

Course Content

Title: API 571 Damage Mechanisms in the Refining Industry

Potential PDH: 24

Code: BTT017

Description:

This course focusses on practical experiences with particular damage mechanisms relevant to the major units of an operating refinery. The course is taught by a refining industry Subject Matter Expert as well as a former Chief Inspector with over 40 years of industry experience.

Outline:

- Damage Mechanisms Course Outline Introduction, goals, outcomes
- Intro to Metallurgy and properties, heat treatment
- Intro to NDE/inspection
- Crude/Vac Unit Overview
 - Desalter and crude ovhd corrosion, incl. vac tower organic acid issues
 - Sulfidation (Organic) and Naphthenic Acid corrosion
 - Ammonium Cl and HCl Corrosion
 - Permanently installed corrosion probes
- Naphtha HT and Cat Reformer Overview
 - HTHA
 - Heater tube oxidation and creep
- Diesel HT/Hydrocracker Overview
 - High temperature H₂/H₂S corrosion
 - NH₃B₂S corrosion (sour water) and REAC's
 - Temper Embrittlement and Minimum Pressurization Temperature
 - PAUT inspection
 - Wet H₂S Cracking WFMT and Surface Eddy Current and FFS of wet H₂S damaged equipment
 - Cl SCC and PASC and downtime protection (soda ash washing), low pt drains, caustic SCC
- FCC Overview
 - Erosion
 - Carbonate SCC and wet H₂S cracking and AUT
- Alkylation
 - HF Alkylation
 - Sulfuric Acid Alkylation
- Coker
 - Thermal Fatigue
 - Carburization
- Amine and Sulfur Units
 - Amine SCC
 - Amine corrosion
- Hydrogen Plant
 - Reformer tubes and headers (Alloy 800 cracking, weldability/solution annealing for cast alloys)
 - UT/EC inspection of Tubes
 - CO₂ corrosion
 - PSA Fatigue



GERRIT M. BUCHHEIM, P.E.

*Refining Metallurgical and Corrosion Engineering Expert & Pono
Division Manager*
Pono Division

Mr. Buchheim is a recognized industry expert in damage mechanisms, particularly, sulfidation, wet H₂S cracking, creep, HTHA, and fire damage assessment. He is an expert in creating IOW's and CCD's, conducting corrosion reviews as part of RBI projects, and in FFS assessments. With his 40 years of metallurgical/corrosion/inspection experience, he has been involved in all aspects of materials engineering including corrosion prevention, failure analysis, RBI, and fitness-for-service assessments. He has focused primarily on aging fixed equipment in refineries, but has also worked with petrochemical and upstream facilities.

Mr. Buchheim has experience focused on the identification, repair and remediation of several common damage mechanisms encountered in the refining and related industries. He has conducted numerous corrosion reviews, risk based inspection implementation reviews, and developed CCD's and Integrity Operating Windows (IOW's) to assist refineries in safe and reliable operations. He has been the lead technical expert in many failure analyses, fire damage assessments, and fitness-for-service assessments. He has also been involved in Mechanical Integrity reviews, audits, due diligence evaluations for plant purchase, numerous cold eyes reviews and failure investigations providing non-testifying legal expert advice.

In support of these efforts, Mr. Buchheim has been active in developing several API and NACE standards. He is a charter member of the API/ASME 579 committee and is currently task group chairman for Part 7 (hydrogen blistering/HIC/SOHIC), and is a member of Part 11 fire damage, and Part 10 creep damage and Part 3 Brittle Fracture. He has also taught the API 579 course for 10 years. He was past chairman of the API 571 Damage Mechanisms task group and has taught an API 571 course for 15 years. He is also a member of the API 581 API RBI API 584 IOW, and API 941 HTHA committees. He is the original author of API 939-C Sulfidation and was Vice Chair of that committee revising API 939-C. He is past chairman of the API 945 Amine SCC committee. He was the vice chairman of API 970 CCD's. He was the vice chair of the NACE SP02-96 committee on wet H₂S cracking for the past two updates and was vice chair of NACE TG 176 Sulfidation in hydroprocessing units. In addition he has organized workshops for API and NACE on HTHA, Cr-Mo cracking, Sulfidation, and wet H₂S Cracking. He also has over 30 industry publications in these areas.

