Porter R. Ritchie

M.S., P.E., C.W.I

Senior Staff Consultant

Mr. Porter Ritchie is a Senior Staff Consultant for ESi. Mr. Ritchie has over eleven years of experience in failure analysis, metallurgy, and materials characterization. As a licensed metallurgical engineer, Mr. Ritchie has investigated material performance and failure issues across a wide range of industries, including oil and gas, automotive, HVAC, home appliances, wind energy, plumbing and fire sprinkler systems.

Mr. Ritchie is skilled at using both nondestructive and destructive examination techniques to distinguish between various failure mechanisms such as corrosion, fatigue, stress corrosion cracking (SCC), hydrogen cracking, and brittle or ductile overload. Additionally, he has experience with several characterization methods including magnetic particle testing, fractography, metallography, optical microscopy, electrochemical testing, and hardness mapping.

Mr. Ritchie holds a Master of Science in Materials Science and Engineering from Ohio State University. His graduate studies focused on materials degradation and weld metallurgy, specifically on the preferential corrosion of pipeline seam welds. His research contributed significantly to the understanding of selective seam weld corrosion (SSWC) of pipelines.

Education

M.S., Materials Science and Engineering,
Ohio State University, 2020

B.S., Materials Science and Engineering,
Ohio State University, 2014

Licenses & Certifications

- State of Washington P.E. License No. 24021663
- State of Ohio P.E. License No. PE 87550

Additional Training

- PADI Certified Open Water SCUBA Diver, 2024

Contact Information

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Areas of Specialization

- Failure Analysis
- Materials Technology, Characterization, and Selection
- Pipelines and Pressure Vessels
- Welding Metallurgy
- Fractography
- Laboratory Services
- Manufacturing
- Corrosion
- Mechanical Properties and Testing

Positions Held

Engineering Systems Inc., Seattle, Washington

- Senior Staff Consultant, 2023 – Present

DNV, Dublin, Ohio

- Senior Engineer, 2014 – 2023

Professional Affiliations/Honors

Association for Materials Protection and Performance (AMPP)

- Member

ASM International

- Member
- Columbus, Ohio Chapter Treasurer (2015-2016)

Failure Analysis Society, an affiliate society of ASM International

- Founding Member 2016 – Present
- Programming Committee Co-Chair, Fracture & Fatigue, Failure Analysis Symposium, IMAT, Detroit, October 2025

American Welding Society (AWS)

- Member
- Certified Welding Inspector, 2024 – Present

The Minerals, Metals, and Materials Society

- Member

Selected Project Experience

Weld Cracking on Fuel Storage Tank Bottom

- Several cracks were identified on the floor of a recently constructed tank in bunker fuel and No. 2 fuel oil service. An investigation was performed to determine the cause of the cracks. Nondestructive examination identified interlinking cracks adjacent to floor plate welds oriented both parallel and transverse to the welds. A fractographic examination of the crack surfaces using a scanning electron microscope revealed intergranular fracture features. The analysis determined the overall morphology of the cracks was consistent with environmentally assisted cracking.

Well Casing Failure During Construction

- A well casing failed at a collar while in wet-sour natural gas service at an underground storage facility. The failure occurred at tapered threads on the well casing where the thickness of the casing was reduced. A material analysis determined the casing failed as a result of ductile overload from an applied bending force or longitudinal force. A review of the casing collar design was performed, and welding of the casing collar to the casing of the other wells at the facility was recommended as possible mitigation.

Leak on Hydrogen Pipeline

- A pipeline transporting hydrogen leaked while in service. An investigation was performed to determine the failure occurred at a lack of fusion defect that formed during manufacturing due to insufficient heat or welding pressure.

Rupture on Natural Gas Liquids Pipeline

- A pipeline transporting natural gas ruptured while in service. Colonies of inside diameter surface-breaking cracks were observed along the bottom of the failed pipe section. A review of the geography near the failure location revealed the rupture occurred at a local low spot on the pipeline where chemical treatments may have collected. It was determined that the rupture initiated at a colony of environmentally assisted cracks consistent with stress-corrosion cracking (SCC).

Leak on Natural Gas Liquids Pipeline

- A pipeline transporting natural gas liquids (NGL) leaked while in service. An investigation was performed to determine the cause of the failure. A material analysis determined the leak occurred at a repair weld containing a pre-existing feature. The morphology of the feature was consistent with a weld imperfection produced at elevated temperature, and hydrogen cracking in the weld heat affected zone.

