

Exponent®
Engineering & Scientific Consulting

Ali Reza, P.E., CFI

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Professional Profile

Mr. Reza investigates Loss of Containment (LOC) events and large loss fires and explosions, with a focus on the petrochemical industry. He has conducted process safety, risk assessment, design, and performance reviews of a wide range of petrochemical facilities, industrial and consumer equipment, and appliances, and is experienced in evaluating site-specific procedures, including engineering and regulatory controls designed to mitigate or prevent such events.

He is experienced in evaluating the relationship between equipment design, automation, and operator decisions and practices, and leads multidisciplinary teams to assess the integrity of large assets and the potential risk and mechanism of failure. He investigates complex engineering failures by evaluating design and specification documents, process and operations data, alarm logs, available videos and photographs, laboratory test results, examination of physical artifacts, and witness interviews in an integrated manner.

Mr. Reza's primary expertise is in the engineering investigation and prevention of industrial, commercial, and residential fires and explosions, particularly in relation to the ignition, flame propagation, chemical kinetics, heat transfer, and fluid mechanics processes associated with combustion and explosion events. He has specific expertise in evaluating the hazards of reactive chemicals and the conditions that might cause a runaway chemical reaction, vapor cloud explosion, or detonation.

He has investigated several hundred fire and explosion incidents, including petrochemical, semiconductor and aerospace plants and equipment, dust explosions in various automotive, metal processing, pharmaceutical and food and dye operations, natural gas and propane explosions, accidental ignition or disposal of munitions fireworks and reactive chemicals, and residential and commercial fires. He has also conducted design and performance reviews of a wide range of commercial and consumer equipment, appliances, and processes.

Mr. Reza has testified as an expert witness in various state and federal courts and presently serves on the NFPA committees on explosives (NFPA 495) and combustible dusts (NFPA 660). He is a registered Mechanical Engineer and a Certified Fire Investigator (by the International Association of Arson Investigators). He also holds certification as a corrosion and materials professional (API 571) from the American Petroleum Institute and assists clients with evaluating their Asset Integrity Management programs, including the review of applicable damage mechanisms that might affect these assets.

He has held research positions with the Ben Gurion University of the Negev in Beersheba, Israel; the National Laboratory for Research in Energy Applications in Lisbon, Portugal; and the Center for Energy and Environmental Studies at Princeton University. Prior to joining Exponent, he was a Research Assistant in the High Temperature Gas Dynamics Laboratory at Stanford University.

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Academic Credentials & Professional Honors

M.S., Mechanical Engineering, Stanford University, 1987

B.S., Mechanical and Aerospace Engineering, Princeton University, 1986

Principal member, NFPA Technical Committee on Explosives that is responsible for a) Explosive Materials Code (NFPA 495) and b) Standard for Safe Havens and Interchange Lots for Vehicles Transporting Explosives (NFPA 498)

Principal member, NFPA Technical Committee on Handling and Conveying of Dusts, Vapors, and Gases that is responsible for a) Standard for Combustible Dusts and Particulate Solids (NFPA 660), b) Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids (NFPA 91).

Alternate, NFPA 56 Technical Committee on Gas Process Safety

Member Technical Program Committee (International Structures and Materials and Reliability, Risk and Safety), International Society of Offshore and Polar Engineers; Chair and Peer Reviewer, Asset Integrity Symposium

Associate Editor, International Journal of Offshore and Polar Engineering (IJOPE)

Peer Reviewer, Journal of Engineering Failure Analysis (Elsevier), Process Safety Progress (AICHE), International Journal of Offshore and Polar Engineering (IJOPE) and International Ocean and Polar Engineering Conference (ISOPE)

Sigma Xi, Scientific Research Honor Society

Princeton University Scholarship 1982-1986

Princeton University Presidents Fund Research Award (1985,1986); The Fred Fox '39 Fund: Research Award, 1985; Class of 1942 Research Award, 1986

Aga Khan Scholar, Stanford University, 1986-1987

Mensa

Licenses and Certifications

Professional Engineer, Alabama, #26506

Professional Engineer Mechanical, Alaska, #AELM11067

Professional Engineer Mechanical, Arizona, #27858

Professional Engineer, Arkansas, #12792

Professional Engineer Mechanical, California, #29226

Professional Engineer, Connecticut, #PEN.0027592

Professional Engineer, Georgia, #PE049289

Professional Engineer, Hawaii, #PE-14611

Professional Engineer, Illinois, #62060618

Professional Engineer, Louisiana, #PE0045213

Professional Engineer Mechanical, Massachusetts, #48304

Professional Engineer Mechanical, Nevada, #020867

Professional Engineer, New Jersey, #24GE04533800

Professional Engineer, New Mexico, #24472

Professional Engineer, New York, #80856-01

Professional Engineer, North Carolina, #37030

Professional Engineer, North Dakota, #PE-7831

Professional Engineer Mechanical, Oregon, #85697PE

Professional Engineer, Rhode Island, #PE.0008165

Professional Engineer, South Carolina, #23627

Professional Engineer Mechanical and Fire Protection, Texas, #156393

Professional Engineer Mechanical, Washington, #46857

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

Certified Corrosion and Materials Professional (API 571)

Certified Fire Investigator (CFI)

Fire Investigation: Techniques of Fire Investigation (1B), California State Fire Marshall

Fire Investigation 1A (Cause and Origin), California Office of State Fire Marshal

Professional Affiliations

National Fire Protection Association

International Society of Explosives Engineers

American Society of Mechanical Engineers

American Institute of Chemical Engineers

International Society of Offshore and Polar Engineers

International Association of Arson Investigators

Languages

Urdu

Publications

Reza A. Environmental and solid waste. Infrastructure from the ground up. 2024 Regional Meeting American Bar Association Forum on Construction Law. December 5, 2024 (Los Angeles).

Reza A. Disaster management and Process Safety Management (PSM) of highly hazardous chemicals. CEE 7325, International Disaster Management, Southern Methodist University. September 2024

Ott B, Delafontaine L, Welchert N, Reza A. Ensuring mechanical integrity in Liquified Petroleum Gas and Liquified Natural Gas facilities. The 34th International Ocean and Polar Engineering Conference, Rhodes, Greece, June 2024. Also accepted for publication in a future issue of the International Journal of Offshore and Polar Engineering (IJOPE)

Ott B, Delafontaine L, Welchert N, Frajnkovič M, Reza A. Considerations for the safe handling and processing of unstable materials. Process Saf Prog. 2024; 1-9. doi:10.1002/prs.12652. Also presented at the 2024 AICHE Spring Meeting and 20th Global Congress on Process Safety, Houston, Tx, March 2024.

