

RESUME

Earl L. Kirkpatrick, P.E.
Principal Engineer
Chairman of the Board

EXPERIENCE SUMMARY

Registered professional engineer, licensed in seven states, with over fifty-two years experience in all phases of corrosion engineering, engineering management and construction management. NACE International certified Corrosion Specialist and Cathodic Protection Specialist.

Responsibility for corrosion control and electrical engineering aspects of surveying and evaluation of client systems or facilities, with written recommendations, reports or plans and specifications. Project manager, project engineer or lead engineer on corrosion control or cathodic protection assignments for airports, industrial facilities, large electrical generating plants, oil fields and pipelines. Experienced in design and testing of electrical grounding facilities. Also expert in lightning protection damage, surges and computer system noise. Internationally recognized expert in mitigation of induced A.C. effects on pipelines. Forensic expert and consultant to legal teams on topics ranging from: coating failures, to corrosion mechanisms, to electrocution, to induced AC problems, to intervener testimony, to metallurgy.

Lectures on corrosion control subjects at various universities and industry groups throughout the country. Actively participates in technical association meetings and activities. Has authored numerous conference papers and magazine articles. Chaired NACE committee T-10B-5a which conceived, wrote and revised RP0177-95 "Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems." Organized and appointed NACE committee T-10A-14 which conceived and wrote RP0285-95 "Corrosion Control of Underground Storage Tank Systems by Cathodic Protection." One of seven members that wrote the initial Standard RP0572 "Design, Installation Operation and Maintenance of Impressed Current Deep Groundbeds."

REPRESENTATIVE EXPERIENCE

The following list is representative of varied project experience. Only ONE example is given in each area of experience.

Aircraft - Chrysler Technologies Airborne Systems, Waco, TX
Investigation of B-747SP leading edge corrosion, recommendations.

Airport - Dallas/Fort Worth International Airport, TX
Project Manager and Project Engineer. Professional Engineering Services for Corrosion Control. Three year \$860K project.

Bellhole Examination - Texas Electric Service Company, Fort Worth, TX
Performed 20 detailed bellhole inspections of failing tape coating system and the underlying pipeline's surface condition on 216 miles of 24" mainline on the Old Ocean Fuel System.

Building Structural Steel - RTR Engineers, Lubbock, TX
Texas Tech University-Health Science Center - building steel corrosion under fireproofing. 2396

Cathodic Interference - Lummus, Hallman, Prichard & Baker, PC, Cleburne, TX
Investigate underslab water line cathodic interference problems. J/N 1714



Chilled Water Piping - Regency Plaza Building, Dallas, TX
Investigate internal corrosion problems and expert testimony.

Church – Prince of Peace Catholic Community, Plano, TX
Investigate corrosion under insulation failures on underground HVAC piping. 2404

Coating Failure Analysis - Upper Trinity Regional Water District, Lewisville, TX
Examine and report on inter-coat adhesion failure above the water line on a raw water intake structure.

Cooling Towers – Greenway Village Senior Care Center, Mesquite, TX
Evaluate C.T. corrosion resulting from lack of effective water treatment.

Communications - MCI Telecommunications, Fort Worth, TX
Terminal & switch grounding system. Evaluate entire grounding system and design modifications. J/N 1093

Cogeneration – Wichita Falls Energy Investments, Wichita Falls, TX
3 gas turbines, 1 steam turbine producing power and steam for glass plant. Design and install impressed current cathodic protection system.

Copper Mine - ASARCO, Hayden AZ
Corrosion audit for Solvent Extraction and Electrowinning facility.

Culverts – TXU Mine Railroad, Fairfield, TX
Comprehensive corrosion evaluation and recommendations for control of rapid corrosion on galvanized, corrugated iron culverts under the roadbed due to A.M.R. Design and coordination of corrosion remediation which included C.P., acid resistant concrete, and protective coatings.

D.C. Traction System - Town of Mulga, Mulga, AL
Natural gas distribution system. Survey, design, install, commission cathodic protection for mitigation of D.C., interference from deep mining traction equipment.