Damage of Underwater Pipeline Support

- A pipeline located along the bottom of a body of water sustained damage to a support anchor. Examination of witness marks indicated the support had been struck by a wire cable from a passing boat. A scanning electron microscope (SEM) was utilized to determine the directionality of the witness marks and compare them with the known travel directions of nearby boat traffic.

Gasoline Leak After Pipeline Repair

- A pipeline in gasoline service developed a leak shortly after the installation of a repair sleeve. A failure analysis determined the leak occurred at a dented girth weld containing a pre-existing hydrogen crack. The bending stress imparted by the repair sleeve caused overload of the pre-existing crack.

Tank Header Elbow Leak

- An austenitic stainless steel pipe elbow leaked while in cryogenic service. A materials failure analysis performed on the elbow determined a fatigue crack initiated at a notch on the inside diameter surface at the root of the longitudinal seam weld and propagated through-wall.

Heat Exchanger Failure

- A tube from a heat exchanger failed while in sour gas service. A materials failure analysis determined the failure occurred as a result of fatigue cracking that initiated at the inside diameter surface of the tube at the root of a fin.

Pig Trap Failure

- A pig trap leaked while in NGL service. A pressure test determined the leak was located at the seal between the end closure and the body of the pig trap assembly. Further analysis determined the leak occurred due to an O-ring failure. Optical and microscopic examination determined the O-ring failed as a result of mechanical damage from pinching that occurred during installation.

Hydrotest Leak at Girth Weld

- A girth weld leaked during hydrostatic pressure testing of a pipeline. A materials failure analysis determined the cause of the leak was a crack that formed as a result of copper contamination of the weld metal. Metallographic analysis and energy dispersive spectroscopy using a scanning electron microscope determined the leak path was consistent with liquation cracking.

Floating Roof Pontoon Corrosion

- Corrosion was observed on aluminum alloy pontoons removed from a floating roof cone of an ethanol storage tank. A materials analysis determined the corrosion consisted of pitting on the bottom of the pontoons.

Flange Adapter Failure

- A large diameter flange adapter in water service experienced multiple failures during commissioning hydrostatic pressure testing. Microstructural analysis and hardness testing were performed on the subject adapter to confirm the ductile iron met manufacturer specifications. An exemplar flange adapter was assembled and hydrostatically pressure tested in the laboratory.

Publications/ Presentations

"Zap or Trap? The Fiery Dilemma of Zinc Oxide Surge Protectors" P. Ritchie, K. Cline, E. Schultz, L. Bilancia, presented at 2025 IMAT Conference, October 20-23, Detroit, MI

"Metal Oxide Varistors in Fires – Cause v Fire Victim" L. Bilancia, P. Ritchie, E. Schultz, K. Cline, *2025 IEEE International Symposium on Product Compliance Engineering (ISPCE), San Francisco, CA, 2025, pp. 1-7* doi: 10.1109/ISPCE64260.2025.11044895

"So Just Like Bending A Paper Clip?" P. Ritchie, H. Iwand, T. Janecek, ASM Journal of Failure Analysis and Prevention, (November 2024)

"So Just Like Bending A Paper Clip?" P. Ritchie, H. Iwand, T. Janecek, presented at 2024 IMAT Conference, September 30 - October 3, 2024, Cleveland, OH

Master's Thesis: Susceptibility of ERW Line Pipe to Selective Seam Weld Corrosion (SSWC), May 2020

"Ice Ice or Under Pressure? Mothballed Pipeline Failure," P. Ritchie, G. Quickel, ASM Journal of Failure Analysis and Prevention, (August 2019)

"Frozen? Mothballs on Ice," P.R. Ritchie, presented at Materials Science & Technology 2017, October 9-12, 2017, Pittsburgh, Pennsylvania

"Welder's Regret: Failure Analysis of Cracks Under a Fillet Weld," P.R. Ritchie, presented at Materials Science & Technology 2016, October 24-26, 2016, Salt Lake City, Utah

Expert Witness Experience

Canadian Energy Regulator (CER) – Prepared expert report (Dec. 7, 2023) and presented findings in mediation for *The Regional Municipality of Peel Application for Cost Apportionment under Section 335 of the CER Act* (File No. 4667309).