Reza A. Hydrogen service and infrastructure limitations (mechanical integrity, Positive Materials Identification, end user considerations, and emissions). Institute for Energy Economics and Financial Analysis 2023 annual conference. San Francisco, June 2023.

Ott B, Delafontaine L, Welchert N, Dee S, Reza A. Ensuring natural gas infrastructure is suitable for hydrogen service. Process Saf Prog. 2023; 42(2): 213-224. doi:10.1002/prs.12455. Also presented at the 2023 AIChE Spring Meeting and 19th Global Congress on Process Safety, Houston, TX, March 2023.

Reza A, Karnesky J. The unified combustible dust standard and Dust Hazards Analysis. Oregon Governor's Occupational Safety & Health Conference, Portland, OR, March 2023.

Ott B, Reza A. Considerations in developing an inspection plan for petrochemical equipment in sulfidation service. The 30th International Ocean and Polar Engineering Conference (Virtual). October 2020

Reza A. The Beirut Explosion: Hazards of ammonium nitrate storage, Chemical Engineering Progress 116(9):27, September 2020.

Karnesky J, Reza A, Xiouris Chris. Accidental activation of an emergency rocket flare and evaluation of ignition mechanism designs. 46th Annual Conference on Explosives and Blasting Techniques. International Society of Explosives Engineers. Denver, CO. January 2020.

Ott B, Reza A, Osorio-Amado C. The role of a piping material verification program to minimize loss of containment incidents in the oil and gas industry. The 29th International Ocean and Polar Engineering Conference, Honolulu, HI, June 2019.

Ott B, Reza A, Veloo P. Considerations in developing an inspection plan for equipment in wet H_2S and Carbon Dioxide service. The 28th International Ocean and Polar Engineering Conference, Sapporo, Japan, June 2018.

Ott B, Reza A, Veloo P. Assigning API 570 pipe classifications based on the composition and temperature of complex hydrocarbon streams. The 27th International Ocean and Polar Engineering Conference, San Francisco, CA, June 2017.

Reza A, Veloo P, Ott B. Damage mechanisms in the petrochemical industry: identification, influencing factors, and effective monitoring strategies. The 26th International Ocean and Polar Engineering

Conference, Rhodes, Greece, June 2016.

Stern M, Somandepalli V, Budiansky N, Reza A, Myers T. Accidents during turnarounds, cleanings, and other infrequent operations. 2016 AIChE Spring Meeting &12th Global Congress on Process Safety, Houston, TX, April 2016.

Reza A. Assessing the potential for a dust explosion and navigating the current regulatory environment. Southern Oregon Occupational Safety and Health Conference, Medford, OR, October, 2014.

Reza A. Explosions in the chemical process industry. The need for a consistent scientific definition. Invited Keynote, Sixth International Conference on Engineering Failure Analysis, Lisbon, Portugal, July 2014.

Jokar A, Christiansen E, Reza A. Refrigeration systems failures due to sudden evaporation and condensation phenomena. Proceedings, ASHRAE Annual Conference, art. no. SE-14- C015, Seattle, WA, July, 2014. Also published in ASHRAE Transactions 120, 2014.

Reza A. What is an explosion? Invited lecture, ME 499, Safe Product Design and Analysis, California State Polytechnic University, Pomona, CA, November 2011, November 2012, February 2014.

Reza A, Ibrahim Z, Tillema D. Engineering investigation of the 2011 explosion at a fireworks storage magazine in Oahu, Hawaii. 40th Annual Conference on Explosives and Blasting Techniques, International Society of Explosives Engineers, February 2014.

Ibrahim Z, Reza A, et al. Forensic examination and failure analysis of a 220 MV step-up transformer fire. ASME 2013 International Mechanical Engineering Congress and Exposition, San Diego, CA, November 2013.

Reza A. What is an explosion? Does an explosion require a fire? What is a fire? Why is this relevant? Invited Keynote, 40th Annual Engineering Insurance Conference, The Canadian Boiler and Machinery Underwriters Association, Toronto, Canada, October 2013.

Reza A, Ibrahim Z, Vaitekunas T. Investigation and analysis of an explosion at the GOEX Black Powder Manufacturing Facility. Loss Prevention Bulletin 235 (IChemE), March 2014. Also published in Chemical Engineering Transactions 2013; 31:475-480. DOI: 10.33303/CET1331080. Also published in Proceedings of the 14th EFCE Symposium on Loss Prevention and Safety Promotion in the Process Industries, Florence, Italy, May 2013.

Reza A, Ibrahim Z. Investigation of odour fade, and subsequent natural gas explosion at the San Diego Bayfront Hilton Hotel. Chemical Engineering Transactions 2013; 31:523-528. DOI: 10.33303/CET1331088. Also published in Proceedings of the 14th EFCE Symposium on Loss Prevention and Safety Promotion in the Process Industries, Florence, Italy, May 2013.

Reza A, Christiansen E. A case study of an ethylene oxide explosion in a sterilization facility. Loss Prevention Bulletin 235 (IChemE), March 2014 Also published in Chemical Engineering Transactions 2013; 31:463-468. DOI: 10.33303/CET1331078. Also published in Proceedings of the 14th EFCE Symposium on Loss Prevention and Safety Promotion in the Process Industries, Florence, Italy, May 2013. .

Reza A, Clayton D. Assessing the potential for a dust explosion and navigating the current regulatory environment. Proceedings, DRI Fire Science and Litigation Seminar, January 2013.

Reza A. Engineering and scientific analysis: Passing the litigation test. Invited lecture, ME 499, Safe Product Design and Analysis, California State Polytechnic University, Pomona, CA, November 2011, November 2012.

Reza A. Proposed natural gas pipeline and metering station to be built by Chief Gathering, LLC. A public presentation to the Dallas Township zoning board, July 2011.

Reza A. The Murrah building bombing. Invited presentation to the Materials Science Society, University of California, Irvine, CA, October 2009. Also presented at American Society of Nondestructive Testing (GLAS), September 2010.

