

Exponent®
Engineering & Scientific Consulting

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Professional Profile

Dr. Subodh Medhekar, Ph.D., P.E., CFSE, is a principal engineer at Exponent with 30+ years of experience in international arbitration, process safety consulting, and LNG and oil & gas facility risk. He specializes in HAZOP, QRA, LOPA, and SIL studies; EPC project dispute analysis; expert witness testimony; and root-cause investigations across the energy, petrochemical, and industrial sectors.

Areas of Expertise:

- International Arbitration & Expert Witness Services (ICC, UNCITRAL, LCIA, AAA) — expert reports, depositions, and trial testimony
- EPC Project Dispute Support — design adequacy, commissioning delays, cost overruns, and engineering standard of care
- Root-Cause Analysis & Incident Investigation — process plant explosions, fires, toxic releases, and mechanical failures
- LNG Liquefaction, Regasification & NGL Facility Risk Assessment and Insurance Loss Estimation (EML/PML)
- Oil & Gas, Refining, Petrochemical, Chlor-Alkali, and Power/Utility Facilities
- Battery Energy Storage Systems (BESS) & Electric Vehicle Hazard Analysis — Li-ion safety, thermal runaway, NFPA 855, UL 9540/9540A
- Process Safety Management (PSM) / Risk Management Programs (RMP) — OSHA 29 CFR 1910.119 and EPA CAA §112(r) Clean Air Act
- Project HSE Reviews (PHSER Stages 1–5), RAGAGEP conformance, and API 520/521 pressure relief and flare system evaluation
- Process Safety Consulting & Process Hazard Analysis (PHA) — HAZOP, HAZID, What-If, FMEA, LOPA, and Alarm Management studies
- Quantitative Risk Assessment (QRA) — process explosion and fire risk, Fire & Explosion Risk Assessment (FERA), and Building Risk Assessment
- Safety Integrity Level (SIL) Studies, Safety Instrumented Systems (SIS), and Functional Safety (IEC 61508/61511)
- Gas Dispersion Modeling & Vapor Cloud / Toxic Release Analysis — H2S, Cl2, NH3, SO2, HF, LNG, LPG (PHAST, ALOHA)

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- Reliability, Availability & Maintainability (RAM) — MTBF/MTTR modeling, Fault Tree / Event Tree Analysis, Monte Carlo and Bayesian uncertainty analysis
- Pipeline Risk Assessment, Tank Farm Safety, and Crude Oil/Gas Production Facility Reviews

Practice Overview

Dr. Medhekar has authored 25+ expert reports, testified at international arbitration trials under International Chamber of Commerce (ICC) and United Nations Commission on International Trade Law (UNCITRAL) rules, and provided deposition testimony in U.S. federal and state courts. He has led 200+ process design reviews and hazard/risk assessments and evaluated 100+ international engineering, procurement, and construction (EPC) projects, providing expert analysis and consulting for international law firms handling EPC and energy disputes, insurance carriers assessing LNG and refinery facility risk, plant owners and operators, EPC contractors, and project management consultants (PMCs).

He helps clients in the oil and gas, LNG, refining, petrochemical, chemical manufacturing, power, utility, and automotive sectors resolve high-stakes technical disputes and operational risks — including commissioning delays and EPC cost overruns, process explosion and fire risk, toxic gas releases ("process plant explosion and chemical release" matters), pipeline strikes and oil spills, mechanical integrity and business-interruption losses, and regulatory enforcement actions under the Clean Air Act.

Dr. Medhekar's consulting approach integrates rigorous process hazard analysis (HAZOP, PHA, FMEA, What-If, LOPA), quantitative risk assessment (QRA, FERA, SIL/LOPA per IEC 61511), gas dispersion modeling (PHAST, ALOHA), and reliability/availability (RAM, FTA, ETA, Monte Carlo) modeling to deliver defensible, court-ready conclusions. Dr. Medhekar has authored or coauthored 150+ technical publications, reports, and presentations on process safety, risk and reliability, and gas dispersion modeling, and he has trained 100+ HAZOP leaders across the U.S. and Asia. He holds a California Professional Chemical Engineer license (#CH6087) and Certified Functional Safety Expert (CFSE #131227003) credentials.