DC Transit System - Dallas Area Rapid Transit, Dallas, TX
Project manager/engineer for Professional Engineering Services for Corrosion Control. Eight years experience on an operating LRT system, including stray current monitoring and T-T-E tests. J/N 2125, 1829, 1756

Dam Gates – Crofton Diving Corp./Corps of Engineers Lake Lanier Dam, Buford, GA
Cathodic protection design/testing, protective coatings recommendations for 2 replacement sluice gates with jet flow gate valves. J/N 2383

Deep Hot Gas Wells - The Houston Exploration Company, Houston, TX
Forensic investigation into high temperature coating failure and CO₂ corrosion on the interior surface of production tubing.

Design-Build - DFW International Airport, TX
Project Corrosion Engineer to airport engineering contractor, HKS, Inc. for a \$1,200,000,000. fast track 4-1/2 year design build for International Terminal D. J/N 2010



Direct Burial Electrical Cables – Petro Design and Engineering, Inc., Christchurch,
New Zealand

Assess fault current influence on adjacent natural gas pipeline and design mitigation.
J/N 2520

Electrical Grounding vs Cathodic Protection - Union Texas Pakistan

Investigate cathodic protection deficiencies in production facilities due to presence of massive bare copper electrical grounding grids.

Electrical Grounding Grid – IBM, San Jose, CA

Generation & electrical system expansion. Design electrical grounding grid.

Environmental Impact – Eaton Peabody, Bangor, ME

Assist attorneys with presentation of environmental impact concerning HVAC lines on a pipeline in a national forest before the State of Maine Board of Environmental Protection. J/N 2114

External Corrosion Direct Assessment – Pipeline Regulatory Consultants/Western Farmer's
Electric Cooperative, Anadarko, OK

E.C.D.A. surveys and bellhole inspections on 8 inch Tex-Con Line. J/N 2333

Flight Simulator – Simuflite Training International, DFW Airport, TX

Investigate and correct electrical grounding problems on a newly installed Lear 35 flight simulator. J/N 1008

Forensic - State Farm Lloyd's

Investigation and report on cathodic interference of residential under slab copper water piping, trial support.

Fossil Fuel Power Plant - Houston Power & Light, Thompsons, TX

W. A. Parrish Units 1-8. Coal & Natural gas units. Design, supervise and commission Cathodic Protection Systems.

Gas Pipeline Distribution - City of Alabaster, Alabaster, AL

Natural gas distribution system and all other underground utilities. Design, install, commission cathodic protection program for entire system.

Gas Pipeline Transmission - Florida Gas Transmission, Winter Park, FL

4,000 mile natural gas transmission system + seven natural gas distribution systems.
Complete corrosion control program and computerized record keeping system.

Glass Plant – Certainteed / St. Gobain Vetrotex Wichita Falls Glass Plant, TX

Multiple CP system upgrades including: surveys, design, construction watch, commissioning, reports and drawings. J/N C, 1033, 1051, 1140, 1190, 1781, 2255, 2356, 2457

Hot Water Boiler - PVI Industries, Inc., Fort Worth, TX

Investigate water side boiler tube corrosion at MGM Grand Hotel, Las Vegas, NV.



Induced A.C. Mitigation - Pride Refining, Abilene, TX
86 mile 6" products pipeline under construction with 63 miles paralleling a 345 KV circuit.
Induced A.C. mitigation system design.

Internal Corrosion - The Fort Worth Club, Fort Worth, TX
Investigated internal copper corrosion problems in a circulating potable water system.

Internal Corrosion Direct Assessment – Best Wide Corrosion Tech SDN BHD, Kuala Lumpur, Malaysia – Petronas Gas Project. Develop proprietary spreadsheet and perform ICDA assessment on multiple natural gas pipelines. J/N 2523

Internal Pipeline Inspection - Texas Gas Gathering, Jonesville, TX
Recommended intelligent pigging to classify internal CO₂ corrosion in a 12 inch natural gas pipeline. Analyzed results.

LNG – Atlantic LNG, Trinidad, West Indies
Ship/shore bonding cable assessment. J/N 2409

Lead Cable - Kansas City Power & Light Co., Kansas City, KS & MO
Lead sheath power cable network. Survey duct runs and evaluate cathodic protection.

Lightning Protection – Houston Lighting and Power Company, Houston, TX
Design lightning protection for Unit Nos. 1 & 2 stacks.