Reza A. Expected damage from a single airplane strike on the New York World Trade Center complex: Why is this discussion relevant? Invited presentation to the Materials Science Society, University of California, Irvine, CA, June 2009.

Bigham G, Reza A, et al. Indoor concentrations of mercury vapor following various spill scenarios. Environmental Forensics 2008; 9(2).

Reza A, Ibrahim Z. Natural gas explosions. Invited presentation, Sempra Utilities Adjuster's Training, October, 2008.

Reza A. Fire and explosion: Origin and cause investigations. Lorman Educational Services — Professional Seminar for Continuing Education, October 2007, August 2008, November 2014.

Carnahan R, Reza A, et al. A case study of two shiploader fires in a coal and petroleum coke facility. 11th International Conference, Fire and Materials, San Francisco, CA, January 2007.

McGoran B, Reza A, et al. Evaluation of a chemical plant explosion and lessons learned. The 1994 detonations at the Terra Industries ammonium nitrate plant. Proceedings, 2006 Annual Meeting of the Chinese Mechanical Engineering Society and 1st Annual Meeting of the Chinese Academy of Engineering, Mechanics and Transportation Engineering Division, pp. 252-257, 2006.

Reza A. Picture this: Using hypothetical loss scenarios for forensic damage and claims evaluations — A case study based on the 9/11 attack on the World Trade Center. The ARC Group Canada Launch Event, Toronto, October 26, 2006.

Reza A, Megerle M, Slee D. Failure investigations of battery powered appliances. CCAI Summer Seminar, San Luis Obispo, CA, July 2006, March 2008.

Reza A, Christiansen E. A case study of a TFE explosion in a PTFE manufacturing facility. Proc. Saf Prog., 26: 77-82. doi: 10.1002/prs.10174. Also in Proceedings, 40th Annual Loss Prevention Symposium, American Institute of Chemical Engineers, pp. 465-477, April 2006.

Colwell J, Mongia R, Reza A. Case study on evacuation rates within the World Trade Center towers on September 11, 2001. Proceedings, 49th Annual Human Factors and Ergonomics Society Meeting, Orlando, FL, September 26-30, 2005; also in Proceedings, DRI Fire and Casualty Seminar, November 17-18, 2005.

Reza A, Lemieux P. LPG and natural gas explosions: Case studies and examples. Summer Meeting, California Conference of Arson Investigators, July 2005.

Colwell J, Reza A. Hot surface ignition of automotive and aviation fluids. Fire Technology 2005; 41(2); also in Proceedings, DRI Fire and Casualty Seminar, November 2-3, 2006.

Reza A, Dekermenjian M. Candles as fire causes. Presented at the Winter and Summer Meetings, California Conference of Arson Investigators, January 2004, July 2004.

Reza A, Christiansen E. Fire debris and gas chromatography. Presented at the Winter and Summer Meetings, California Conference of Arson Investigators, January 2004, July 2004.

Colwell J, Reza A. Use of soot patterns to evaluate smoke detector operability. Fire & Arson Investigator, July 2003.

Dekermenjian M, Reza A, Koonce M, Poblotzki J. Exothermic reactions between cryogenic fluorine, nitrogen trifluoride and stainless steel. Presented at the 37th Annual Loss Prevention Symposium, AICHE Spring National Meeting, March 2003.

Reza A, Shekerlian S. The FEMA investigation of the World Trade Center collapse. Mechanical Engineering Seminar, Harvey Mudd College, Claremont, CA, September 11, 2002.

Mongia R, Reza A, et al. Effect of exhaust stack geometry on the amount of liquid condensate during plant start-up. Proceedings, 95th Annual Conference of Air and Waste Management Association, Baltimore, MD, 2002.

Reza A, Kemal A, Markey P. Runaway reactions in the aluminum, aluminum chloride, HCl and steam system. An Investigation of the 1998 CONDEA Vista Explosion in Maryland. Process Safety Prog., 21: 261-267. doi: 10.1002/prs.680210312. Also, in 36th Annual Loss Prevention Symposium. AICHE Spring National Meeting, March 2002.

Reza A. Accident investigations and analysis. Invited Lecture, AEGIS Claims Roundtable, San Diego, CA, February 2001.

Martin R, Reza A, Anderson L. What is an explosion? A case history of an investigation for the insurance industry. J Loss Prevention Process Industries 2000; 491-497.

Reza A. How to use technical experts effectively. Invited Lecturer, Mid Year Meeting, National Association of Public Insurance Adjusters, Denver, CO, December 1999; Annual Meeting of the National Propane Gas Defense Association, San Francisco, CA, October 1999.

Huet R, Reza A, et al. Mechanical failure of a pressure vessel: Causes and insurance coverage implications. Proceedings, International Symposium on Case Histories on Integrity and Failures in Industry, Milan, Italy, September 1999. Also published in Case Histories on Integrity and Failures in Industry, EMAS, 1999.

Reza A. Fires and explosions — Analysis and investigative techniques. Invited Lecture, Department of Aeronautics and Astronautics, Stanford University, April 1996, 1998, 1999, 2004.

Reza A, McCarthy RL. Measurements to determine the effect of selected additives on the detonability of ANFO mixtures. 25th Annual Conference on Explosives and Blasting Techniques, International Society of Explosives Engineers, February 1999.

Reza A. Investigating gas pipeline fires and explosions. Invited Lecture, South Korea Utility Companies, Menlo Park, CA, November 1996.

Reza A. Electrical fire investigation. Invited Lecture, Consolidated Edison Equipment Root Cause Analysis Training Course, NY, February 1995, March 1995.

Reza A. The 1988 ammonium perchlorate plant explosion in Henderson, Nevada. Invited Presentation, Society of Professional Engineers, Santa Clara Chapter, CA, 1991.

Reports

Reza A, Evaluation of MEC (Munitions and Explosives of Concern) clearance at the [Confidential] site [Confidential client], October 2024.

Reza A, Engineering investigation of March 27, 2019 Ammonium Nitrate explosion in Camden, AR. White

et al vs. Eldorado Chemical Company. June 2024.

Reza A, The 2018 chemical decomposition and fire onboard the Maersk Honam Combustion, reactivity, transportation, and storage practices. Expert Witness Report [Confidential action and venue]. August 2023.