Before joining Exponent, Dr. Medhekar held consulting and engineering positions at PLG, Inc. (Newport Beach, California) supporting probabilistic risk assessments for nuclear power and chemical/refinery operators, the Center for Risk Studies and Safety (Santa Barbara, California), Indian Oil Refinery (Baroda, India), and Union Carbide (Thane, India). He earned his Ph.D. (1991) and M.S. (1988) in Chemical Engineering from the University of California, Santa Barbara, and his B.Tech. in Chemical Engineering from the Indian Institute of Technology, New Delhi (1984).

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, University of California, Santa Barbara, 1991

M.S., Chemical Engineering, University of California, Santa Barbara, 1988

B.Tech., Chemical Engineering, Indian Institute of Technology, New Delhi, 1984

Outstanding Achievement Award, PLG, Inc., 1995

Best Paper Award, Society of Plastics Engineers, Inc., 2000

UC Regents Scholarship, University of California, Santa Barbara, 1986–1991

Tata Endowment Scholarship, Tata Trusts, 1986

Aryabhatta Science Talent Award, 1978

Ramanujam Math Talent Award, 1978

Licenses and Certifications

Professional Engineer Chemical, California, #6087

Certified Functional Safety Expert (CFSE)

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

ASQ Certified Reliability Engineer (CRE)

Prior Experience

Principal Engineer, Exponent — Engineering & Scientific Consulting, Irvine, CA, 1997–Present

Senior Consultant, PLG, Inc., Newport Beach, CA, 1991–1997

Graduate Researcher, Center for Risk Studies and Safety, University of California, Santa Barbara, CA, 1985–1991

Process Engineer, Indian Oil Refinery, Baroda, India, 1985

Process Engineer, Union Carbide, Thane, India, 1984

Professional Affiliations

American Institute of Chemical Engineers (AIChE)

American Chemical Society (ACS)

Society for Risk Analysis (SRA)

Publications

Peer-Reviewed Articles

Medhekar, S.R. "Safety Instrumented Systems for Process Safety." Chemistry, Process Design, and Safety for the Nitration Industry, ACS Symposium Series, American Chemical Society, Washington, DC, 2013.

Medhekar, S.R., Bley, D.C., & Gekler, W.C. "Frequency estimates for transport-related hydrofluoric and sulfuric acid release scenarios." Process Safety Progress, vol. 12, no. 3, July 1993.

Medhekar, S.R., Bley, D.C., & Gekler, W.C. "Prediction of vessel and piping failure rates in chemical process plants using the Thomas Model." Process Safety Progress, vol. 12, no. 2, April 1993.

Medhekar, S.R., Caligiuri, R.D., & Moalli, J. "Practical risk analysis as a tool for minimizing plastic product failures." Proceedings, Society of Plastics Engineers, ANTEC, 2000.

Medhekar, S.R., Amarasooriya, W.H., & Theofanous, T.G. "Integrated analysis of steam explosions." Proceedings, 4th International Topical Meeting on Nuclear Reactor Thermal Hydraulics, Karlsruhe, Germany, October 1989, pp. 319–326.

Medhekar, S.R., Abolfadl, M.A., & Theofanous, T.G. "Triggering and propagation of steam explosions." Proceedings, 25th ASME/AIChE National Heat Transfer Conference, Houston, TX, July 1988, pp. 244–251.

Presentations (Selected, Most Recent)

Medhekar, S.R. & Arora, A. "Neptune PHA Recommendations for H2 Bus." Invited Presentation, Gillig Board, November 2024.

Medhekar, S.R. "Investigation of the MFM Pipe Failure." Invited Presentation, Sewer Authority Mid-Coastside (SAM) Board, August 2023.

