



Operating Plant and Systems Professionals

'Your Increased Profitability is Our Bottom Line'

K. Daniel Efird **Senior Corrosion Specialist**

CAREER PROFILE

Dan is a recognized authority on corrosion prevention and control with 37 years of research, technical and supervisory experience in corrosion, corrosion control and materials in crude oil and gas, chemical, petrochemical, and marine industries. He has extensive experience as an expert witness for corrosion related cases. He also has broad experience in corrosion testing and research for oil and gas onshore/offshore production and marine operations. Research areas include flow effects and crude oil effects on corrosion, packer fluid corrosion, drilling fluid corrosion, stress corrosion and sulfide corrosion cracking, corrosion inhibitors, corrosion test technique development, high temperature pipeline coatings, heat transfer effects on corrosion and coatings, Cu-Ni alloy marine corrosion, high temperature seawater corrosion and alloy effects on marine fouling.

Dan is also expert in the design and implementation of corrosion experiments to efficiently achieve appropriate, valid results. He is experienced in the design and implementation of preventive corrosion engineering, life extension, corrosion management systems, risk based inspection, and materials QA/QC. He has served as an experienced expert witness in corrosion related issues, and is an expert in planning, organization and implementation of customized corrosion courses, courses on specific corrosion topics and corrosion engineering in general. Dan has had direct involvement with overseas oil and gas production operations in the North Sea, Middle East, Africa and South America, and with US domestic operations. Dan has authored a 35 peer reviewed technical publications on corrosion in marine and oil and gas environments.

PROFESSIONAL EMPLOYMENT

Facilitated Integration Technology, Inc., San Antonio, TX 2005 - Present **Senior Corrosion Specialist**

- Specialization in corrosion control engineering, consulting, failure analysis, expert witness, research and testing, and education and training.
- Development and application of innovative corrosion testing methods targeted at solving specific corrosion problems.
- Design and implementation of life extension programs for existing facilities, corrosion management systems, corrosion monitoring programs and risk based inspection programs.

Exxon Production Research, Houston, Texas, 1990 – 1998 **Engineering Associate, Sr. Engineering Specialist**

- Materials Section Operations Support Group Leader covering the technical areas of corrosion control and chemical inhibition, coatings, cathodic protection, elastomers and nonmetallics, and composites.
- Comprehensive corrosion engineering support provided for all domestic and international operating areas. Designed and supervised in-house corrosion research and testing projects and projects contracted to outside laboratories.
- Areas of research included flow effects on corrosion, packer fluid corrosion, drilling fluid corrosion, acidizing corrosion control, corrosion inhibitors, development of corrosion test techniques, and high temperature pipeline coatings.

Occidental International Exploration and Production Co., Bakersfield, California, 1982 – 1990, Manager, Corrosion Engineering

- Overall responsibility for corrosion and materials engineering coordination, consulting and trouble shooting for international oil and gas engineering, exploration, drilling, construction, and operations. Provided technical support for operating areas where corrosion engineers were on the local staff, including technical supervision of these engineers.
- Comprehensive corrosion engineering support provided for all other international operating areas. Coordinated and supervised corrosion research and testing projects in-house and when contracted to outside laboratories.
- Project manager for corrosion related construction projects, e.g., field cathodic protection systems, large coating projects, field corrosion monitoring systems, etc.
- Materials specification, welding and corrosion design support for international construction projects.
- In-house technical presentations to operating regions as needed or requested.
- Responsibility for the proper application of chemical control of oil pollution, and pollution control in produced water treatment for international operations.

Occidental Petroleum (Caledonia), Ltd., Aberdeen, Scotland, 1977 – 1982, Sr. Corrosion Engineer

- Responsibility for the corrosion engineering program for Occidental North Sea operations (offshore platforms, pipelines and terminals), including cathodic protection, chemical treatment, coatings, corrosion testing and monitoring, and failure analysis.
- Coordinated and supervised corrosion research and testing projects contracted to outside laboratories, and was project manager for corrosion related construction projects.
- Provided division wide support for materials specification, welding and corrosion control design.

Occidental of Libya, Inc., Tripoli, Libya, 1977, Senior Corrosion Engineer

- Responsible for the corrosion and materials engineering program for the Occidental Libyan facilities. Assignments were in areas of corrosion monitoring and cathodic protection.
- Transferred to Aberdeen when the position in Libya was nationalized.