Mr. Buchheim worked about 20 years for refiners (Exxon and BP) in central engineering roles and refinery assignments and consulted for 11 years with another company and for the past 6 years with Becht Engineering. He has been an active volunteer for industry groups such as API, NACE, IPEIA, WRC, and MPC. He acts as the plant metallurgist/corrosion engineer to answer misc. questions for about 15 refineries. He has built a first class Metallurgical/Integrity Management team at Becht with over 50 members.

Mr. Buchheim received both his BS and MS in Metallurgical Engineering from Carnegie Mellon University in Pittsburgh, PA. He is a licensed professional engineer in Ohio.

Mr. Buchheim is based in Kihei, HI.

JEREMY C. STAATS, P.E.

Refining Metallurgical and Corrosion Engineer

Assistant Division Manager

Pono Division

Mr. Staats is an experienced refining metallurgical and corrosion engineer. He's knowledgeable on creep, HTHA, environmental cracking and sulfidic corrosion damage mechanisms and associated fitness-for-service methods. As a refinery based metallurgical and corrosion engineer, he's proficient on materials selection, failure investigations, failure analysis, inspection planning, TA support, repair plans, RBI, IOW's, and CCDs. He's been intimately involved with implementation of RBI, CCD's, and corrosion reviews both as a consultant and refinery metallurgical and corrosion engineer. Mr. Staats has also participated in mechanical integrity reviews and audits for fixed equipment, both as a consultant and end user.

Mr. Staats has authored papers covering fitness-for-service methods for wet H₂S cracking, particularly the API 579 Part 7 HIC rules. He's also authored papers on brittle fracture and the background research for temperature, stress, and fracture relationships as well as papers covering risk assessment techniques for High Temperature Hydrogen Attack (HTHA).

Mr. Staats is the current chair for API 571 – Damage Mechanisms Affecting Equipment in the Refining Industry. He is past vice chair for NACE TG 326, Weldments, Carbon Steel: Prevention of Environmental Cracking in Refining Environments and also led the NACE State of the Art session on processing tight oil crudes and associated corrosion issues.

Mr. Staats has over 13 years' experience as a refining metallurgical and corrosion engineer. Prior to joining Becht Engineering, he worked as a consultant both in a central office and as an onsite refinery contractor. Mr. Staats also worked for Flint Hills Resources as a refinery metallurgical and corrosion engineer at their Corpus Christi location. He has spent the last 5.5 years working for Becht as a Materials and Corrosion Engineer and now is an assistant Division Manager for the PONO Division. More recently at Becht Engineering, Mr. Staats has focused on projects that incorporate CCD and IOWs into inspection data management systems. He is also active in materials and corrosion issues in the chemical and pulp and paper industries.

Mr. Staats received his BS in Metallurgical Engineering from the Missouri University of Science and Technology in Rolla, MO. He is a licensed professional engineer in the state of Texas.

Mr. Staats is based in Raysville, MO.



MARK CARTE

NDE Subject Matter Expert - Consultant and Trainer
Pono Division

Mark has served industry for 45 years as a Non Destructive Examination (NDE) Practitioner and Consultant. His NDE experience spans Up, Mid and Downstream Petroleum and Petrochemical Industry. He also has extensive NDT experience in Aerospace, Military and Power Generation.

Mark's expertise includes design, fabrication and testing of NDE equipment along with mock-ups, calibration/performance demonstration standards and NDE procedures/work processes and training.

Expert in developing multidiscipline NDE approaches; detection and quantification for FFS work for specialized damage mechanisms, such as:

- Wet H₂S Damage, High Temperature Hydrogen Attack, Chloride Stress Corrosion Cracking

Expert in developing unique NDE Applications:

- Tube to Tube Sheet Welds, Phased Array UT Scanner, Mock-Up, procedure and inspection work process; Boiler Tube Cracking, internal inspection with Phased Array UT Angle Beam; Multi-Layered Vessel weld inspection with Phased Array UT, ToFD and FMC TFM; ERW Piping Long Seam inspection; Small bore instrument piping

Expert in Validating Thickness Measurements and Thickness Data Analysis and Teaching inspectors how to Review Data.

NDE Trainer:

Mark actively provides hands on NDE training including UT, PT MT WFMT & VT for Operating Company employees and NDE service providers. He has ASNT Level II certifications in the aforementioned disciplines. Mark conducts NDE training workshops on-site using samples of damaged material, NDE equipment, surface preparation examples with emphasis on true capabilities of NDE techniques.