Medhekar, S.R. "OCA Review: Modelling of Pesticide Releases." Confidential client briefing, August 2023.

Medhekar, S.R. "Monte Carlo Simulations for Remedial Costs and Schedule Delays." Summary of Opinions, Confidential client, July 2022.

Medhekar, S.R. "Safety Interlocks and Incorrect Plant Startup." Summary of Opinions, Confidential client, October 2021.

Hudgins, A. & Medhekar, S.R. "Assessing the Effectiveness of Covered Conductors and Their Role in Risk Reduction." FMEA/PHA Workshop, Southern California Edison (SCE), October 2021.

Medhekar, S.R. & Morris, J. "Offsite Consequence Analysis (OCA) Peer Review & Independent Evaluation." County of San Benito, CA, October 2020.

Medhekar, S.R. "Delay Analysis for Impacted Schedule: Mechanical Completion and Initial Acceptance for a Major EPC Project." Confidential client, February 2020.

Medhekar, S.R. & Hart, R. "EML and PML for Cheniere Energy: CCLNG and SPLNG Sites." Invited Presentation, Houston, TX, January 2019.

Medhekar, S.R. "HAZOP Leader Training Course." Multiple training courses for 100+ HAZOP leaders, U.S. and Asia, 2011–2014.

Medhekar, S.R. "Safety Instrumented Systems for Process Safety." Oral Presentation, Spring ACS Meeting, San Diego, CA, March 2012.

Technical Reports (Selected, Most Recent)

Root Cause Evaluation of an Acid Plant Fire at Smelter Facility. Incident Investigation Report, confidential client, February 2025 (contributing author).

Medhekar, S.R. & Hart, R. Insurance Risk Assessment Report for Confidential LNG Liquefaction Terminal Client, February 2025.

Medhekar, S.R. & Arora, A. Preliminary Hazard Analysis (PHA) Study for Gillig, LLC H2 Bus, November 2024.

System Vulnerabilities, Pipeline Failure Risks, and Mitigation Options. Resiliency Risk Assessment, confidential client, October 2024 (contributing author).

Medhekar, S.R. & Reding, N. Combustible Dust Hazard and Gap Analysis for Spray Tower. Confidential client, November 2023.

Medhekar, S.R. Evaluation of the Montara Force Main Failure. Sewer Authority Mid-Coastside, July 2023.

Medhekar, S.R. & Hart, R. Sabine Pass LNG Terminal Insurance Risk Assessment, February 2022.

Medhekar, S.R. & Hart, R. Corpus Christi LNG Terminal Insurance Risk Assessment, February 2021.

Medhekar, S.R. Trical Risk Management Plan (RMP), January 2021.

Medhekar, S.R. & Arora, A. Preliminary Hazard Analysis (PHA) Study for Gillig, LLC Electric Bus, June 2020.

Medhekar, S.R., Arora, A., & Hu, Y. Risk Assessment of Borrego Battery Energy Storage System, Breckenridge, MA, July 2019.

Medhekar, S.R. Egyptian Refining Company SIL Validation Study Report, July 2019.

Medhekar, S.R. & Arora, A. Battery Pack Manufacturing Process Hazard and Operability Study, May 2018.

Medhekar, S.R., Chilin, D., Carnahan, R., & Gibbs, J. Root Cause Evaluation of Steam Turbine Damage. Confidential client, April 2018.

Medhekar, S.R., Sipe, J., Jokar, A., & Chilin, D. Risk Assessment of Indoor Gas Meter Sets. Confidential client, November 2018.

Arora, A., Medhekar, S.R., & Bak, W. Risk Assessment of Tranquility Lithium-ion Energy Storage System. PG&E Energy Procurement, September 2015.

Multiple HAZOP, SIL, QRA, FERA, RAM, and PHSER Stage 2–5 reports (2006–2018) for KNPC Clean Fuels Project; Saudi Aramco Shaybah; KOC WARA Pressure Maintenance; KOC ESS Project; SARB Field Development; Borouge 3; ERC Mostorod (Egypt); and Daewoo RRE4 — complete list available on request.