International Nickel Company, Inc., LaQue Corrosion Laboratory, Wrightsville Beach, NC, 1975 - 1977, Corrosion Research Manager

- Responsible for the corrosion research section of the laboratory, and supervised all personnel and research projects dealing with marine corrosion and fouling.
- The areas of research included basic research in marine corrosion, marine environment materials performance and specifications, development of corrosion test techniques, alloy effects on fouling.
- Consultant to industrial companies and government organizations on marine corrosion and fouling.

International Nickel Company, Inc., LaQue Corrosion Laboratory, Wrightsville Beach, NC, 1971 – 1975, Engineer-Scientist

- Conducted research on corrosion mechanisms and fouling in the marine environment, marine materials performance and specifications, and the application of test techniques to obtain engineering data.
- Responsible for all phases of assigned research projects, planning and conducting engineering seminars, and consulting in marine corrosion with industrial and government bodies.

The Dow Chemical Company, Inc., Louisiana Division, Plaquemine, LA, 1967 – 1969, Materials Engineer

- Responsible for investigation and mitigation of Division corrosion and materials failures, materials specifications for process equipment, and materials failure analysis.
- Specifically involved with corrosion prevention and materials specification for chlorine/caustic production plants, chlorinated hydrocarbon plants, and ethylene production plants.

ACCREDITATION

Licensed Professional Engineer - Corrosion, State of California, License No. 338
Corrosion Specialist - NACE International, License No. 1819

EDUCATION

University of Florida

M.S. Materials Engineering, 1970

North Carolina State University

B.S. Metallurgical Engineering, 1967

B.S. Chemical Engineering, 1966

PROFESSIONAL AFFILIATIONS

NACE International (NACE)

ASM International

American Society for Testing and Materials (ASTM)

Steel Structures Painting Council (SSPC)

PROFESSIONAL AWARDS

A. B. Campbell Award for Young Authors, 1975 (NACE International)

Technical Achievement Award, 1995 (NACE International)

Distinguished Service Award, 2005 (NACE International)

PUBLISHED PAPERS

1. K. D. Efird, "Crevice Corrosion of a Copper-Nickel Alloy and its Relationship to the Experimental Potential-pH Diagram," MS Thesis, University of Florida, 1970.
2. D. B. Anderson and K. D. Efird, "The Influence of Chromium on the Corrosion Properties of Copper-Nickel Alloys in Seawater," Proceedings: 3rd International Congress on Marine Corrosion and Fouling, Gaithersberg, Md., 1972.
3. K. D. Efird and D. B. Anderson, "Copper-Nickel Resists Recirculated Seawater," Power, February, 1974.
4. K. D. Efird, "Experimental Potential-pH Diagrams for 90-10 and 70-30 Copper-Nickel in Seawater," Corrosion, Vol. 31, No. 3, March 1975.
5. K. D. Efird and D. B. Anderson, "Seawater Corrosion of 90-10 and 70-30 Cu-Ni: Fourteen Year Exposures," Materials Performance, Vol. 14, No. 11, November 1975.
6. K. D. Efird, "The Effect of Temperature on Crevice Corrosion of Stainless Steels in Seawater," Proceedings: 6th International Congress on Metallic Corrosion, Sydney, Australia, December 1975.
7. K. D. Efird, "The Interrelation of Corrosion and Fouling of Metals in Seawater," Materials Performance, Vol. 15, No. 4, April 1976.
8. K. D. Efird, "The Effect of Fluid Dynamics on the Corrosion of Copper Base Alloys in Seawater," Corrosion, Vol. 33, No. 1, January 1977.
9. K. D. Efird and E. D. Verink, "The Crevice Protection Potential for 90-10 Copper-Nickel," Corrosion, Vol. 33, No. 9, September 1977.
10. K. D. Efird, "The Synergistic Effect of Ni and Fe on the Seawater Corrosion of Copper Alloys," Corrosion, Vol. 33, No. 10, October 1977.
11. K. D. Efird and T. S. Lee, "The Carbon Mechanism for Aqueous Sulfide Corrosion of Copper Base Alloys," Corrosion/78, Paper No. 24, March 1978.