Industry Involvement:

- API Subcommittee for Inspection and Mechanical Integrity. (SCIMI)
- API Inspection and Mechanical Integrity Summit Vice Chair
- Materials Technology Institute (MTI), National Association of Corrosion Engineers (NACE)
- Harwell Offshore Inspection Services (HOIS)

Mark is based in Houston, TX.



JIM EDMONDSON

Refining Materials and Corrosion Expert
Pono Division

Jim is a recognized industry expert in refinery damage mechanisms, opportunity crude processing and process chemistry / chemicals. During his 42 years of corrosion / refining / research experience, he has been involved in all aspects of managing integrity risk due to changing crude slates and process conditions; including corrosion prevention, failure analysis, damage mechanism reviews, and CCD / IOW development. He has worked primarily with refinery and petrochemical facilities.

Jim was responsible for managing internal and external standards while serving as a technology gatekeeper in the area of downstream materials and corrosion. Jim also investigated several high-profile incidents; participating in scope definition, causal investigation and recovery / mitigation efforts. He also conducted research and provided technical support to sites in the areas of lean amine corrosion, naphthenic acid and sulfidic corrosion modeling, and mitigation of risks due to various crude contaminants. Jim was a member of several multi-disciplinary teams that developed tools to assist refining sites in managing CDU overhead corrosion, non-aqueous erosion-corrosion, and opportunity crude processing. These efforts resulted in several software tools and key recommended practices to improve reliability and reduce integrity risk.

Jim was a member of API Subcommittee on Corrosion and Materials. He has been active on a number of API Subcommittee on Corrosion and Materials Task Groups, including current Task Group Chairman of API RP 932-B on Hydroprocessing REAC corrosion and past leader of the Task Group on Fuel-Grade Ethanol SCC research. Jim is also active in NACE as past Chairman of TG 489 on crude contaminants. Jim has contributed to several other task groups, notably in the areas of CDU overhead corrosion and injection / mixpoints.

Jim worked more than 17 years for Shell Oil Company after a 25-year career with Betz Laboratories and successor companies. His career with Shell was in central engineering and research roles providing material/corrosion and process chemistry/process chemical support to multiple refineries and petrochemical plants. For the last 5-years at Shell, Jim served as the Principal Technical Expert for Downstream Materials and Corrosion. At Betz, Jim developed revolutionary neutralizing amine chemistry, unique H₂S scavengers, and novel naphthenic acid inhibitors. His research efforts resulted in 13 US patents.

Jim received his BS from The University of Houston in Chemistry.

Jim is based in Lovelady, TX.

SAM LORDO

*Refinery Desalting and Corrosion Expert
Pono Division*

Sam is a recognized industry expert and has over 40 years' experience in refinery process chemistry/chemical treatments, opportunity crude processing and crude desalting. During his 40 years of corrosion / refining / petrochemical experience, he has been involved in all aspects of managing risk due changing crude slates and process conditions; including corrosion prevention, fouling prevention and control, failure analysis, and crude desalting.

He also directed research and provided technical support to sites in the areas of:

- Desalting operations and chemical additive strategies
- Aqueous corrosion control and chemical additive strategies
- Non-aqueous corrosion control strategies and risk assessments (eg., naphthenic acid, high temperature sulfidation)
- Fouling control strategies for various Refinery and Chemical Plant processes
- Developed strategies to mitigate of risks due to various crude contaminants
- Sam worked as a member of a member of several multi-disciplinary teams that developed tools to assist refining sites in managing crude desalting, CDU overhead corrosion, non-aqueous erosion-corrosion, unit fouling, and opportunity crude processing. These efforts resulted in several software tools and key recommended practices to improve reliability and reduce integrity risk.
- Developed a number of Best Practices around chemical treatment

Sam has contributed in the development of 4 patents.

Sam has been a member of NACE for >20 years, author of several papers on corrosion control, desalting, crude oil management. With NACE Sam participated in a number of Task Groups.

Sam is active in Crude Oil Quality Association (COQA) and the Opportunity Crude Conferences presenting on a wide variety of topic regarding crude oil processing. He is an active member of and American Fuels and Petrochemical Manufacturers (AFPM). At AFPM was a member of the 2002 AFPM Q&A Panel, worked on the screening committee (>15 years) and received the 2016 AFPM Lifetime Achievement Award.