Liquified Natural Gas – Atlantic LNG, Point Fortin, Trinidad
Ship/shore bonding cable grounding vs. cathodic protection assessment. 2409

Marine Structure - U.S. Coast Guard Sabine Pass Station, TX
Sheet piling dock structure. Design cathodic protection.

Military - U.S. Navy/Huitt-Zollars, Inc., Fort Worth, TX
5 year IDR for A/E services.

Nuclear Power Plant - Washington Public Power Supply System, Elma, WA
1800 MW Nuclear Unit Numbers 3 & 5 underground structures. Design cathodic protection and electrical grounding systems.

Oxygen Corrosion - Shenandoah Oil Company, Ballinger, TX
Investigate accelerated corrosion due to high concentrations of oxygen in a waterflood pump discharge swedge nipple.

Oilfield - ARAMCO, Alkobar, Saudi Arabia
Berri & Qatif Oil Fields. Design cathodic protection systems and 7.2 KV power distribution systems.

Pharmaceutical Manufacturing - Carrington Research, Dallas, TX
Investigate subsurface pitting attack of steam heated stainless steel mixing vessel.



Pipeline Integrity Management – Direct Fuels, Hurst, TX

Rewrote I.M. Plan to comply with Railroad & Public Utility Commission's noted deficiencies.
Developed P&P drawings for the dual pipeline right-of-way. J/N 2196

Pipeline Survey - Texas Eastern Trans. Corp., Houston, TX

8" products pipeline, Watkins Glen, NY to Selkirk, NY. Close interval potential survey and evaluation of new survey techniques.

Pipe-Type Cable - Dallas Power & Light Company, Dallas, TX

138 KV pipe-type cable system, 13 circuits. Survey and adjust cathodic protection systems, inspect coatings.

Power Transmission - Arkansas Power & Light Co., Little Rock, AK

Hot Springs-McNeil 500 KV circuit. Survey, design cathodic protection system for steel tower foundations.

Protective Coatings - American Airlines AFW Maintenance Base, Fort Worth, TX

Design & specification of protective coatings for steel tankage and concrete secondary containment exposed to multiple severe chemicals in industrial waste water treatment plant.

Quality Assurance - Dallas Area Rapid Transit, Dallas, TX

Project Engineer for electrical & corrosion control acceptance tests on 80% of the 20 mile Light Rail Starter System.

Railroad - Burlington Northern Railroad, Ft. Worth, TX

Mark IV Transload Facility.
Cathodic Protection Design/Installation.

Rapid Transit - Dallas Area Rapid Transit, Dallas, TX

Project Engineer for QA/QC Acceptance Tests on track, structures, grounding systems and corrosion control facilities. Corrosion Engineer for DART Operations Group.

Sluice Gates – Buford Dam, Lake Lanier, Buford, GA

Protective coatings and cathodic protection design for replacement jet flow gates. 2383

Stainless Steel Heat Exchanger - QO Chemical, Memphis, TN

Mechanical & metallurgical recommendations to overcome accelerated corrosion of 316L SS components in a heat exchanger.

Steel Mill – Nucor Steel, Blytheville, AR

Investigate pinch roller corrosion. J/N 2519

Sulfur Mine - Pennzoil Sulfur Company, Pecos, TX

Recommendations to reduce extremely high internal corrosion rates in Frasch process piping system.

Tainter Gates – Luminant Power, Monticello S.E.S., Mt. Pleasant, TX

Cathodic protection design, installation and commissioning. 2324, 2324.01, 2348



Tank Farm - Fina Oil & Chemical, Dallas, TX

Grapevine Bulk Fuel Terminal. Design cathodic protection, plans and specs for tank bottoms and U/G piping.

Tank Lining Coatings - American Airlines Alliance Maintenance Base, Haslett, TX

Specification for lining system for an extremely aggressive industrial waste water environment.

Technology Transfer - Tecnologia Total LTDA., Bogota, Colombia, S.A.

Classroom lectures and "hands-on" training in field testing methods to assess need and design cathodic protection for a large refined products pumping station and aboveground tank farm.

Training - Dallas Power & Light Co., Dallas, TX

Basic corrosion mechanisms, cathodic protection as applied to Pipe-Type Cables and Steel Tower Foundations - 12 contact hours.