12. K. D. Efird and T. S. Lee, "Putrid Seawater as a Corrosive Medium," Corrosion, Vol. 35, No. 2, February 1979.
13. K. D. Efird, "The Hot Riser Problem - The Operators Viewpoint," Proceedings: Hot Risers, Managing the Corrosion Problems, Oyez IBC, Ltd., London, February 1979.
14. K. D. Efird and G. E. Moller, "Electrochemical Characteristics of AISI 304 and 316 Stainless Steels in Fresh Water as Functions of Chloride Concentration and Temperature," Materials Performance, Vol. 18, No. 7, July 1979.
15. K. D. Efird, "Corrosion within Seawater Systems on Offshore Structures," Proceedings: Marine Corrosion on Offshore Structures, Society of the Chemical Industry, London, 1981
16. K. D. Efird, "Current Waveform Initiated Corrosion Failure of Platinum/Niobium Impressed Current Anodes in Seawater Cathodic Protection Systems," Materials Performance, Vol. 21, No. 6, June 1982.
17. K. D. Efird, "Failure of Monel Ni-Cu-Al Alloy K-500 Bolts in Seawater," Materials Performance, Vol. 24, No. 4, April 1985.
18. R. J. Jasinski and K. D. Efird, "Electrochemical Corrosion Measurements in Crude Oil," Corrosion, Vol. 43, No. 8, August 1987.
19. K. D. Efird, "Galvanic Corrosion in Oil and Gas Production," ASTM STP 978, GALVANIC CORROSION, H. P. Hack, Ed., American Society for Testing and Materials, Philadelphia, 1988.
20. R. J. Jasinski and K. D. Efird, "Electrochemical Corrosion Probe for Hydrocarbon/Water Mixtures," Corrosion, Vol. 44, No. 9, September 1988.
21. K. D. Efird and R. J. Jasinski, "The Effect of the Crude Oil on the Corrosion of Steel in Crude Oil/Brine Production," Corrosion, Vol. 45, No. 2, February 1989.
22. K. D. Efird, "Predicting the Corrosion of Steel in Crude Oil Production for Preventive Corrosion Engineering," Materials Performance, Vol. 30, No. 3, March 1991, pp. 63-66.
23. K. D. Efird, "Preventive Corrosion Engineering in Crude Oil Production," 23rd Annual Offshore Technology Conference, Houston, Texas, May 6-9, 1991, Paper OTC 6599.
24. K. D. Efird, et. al., "Wall Shear Stress and Flow Accelerated Corrosion of Carbon Steel in Sweet Production," 12th International Corrosion Congress, Houston, Texas, September 19-24, 1993.
25. K. D. Efird, et. al., "Experimental Correlation of Steel Corrosion in Pipe Flow with Jet Impingement and Rotating Cylinder Laboratory Tests," Corrosion, Vol. 49, No. 12, December, 1993.
26. K. D. Efird and J. A. Herce, "Effects of Solution Chemistry and Flow on the Corrosion of Carbon Steel in Sweet Corrosion," NACE CORROSION/95, Orlando, FL, Paper No. 111, March, 1995.
27. K. D. Efird, Chapter 36 "Petroleum," Corrosion Tests and Standards: Application and Interpretation, Robert Baboian Editor, ASTM Manual Series: MLN 20, ASM, Philadelphia, PA, 1995.
28. K. D. Efird, "Disturbed Flow and Flow Accelerated Corrosion in Oil and Gas Production," Journal of Energy Resources Technology, Vol. 120, No. 1, March, 1998, pp.72-77.
29. K. D. Efird, "Hydrogen Sulfide (Sour) Corrosion in Oil and Gas Production," 6th New Orleans Offshore Corrosion Conference, New Orleans, LA, December, 1998.
30. K. D. Efird, "The Effect of Disturbed Flow on Flow Accelerated Corrosion," EPRI Corrosion and Degradation Conference, St. Petersburg Beach, FL, June 2-4, 1999.
31. K. D. Efird, "Disturbed Flow and Flow Accelerated Corrosion," U.S. Nave & Industry Corrosion Technology Information Exchange, Louisville, KY, July 19-22, 1999.
32. K. D. Efird, "Disturbed Flow and Flow Accelerated Corrosion in Oil and Gas Production," 7th New Orleans Offshore Corrosion Conference, New Orleans, LA, December, 1999.
33. K. D. Efird, "Flow-Induced Corrosion," Uhlig's Corrosion Handbook, Second Edition, R. Winston Revie, Ed., John Wiley & Sons, Inc., Chapter 14, pp. 233-248, 2000.
34. K. D. Efird, "Jet Impingement Testing for Flow Accelerated Corrosion," NACE CORROSION/2000, Orlando, FL, Paper No. 00052, March, 2000.
35. K. D. Efird, J. L. Smith, S. E. Blevins, and N. D. Davis, "The Crude Oil Effect on Steel Corrosion: Wettability Preference vs. Brine Chemistry," CORROSION 2004, NACE International, New Orleans, March, 2004, Paper 04366.