Education: University of Missouri Columbia, BS Chemical Engineering.

Sam is based in Fulshear, TX.



DAVID E. MOORE, P.E.

Refining Metallurgical and Corrosion Engineering Expert
Pono Division

Mr. Moore is a recognized industry expert in refinery damage mechanisms. During his 41 years of metallurgical/corrosion/inspection experience, he has been involved in all aspects of materials engineering including corrosion prevention, failure analysis, damage mechanism review, and fitness-for-service assessment. He has focused primarily on refineries but has also worked with petrochemical and upstream facilities.

Mr. Moore has extensive knowledge with the identification, repair and remediation of several common damage mechanisms encountered in the refining industry. His experience has been developed through many years of performing failure analysis and leading root cause investigations, through refinery project materials selections, through technical support to refinery turnarounds and through leadership of refinery inspection organizations. His recent work activities have been primarily related to the development of CCDs (Corrosion Control Documents) and IOWs (Integrity Operating Windows), including serving as Master Editor for the second edition of API RP 584.

During his career, Mr. Moore has been active in API, NACE and MTI. He is a past chairman of the API Committee on Refining Equipment and a past chairman of the API Subcommittee on Corrosion and Materials. He was the author of the MTI book "Fabrication of 2205 Duplex Stainless Steel REACs in Refinery Hydroprocessing Units." His consulting work includes additional work to increase the understanding of industry failures of 2205 Duplex Stainless Steel REACs, including work for API to complete an industry survey of experiences.

Mr. Moore worked more than 41 years for refiners, including BP, ARCO and Chevron, in central engineering roles and refinery assignments. He retired from BP as the Discipline Leader and Senior Advisor for Materials and Corrosion in their Refining Technology and Engineering organization.

Mr. Moore received his BS in Metallurgy and Materials Science from Lehigh University in Bethlehem, PA and his MBA from UCLA. He is a licensed professional metallurgical engineer in California.

Mr. Moore is based in Kihei, HI.



KEITH E. McKINNEY, P.E.

Refining/Petrochemical/LNG Corrosion and Asset Integrity Expert
Pono Division

Mr. McKinney is a recognized industry expert in refinery and petrochemical damage mechanisms, corrosion under insulation management, and asset integrity management systems. During his 35 years of metallurgical/corrosion/inspection experience, he has been involved in all aspects of managing asset integrity risk including corrosion prevention, failure analysis, damage mechanism review, and implementation of asset integrity management systems. He has worked with refinery, petrochemical, Gas-to-Liquids and LNG facilities.

Mr. McKinney's experience has focused on the identification, repair and remediation of damage mechanisms encountered in the refining, petrochemical and LNG industries. He has conducted numerous corrosion and turnaround workscope reviews to assist plants in safe, reliable and cost effective operations. He has been the lead technical expert in failure analyses, fire/explosion damage assessments, and fitness-for-service assessments, including managing multi-discipline engineering teams to perform the recovery. He has also led Mechanical Integrity and multi-discipline Asset Integrity management system/process safety reviews and audits including due diligence evaluations for plant purchase. In addition, Mr. McKinney has performed failure investigations and provided legal expert advice in several cases as a corporate expert.

Mr. McKinney has spent a significant part of his career helping manufacturing sites implement effective asset integrity programs and management systems. This included the development of company mechanical integrity standards and best practices and working at the site level to implement them. Over the last 15 years, Mr. McKinney led the development in implementation of risk assessment and mitigation strategies for corrosion under insulation (CUI) for the Royal Dutch Shell Group.

Mr. McKinney worked for 35 years for the Royal Dutch Shell Group and Phillips 66 in central engineering roles and refinery assignments in the USA, The Netherlands and Malaysia. During his time with Shell, he also supported strategic third parties worldwide outside of the Royal Dutch Shell Group on various integrity issues and programs. Prior to his retirement from Shell, Mr. McKinney was the Global SME for Corrosion Under Insulation and managed and the Focused Asset Integrity Reviews/Audits process safety assurance program within Shell Downstream Manufacturing and LNG.

Mr. McKinney received his BS and MS in Mechanical Engineering from Texas A&M University - College Station. He is a licensed professional engineer in Texas.

Mr. McKinney is based in Magnolia, TX.