Reza A, Engineering investigation of March 27, 2019 Ammonium Nitrate explosion in Camden, AR. McDougal vs. Eldorado Chemical Company. February 2023.

Jaimes D, Slee DT, Reza A. Phenomenex flash fire investigation. Exponent, September 2021.

Reza A. Engineering investigation of a potential SIF (Significant Injury and Fatality) incident involving a high-priority gas transmission pipeline on June 29, 2022 [Confidential client]

Reza A. Engineering investigation of a 155mm M485 illumination shell allegedly involved in an accident during recycling operations. Ecology Recycling Services vs. Engineering Remediation Resources Group and the United States of America. Confidential rebuttal report June 2020. Confidential supplemental report July 2020.

Karnesky J, Reza A, Besnard A. Dust Hazard Assessment: Additive manufacturing at [confidential]. Exponent, November 2019.

Reza A, Valero Refining-Meraux LLC vs. Murphy Oil Corporation: Response to Valero's complaint. Process Safety information, Mechanical Integrity, Management of Change, and Post-Weld Heat Treat requirements, November 2018. Rebuttal report, January 2019.

Reza A, Moore D, Karnesky J, Getsinger D, Anderson D. Engineering investigation of the October 2017 temporary pump skid fire at the [confidential] refinery. Exponent, January 2018.

Reza A, Performance of the unit 6 and unit 7 Air Cooled Intercooler Heat Exchangers at the Los Angeles Department of Water and Power Scattergood Plant, December 2017.

Reza A. engineering investigation of an accident involving a snow horn fitting. Arreola vs. Linde North America. Exponent, August 2017.

Reza A, Expert report regarding citations issued to DuPont (La Porte, Texas) under the OSHA National Emphasis Program for chemical facilities, February 2017.

Reza A, Moore D, Whittlesey R. Engineering investigation of the Dec 2013 petroleum discharge from the hose-end valve on the [confidential] platform. Exponent, November 2016.

Reza A, Slee, D. Engineering investigation of an explosion in an automatic ammunition loading machine Dean vs. Ammo Load Worldwide. Exponent Failure Analysis Associates, October 2015

Reza A, Karnesky J. Dust hazard assessment of the starch stripping operation at [confidential], Riverside, CA. Exponent, September 2015.

Reza A, Karnesky J. Engineering investigation of the Fushun China grain elevator explosion. Exponent Failure Analysis Associates, December 2014.

Reza A, Bosco J, Lee J. Spill prevention, control, and countermeasure (SPCC) plan for the JM Oil Company storage facility. Exponent, January 2015.

Reza A, Clayton D. Dust explosion hazard assessment for the Burbank Recycling Center. Exponent Failure Analysis Associates, June 2013.

Reza A. Engineering investigation of the failed "Death Drop" magic illusion on July 4, 2009 in Las Vegas, NV. Exponent Failure Analysis Associates, October 2012.

Reza A, Ibrahim Z. Engineering and regulatory investigation of the April, 2011 explosion at the Donaldson Enterprises fireworks storage bunker in Oahu, HI. Exponent Failure Analysis Associates, June 2012.

Reza A. Engineering investigation of the alleged Carbon Monoxide excursion at the Neff residence in Helena, MT. Exponent Failure Analysis Associates, February 2012.

Reza A. Rebuttal report in the matter of United States of America vs. Sierra Pacific Industries, et al. The Moonlight Fire. Exponent Failure Analysis Associates, October 2011.

Reza A, Medhekar S. Hazard and operability study for Aluminizing arc spray operations at [confidential]. Exponent Failure Analysis Associates, September 2011.

Reza A, Clayton D. Investigation of the October 2008 induction furnace explosion at Talladega Castings and Machine Co., Talladega, AL. Exponent Failure Analysis Associates, July 2011.

Leggett D, Reza A. Risk assessment of chemical storage and handling at the AMPAC groundwater treatment system, Henderson, NV. Exponent Failure Analysis Associates, May 2011, revised report June 2011.

Reza A, Ibrahim Z. Investigation of the March 2011 fire at the Funicello/Holt residence in Encino, CA. Exponent Failure Analysis Associates, March 2011.

Reza A, Clayton D. Investigation of a methanol/nitromethane fuel flash fire in the matter of Simon vs. Traxxas, January 2011.

Reza A, Ott B. Assessment of the extent of damage due to the hydrochloric acid spill at Chartered Semiconductor, Singapore. Exponent Failure Analysis Associates, May 2010.

Reza A, Ibrahim Z. A review of investigations conducted regarding a May 2008 chiller failure at [confidential]. Exponent Failure Analysis Associates, May 2010.

Christiansen E, Reza A. Exponent rebuttal report. Mountain View Recreation vs. Imperial Commercial Cooking Equipment et al. (Casino Fire in Pahrump, NV). Exponent Failure Analysis Associates, May, 2010. Supplemental report, November 2010.

Reza A, Krauss D. Investigation of the May 2008 Propane Explosion at the Byrd Chicken Farm, Danville, AL. Exponent Failure Analysis Associates, October 2009. Rebuttal report, November, 2010.

Reza A. Merkur, d. d. fire suppression system explosion investigation Exponent Failure Analysis Associates, December 2009. Also, supplemental report, Merkur, d. d. fire suppression system blast overpressure modeling, May 2010.

Christiansen E, Hosseini K, Reza A. M/V Robert Schulte scrap metal loading monitoring. Exponent Failure Analysis Associates, March 2010.

Reza A, Lieberman D. Engineering investigation of the October 3, 1997 fires at United Integrated Circuits Corporation in Hsinchu, Taiwan. Exponent Failure Analysis Associates, December 2009. Supplemental reports (with J Karnesky), October 2017, July 19 2018, July 26 2018, and June 2019)

Reza A. Engineering investigation of in-bore malfunction of an M374A3 mortar shell, Pohakuloa training area, Hawaii, March 2006. Exponent Failure Analysis Associates, December, 2009.

Reza A, Clayton D. Arc spray booth dust explosion investigation at [confidential]. Exponent Failure

Analysis Associates, December 2009.

Reza A, Slee D. Engineering investigation of the Parco dei Principi Hotel Fire in Rome, Italy. Exponent Failure Analysis Associates, May 2009. Rebuttal report, August 2009; supplemental report, September 2009.

Reza A, Christiansen E. An NFPA 921 based review of UICC's investigation of the October 1997 fires at their Hsinchu, Taiwan facility. Exponent, 2008.

