

Exponent®
Engineering & Scientific Consulting

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Professional Profile

Holding degrees in both Mechanical Engineering and Materials Science and Engineering, Dr. Robert Caligiuri specializes in combining the principles of solid mechanics with an understanding of the physical, mechanical and corrosion behavior of metals to solve complex problems in industrial applications. He has over 35 years of experience conducting failure investigations, root cause studies and risk assessments for clients in the petrochemical, consumer product and transmission pipeline industries throughout North America, Europe and Asia. He has specialized expertise in the use and application of the standards, codes and regulations that govern the design, operation, and maintenance of engineered systems.

General Failure Analysis

Dr. Caligiuri has investigated hundreds of failures of metallic components in mechanical systems and structures, ranging in size from coronary implant devices to mechanical machinery to large civil engineering structures. The common thread through all of these investigations has been the relationship between the metallurgy of the component materials, and the presence of stress concentration points such as fasteners, welds, and other mechanical joints to the response of the system to applied loads. This has often required performing finite-element stress analyses of the relevant components in the system or structure. He has applied this expertise to the specific problem of failures in steel platforms, steel-frame high-rise buildings, chemical process equipment, pressure vessels, aircraft and spacecraft, construction equipment, and vehicles. He has reviewed many of the applicable codes and industry standards, including ASME, AWS, ASTM, and NACE.

Pipelines and Process Piping

Dr. Caligiuri has investigated over 75 failures in pipelines, ranging in size from 1-inch copper water distribution pipelines to downstream 16-inch liquid petroleum pipelines, to downstream 36-inch-diameter natural gas transmission pipelines. His investigations have included review and analysis of destructive and nondestructive testing, including review and interpretation of radiographic images of welds in accordance with industry standards. In addition, he has investigated the failures of components in upstream hydrocarbon production and processing facilities, including drilling strings, casings, valves, and gathering field lines. Dr. Caligiuri has researched the corrosion and stress corrosion cracking of materials exposed to H2S, and has investigated field failures of components exposed to sour environments, including welded piping. He has extensively reviewed and evaluated the applicability of most major piping-related industry standards and codes, including ASME B31.1, ASME B31.3, ASME B31.4, ASME B31.8, ASME BPVC Section IX, API-5C, API 1104, API 570, and NACE MR0175.

Welds and Welded Connections

Dr. Caligiuri has investigated numerous failures in welds and welded metallic components. The common thread through all of these investigations has been the relationship between the metallurgy of the weld

metal, the heat-affected zone, and the base metal to the response of welded joints to applied loads and associated stress concentration points. Particular past experience has included welds in steel structures, pipelines, tanks and pressure vessels in refineries and chemical plants, and offshore marine facilities and terminals. He has specific experience related to the interpretation of welding procedures, specifications, codes, and standards, and their applicability to fabricated structures and mechanical systems, including AWS D1.1, AWS D1.2, AWS A5.1, ASME BPVC Section IX, and others.

Consumer Products

Dr. Caligiuri has conducted or supervised on behalf of consumer product manufacturers numerous root-cause investigations into potential safety and warranty issues. Such products have included: clothes washers, clothes dryers (gas and electric), dishwashers, refrigerators and sealed system components, ice makers, microwave ovens, conventional ovens, coffee pots, blenders and mixers, gas furnaces and water heaters, room dehumidifiers, child safety seats, disposable lighters, and automotive components such as restraint systems, airbags, transmissions, fuel delivery systems, and steering wheels. Dr. Caligiuri has pioneered the use of the top-down approach to root-cause analysis for consumer products and the use of analytical tools like FMEAs and fault trees in such studies. Selected projects are summarized below.

Academic Credentials & Professional Honors

Ph.D., Materials Science and Engineering, Stanford University, 1977

M.S., Materials Science and Engineering, Stanford University, 1974

B.S., Mechanical Engineering, University of California, Davis, 1973

Elected Member of the National Academy of Engineering (NAE), 2023

Fellow, American Society for Materials, 2003

Elected Member of Tau Beta Pi Engineering Honor Society

Elected Member of Sigma Xi Honors in Research Society

Recipient of the Distinguished Engineering Alumni Medal from the University of California, Davis, 2023

Licenses and Certifications

Professional Engineer, Arkansas, #16736

Professional Engineer Metallurgical, California, #1774

Professional Engineer, Michigan, #6201057185

Professional Engineer, North Carolina, #037114

Professional Engineer Metallurgical, Texas, #118283

Professional Engineer, Utah, #190547-2202

Professional Engineer Metallurgical, Washington, #52817

Prior Experience

Research Scientist and Program Manager, Physical Sciences Division, SRI International, Menlo Park, CA, 1978-1987

Visiting Scientist, Mechanics and Materials Laboratory, Tsukuba Research Center, Tsukuba, Japan, 1984

Staff Metallurgist, Metals and Ceramics Division, Lawrence Livermore National Laboratory, Livermore, CA, 1977-1978

Research Assistant, Department of Materials Science and Engineering, Stanford University, Stanford, CA, 1974-1977

Teaching Assistant, Department of Materials Science and Engineering, Stanford University, Stanford, CA, 1974

Engineering Assistant, Department of Mechanical Engineering, University of California at Davis, Davis, CA, 1973

Professional Affiliations

American Society for Materials

Metallurgical Society of American Institute of Mining and Metallurgical Engineers

AWS Welding Handbook Editorial Committee; 1987

American Society of Mechanical Engineers—ASME

Publications

Slone CE, Sellers MCK, Caligiuri RD, Latanision RM, Barrett Z, Engel C. "Environmentally assisted cracking resistance of 7xxx-series aluminum alloys in chloride-rich environments compared to humid air." Corrosion Science 2026; 270:114069.

Lemberg JA, Budiansky N, Colella F, Caligiuri R. Corrosion of newly commissioned stainless steel beer fermentation and aging vessels. J Fail. Anal. and Preven. 2026; 1–17.

Ames N, Lemberg J, Caligiuri RD. Fatigue failure of a 2500 ton forge press. Journal of Failure Analysis and Prevention 2017; 17:15-22.

Caligiuri RD. Critical crack path assessments in failure investigations. Journal of Fracture and Structural Integrity 2015 Oct; 34:125-132.