FRANK J. SAPIENZA

Refining Corrosion and Metallurgy Specialist and CCD Project Manager
Pono Division

Mr. Sapienza is an experienced corrosion and materials engineer within the refining industry. Through his time in the refinery, he has conducted corrosion reviews, damage mechanism assessments, asset strategy development, risk based inspection and CCD implementation for HF alkylation units, FCCs, crude units, hydrotreaters, reformers, sulfur plants, amine units, tank systems, sulfolane and aromatics units. He also led metallurgical failure analysis as well as root cause failure investigations, materials selection and life cycle analysis, IOW development and MDMT 579 evaluations.

Mr. Sapienza is the current chair of TG 358: Hydrofluoric Acid and Hydrogen Fluoride: Review of NACE Publication 5A171, leading the update of NACE 5A171 and TEG 119X: Hydrofluoric Acid: Materials for Receiving, Handling, and Storing, facilitating HF information exchange. Prior to his chair position, he served as the vice chair on both committees. He is also a contributing member in TG 510, writing and contributing edits to sections of API 751 5th edition.

He has also been involved in writing HF corporate standards, company best practices, and engineering standards. He has conducted corporate mechanical integrity audits and participated in 751 HF alkylation audits.

Mr. Sapienza has developed inspection and mechanical integrity work scopes for multiple HF alky/FCC turnarounds, as well as hydrotreating, coker and crude unit turnarounds. He provided technical corrosion and materials support for these turnarounds. His turnaround experience also includes technical lead and execution lead assignments.

Mr. Sapienza is knowledgeable in ASME Sec IX/API 582 WPS/PQR development and welding methodology. He has led multidisciplinary site teams for asset strategy management, naphthenic acid corrosivity management, and crude overhead corrosion management. He is experienced in inspection plan development and CML analysis.

Mr. Sapienza has 7 years' experience in the refining industry. He spent 5 years at the Chalmette refinery under Exxon Mobil and PBF Energy as a corrosion and materials engineer. Following this Mr. Sapienza was a special emphasis lead and corrosion and materials engineer at the Alliance refinery under Phillips 66.

Mr. Sapienza received his B.S. and M.S. from University of Florida in Materials Science and Engineering with a metallurgy specialty.

Mr. Sapienza is based in New Orleans, LA.



BILL COYLE

Refining & Petrochemical Metallurgical/Corrosion Engineering Expert
Pono Division

Mr. Coyle has established himself as an industry expert in materials and corrosion aspects associated with both Upstream and Downstream Oil & Gas business sectors. His professional career in the oil industry spans 38 years with experience gained through employment with 5 major corporations.

His first 8 years of employment was with Union Oil Company of California (aka, Unocal Corporation) as a Research Engineer in the Corrosion Research Group at the Corporate Research Center in Brea, CA where his primary areas of responsibility included metallurgical work related to Unocal's refining operations and managing the cathodic protection activities for Unocal's offshore platforms and marketing and chemical facilities. In 1989, he moved to Texas to work in the upstream oil & gas business as a Senior Metallurgist III for Otis Engineering (Halliburton Energy Services). In that capacity he was responsible for making materials recommendations for downhole equipment, conducting failure analyses, managing a corrosion testing laboratory, working with mills on alloy development programs, and consulting with major oil company clients regarding downhole corrosion and cracking problems. In 1994 Bill relocated to Northern California as Principal Metallurgist at Tosco's Avon Refinery in Martinez, CA. There he solved corrosion and materials-related problems in the refinery and provided final opinion on matters involving metallurgy, welding, code repairs, refractories, and coatings. He managed the refinery corrosion control program and directed the utilization of materials to ensure safe, reliable, and cost-effective operation. In 1999 he joined Shell Oil Products, US as a Senior Staff Corrosion & Materials Engineer at their Martinez, CA refinery where he implemented work processes to write and effectively maintain unit-specific corrosion control documents (CCD's), pressure vessel and piping RBI models, and process corrosion monitoring tools. He developed and delivered formal training to Operations personnel to increase awareness of fixed equipment integrity issues and provided technical support for all process unit turnarounds and capital projects.