Underground Coating Performance Evaluation - Old Ocean Fuel Co., Fort Worth, TX

24" natural gas pipeline, Rosenberg, TX to Hillsboro, TX. Bell hole inspection evaluation of pipe and coating.

Underground Pipeline Coatings - Florida Gas Transmission Company, Winter Park, FL

Pipeline coating specifications for multiple environments based upon elevated temperature and cathodic disbondment laboratory tests.

Underground Storage Tanks - Trinity Coatings, Fort Worth, TX

Design and install cathodic protection system modifications for a 21 tank UST field with a total capacity of 113,000 gallons.

Value Engineering/Peer Review - Tarrant County Water Control Improvement District Number One, Fort Worth, TX. 11 plus miles 108 inch RCCP raw water transmission line.

Wastewater Treatment Plant - City of Dallas, TX

Design/install cathodic protection for very large filter building foundation piles.

Water Pipeline - Puerto Rico Water & Sewer Authority, San Juan, Puerto Rico.

Corrosion control recommendations and testing for 43.3 miles of 72 inch PCCP raw water & 12 miles of 36" finished water pipelines.

Water Tanks - Camp Dresser & McKee Inc., Fort Worth, TX

Inspect protective coatings and cathodic protection systems in municipal water tanks, recommendations.

Water Treatment - Pinecrest Retirement Community, Lufkin, TX

Recommend options for water treatment to overcome internal corrosion of copper potable water lines. 2167

Well Casings - North American Royalties, Midland, TX

Survey, design & install cathodic protection on 24 well casings, flow lines and LACT facilities in Central OK.



REGISTRATIONS AND RATINGS

Professional Engineer - Alabama #12067
Professional Engineer - Arizona #30463, Chemical
Professional Engineer - Arkansas #6711
Professional Engineer - California #CR59, Corrosion
Professional Engineer - Louisiana #22968, Electrical
Professional Engineer - Oklahoma #24828
Professional Engineer - Texas #44877
Certified Corrosion Specialist - #1777 - NACE International
Certified Cathodic Protection Specialist - #1777 - NACE International
Licensed Commercial Pilot, Instrument Rated with over 2,000 hours logged
Ordained Presbyterian Elder

EMPLOYMENT HISTORY

ELK ENGINEERING ASSOCIATES, INC.	2010 - Present
▪ Principal Engineer / Chairman of the Board	
ELK ENGINEERING ASSOCIATES, INC.	1994 - 2010
▪ Founder, President, & Chairman of The Board	
KIRK ENGINEERING COMPANY, INC.	1972 - Present
▪ Founder & President	
BENDER CORROSION ASSOCIATES, INC.	1983 - 1994
▪ Senior Vice President	
EBASCO SERVICES INCORPORATED	1978 - 1983
▪ Senior Engineer	
CONTROL, INC.	1971 - 1978
▪ Vice President, Corrosion Services	
GENERAL CORROSION SERVICES	1970 - 1971
▪ Corrosion Engineer	
FLORIDA GAS TRANSMISSION CO.	1959 - 1970
▪ Senior Corrosion Engineer	

PROFESSIONAL AFFILIATIONS

A.S.M. International - Member
American Chemical Society - Member
American Water Works Association - Member
IEEE – Life Senior Member
Kilgore College Corrosion Technology Course, Advisory Committee Member since 1980.
Marine Corps League, Life Member, Chaplain
NACE, International - Life Member
- Member numerous Technical Committees, Past Chairman 2 Committees
- Past Local & Regional Officer
- National & Regional Symposia Chairman
- 1990 Recipient Distinguished Service Award
National Center for Construction Education and Research
ACTP Proctor



Pipeline Corrosion Control – Performance Evaluator
Pipeline Core-Performance Evaluator

EDUCATION

Attended University of Miami - Electrical Engineering - 1954-59
Numerous engineering conferences and short courses
OSHA – 10 Hour Construction Industry Outreach Training Program
OSHA – 30 Hour Construction Industry Outreach Training Program

PUBLISHED PAPERS

"Stray Current Interference From a Light Rail Traction System," Paper Number 11338, Corrosion/2011, Houston, TX, NACE International, Houston, TX, 2011.

"Copper Grounding and CP in Nuclear Facilities," Paper Number 11184, Corrosion/2011, Houston, TX, NACE International, Houston, TX, 2011.