Caligiuri RD, Eiselstein LE, Eastep LN. Proper design and fabrication of socket welds for use in sour service. Materials Science Forum/Advanced Materials Research, 2010; 638-642: 3649-3654.

Eiselstein LE, Caligiuri RD. Metal Ion leaching from implantable medical devices. Materials Science Forum/Advanced Materials Research, 2010; 638-642: 754-759.

Caligiuri RD, Eiselstein LE, Schmidt CG, Giovanola JH. Stable deformation at very high strain rates in UHCS. Int J Microstructure Mat Properties 2008; 3(5).

James B, Sire R, Caligiuri R. Determination of the failure mode and the rupture pressure in a mechanically damaged pipeline. J Fail Anal Preven 2008; 8:223-230.

Caligiuri RD, Eiselstein LE, Schmidt CG, Giovanola JH. Stable deformation at very high strain rates in UHCS. In: THERMEC 2006, International Conference on Processing and Manufacturing of Advanced Materials. Chandra T (ed), Trans Tech Publications, July 2006.

Caligiuri RD, Gupta A, et al. Fatigue damage assessment techniques for SPM anchorages. Proceedings, 16th International Offshore and Polar Engineering Conference, San Francisco, CA, May 28-June 2, 2006.

Caligiuri RD, Foulds J, Sire R, Andrew S. Thermal constraint considerations in design of a heat recovery boiler. Engineering Failure Analysis 2006; 13:8.

Caligiuri RD, Eiselstein LE. Superplastic densification of ultrahigh carbon steel powder compacts. Materials Science Forum 426-432:877-882. Trans Tech Publications, Switzerland 2003.

Caligiuri RD, Eiselstein LE. Particulate composite of white cast iron. Materials Science Forum 426-432:895-900. Trans Tech Publications, Switzerland, 2003.

Caligiuri RD, Sire RA, Andrew SP, Parnell TK. Analysis of rail cracking and development of a rail screening guideline based on fracture mechanics principles: Fatigue and durability assessment of materials: Components and structures. Proceedings, 5th International Conference of the Engineering Integrity Society, Queen's College, Cambridge, UK, April 7-9, 2003.

Moncarz PD, McDonald BM, Caligiuri RD. Earthquake failures of welded building connections. International Journal of Solids and Structures 2001; 38:2025-2032.

Andrew SP, Caligiuri RD, Eiselstein LE, Parnell TK. Evaluation of a failure in a chlorine production facility. Proceedings, IMECE2001, 2001 ASME International Mechanical Engineering Congress and Exposition, New York, NY, November 2001.

Caligiuri RD, Moalli JE, Medhekar S. Practical risk analysis as a tool for minimizing plastic product failures. Proceedings, Society of Plastics Engineers, ANTEC 2000 (Best Paper Award).

Caligiuri RD, Eiselstein LE. Superplasticity at ultrahigh strain rates — Can it occur? In: Processing and Properties of Structural Deformation. Taleff EM, Syn CK, Lesuer DR (eds), The Minerals, Metal and Materials Society, Warrendale, PA, March 2000.

Caligiuri RD, Huet R, Andrew S, Reza A. Mechanical failure of a pressure vessel: Causes and insurance coverage implications. Proceedings, Case Histories on Integrity and Failures in Industry. Bicego V, Nitta A, Price JWH, Viswanathan R (eds), Milan, Italy, September 28-October 1, 1999.

Caligiuri RD, Moncarz PD, McDonald B. Earthquake failures of welded building connections. Proceedings, 6th Pan-American Congress of Applied Mechanics and Eighth International Conference on Dynamic Problems in Mechanics/Applied Mechanics in the Americas, Rio de Janeiro, Brazil, January 4-8, 1999.

Caligiuri RD, Rao GL. Operational reliability analysis for manufacturing plants. Proceedings, American Society of Mechanical Engineers Winter Annual Meeting, Safety Engineering and Risk Analysis, New Orleans, LA, November 1993.

Caligiuri RD, Parnell TK, Rao GL. Safety analysis of custom designed manufacturing equipment. Proceedings, American Society of Mechanical Engineers Winter Annual Meeting, Safety Engineering and Risk Analysis, New Orleans, LA, November 1993.

Caligiuri RD, Parnell TK. Analysis of the dynamic response of a buried pipeline due to a surface explosion. In: Computational Aspects of Impact and Penetration. Schwer LE, Kulak RF (eds), Elme Press International, 1991.

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Caligiuri RD, Schmidt CG, Giovanola JH, Erlich DC. Effect of grain size on high strain rate deformation of copper. Metallurg Trans A 1991; 22A:2349.

Andrew SP, Caligiuri RD, Eiselstein LE. A review of penetration mechanisms and dynamic properties of tungsten and depleted uranium penetrators. Proceedings, Tungsten and Tungsten Alloys — Recent Advances Symposium. Chen E (ed), The Metallurgical Society, 1991.

Caligiuri RD, Eiselstein LE. Powder metallurgy near net shape processing of heavy metal chemical energy warhead liners. Proceedings, 11th International Symposium on Ballistics, Brussels, Belgium, May 1989.

Eiselstein LE, Caligiuri RD. Atmosphere corrosion of the suspension cables on the Williamsburg Bridge. pp. 78-95. In: Degradation of Metals in the Atmosphere. ASTM STP 965, American Society for Testing and Materials, Philadelphia, PA, 1988.

Eiselstein LE, Caligiuri RD, Schmidt CG. Development of advanced, all-metallic laminated armor systems for lightweight applications (U). Volume II. Proceedings, 3rd TACOM Armor Coordinating Conference, U.S. Army Tank Automotive Command, pp. 55-102, 1988 (SECRET).

Eiselstein LE, Caligiuri RD. Application of laminated metallic armors to heavy hybrid armor systems. Proceedings, 4th TACOM Armor Coordinating Conference for Light Combat Vehicles, Monterey, CA, March 1988.

Schmidt CG, Caligiuri RD, Eiselstein LE. Low temperature sensitization of Type 304 stainless steel pipe weld heat affected zone. Metallurg Trans A 1987; 18A:1483.

Caligiuri RD, Sherby OD. Bulk forming of superplastic alloys. Proceedings, AGARD Lecture Series No. 154: Superplasticity, North Atlantic Treaty Organization, 1987.