A complete list of 150+ technical reports, PSM/RMP documents, HAZOP/SIL/QRA studies, and PHSER reviews authored or co-authored from 1990 to present is available upon request.

Project Experience

International Arbitration & EPC Dispute Technical Support

- Authored expert reports and testified at ICC Arbitration trial in Baltisse N.V. et al. v. M. Szamborski et al. (ICC Case No. 25831/FS, Poland, 2022) on manufacturing technology and EN standards conformance, supporting client position on production-technology adequacy.
- Provided expert testimony in UNCITRAL Arbitration No. UNC76/AVH (Barracuda & Caratinga Leasing v. Kellogg Brown & Root), opining on offshore process facility design and EPC contractor obligations.
- Worked as testifying LNG process design expert for an arbitration proceeding between LNG plant owner and LNG process licensor/EPC contractor. Dispute involved assessment of LNG production processes, design defects of the trains, performance tests measuring throughput capacity and power consumption. Case settled out of court.
- Served as testifying expert in AAA construction arbitration case for a specialty chemical manufacturer on EPC contractor due diligence, weld inspections, hydro testing, process

equipment design issues and construction delays and project cost overruns; supported confidential out-of-court settlement (2022).

- Authored an expert report and provided deposition testimony. Dispute between refinery owner and EPC contractor. Case related to the suitability of continued refinery operations with four clad reactors in hydrogen service after the discovery of clad weld anomalies during commissioning stage.
- Provided sworn statement as a testifying expert under LCIA Arbitration, for a polypropene plant explosion case. Dispute between technology licensor and plant owner regarding design of plant blowdown systems. Case settled out of court.
- Provided technical assessments as a potential testifying expert for a dispute between a vendor and a refinery owner regarding ground flare design and flare operation related issues. Parties settled out of court.
- Led delay analysis using Monte Carlo simulation on a Primavera schedule for a major EPC project to identify Critical Path Method (CPM) drivers of mechanical completion and initial acceptance slippage, supporting client's defense against multi-month delay claims (2020).

LNG & Natural Gas Facilities Technical Evaluations & Risk Assessments

- Currently on roll (2025-2026 PO, and four 1-year optional extensions) with the Federal Energy Regulatory Commission (FERC) to provide engineering support services to examine abnormal operating conditions or incidents at operational LNG facilities and expected to review technical documentation related to the facility’s LNG storage tank or incident including related studies, reports, analyses, engineering design information, operations and maintenance procedures, and repair plans.
- Small-scale Modular LNG trains (Nigeria). LNG process design review of LNG production processes and performance tests measuring throughput capacity and power consumption.
- Performed insurance risk assessments and estimated/probable maximum loss (EML/PML) studies for Cheniere Energy's Sabine Pass and Corpus Christi LNG terminals (2019–2022), informing the insurer's coverage and underwriting decisions for two of the largest U.S. LNG export facilities.
- Led HAZOP, QRA, and SIL studies for large- and mid-scale international LNG liquefaction plants and domestic LNG regasification terminals, identifying critical process safety gaps and supporting EPC contractor design revisions.
- Delivered preliminary risk assessment for the Clearwater LNG project and LNG Safety Analysis Methodology Guide for Mitsubishi Heavy Industries, establishing facility-level risk acceptance criteria for marine-side and land-side LNG operations.

Chemical & Petrochemical Manufacturing Failure Analysis

- Served as technical lead and nominated testifying expert in a confidential chlor-alkali plant matter, assessing mechanical integrity, design and maintenance adequacy, and system-level performance limitations re-saturator failures, diaphragm cells, and salt-system behavior tied to business-interruption-loss claims (settled out of court, 2026).
- Technical lead and testifying expert on confidential chlor-alkali plant performance, mechanical integrity, and business-interruption-loss matters; investigations of acid plant fires at smelter facilities and combustible dust gap analyses.