Reza A, Clayton, D. Hazard evaluation of foam dust accumulations in the rebond department at Flexible Foam Products, Inc., Archbald, Pennsylvania. Exponent Failure Analysis Associates, September 2008.

Reza A, Slee, D, Christiansen, E. Vanlandingham fire investigation. Exponent Failure Analysis Associates, April 2008.

Reza A, Clayton D. Iron Mountain dust explosion investigation. Exponent Failure Analysis Associates, March 2008.

Reza A. Engineering investigation of the May 2003 fire at 220 Mapleton Road, Moncton, New Brunswick. Exponent Failure Analysis Associate, March 2008.

Saraf S, Medhekar SR, Reza A, Dillon S, Lieberman D. BP Whiting Refinery — RGP/PGP storage area gap analysis. Prepared for BP Products America Inc., Whiting Business Unit, Exponent Failure Analysis Associates, Inc., November 2007.

Reza A, Slee D, Christiansen E. Marjorie Morningstar fire investigation. Exponent Failure Analysis Associates, October 2007.

Reza A, Baldwin, J, Christiansen E. Wood Brothers scraper tire incident investigation. Exponent Failure Analysis Associates, September 2007.

Reza A, Lieberman D, Hobe M. Layout review and quantity-distance storage criteria verification for proposed propellant manufacturing and inflator assembly plant. Exponent Failure Analysis Associates, June 2006.

Reza A. Engineering investigation of the oxygen booster pump fire at Jim Walter Resources in Brookwood, AL in the matter of Hutchins vs. Haskel. Exponent Failure Analysis Associates, October 2006.

Reza A, Hobe M. Proposed confined space classification for the water treatment vaults at the perchlorate-in-groundwater remediation facility in Henderson, NV. Exponent Failure Analysis Associates, December 2005.

Reza A. Engineering investigation of the sander dust bin explosion at the Georgia-Pacific plant in Talladega, AL. Exponent Failure Analysis Associates, June 2005; rebuttal report, October 2005.

Reza A, Hobe M. Classification and construction requirements for the AMPAC perchlorate-in-groundwater remediation facility in Henderson, NV. Exponent Failure Analysis Associates, June 2005.

Reza A, Wade R, Lemieux P, Deitsch J. Risk management plan, based on EPA mandated 'RMP Consequence Analysis' guidelines, for the AMPAC in situ bioremediation facility in Henderson, NV. Exponent Failure Analysis Associates, June 2005.

Reza A. Nabors 7ES oil rig fire, engineering failure analysis: Ignition, fuel source, fire spread and fire department response. Exponent Failure Analysis Associates, March 2005.

Hertzberg J, Carnahan R, Reza A. Robertshaw TS-11 and 7000 series gas valve investigation. Exponent Failure Analysis Associates, October 2004.

Reza A, Young D. Engineering investigation of the May 2003 explosion at 5601 N. Moccasin Trail, Tucson, AZ. Exponent Failure Analysis Associates, June 2004.

Eiselstein L, Belanger J, Buehler C, Reza A, Ogle R, Adan M. Investigation of the explosion at Ultem Monomer production plant. Exponent Failure Analysis Associates, December 2003.

Reza A, Young D. Engineering investigation of the February 25, 1999, explosion at Jahn Foundry. Exponent Failure Analysis Associates, February 2003.

Reza A. Damage to the WTC complex due to the collapse of only one tower: mechanical systems, fire and smoke and dust contamination. Exponent Failure Analysis Associates, September 2002.

Mongia R, Reza A. Product analysis and testing: BBW Uniclear candles. Exponent Failure Analysis Associates (Confidential), December 2000.

Dekermenjian M, Almaula S, Reza A. Review and analysis of compliance requirements for proposed Medtronic facility. Exponent Failure Analysis Associates, December 2000.

Dekermenjian M, Kemal A, Paduano D, Saraf V, Reza A. Investigation of the July 30, 2000 explosion at Advanced Specialty Gases in Dayton, Nevada. Exponent Failure Analysis Associates, November 2000.

Reza A, Belanger J, Mongia R. Engineering investigation of the May 20, 1990, fire at Socofi Abattoir, St. Louis de France, Quebec. Supplementary report. Exponent Failure Analysis Associates, June 2000.

Reza A, Martin R. Investigation of water turbine failure (the Manitoba Hydro Electric Board v. The Royal Insurance Company Limited, et al.), Exponent Failure Analysis Associates, November 1999.

Horne RB, Barrick R, BenKinney M, Coakley S, Hopkins S, Pound B, Reza A, Wachob H. SSN 705: Hydraulic oil study. Exponent Failure Analysis Associates, April 1999.

Reza A, Smith T, Long, Jr. R. Investigation of the October 13, 1998 explosion at Condea Vista Chemicals, Baltimore, Maryland. Exponent Failure Analysis Associates, March 1999.

Belanger J, Buehler C, Reza A. Investigation of the October 1997 polysilicon CVD exhaust line explosion at Integrated Device Technology, San Jose, California. Exponent Failure Analysis Associates, August 1998.

Reza A, Medhekar S. A Comparison of TRW 1990-1994 injury and fatality data against other industries. Exponent Failure Analysis Associates, May 1998.

Reza A, Loud J, Meyer J. Investigation of the effect of smoke contamination on Tekelec communications equipment. Failure Analysis Associates, March 1998.

Reza A, Eiselstein L, Huet R, Belanger J. Investigation of the April 1994 Halliburton perforation gun explosion in Kenai, Alaska. Failure Analysis Associates, January 1998.

Reza A, Nunes S, Hobe M. Engineering Investigation of the May 20, 1990 Fire at Socofi Abattoir, St. Louis de France, Quebec. Failure Analysis Associates, December 1997.

Reza A, Wagner-Jauregg A. Explosion at Catalytica Fine Chemicals. Failure Analysis Associates, November 1997.

Reza A. Investigation of the July 1997 dust collector explosion at the Western Electro-Chemical Company

ammonium perchlorate plant, Cedar City, Utah. Failure Analysis Associates, October 1997.

Reza A, Wagner-Jauregg A. Fire origin and cause investigation: Denise James residence, Angel Pond subdivision, Fort Yukon, Alaska. Failure Analysis Associates, June 1997.