Caligiuri RD, Eiselstein LE, Sherby OD. Properties and applications of ultrahigh carbon steel laminates. Proceedings, 34th Sagamore Army Materials Technology Conference: Innovations in Ultrahigh Strength Steel Technology, pp. 499-525, Lake George, NY, September 1987. Army Materials Technology Laboratory, Watertown, MA, 1987.

Eiselstein LE, Caligiuri RD, Schmidt CG. Stress corrosion cracking of steam turbine disc alloys in dilute environments. Proceedings, 2nd International Symposium on Environmental Degradation of Materials in Nuclear Power Systems-Light Water Reactors, American Nuclear Society, pp. 311-318, 1987.

Caligiuri RD, Schmidt CG, Giovanola CG, Erlich DC. The role of fine grain microstructures in promoting stable deformation at very high strain rates in polycrystalline copper. Proceedings, Army Symposium on Solid Mechanics, U.S. Army Materials Technology, 1986.

Caligiuri RD, Eiselstein LE, Schmidt CG. Development of advanced all-metallic laminated armor systems for lightweight applications (U). Proceedings, Symposium on Composite Materials in Armament Applications. U.S. Army Armament Research and Development Center, Picatinny Arsenal, Dover, NJ, August 1985 (SECRET).

Caligiuri RD, DeCarli PS, Rabinowitz M. Explosive compaction of amorphous ferromagnetic metal powders. Proceedings, 4th International Conference on the Properties and Applications of Magnetic Materials, Illinois Institute of Technology, May 1985.

Schmidt CG, Caligiuri RD, Eiselstein LE. Stress corrosion cracking susceptibility of alternative alloys for BWR piping. Paper No. 99. pp. 99/1-99/11. In: Corrosion/85, Annual Meeting of the National Association of Corrosion Engineers, Boston, MA, March 1985.

Caligiuri RD, Smith JA. Influence of microstructure on the performance of explosively driven penetrators. Proceedings, 8th International Symposium on Ballistics, Orlando, FL, October 1984; American Defense Preparedness Association, Arlington, VA, October 1984.

Caligiuri RD, Eiselstein LE, Schmidt CG. Use of constant extension rate tests to characterize low temperature sensitization in Type-304 stainless steel weld-heat-affected zone. Proceedings, 2nd Seminar on Countermeasures for Pipe Cracking in BWRs, p. 10-1, Palo Alto, CA, November 1983, EPRI NP-3684-SR, Electric Power Research Institute, Palo Alto, CA, September 1984.

Schmidt CG, Caligiuri RD, Eiselstein LE. Intergranular stress corrosion cracking of low temperature sensitized Type 304 stainless steel pipe welds. Proceedings, International Symposium on Environmental Degradation of Materials in Nuclear Power Systems — Light Water Reactors, pp. 423-437, Myrtle Beach, SC, August 1983, National Association of Corrosion Engineers, Houston, TX, 1984.

Caligiuri RD, Eiselstein LE, Curran DR. Microkinetics of stress corrosion cracking in steam turbine disk alloys. Proceedings, International Symposium on Environmental Degradation of Materials in Nuclear Power Systems — Light Water Reactors, pp. 824-836, Myrtle Beach, SC, August 1983, National Association of Corrosion Engineers, Houston, TX, 1984.

Eiselstein LE, Syrett BC, Wing SS, Caligiuri RD. The accelerated corrosion of Cu-Ni alloys in sulphide-polluted seawater: Mechanism No. 2. Corrosion Sci 1983; 23(3):223-239.

Caligiuri RD. Computational model for laminate composite armor design (U). Proceedings, Conference on Design of Armor Systems, Monterey, CA; April 1982, JTCG/AS-83-T-002(2); Naval Air Systems Command, Washington, DC; October 1983 (SECRET).

Caligiuri RD, Landon PR, Duletsky. The influence of the M23 (C,N)6 compound on the mechanical properties of Type 422 stainless steel. Metallurg Trans A 1983; 14A:1395.

Caligiuri RD. Low temperature sensitization of Type 304 stainless steel pipe weld-heat-affected zones. Proceedings, Specialists Meeting on Subcritical Crack Growth, Freiburg, West Germany, May 1981, NUREG/CP-0044; International Atomic Energy Agency and the U.S. Nuclear Regulatory Commission, Vienna, Austria, May 1983.

Caligiuri RD, Smith JA, Cook WH, Denigan WH. Application of superplastic flow processes to SFF warhead design. Proceedings, Workshop on Shaped Charge Warheads, Aberdeen, MD, October 1982; American Defense Preparedness Association, Arlington, VA, 1983.

Caligiuri RD, Eiselstein LE, Fox MJ. Low temperature sensitization of Type 304 stainless steel pipe weld heat affected zones. Proceedings, Specialists Meeting on Subcritical Crack Growth, pp. 199-228, Freiburg, West Germany, May 1981, NUREG/CP-0044; U.S. Nuclear Regulatory Commission, May 1983.

Eiselstein LE, Syrett BC, Wing SS, Caligiuri RD. The accelerated corrosion of copper-nickel alloys in sulfide polluted seawater. Paper No. 59. Corrosion/82, Annual Meeting of the National Association of Corrosion Engineers, Houston, TX, March 1982.

Caligiuri RD, Sherby OD, White RA. Superplasticity and its application. Proceedings, 25th Sagamore Army Materials Conference Advances in Metal Processing, July 1978; Plenum Press, New York, NY, 1981.

Sherby OD, Wadsworth J, Caligiuri RD, Eiselstein LE, Snyder BC, Whalen RT. Superplastic bonding of ferrous laminates. Scripta Metallurgica 1979; 13:941-946.

Caligiuri RD, Whalen RT, Sherby OD. Superplastic hot pressing of white cast iron. Int J Powder Metall Powder Technol 1976; 12:1.

Presentations and Published Abstracts

Caligiuri RD, Sire RA. Fatigue and fracture in tubular offshore support structures. Thermec 2018: International Conference on Processing and Manufacturing of Advanced Materials, Paris, France, July 9-12, 2018.

Lemberg J, Ames N, Caligiuri RD. Fatigue failure of a 2500-ton forging press. MS&T Paper No. 2150210-5741, October 2015.