Root-Cause Investigations & Standard-of-Care Expert Opinions

- Investigated an underground pipeline strike resulting in a large oil spill, opining on engineering standard of care for project management/construction activities, industry standards, and root causes for confidential client (2024).
- Authored rebuttal expert report on online H2S detector/analyzer alarms, reasonable operator practices, and shutdown protocol following a sour-gas-slug breakthrough into a large gas pipeline (2024).
- Led root-cause evaluation of an acid plant fire at a smelter facility and a steam turbine damage investigation for confidential energy clients, supporting insurance loss adjustment and equipment-vendor warranty discussions.

Oil & Gas, Refining, and Refinery Expansion Technical Support

- Served as process safety technical lead on 25+ refinery and refinery-expansion projects across Kuwait, the UAE, Oman, South Korea, Egypt, Japan, Thailand, Qatar, and Taiwan — including KNPC Clean Fuels Project (Units 5/29/107/129/138/141/144/150/183 and multiple vendor packages), Saudi Aramco Shaybah, ERC Mostorod (Egypt), and KOC WARA Pressure Maintenance.
- Conducted PHSER Stages 2-5 reviews (FEED through pre-startup/pre-commissioning) for KOC, KNPC, and ADNOC projects, identifying construction-stage HSE punch-list items and supporting clients' Ready-for-Startup decisions.
- Performed CFD modeling to estimate overpressure at the emergency generator building for the KNPC LPG-4 facility, validating safe-occupancy assumptions for control-room siting (Daelim, 2011).

Battery Energy Storage Systems (BESS) & Electric Mobility Hazards Analysis

- Led hazard analyses and bankability/standards reviews (NFPA 855, UL 9540/9540A) for battery energy storage system (BESS) deployments, advising the client on enclosure ratings, thermal-runaway propagation risk, and code-conforming siting.
- Performed Li-ion battery pack manufacturing PHA and risk assessments of the Borrego BESS (Palmer, Massachusetts) and Tranquility Li-ion Energy Storage System for PG&E Energy Procurement, supporting utility procurement and grid-interconnection decisions.
- Conducted Preliminary Hazard Analysis (PHA) studies for Gillig, LLC's Electric Bus and Hydrogen (H2) Bus platforms, identifying high-voltage and H2-leak scenarios that informed product safety case closure with Gillig Board.

Process Safety Management (PSM) & Risk Management Programs (RMP) Consulting

- Provided lead technical contributions to 20+ RMP and OSHA PSM programs for major refineries and chemical plants (Unocal Los Angeles Refinery — Sulfur Recovery, Sour Water Stripping, Chlorine Injection, DHT-3, FCCU-152, Sulfuric Acid Plant; Paramount Petroleum Crude Units #1 & #2; Trical), supporting clients' compliance with OSHA 29 CFR 1910.119 and EPA CAA §112(r).
- Authored responses to an EPA Notice of Potential Violations of Clean Air Act §112(r)(1) addressing relief-valve and rupture-disk sizing and venting per API 520/521 for a confidential client (2021).

Gas Dispersion Modeling & Toxic Release Risk Analysis

- Performed vapor cloud dispersion analyses for H2S, Cl2, NH3, SO2, HF, LNG, and LPG releases (process-plant, rail, and truck transport scenarios) using PHAST and ALOHA, generating hazard footprints and risk contours communicated to regulators, plant managers, and legal counsel.
- Authored frequency estimates for seismic-initiated hydrofluoric acid release scenarios at Mobil Torrance, Ultramar, and Allied Signal El Segundo refineries for the South Coast Air Quality Management District (SCAQMD), supporting regulatory decision-making on HF-alkylation processes.