Prior to his retirement in 2019, Mr. Coyle spent 11 years as Technical Team Leader, Materials Engineering - Refinery Technical Support at Chevron Energy Technology Company where he supervised 8-10 materials engineers including four SME's (Corrosion, Metallurgy, Nonmetallics, and Welding), plus contractors, technicians, interns, and international trainees. His work supported Chevron's wholly-owned and joint venture refineries, petrochemical plants, and upstream complex process facilities. He developed/taught in-depth refining process unit corrosion/metallurgy classes throughout Chevron and provided technical support for Damage Mechanism Identification (Chevron's internal version of API 571), special emphasis inspection programs (e.g., sulfidation, HTHA, Ammonium Bisulfide, etc.) and IOW implementation.

Throughout his career, he has worked 19 years in central engineering (Unocal and Chevron), worked 14 years in refineries (Tosco and Shell), and worked 5 years in Upstream (Otis Engineering/Halliburton). Company personnel regularly utilized him as a resource for routine questions, as well as failure analysis and significant incident investigations. He has personally completed hundreds of failure analyses and acted as the lead technical expert on hundreds more. Bill has provided non-testifying legal expert advice on several lawsuits. He has published a number of technical papers on both upstream and downstream corrosion and materials issues and has been actively involved in NACE (former Chair and Vice-Chair positions on key task groups) and API. Mr. Coyle has contributed to the development of numerous industry-consensus documents and most recently was Chevron's representative on the API Committee for Refining Equipment (CRE).

Mr. Coyle earned his Bachelor of Science Degree in Metallurgical Engineering from California Polytechnic State University in San Luis Obispo, CA in 1981. He is a Registered Professional Engineer (Metallurgical) in Texas and is based in Concord, CA.



Lisa Roberts

Refining Materials and Corrosion and RBI Expert
Pono Division

Ms. Roberts is a Refining Corrosion/Materials and Risk Based Inspection expert with 38 years' experience in the refining industry. She has been involved in many aspects of corrosion and materials such as proper selection, damage mechanism assessment, and process compatibility. She has developed and implemented programs for Sulfidation, REAC, Atmospheric Overheads, CUI, HTHA, PMI, RBI, and the complementary IOWs via corrosion reviews refinery-wide. She has been directly involved in turnaround planning, turnaround execution, and repair development, unit inspection & corrosion reviews, fitness for service, corrosion prevention and failure analysis via RCFA.

Ms. Roberts has knowledge in the identification, repair, and remediation of many common damage mechanisms in the refining industry and has worked closely with inspection personnel to develop sustainable programs. Ms. Roberts has championed the RBI process as a partner with damage mechanism assessment and IOW evaluation. She has been involved in focused fixed equipment reliability and inspection with strong knowledge of damage mechanism and a practical experience for identifying vulnerable locations and providing appropriate repair. She has a keen eye for assessing inspection needs by process system & circuit development, identifying inspection locations, and developing a systematic approach within an inspection database. Recent experience also includes implementation of on-line corrosion monitoring.

Along with the refinery corrosion and materials reviews, Ms. Roberts is experienced in selecting materials for both large and small capital projects. This knowledge extends into not only new, but the assessment of existing for an expanded crude slate or process change.

Ms. Roberts has worked for Shell Oil, ConocoPhillips, and Phillips66 as refinery engineer and engineering lead supervisor, environmental engineer, inspection supervisor, and corrosion/materials engineer.

Ms. Roberts received her BS in Metallurgical Engineering from Columbia University in New York, NY.

Ms. Roberts is based in Alton, IL.



CLINTON SCHULZ, P.E.

Refining Metallurgical/Corrosion Expert
Pono Division

Mr. Schulz is a recognized expert in corrosion and materials engineering for petroleum refinery process applications, and has related experience in almost all aspects of petroleum refinery fixed equipment reliability work. During his 42 year career, he has performed metallurgical failure analyses, materials selection, and corrosion engineering. His experience in the area of fixed equipment reliability engineering includes welding, design and analysis of gasketed flanged joints, fitness for service assessments, fired heater tube life assessment, coke drum life extension and repair work, identification of inspection techniques for particular equipment service, and the development of various repair techniques. Complementary refinery experience includes Process Safety Management and management of reliability engineering and inspection, and as a witness in legal proceedings.

In the area of corrosion engineering, he has worked in crude unit desalting, atmospheric crude tower corrosion, and hot oil corrosion (sulfidation/naphthenic acid), including crude oil slate selection, hydrotreater reactor effluent salting and sour water corrosion, amine and SRU corrosion, and HF Alkylation corrosion. His interests include the quantitative application of process modeling software, ionic chemistry software, and heat transfer software to the analysis and development of solutions to refinery corrosion problems. He is very experienced in the leading of teams for the development of Corrosion Control Documents and Integrity Operating Windows, with particular experience in hydroprocessing and sulfur/amine technology.