Caligiuri, RD. HTHA in carbon steels below the Nelson Curve. Thermec 2013: International Conference on Processing and Manufacturing of Advanced Materials, Las Vegas, NV, December 2-6, 2013.

Ames, N, Sire RA, Caligiuri, RD. Validation of computer simulations used in failure analysis investigations. ASME Conference on Validation and Verification, Las Vegas, NV, May 5-7, 2012.

Caligiuri RD, Sire RA. Fracture mechanics analysis of defects in pipeline seam welds. International Conference on the Mechanical Behavior of Materials, Lake Como, Italy, June 5-9, 2011.

Caligiuri RD, Almaula S. The need for risk-based engineering reliability studies in the restructured electric utility industry. Disaster Management for Electric Utilities Conference, Phoenix, AZ, October 29-30, 1998.

Caligiuri RD, Moncarz PD, McDonald BM, Sire RA, Borduin WP. Ultimate moment capacity of many steel connections: failure in design, materials or workmanship. EUROMAT '98 Conference on Materials in Oceanic Environment, Lisbon, Portugal, July 22-24, 1998.

Caligiuri RD, Sire RA, McDonald BM. Ductile initiation of cleavage fractures in welded moment frame connections. 12th Engineering Mechanics Conference, American Society of Civil Engineers, La Jolla, CA, May 17-20, 1998.

Caligiuri RD, McDonald BM, Sire RA. Failures in steel frame building connections: A multi-billion dollar example of professional wishful thinking. International Federation for Information Processing 8th Working Conference on Reliability and Optimization of Structural Systems, Krakow, Poland, May 11 13, 1998.

Caligiuri RD, Huet R. Overview of typical fastener failures. ASM International Materials Solutions Conference, Indianapolis, IN, September 15-18, 1997.

Caligiuri RD. Failure analysis, prevention, and testing. Keynote Address. International Conference and Exhibits on Failure Analysis, Montreal, Canada, July 1991.

Caligiuri RD, Parnell TK. Development of dynamic failure criteria for ceramic armor materials. In: Failure Criteria and Analysis in Dynamic Response Symposium. Lindberg HE (ed), American Society of Mechanical Engineers Winter Annual Meeting, November 1990.

Caligiuri RD, Parnell TK. DYNA3D analysis of the dynamic response of a buried pipeline due to a surface explosion. DYNA3D User Group Conference, Bournemouth, Dorset, UK, September 1990.

Caligiuri RD, Andrew SP, Eiselstein LE. A review of high strain rate properties and penetration mechanisms of depleted uranium and tungsten alloys. Army Research Development and Engineering Command/Army Research Office Workshop on Metallurgical Aspects of Deformation/Failure Mechanisms in (The Terminal Ballistics of Heavy Metal) Kinetic Energy Penetrators, Picatinny Arsenal, Dover, NJ, April 1990.

Caligiuri RD, Eiselstein LE. Development of metallic laminate composites for heavy armor. Defense Advanced Research Projects Agency/Army/Marine Corps Armor/Anti-Armor Joint Program Office Information Exchange. Los Alamos National Laboratory, Los Alamos, NM, March 1990.

Caligiuri RD. Schmidt CG, Eiselstein LE. Stress corrosion cracking susceptibility of alternative alloys for BWR piping. Paper No. 99. Corrosion/85, Annual Meeting of the National Association of Corrosion Engineers, Boston, MA, March 1985.

Caligiuri RD. The accelerated corrosion of copper-nickel alloys in sulfide polluted seawater. Paper No. 59. Corrosion/82, Annual Meeting of the National Association of Corrosion Engineers, Houston, TX, March 1982.

Reports

Caligiuri RD. Investigation of the exhaust elbow from the Deutschland generator. Prepared for Wilson, Elser, Moskowitz, Edelman & Dicker, August 2005 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. Infringement testing and analysis of a GE Profile Harmony washer — Supplemental report. Prepared for The United States District Court, Western District of Michigan, August 2005 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. Analysis of Cricket ED1-CR lighter design. Prepared for Quarles & Brady Streich Lang, LLP, February 2005 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD, Dickinson L, Edmonds J, Fife M, Harrigan T, Klopp R, Dugnani R, Coakley S. LVMC monorail driveline performance evaluation and root cause analysis of driveline failures. Prepared for Las Vegas Monorail, Transit Systems, December 2004. Exponent, Menlo Park, CA.

Caligiuri RD. Rebuttal to statement of opinion by Frank G. Adams, PE. Prepared for Jones Day, LLP, September 2004 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. Analysis of the girth welds in the Malongo Critical pipeline. Prepared for Jones Day, LLP, August 2004 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. Investigation of fractured ammonia discharge valves from the F/V Daniela. Prepared for Lord, Bissell, and Brook, LLP, July 2004 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. Bracken v Whirlpool expert report. Prepared for Nall & Miller, LLP, April 2004 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. June 10, 1999, Olympic pipeline rupture expert report. Prepared for Davis Wright Tremaine LLP, April 2004 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. Analysis of leakage from a toxaphene solution storage tank. Prepared for McKenna, Long & Aldridge, June 2003 (Rules 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. August 19, 2000, pipeline rupture, Carlsbad, NM — Root cause analysis. Prepared for El Paso Corporation, July 2002 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. Cain Foods explosion. Prepared for Hermes Sargent Bates, LLP, May 2002 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. Tesoro P174C pump failure — Preliminary report. Prepared for Reinwald, O'Connor & Playdon, May 2001. Exponent, Menlo Park, CA.

Caligiuri RD. Metallurgical and mechanical issues related to the failure of welded connections in the Trident Center complex during the Northridge Earthquake — Rebuttal report. Prepared for Castro and Worthge, LLP, March 2001 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD. Metallurgical and mechanical issues related to the failure of welded connections in the

Trident Center complex during the Northridge Earthquake — Preliminary report. Prepared for Castro and Worthge, LLP, January 2001 (Rule 26B Report). Exponent, Menlo Park, CA.

Caligiuri RD, James BA. Investigation of cracking in YAN detachable ski-lift grips at Sierra at Tahoe Ski Resort. Prepared for Robins, Kaplan, Miller and Ciresi, LLP, January 1999. Exponent, Menlo Park, CA.