Automotive, Consumer Products & Biomedical

- Provided expert report and deposition testimony in a vehicle-theft subrogation matter (Subrogation Plaintiffs v. Hyundai Motor America, Hyundai Motor Company, Kia America, Inc., and Kia Corporation) supporting an insurance-carrier consortium (2026).
- Authored expert report and provided deposition testimony in Nicholas Magarian v. Linde Gas & Equipment, Inc. on industrial-gas equipment safety (2025).
- Delivered FMEA, fault-tree, and reliability analyses for EV drive units, fuel systems, airbag/SRS, EV battery systems, H2 fuel cells, and autonomous-vehicle drive systems for major OEMs and Tier 1 suppliers.
- Performed FMEAs for P&G, Hamilton Beach/Proctor-Silex, Motorola, ALZA, Allergan, and Delta Faucet.

Power, Utility & Nuclear

- Performed Level 1-3 Probabilistic Risk Assessments (PRA) at PLG, Inc. for five U.S. nuclear plants — Browns Ferry-2, Watts Bar-1, Sequoyah-1, Diablo Canyon-1&2, and Oyster Creek — addressing loss-of-coolant accidents, containment source-term quantification, and offsite radiological dispersion.
- Reviewed effectiveness of covered conductors in wildfire risk reduction for Southern California Edison (SCE) via an FMEA/PHA workshop, supporting utility hardening-program prioritization.

Deposition & Trial Testimony

Arbitration Trial Testimony

ICC arbitration proceedings in Poland — Baltisse N.V. et al. v. M. Szamborski et al., ICC Case No. 25831/FS (October 2022). Authored expert reports and testified at the ICC arbitration trial on manufacturing aspects, production technology, and EN standards.

UNCITRAL Arbitration No. UNC76/AVH — Barracuda & Caratinga Leasing Company B.V. v. Kellogg Brown & Root LLC (May 2010). Authored an expert report and testified at the international arbitration trial.

Litigation Expert Reports (Selected, Recent)

Vehicle-theft subrogation matter — consortium of insurance companies v. automotive manufacturer, U.S. District Court for the Central District of California; testifying expert (trial scheduled September 2026).

Cogeneration plant performance and business-interruption-loss claims; technical lead and anticipated testifying expert; settled out of court (May 2026).

Chlor-alkali plant mechanical integrity, design/maintenance adequacy, and business-interruption-loss claims; technical lead and nominated testifying expert; settled out of court (April 2026).

Engineering standard-of-care and root-cause analysis for underground pipeline strike and oil spill (September 2024).

Rebuttal expert report on online H2S detector alarms and operator practices during sour-gas-slug breakthrough into a gas pipeline (March 2024).

Investigation of level control valve failure leading to ammonia gas release (May 2024).

H2S/SO2 concentration measurements for regulatory enforcement (September 2024).

AAA construction arbitration affidavit on EPC due diligence, QA/QC, weld inspections, hydro testing, and construction delays; settled out of court (December 2022).

LCIA arbitration sworn statement — plant blowdown system design dispute (technology licensor v. plant owner); settled out of court (September 2022).

Flare design and operation dispute (vendor v. refinery owner); testifying expert; settled out of court (February 2022).

EPA Notice of Potential Violations of Clean Air Act §112(r)(1) — relief valve and rupture disk sizing per API 520/521 (April 2021).

Depositions

Subrogation Plaintiffs v. Hyundai Motor America, Hyundai Motor Company, Kia America, Inc., and Kia Corporation — expert report and deposition (March 2026).

Nicholas Magarian v. Linde Gas & Equipment, Inc. — expert report and deposition (June 2025).

Metropolitan Nashville Airport Authority v. AECOM Technical Services, Inc. — expert report and deposition (October 2024).

Exxon Mobil Corp. v. Doosan Heavy Indus. Const. Co., Ltd., et al., 280th Judicial District Court of Harris County, TX, Cause No. 2004-18011 — refinery owner v. EPC contractor; expert report and deposition (May 2006).

SCAQMD v. SoCal Refineries — regulatory dispute on HF-alkylation processes; multiple expert reports and depositions (1991).