examination Sub-committee of the Nuclear Industry Check Valve Group (NIC). Presented to the Nuclear Industry Check Valve Group, December 2003.

“Dynamic Torque Models for Quarter-Turn Air-Operated Valves,” Kalsi M.S., **Sharma V.**, Presented to the Annual Korea Institute of Nuclear Safety Workshop on AOVs/MOVs, KINS/PR-016 Vol. 3, May 2003.

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