Caligiuri RD, Binnard G. Electrical and mechanical investigation of fire damaged push button stove controls. Prepared for McNamara, Houston, Dodge, McClure & Ney, February 1998. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Moalli J. Failure modes and effects analysis of compressed natural gas fuel systems for cars and trucks. Prepared for General Motors Corporation, February 1998. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD. Williams v Stewart: Analysis of burner controls for the electric counter-top stove involved in the October 11, 1996, fire at 465 Culp Street in Hayward, CA. Prepared for McNamara, Houston, Dodge, McClure & Ney, February 1998. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Parnell TK, Eiselstein LE, Wu M, Huet RP. Analysis of drill pipe joint failures and recommendations for service. Prepared for Sedco Forex and Grant Prideco, Inc., November 1997. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Ferro PD. Evaluation of the Ukrainian die casting project. Prepared for Defense Enterprise Fund, June 1997. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Huet RA. Investigation of the December 7, 1994, crane accident at Laughlin, Nevada. Prepared for Barker, Brown, Busby and Sutherland, PC, November 1996. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, James B, Laffitte J, Wills D. Metallurgical analysis of welds in the lower arm mounting members of a 1995 Hyundai Accent VIN#KMHVD14N9SU023788. Prepared for Hyundai Motor America, June 1996. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Haussmann GJ. Findings report: Stanford Linear Accelerator Center hydrogen brazing furnace explosion. Prepared for Environment, Health and Safety Division of Stanford Linear Accelerator Center, April 1996. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD. Investigation into the cause of the February 1995 Dixon steam boiler explosion at Humboldt Feeding, Inc., Lovelock, NV. Prepared for Diehl and Rodewald, PC, January 1996. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Huet R. Investigation into the damage to the rotor path liner materials in Rolls Royce RB211 Engines 80202 and 80203. Prepared for Reumart & Partners and Advokatfirmaet O. Bondo Svane, March 1995. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD. Failure modes and effects analysis of large truck mounted liquefied natural gas fuel system. Prepared for The American Trucking Association Foundation; October 1994. Failure Analysis Associates, Menlo Park, CA, and PLG.

Caligiuri RD, Andrew SP, Huet R. Reza A. A report on the October 1993 incident at the PG&E McDonald Island facility. Prepared for Reliance National Company, June 1994. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Rao VB, Rao GL, Eiselstein LE. Report on failure modes and effects analysis for carbon-dioxide powered syringe. Prepared for Collagen Biomedical, May 1994. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Andrew SP, et al. Fitness-for-service of chlorine ton containers and 150-pound cylinders. Prepared for The Chlorine Institute, Inc., May 1994. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Eiselstein LE, Rao GL, Wagner A. Experiments on gas dispersion from sealed system leaks. Prepared for Whirlpool Italia s.r.l., April 1994. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Eiselstein LE, Rao GL. Internal isobutane-air ignition experiments. Prepared for Whirlpool Italia s.r.l., April 1994. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Blanchard R, et al. Tests on partially sealed Klixon overload protectors in an explosive isobutane-air environment. Prepared for Aspera Compressor Company, April 1994. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Eiselstein LE, Wagner A, Reza A, Rao GL. Experiments on the effect of suction-side leaks on refrigerator performance. Prepared for Whirlpool Italia s.r.l., April 1994. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Rao VB, Li R, Blanchard R, Reza A, Rao GL. Voltage surge tests on Aspera compressor switches in an explosive isobutane-air environment. Prepared for Aspera Compressor Company, April 1994. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Kokarakis JE, Moalli JE, Parnell TK. Avon station incident investigation. Prepared for Texaco Trading and Transportation, Inc., March 1993. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Reza A, Parnell TK. Combustion tests on and chemical analysis of Therminol 66 heat transfer fluid used at American Azide. Prepared for American Azide Corporation of Utah, January 1993. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Rao VB, Rao GL, Parnell TK. American Azide Corporation reactor and dryer safety studies. Prepared for American Azide Corporation, January 1993. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Andrew SP, Eiselstein LE. Recommended practices for materials compatibility. Prepared for American Azide Corporation, November 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M. Environmental hazard assessment, American Azide, Inc., Cedar City, Utah. Prepared for American Pacific Corporation, September 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Parnell TK, Andrew SP, Eiselstein LE. Computational modeling of dynamic failure in armor/anti-armor materials. Prepared for U.S. Army Research Office, Contract DAA-L03-88-C-0029, May 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Reza A, El-Fadel M, Parnell TK. Gas release from leaky natural gas pipeline, the PEPCON explosion in Henderson, Nevada. Prepared for PEPCON, 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Baena BS, Reza A. Natural gas and methane migration in porous media. Prepared for PEPCON, May 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Baena BS, Reza A. Background concentrations and emissions of methane in ambient air. Prepared for PEPCON, May 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Baena BS, Reza A. Methanogenesis, methanotrophy, epifluorescence and methanogens. UV radiation and methanogens, natural gas carbon dating. Prepared for PEPCON, May 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Baena BS, Reza A. Odorants in natural gas monitoring, sensing, and fading. Prepared for PEPCON, May 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Cleary C, Reza A. Soil microbiological characterization, the PEPCON explosion in Henderson, Nevada. Prepared for PEPCON, April 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Reza A. Gas migration and concentration decay along leaky natural gas pipeline, the PEPCON explosion in Henderson, Nevada. Prepared for PEPCON, April 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Cleary C, Reza A. Evaluation of asphalt and soil permeability, the PEPCON explosion in Henderson, Nevada. Prepared for PEPCON, April 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Cleary C, Reza A. Heat propagation in asphalt at high temperatures. Prepared for PEPCON, April 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Cleary C, Reza A. Soil gas characterization, the PEPCON explosion in Henderson, Nevada. Prepared for PEPCON, April 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, El-Fadel M, Cleary C, Reza A. Field testing of gas permeation along the natural gas pipeline, the PEPCON explosion in Henderson, Nevada. Prepared for PEPCON, April 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Andrew SP, Lange CH, Parnell TK. Analysis of cracking in the Windsor recovery boiler superheater. Prepared for Domtar, Inc., April 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Harris D, El-Fadel M, Reza A. Experimental gas release from a through-wall crack in a pipeline segment. Prepared for PEPCON, April 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Sire RA. Investigation of corrosion pitting in silane gas tubing at advanced micro devices. Prepared for Argonaut Insurance, Inc., March 1992. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Burke MA. Improvements to and extensions of the Burke model. Prepared for BPD, Difesa E Spazio, December 1991. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Rao G, Reza A. Investigation into the cause and origin of the focused repair center explosion. Volume I. Prepared for United Airlines, Inc., and Jacobs Engineering Group, Inc., February 1991. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Parnell TK, Reza A. Gas flow and heat transfer in a pipe tee joint. Prepared for Chevron Corporation, November 1990. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Burke MA, Woytowitz PJ. Development of a nonlinear multiaxial viscoelastic model for solid rocket propellant. Prepared for BPD Difesia E Spazio, June 1990. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Burke MA, Woytowitz PJ. Technical services interim report. Prepared for Thermal-Structural Analysis Group, Italy, May 1990. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD. Con Edison Hellgate facilities gas main rupture. Prepared for Consolidated Edison Company of New York, Inc., February 1990. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Andrew SP, Parnell TK. Computational modeling of dynamic failure in armor/anti-armor materials. Reports 1, 2, 3 in 1989; Reports 4, 5, 6 in 1990. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Wachob HF, Eiselstein LE. Improved corrosion resistance of magnesium alloys through mechanical alloying. SBIR Phase I Report. Prepared for Wright-Patterson Air Force Base, 1989. Failure Analysis Associates, Menlo Park, CA.