"Restoring Effective Cathodic Protection to BPP in a Large Coal Fired Power Plant," with Dennis Marek, Jr., EPRI Buried Pipe Integrity Group Open Door Session, Electric Power Research Institute, Palm Coast, FL, 2011.

"Combining an E-Log I Test with a CEPT Survey on a well casing," presented to NACE International, DFW Section – Barnett Shale Basic Corrosion Control Seminar N. Texas Section Meeting, Ennis, TX 2008.

"The Facts & Myths About 'Shorted' Casings," presented to TEC 292 X [35, 05] Direct Assessment Methodology Application, NACE International, Corrosion Technology Week, Orlando, FL 2006.

"Cathodic Protection of a Well Grounded Tank Farm and Pump Station," Paper Number 04040, Corrosion/2004, New Orleans, LA, NACE International, Houston, TX 2004.

"Retrofit Induced AC Mitigation," Paper No. 03707, Corrosion/2003, San Diego, CA, NACE International, Houston, TX 2003.

"Electrical Grounding Case Histories," Paper Number 03701, Corrosion/2003, San Diego, CA, NACE International, Houston, TX, 2003.

"Improved Grounding Causes Minimal Impact on CP Systems," Materials Performance, Vol. 42, No. 1, NACE International, Houston, TX, 2003.

"Conflict Between Copper Grounding and CP In Oil & Gas Production Facilities," Materials Performance, Vol. 41, No. 8, NACE International, Houston, TX, 2002.

"Electrical Grounding and Cathodic Protection Issues in Large Generating Stations," Materials Performance, Vol. 40, No. 11, NACE International, Houston, TX, 2001.



"Design Considerations for Mitigation of Induced AC on Pipelines," with John Dabkowski, Paper Number 01597, Corrosion/2001, Houston, TX, NACE International, Houston, TX 2001.

"The Conflict Between Copper Grounding Systems and Cathodic Protection Systems," second EPRI Corrosion and Degradation Conference, Key West, FL, Dec. 2000, Electric Power Research Institute, Charlotte, NC.

"Copper Grounding Systems Have a Negative Effect on C.P. Facilities," Paper Number 00743, Corrosion/2000, Orlando, FL, NACE International, Houston, TX, 2000.

"The Conflict Between Copper Grounding Systems and CP," with Mohammad Shamim, Materials Performance, Vol. 38, No. 9, NACE International, Houston, TX, 1999.

"Corrosion Failures By Design or Corrosion Problems That Could Have Been Prevented By Proper Design," Corrosion and Degradation Conference, St. Pete Beach, FL, Electric Power Research Institute, Charlotte, NC, 1999.

"Copper Grounding Systems Have A Negative Effect On Cathodic Protection In Production Facilities," with Mohammad Shamim, Eighth Middle East Corrosion Conference, Manama, Bahrain, NACE International, Houston, TX, 1998.

"Structure Assessment and Coating Selection," Protective Coatings & Life Expansion of Overhead Transmission Line Structures Seminar, Nashville, TN, Electric Power Research Institute, 1997.

"Induced AC Voltages on Pipelines May Present A Serious Hazard," Pipeline & Gas Journal, Vol. 224, No. 10, Oildom Publishing Company of Texas, Inc., Houston, TX 1997.

"Basic Concepts of Induced AC Voltages on Pipelines," Materials Performance, Vol. 34, No. 7, NACE International, Houston, TX, 1995.

"Cathodic Protection of Power Line Structure Foundations," Materials Performance, Vol. 27, No. 8, National Association of Corrosion Engineers, Houston, TX, 1988. Note: also published in Israel, 1988.

"Alternatives to Copper Grounding in Sites Requiring Cathodic Protection," Materials Performance, Vol. 25, No. 9, National Association of Corrosion Engineers, Houston, TX, 1986.

"Effects Of Electrical Grounding On Corrosion," Paper Number 53, Corrosion/79, Atlanta, GA, National Association of Corrosion Engineers, Houston, TX, 1979.

"Polarization Cells - A Versatile New Tool For The Corrosion Engineer," Paper Number 6, Corrosion/74, Chicago, IL, National Association of Corrosion Engineers, Houston, TX, 1974.

PLUS NUMEROUS LOCAL, REGIONAL AND NATIONAL SHORT COURSES AND CONFERENCES