Reza A, Walter F. An investigation of the February 1996 FCCU explosion at the Texaco Refinery in Anacortes, Washington. Failure Analysis Associates, June 1996.

Wagner-Jauregg A, Reza A. Explosion at 2868 Homestead Road. Failure Analysis Associates, April 1996.

Reza A, Abbott J, Hinman E, McCarthy R. Measurements to determine the detonability of 10 gallon ammonium nitrate mixtures. Failure Analysis Associates, July 1995.

Kytomaa H, Foulds J, Reza A, Hinman E, Correia P. Old Harbour Power Station boiler #4 explosion, June 3, 1994, Jamaica. Failure Analysis Associates, November 1995.

Reza A. Investigation of the August 16, 1995 slurry building fire at the Ensign-Bickford North American Explosives Facility, Graham, Kentucky. Failure Analysis Associates, October 1995.

Reza A. Propane dispersion tests with Delonghi air conditioners: An experimental study to assess slow and fast leaks of hydrocarbon refrigerants. Failure Analysis Associates, May 1995.

Reza A. Investigation and analysis of the September 20, 1991, fire at 2628 West Charleston Boulevard, Las Vegas, Nevada. Failure Analysis Associates, April 1995.

Reza A. A report on the fire and explosion in the compressed air system at Consumers Glass Company Ltd., Toronto, Canada, May 23, 1984. Failure Analysis Associates, February 1995.

Reza A, Wagner-Jauregg A, Rao G. Fire tests on Delonghi air conditioners: A comparison of R-290 and R-22 refrigerants. Failure Analysis Associates, February 1995.

Reza A. Fire investigation, Rodriguez rental fire, 156 Orchard Avenue, Salinas, California. Failure Analysis Associates, December 1994.

Caligiuri R, Andrew SP, Huet R, Reza A. A report on the October 1993 explosion at the PG&E McDonald Island facility. Failure Analysis Associates, June 1994.

Eiselstein L, Wagner-Jauregg A, Reza A, Rao G, Caligiuri R. Experiments on the effect of suction-side leaks on refrigerator performance. Failure Analysis Associates, April 1994.

El-Fadel M, Cleary C, Reza A. Evaluation of the Pilot Petroleum Facility, 475 Seaport Boulevard, Redwood City, California. Failure Analysis Associates, February 1994.

Reza A, Rao G, Caligiuri R. Internal isobutane-air explosion tests in Aspera compressors. Failure Analysis Associates, January 1994.

Reza A, Rao V, Blanchard R, Rao G, Caligiuri R. Tests on unsealed and prototype sealed Klixon overload protectors in an explosive isobutane-air atmosphere. Failure Analysis Associates, January 1994.

Huet R, Blanchard R, Reza A, Li R. Capacitor overheating of laptop computers. Failure Analysis Associates, October 1993.

Reza A, Blanchard R. Report on the investigation of a fire in an electronic voice mail Memo II system. Failure Analysis Associates, July 1993.

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Project Experience

Loss of Containment (LOC) and Process Safety Management (PSM) Investigations (Multiple Locations)

1990-present. Conducted Direct Cause Analysis (DCA) and Root Cause Analysis (RCA) of fires, explosions, and mechanical failures at multiple upstream, midstream, and downstream petrochemical and gas utility facilities (e.g., offshore platforms and loading terminals, tank farms, gas storage reservoirs and pipelines, and oil refineries). Damage Mechanisms investigated have included High Temperature Hydrogen Attack (HTHA), Sulfidation corrosion, Wet H2S corrosion, Hydrogen Fluoride (HF) corrosion and Hydrogen Blistering and cracking. Reviewed compliance and gaps against OSHAs PSM standard (CFR 1910.119), with special emphasis on Process Safety Information (PSI), Mechanical Integrity (MI) and Management of Change (MOC).

Accidental Ignition, Explosion, or Detonation During Manufacturing, Disassembly, Use, and Destruction of Explosives and Pyrotechnics and Reactive Chemicals

1990-present. Failure analysis and incident investigation of explosives, reactive chemicals, munition, shells, pyrotechnic devices, fireworks, and novelty products during the manufacturing, use and disposal cycles. Projects have included malfunction, sensitivity to stray ignition sources including static electricity, misuse, abuse, improper disposal, and issues related to compliance against Federal regulations and Department of Defense specifications.

Dust Explosion and Flash-fire Investigations and Dust Hazards Analysis

1990-present. Failure analysis of dust explosions related to chemical, metal, agricultural, wood and paper, pharmaceutical, and food processing industries. Risk assessment and hazards analysis consistence with Recognized and Generally Accepted Good Engineering Practice (RAGAGEP) across multiple industry segments.

September 11, 2001, Attack on the World Trade Center in New York City

The September 11, 2001, attack on the World Trade Center complex in New York destroyed both 110-story towers, as well as surrounding low-rise and subterranean structures due to impact and fire spread from flaming debris. A dispute subsequently developed between the long-term leaseholder for the property and their property insurance carriers regarding the extent of insurance coverage for the loss — was it one “occurrence” or two “occurrences” under the language of the policies? The attack also prompted several questions concerning fire spread, fire protection, and emergency response in high-rise structures. Exponent was retained by the property insurance carriers to evaluate the extent of damage under several hypothetical loss scenarios.

Determined how much damage would have occurred to the property if only a single plane had struck one of the towers. Analyzed the collapse and debris patterns for each tower to assess damage to the sub-grade mechanical, electrical, and plumbing infrastructure and predicted the effects of heavy and light debris impacts on the remaining tower. Analysis included the effects of fire spread, smoke, and dust contamination in the remaining tower, and wind-tunnel studies of the performance of single and twin towers. A computer model (FDS) was used to determine the rate of fire growth and maximum temperatures within a typical office on one floor of the tower. The temperature/time history was then used to evaluate the effect on structural components.

Federal Building Bombing, Oklahoma City, Oklahoma

On April 19, 1995, a 4,800-pound ammonium nitrate–based (ANFO or AN-Nitromethane) bomb, concealed in a rented truck, exploded 20 feet from the Alfred P. Murrah Federal Building in downtown Oklahoma City. The explosion and partial collapse of the nine-story building killed 168 people and injured several hundred more. During the subsequent investigation, Exponent was retained to determine whether certain additives could render ANFO mixtures inert. Conducted an extensive series of test detonations and demonstrated that these additives were completely ineffective. The results were presented to a Congressional Subcommittee, which determined that these additives should not be required for all future ammonium nitrate manufactured or sold in the United States.