Caligiuri RD, Shockey DA, et al. Technical support for the Honeywell blue team heavy armor program. Prepared for Honeywell Underseas Systems Division, SRI Project PYD-3345; December 1988. SRI International.

Caligiuri RD, Eiselstein LE. Rapid solidification processing of wire for tire reinforcement. Prepared for Societa Pneumatici Pirelli Spa, January 1988. SRI International.

Caligiuri RD, Eiselstein LE. Explosive compaction of rapidly solidified Nd-Fe-B ferromagnetic powders. December 1987. SRI International.

Caligiuri RD, Eiselstein LE, Schmidt CG. Development of advanced, all-metallic laminate armor systems for lightweight applications (U). Prepared for the Defense Advanced Research Projects Agency and the Army Research Office, July 1987 (SECRET). SRI International.

Caligiuri RD, Eiselstein LE. Stress corrosion cracking of A-471 steam turbine disk alloys. Prepared for Electric Power Research Institute, EPRI NP-5182, June 1987. SRI International.

Caligiuri RD, Eiselstein LE. Corrosion behavior of materials used in sour-gas-rich oil fields. Prepared for Niigata Engineering Company, Ltd., May 1987. SRI International.

Caligiuri RD, Schmidt CG, Eiselstein LE. Stress corrosion cracking susceptibility of Type 316 nuclear-grade stainless steel and XM 19 alloy in simulated BWR water. Prepared for Electric Power Research Institute, April 1987. SRI International.

Caligiuri RD, Eiselstein LE, McKubre MCH. Prediction of crack growth in aqueous environments. Prepared for the Office of Naval Research, September 1986. SRI International.

Caligiuri RD, Erlich DC, Henley DR. Dynamic compaction of TZM powders. Prepared for Lockheed Missiles and Space Company, December 1985. SRI International.

Schmidt CG, Giovanola JH, Erlich DC. Role of microstructure in promoting stable deformation at very high strain rates in copper. Prepared for the Defense Advanced Research Projects Agency and the Army Missile Command, October 1985. SRI International.

Caligiuri RD, Eiselstein LE. Corrosion damage to the Williamsburg Bridge main suspension cables. Prepared for Ammann and Whitney Consulting Engineers, May 1985. SRI International.

Caligiuri RD, Schmidt CG. Influence of microstructure on the performance of shaped charge and self forging fragment liners. Prepared for Air Force Systems Command, Eglin Air Force Base, March 1985. SRI International.

Caligiuri RD, Schmidt CG, Giovanola JH, Erlich DC. Role of fine microstructures in promoting stable deformation at very high strain rates in zinc-22% aluminum and ultrahigh carbon steel. Prepared for Defense Advanced Research Projects Agency and Army Missile Command, March 1985. SRI International.

Caligiuri RD. The crystallization kinetics of two amorphous ferromagnetic alloys. Prepared for Electric Power Research Institute, December 1983. SRI International.

Caligiuri RD, Schmidt CG, Wing SS. Low temperature sensitization of Type 304 stainless steel weld-heat affected zone. Prepared for Electric Power Research Institute, EPRI NP-3368, November 1983. SRI

International.

Caligiuri RD, DeCarli PS. Explosive compaction of amorphous ferromagnetic powders. Prepared for Electric Power Research Institute, April 1983. SRI International.

Caligiuri RD, Erlich DC, et al. Computational model for armor penetration. Volume I. Prepared for Ballistics Research Laboratory, April 1983. SRI International.

Caligiuri RD, Eiselstein LE. Investigation of water-based corrosion in radiant heating systems. Prepared for Wirsbo Bruks Air Base, January 1983. SRI International.

Caligiuri RD. Production of ultrahigh carbon steel for evaluation in explosively driven penetrator applications. Prepared for the Air Force Armament Laboratory, Eglin Air Force Base, December 1982. SRI International.

Caligiuri RD, Eiselstein LE, Curran DR. Microkinetics of stress corrosion cracking in steam turbine disk alloys. Prepared for Electric Power Research Institute, April 1982. SRI International.

Caligiuri RD. Evaluation of the response of ultrahigh carbon steel to dynamic loading (U). Prepared for the Defense Advanced Research Agency, March 1982 (SECRET). SRI International.

Caligiuri RD, Landon PR, Duletsky. The influence of the M23 (C,N)6 compound on the mechanical properties of Type 422 stainless steel. Lawrence Livermore National Laboratory, Technical Report UCRL-85412, February 1981.

Caligiuri RD, Eiselstein LE, Wing SS, Syrett BC. Mechanisms of corrosion of copper-nickel alloys in sulfide-polluted seawater. Prepared for the Office of Naval Research, December 1980. SRI International.

Caligiuri RD, Dao KS, Shockey DA. Determination and assessment of failure modes in metal matrix composite projectiles (U). Prepared for the Naval Research Laboratory, June 1979 (SECRET). SRI International.

Caligiuri RD, Shockey DA, et al. Evaluation of the armor potential of ultrahigh carbon steel (U). Prepared for the Defense Research Projects Agency, January 1979 (CONFIDENTIAL). SRI International.

Project Experience

General Failure Analysis

Henderson, NV, Chlorine Leak — Investigated the source of a large leak that occurred at a liquid chlorine production facility. Efforts included detailed metallurgical examination of corroded components, use of computational fluid dynamics to model the flow of liquid chlorine, and corrosion experiments in brine-contaminated chlorine. Assisted in the evaluation of the overall integrity of the facility and start-up activities.

Thermal Energy Storage System Assessment — Evaluated the causes for malfunctions in a large-capacity thermal energy storage system installed at a facility in Los Angeles that was not functioning properly. Investigated how the liquid glycol refrigerant could penetrate into the plastic balls containing water and prevent them from freezing properly. Developed a method for rapidly evaluating the glycol content in each of the 3-million-plus plastic balls in the system.

Cast-Iron Check Valve Failure — Determined the cause of the failure of a grey cast-iron check valve installed in the ammonia-based refrigeration system at an ice cream factory. The valve failure allowed the escape of liquid ammonia, which resulted in a large explosion and fire.

Cast-Iron Shut-off Valve — Determined the cause of the failure of a grey cast-iron shut-off valve installed on an ammonia refrigeration unit on a commercial fishing boat. The escaping ammonia resulted in the death of a crew member.

Wax Plant Explosion — Evaluated how the proper functioning of a flammable gas detector may have contributed to the explosion and fire at a major petroleum by product production facility in Western Pennsylvania. Efforts included testing of the mechanical functionality of the air sampling system of the device.

Fire-Damaged Refinery Process Vessels — Performed an API 579 fitness-for-service analysis on pressure vessels and heat exchangers damaged by a fire at a refinery. Work included metallurgical examinations and testing, an ultrasonic testing evaluation, and non-linear finite-element stress analyses. Assisted with evaluating the repair schedule.

Construction Crane Failure — Evaluated the tip-over of a vehicle-mounted long boom crane being used to disassemble a tower crane at a hotel construction site in Laughlin, NV. Efforts included using the model MATYMO to simulate the movements of the crane and the actions of the crane operator just prior to the tip-over.

Motorcycle Accident Investigation — Evaluated potential mechanical causes for the separation of the fuel tank from a motorcycle during a vehicular accident that led to a fire. Efforts included metallurgical examination of attachment bolts, finite-element analysis, and laboratory testing of fuel tank attachment mechanisms.

Farm Vehicle Rollover Investigation — Investigated whether or not the drive shafts of a four-wheel farm utility vehicle failed while the vehicle was traversing a steep slope at a ranch in California, causing it to roll down the hill. Work included metallurgical examination of the failed drive-shaft components, stress analysis, and testing of exemplar drive shafts.

Satellite Launch Damage — Investigated the cause of damage to the solar panel array of a commercial communications satellite. One of the two large solar panels was unable to deploy properly once in orbit. Examined the contribution of unanticipated vibrations during launch to the damage suffered. Presented results to a blue-ribbon panel established to review whether further satellite launches from the launch facility should be permitted.

Mixing-Valve Failure — Investigated the role that a potentially malfunctioning mixing valve may have played in the scalding of a handicapped person at a rest home. Evaluated applicable codes and standards.

Pipelines and Process Piping

PG&E Pipeline Explosion — Investigated the cause of the rupture of PG&E’s 36 inch diameter natural gas pipeline that ruptured near San Bruno, California in September 2010. Provided testimony to the California Public Utilities Commission related to the incident

New York Steam Pipe Explosion — Investigated the cause of the rupture of a 20-inch underground steam main in downtown Manhattan. Efforts include participating in metallurgical examinations of pieces removed from the failed pipeline.

Camisea Field, Peru — Performed an overall integrity assessment of a 36-inch-diameter gas line and a 14-inch-diameter liquid line that traversed 800 km from the Amazon basin, over the Andes Mountains, to Lima. The pipeline system had experienced six leaks within 24 months of initial operation.

PEPCON Explosion — Investigated the cause of a series of explosions that destroyed a solid rocket oxidizer plant in Henderson, NV. Assessed the role that a 16-inch high-pressure natural gas transmission

line that traversed the plant and was damaged by the explosions may have played in the incident.

Upstream Oil and Gas Processing Facility — Assessed the occurrence and cause of sulfide-induced stress corrosion cracking in small-bore process-piping welds that led to releases of H2S gas to the environment.

Bellingham, WA, Pipeline Rupture and Fire — Investigated the failure of a 16-inch-diameter liquid line, including evaluation of external piping damage. Assessed the role that external mechanical damage may have contributed to the leak and subsequent fire.

Carlsbad, NM, Pipeline Rupture — Investigated the failure of a 36-inch natural gas transmission line, including evaluation of the effects of internal corrosion. Assessed the extent to which water ingress into the transmission line from third-party producers, and the pipeline configuration, may have contributed to the observed internal corrosion.

Aircraft Engine Refurbishment Facility Explosion and Fire — Examined how the failure of an aluminum pneumatic process piping system designed to handle particulate matter moving at high velocity may have contributed to an explosion and fire that destroyed an aircraft turbine blade refurbishment facility. Issues studied included particulate-induced erosion and build-up of static charge.

Qualcomm Stadium Contamination — Investigated potential sources for the gasoline found in the groundwater under Qualcomm Stadium in San Diego, CA. Evaluated the results of hydrostatic testing and in-line inspection data on underground piping located at a nearby gasoline and diesel fuel distribution terminal.

Post/Hyde Street Explosion — Investigated the cause of an explosion that destroyed a building at the intersection of Post and Hyde Street, in San Francisco, CA. Evaluated whether or not external 2-inch-diameter natural gas distribution line may have played a role in the incident.

Good News Building Explosion — Investigated the cause of an explosion that destroyed a building in Steamboat Springs, CA, and assessed whether or not damage to a natural gas distribution line may have contributed to the incident.