Explosion within a Fluorinated Polymer Manufacturing Facility, Alabama

A 1999 explosion in the purification area of a fluorinated polymer manufacturing plant in the United States caused fatal injuries to three employees. An additional employee was severely injured. Conducted an engineering investigation of the incident, including an analysis of the runaway chemical reaction that caused the explosion. Concluded that adiabatic compression after high-pressure gas was allowed to impinge against a blind flange created temperatures sufficient to ignite a TFE/air mixture within the system. The initial deflagration provided sufficient energy for a self-sustaining decomposition reaction to propagate within the TFE line into the upstream pressure vessel. Also reviewed the HAZOP performed by the employer that failed to note critical parameters that contributed to the incident.

Ammonium Nitrate Plant Detonations, Port Neal, Iowa

On December 13, 1994, two massive detonations leveled portions of a Port Neal, Iowa, ammonium nitrate plant owned by Terra Industries. Four plant workers were killed, eighteen others suffered serious injury, and damage to the plant and surrounding community was estimated in the hundreds of millions of dollars. Reviewed the events surrounding the accident, analyzed the plant's process data for reliability, and conducted extensive research regarding ammonium nitrate properties and decomposition mechanisms. Also completed analytical modeling and experimental testing to resolve the conflicting accident theories, and inspected and performed metallurgical analysis of various artifacts from the explosion site. The investigation revealed that the detonations occurred due to unsafe plant operations, including poor maintenance and inadequate employee training. Specifically, plant operators allowed the ammonium nitrate within their 18,000-gallon-capacity neutralizer vessel to become contaminated and highly acidic. Operators then injected superheated steam directly into the neutralizer vessel, precipitating a runaway chemical reaction.

Foundry Dust Explosion, Springfield, Massachusetts

Conducted an engineering investigation of a series of explosions that destroyed the Shell Mold building at the Jahn Foundry in Springfield, Massachusetts, on February 25, 1999. Determined that the subject explosions were fueled initially by dust dislodged from an overhead exhaust duct or inadvertently dispersed during routine maintenance. A subsequent deflagration (dust explosion) occurred within the exhaust ducts associated with the overhead odor control system. This explosion was fueled by resin-rich deposits of dust within the odor control system.

Abattoir Structural Fire, Montreal, Canada

Conducted an engineering investigation of the May 20, 1990, fire at the Socofi abattoir (slaughterhouse) in St-Louis de France, Quebec. Retained to determine whether certain Arcoplast panels used in the construction of the abattoir met requirements of the Canadian National Building Code (NBC). Investigated the properties and composition of the Arcoplast panels and conducted experiments to determine flame spread and determine whether the materials exacerbated the fire damage. Determined that the Arcoplast

panels were developed in an ad hoc manner after the distributor marketed and received an order for the product from the building developer. The panels did not meet NBC fire safety requirements and were the primary reason for the rapid fire growth and spread within the building.

Chemical Plant Runaway Reaction and Explosion, Baltimore, Maryland

Led the engineering investigation of the October 1998 explosion and subsequent fire at the Condea Vista plant in Baltimore, Maryland. Determined that the explosion occurred due to a runaway chemical reaction inside a batch reactor, while plant personnel were using high-pressure steam to clean out residual chemicals. Process materials released from the various vessels and process piping, which ruptured in this event, fueled the subsequent fire.

Sodium Azide Explosions

Investigated several incidents that resulted in the ignition of sodium azide propellant at various manufacturing plants across the U.S. Investigations generally focused on identifying how this strictly controlled material was ignited, assessing over-pressure damage and evaluating existing safety procedures.

Occidental Petroleum Piper Alpha Oil Platform Gas Explosion, North Sea, Scotland

A 1988 explosion and fire in the Piper Alpha oil platform, located in the North Sea off the coast of Scotland, completely destroyed the structure and resulted in the loss of 167 lives. Exponent participated in the public inquiry conducted by the British government and conducted an independent engineering investigation of the subject explosion. One of the key technical issues was the possibility that leaking natural gas had been ignited by hot metal surfaces associated with a gas turbine. Conducted full-scale tests to determine whether the hot skin of certain turbines that operated on the platform could have caused ignition. Also assessed propane vapor concentrations and modeled the vapor cloud from a postulated leak at an improperly tightened flange.

Turbine Repair Center Dust Explosion, San Francisco, California

Investigated a fire and explosion that occurred at a powder metallurgy facility at the United Airlines Maintenance Operations Center in the San Francisco International Airport. The explosion caused over $20 million in property damage to the Operations Center and injured two employees. Key technical issues included the reactivity of finely divided metal powder, the design and construction of high-velocity pneumatic material-handling systems, the response of structures to dynamic loading from internal explosions, and electrostatic discharge in partially grounded metal hoses. Also assisted in identifying those pieces of equipment that could be salvaged, and advised on the redesign of the facility to prevent future explosions.

Ammonium Perchlorate Plant Explosion, Henderson, Nevada

Investigated the large fire and explosions that destroyed the manufacturing facilities of Pacific Engineering and Production Company (PEPCON), one of two U.S. producers of ammonium perchlorate. The largest of five individual explosions at PEPCON was equivalent to 1.5 million pounds of TNT, and another explosion was equivalent to 500,000 pounds of TNT. Served as one of the principal technical experts for PEPCON and addressed such issues as the effect of heat, shock pressure, hydrocarbons, and aluminum on the detonation characteristics of ammonium perchlorate; the response of structures to dynamic loads from external explosions; and the migration of gases and other potential sources of pollutants through the ground.

Chlorine Leak, Henderson, Nevada

The town of Henderson, Nevada, was evacuated following a chlorine leak at a chemical plant. Exponent FaAA investigated the accident under the observation of several federal and state agencies, including the Occupational Safety and Health Administration, the Nevada Department of Occupational Safety and Health, the Environmental Protection Agency, and the Air Pollution Control Board. During this investigation, assisted in characterizing the failure mode, documented damage to the plant, and developed protocols to prevent reoccurrence of failure. The plant was recertified and is back in full-scale production.