Donner Summit, CA, Pipeline Leak — Investigated a diesel and gasoline pipeline leak that occurred in an environmentally sensitive area in the Sierra Mountains, near Donner Lake, and the role that external damage and subsequent stress corrosion cracking may have played in the leak.

Rocklin, CA, Pipeline Leak — Investigated a diesel fuel spill in a new housing development near Rocklin, CA. Assessed the extent to which external mechanical damage to the pipeline may have contributed to the leak.

Walnut Creek, CA, Pipeline Rupture — Investigated the failure of this 24-inch-diameter natural gas pipeline that involved, in part, an evaluation of third-party damage.

Cast Iron Natural Gas Distribution Line — Investigated the possible role of a cast iron natural gas distribution line in the cause of a fire that destroyed a house in suburban Detroit, MI. Efforts included evaluating the extent of graphitic corrosion to the buried pipeline.

Welds and Welded Connections

Offshore Crude Oil Pipeline — Examined the quality of the welds in a newly constructed 24-inch-diameter liquid pipeline relative to applicable standards, and the role of the welds in the integrity of the pipeline.

Steel Moment Frame Weldment Failures — Investigated the causes of failed welds found in steel moment frame buildings after the Northridge Earthquake in Los Angeles, CA. Conducted ultrasonic and visual inspection of weldments in buildings, conducted metallurgical examinations of failed welds removed from

buildings, and performed finite-element analyses of moment frame connections.

Refinery Reactor Fitness for Service Evaluation — Evaluated the fitness for service of new welded alloy steel refinery reactors that may have been fabricated using the incorrect weld filler metal. Efforts included assessing the potential for creep-related failures and hydrogen embrittlement of the welds in accordance with methods prescribed in API 579.

SBM Anchorage Failure — Analyzed the cause of the failure of an offshore single-point mooring system during the off-loading of a very large tanker. Evaluated the relative roles of fatigue and overload in the failure of the structural welds in the rocker beam assemblies, including estimating the potential fatigue loading spectra under various tidal conditions.

Underground Natural Gas Storage Facility Casing Failure — Assessed the potential role of failures at seal-welded threaded connections in the casing string in a massive loss of natural gas from a salt-dome storage cavern. Reviewed the specifications and welding procedures relevant to the fabrication and welding of the casing, including the effect of preheat. Performed finite-element stress analyses of the threaded and seal-welded connections.

Shipping Container Trailer Weld Failure — Examined the cause of the failure of a mudflap assembly on a trailer used to transport shipping containers. The broken mudflap component subsequently perforated the fuel tank of a minivan that ran over it, resulting in a vehicle fire. Evaluated the role of fatigue and overload on the failure of the weld, including detailed metallurgical examinations and finite-element stress analyses.

Industrial Platform Failure — Investigated the cause of failure of a welded moveable platform used in the assembly of recreational vehicles. Used finite-element analysis to assess the robustness of the platform design and construction.

Tractor Trailer Accident — Investigated the role that failure of repaired welds in the structural frame of a tractor trailer may have played in the loss of control of the vehicle. Performed metallurgical analyses of the failed welds and finite-element analyses to assess the loads on the welds during operation of the vehicle.

Pesticide Storage Vessel Failure — Examined the failure of a weld in an aluminum pesticide storage vessel that resulted in the contamination of a large area with pesticides. Evaluated the welding procedures used to fabricate the vessel.

Paper Mill Superheater Tie-Weld Failures — Investigated the cause of cracking in welds used to tie together serpentine tubes in a paper mill recovery boiler. Efforts included in-service examination of tie welds, metallurgical examination of failed tie welds, and finite-element stress analysis of welded connections.

Consumer Products

Minivan Door-Latch Mechanism — Investigated the cause of the failure of automatic sliding rear door mechanisms on minivans. Several field failures resulted in two recalls by the vehicle manufacturer. Work involved inspection of failed and returned parts, statistical analysis of data, and laboratory testing of exemplar parts. Results were used in arbitration between the vehicle manufacturer and the parts supplier.

Child Safety Lock on Cigarette Lighter — Investigated the efficacy of a CPSC-mandated child safety lock on a disposable cigarette lighter. Analyzed the mechanism that prevented accidental release of flammable vapors. Inspected and reviewed the manufacturing facilities of disposable lighter producers.

Steering Wheel Fatigue Failure — Investigated the cause of the fatigue failure of steering wheels mounted to the airbag assemblies in minivans. Evaluated the contribution of spot-weld design and engine vibration to the problem. Results presented to the NHTSA as part of a recall campaign.

Microwave Oven Recall — Investigated the cause of fires originating from microwave ovens mounted as part of the ventilation system of cook-top ranges. Efforts isolated the cause of field fires to the creation of plasmas in the microwave energy channel. Work product was used to justify recall of 1.7-million units as directed by the CPSC.

Room Dehumidifier Recall — Investigated the cause of fires in portable room dehumidifier units related to electrical wiring crimps. Work product used in presentation to CPSC to direct a voluntary recall of the product.

Refrigerator Fire Recall — Investigated the cause of fires in the ice maker mounted in side-by-side refrigerators. Examined several sources of arc-tracking laminated door-flap heaters. Results used in CPSC hearings to decide which units to recall.

Dishwasher Heating-Element Failure — Investigated the cause of failures of submerged dishwasher calometric heating elements. Work involved testing of exemplar heating elements to identify the source of the problem, as well as testing of proposed fixes. Results used in CPSC presentations.

European Dryer Fire Investigation — Analyzed the cause of melting and the ultimate ignition of electric clothes dryers in Europe. Examined the effect of an embedded calometric heater in a cast aluminum heat sink. Results of investigation were presented to various European Consumer Product Agencies to define a potential recall.

Vehicle Air Bag Initiation Mechanism — Investigated the cause of the failure of circuitry leading to the inadvertent deployment of driver airbags. Performed examinations of exemplar control boards to replicate the observed failures and assessed the role of unexpected system vibrations in the failures.

Washing Machine Intellectual Property Issues — Examined the infringement issues surrounding the introduction of a washing machine product line based on the inverse toroid system of washing clothes in reduced-water environments. Work involved setting up sophisticated instrumentation to monitor the transit of clothes during a wash cycle.

Editorships & Editorial Review Boards

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