Chemical Process Plant Vapor Cloud Release and Explosion Hazard Evaluation

Evaluated the primary vapor cloud explosion (VCE) hazard at a major petrochemical process facility. Computed emission rates for three identified worst-case scenarios, including a liquid, a vapor, and a two-phase aerosol leak. Performed a dispersion analysis to determine the drift distance of each cloud. Computed the extent and duration of the cloud between the lower explosive limit (LEL) and upper explosive limit (UEL). The VCE clouds in each modeled scenario were ignited with a specified ignition source to determine the worst-case overpressure. Analysis indicated that significant overpressures occurred only when the flammable mixture was either partially confined or obstructed, such as within a dense process area. In open or unconfined areas, the vapor cloud burned but did not produce high overpressures.

Ammonium Perchlorate Plant Dust Explosion, Cedar City, Utah

Investigated the explosion at the Western Electro-Chemical Company's (WECCO) plant that killed one employee and injured three. The incident was triggered by a fire at the batch house dust collector. The ignition likely occurred due to metal-to-metal friction after an employee used an unauthorized steel-tipped shovel to clear out ammonium perchlorate that had clogged the filters of the dust collector. The fire provided a continuous ignition source for the subsequent dust explosion that propagated via the vacuum lines.

Perforation Gun Detonation, Kenai, Alaska

Investigated a perforation gun explosion at the Halliburton Industries assembly plant that killed one employee and seriously injured five others. Concluded that the employees accidentally ignited shaped charges that were in contact with the detonation cord within the gun.

Advanced Specialty Gases Explosion, Dayton, Nevada

Investigated an explosion in a nitrogen trifluoride manufacturing plant that occurred after a change of packing inside a distillation column disturbed the passivation layer within the column. The resulting runaway chemical reaction between cryogenic fluorine, cryogenic nitrogen trifluoride, and unprotected stainless steel destroyed the plant.

Gas Fire and Explosion, New York City, New York

Investigated the fire and explosion after a 36 inch-diameter, 300 psi natural gas pipeline in the Bronx ruptured. Two people were killed, and an entire city block was virtually destroyed. Determined that an earlier explosion in a nearby underground electrical vault had subjected a 40-year-old Dresser coupling on the pipe to a dynamic load, which subsequently caused its failure and triggered the leak.

Coke and Coal Shiploader Fires, Port of Los Angeles, California

Investigated two fires that occurred within five months on a coal and petroleum coke shiploader operating at the Los Angeles Port. Determined the fire origin and spread mechanism by analyzing the burn patterns on the shiploader and conducting belt-stretch analysis, laboratory scale combustion tests on coke and coal mixtures, metallurgical examination of the conveyor idlers and bearings, and review of applicable standards. The outer race of a failed bearing from one of the conveyor return idlers reached temperatures over 1100 °F, sufficient to ignite coal and coke particles that had migrated into the bearing. The hot embers ignited a significant amount of coal and coke debris that had accumulated in a pocket near the bearing due to the geometry of the conveyor idler frame. This resulting fire ignited the non fire-retardant conveyor belt that was part of the original design. The belt eventually snapped after it caught fire, spreading the fire to other parts of the shiploader and causing extensive damage. Determined that design considerations available to prevent coke and coal accumulations around rotating machinery and conveyors would have minimized the likelihood of subject fires.

Mobile Drill Rig Fire, Alaskan North Slope

Investigated a fire that destroyed a 2-million-pound, 120-foot mobile oil drilling rig that operated on the North Slope of Alaska. A tire blow out during a routine pad to pad move caused a hydraulic leak at the steering cylinder, which ignited. Factors precipitating this incident included deficient and incomplete system engineering during the initial design of the rig, tires and rims that were under-designed for the expected load, and a hydraulic system that was mounted near the tires and utilized combustible hydraulic fluid. Also reviewed the fire department response to the event and determined that, given the available conditions and access to fight this fire, their response was completely appropriate.

Explosion and Fire at Natural Gas Processing Facility, McDonald Island, California

Investigated a major explosion and fire at the McDonald Island natural gas processing facility that caused extensive damage to the facility. The complex provided access to 75 billion cubic feet of natural gas stored beneath the Sacramento Delta. Determined that the root cause of the explosion was a failure within a high-pressure natural gas tank due to mechanical failure of certain components under high loading stresses.

Venezuelan Natural Gas Pipeline Rupture and Fire

Investigated the rupture of a high-pressure, 20 inch-diameter natural gas transmission pipeline in Venezuela in September 1993. The subsequent ignition of the gas jet caused an inferno that killed at least 50 people. Key technical issues included evaluating the effect of external mechanical damage from trenching equipment on pipe integrity, flame height and radiation flux on adjacent roadway, pipeline material fracture toughness, critical flaw size, and pipe siting and burial requirements.

Gas Explosion in Apartment Complex, Santa Clara, California

Investigated the 1996 natural gas explosion that destroyed a 15-apartment complex in Santa Clara, California. The three two-story buildings in this complex had been tented for termite fumigation. For various reasons, the gas supply to the building was not turned off properly, and the main gas regulator was left pressurized. Determined that the regulator diaphragm failed, and the gas accumulated inside the tents. The resulting explosion and fire completely destroyed the complex.

Gas Explosion, San Francisco, California

Investigated the June 1994 explosion and fire at 901 Post Street that killed three people and destroyed a three-story building in San Francisco. The alleged cause of the explosion was damage to a natural gas

service line by third parties, which allowed natural gas to enter the building basement. Key technical issues included explosion over-pressure calculations for the basement and first floor to determine whether this was an underground or above-ground explosion, inspection and evaluation of various natural gas appliances in the basement, analysis of alternative fuel sources and ignition mechanisms (including pilot lights, sewer gas, and various possible volatile liquid contaminants), evaluation of the mechanical and physical properties of the pipeline, installation practices, and construction of the building.

Candle Fires

Analyzed product design and usage data for a unique line of clear, fragranced candles that are used in homes across the nation. Conducted experimental and analytical studies to address the potential risk of fire and injury to consumers. Conducted long-duration, continuous-burn tests to investigate the propensity for flashover. Inspected the candle manufacturing process and conducted in-situ sampling of the raw materials to identify potential contamination scenarios and quantify the risk of flashover and possible injury to the end user. Exponent also conducted consumer tests of the warning label that is currently on the candle and proposed changes based on American National Standards Institute (ANSI) recommendations.