One of his particular corrosion interests is HF Alkylation. In the area of HF Alkylation, he represented his employer in the group sponsored research into the effect of residual element on the corrosion of carbon steel by HF acid, and he authored a NACE paper on the corrosion rates of carbon steel in HF Alkylation service. He worked with a process modeling software licensor to develop a unit level HF Alkylation process model, with particular application for corrosion analysis. And he has participated or led many investigations into HF Alkylation corrosion and welding failures, with almost 40 years of firsthand experience into what can go wrong in HF Alkylation operations.

He holds a patent for a successful ferrule and tube design to avoid film boiling failures in SRU Waste Heat Boiler Service. He has published papers on amine corrosion, HF alkylation corrosion, the application of statistics for heat exchanger reliability problems, and on SRU Waste Heat Boiler film boiling failures.

His refinery employers have included Shell, Valero, and CITGO Refining and Chemicals. He retired from the CITGO Corpus Christi Refinery in 2019 as a Senior Reliability Consultant for Corrosion and Fouling after 32 years of service.

He holds a BS in Mechanical Engineering and an MS in Materials Engineering, both from the University of Texas. He is a registered Professional Engineer in Texas.

Mr. Schulz is based in Georgetown, TX.



MATTHEW K. CASERTA, P.E.

Mechanical Integrity Expert and Assistant Division Manager
Pono Division

Mr. Caserta is a registered professional engineer in the states of Ohio and Texas. He has over 19 years of a wide breadth of engineering experience in oil refining, chemical processing, and consulting. Mr. Caserta's varied background provides unique insights into process interactions, equipment reliability, and corrosion and materials concerns. He currently manages Becht's corrosion control document (CCD) /integrity operating window (IOW) implementation team. He has personally been involved in development of CCDs and IOWs for over 100 different process units.

The past 15 years of Mr. Caserta's career has focused on mechanical integrity, fixed equipment reliability, and inspection. He has a strong knowledge of damage mechanisms through practical experience. He has been involved in risk-based inspection assessments, mechanical integrity audits, and process engineering. He has experience as a Chief Inspector planning and executing turnarounds, supervising day-to-day inspection needs, and managing projects.

Prior to joining Becht, Mr. Caserta served Inspection Supervisor at a 100,000 bpd refinery. During this time, he managed a team of over 25 inspection and engineering professionals. This experience included inspection planning and executing turnarounds, supervising day-to-day inspection needs, and managing projects. He has overseen a complete re-circuitization and inspection of refinery piping systems. Mr. Caserta also implemented corrosion under insulation and fireproofing programs. He has also led the implementation of onsite and offsite quality assurance programs. Mr. Caserta also has experience as a reliability engineer focusing on fixed, fired, and rotating equipment. This experience included fitness-for-service assessments, inspection planning, turnaround execution, bolted joints, and reliability upgrades.

Additionally, Mr. Caserta spent over 5 years as an engineering consultant prior to joining Becht. His accomplishments included risk-based inspection implementations of over 100 different process units, developing mechanical integrity audit protocols, procedure development, and inspection planning. He was also an API certified trainer for the API 580/581 training course. Mr. Caserta has traveled to refineries and petrochemical facilities throughout North America and Europe.

Before becoming involved in Mechanical Integrity, Mr. Caserta worked as a production supervisor and process engineer at multiple food and chemicals facilities.

Mr. Caserta received his BS in Chemical Engineering from The University of Dayton. He holds an API 510 certification and formerly an NBIC certification.

Mr. Caserta is based in Wadsworth, OH.

David J. Keen

David Keen is a qualified Metallurgist with >45yrs domestic and international experience in fertilizer and explosives manufacturing facilities across 12 countries globally. These facilities include Ammonia, Urea, Nitric Acid, Sulphuric Acid, Phosphoric Acid, Ammonium Nitrate, Fertilizer plants and Steam Generation utilities. David is a SME on equipment integrity management and has in recent years downloaded this knowledge into a series of training modules focused on preventing equipment failures through experiential learning and team problem solving sessions.

He has held various positions including Company Chief Eng, VP Reliability & Risk, Company Engineer Fixed Equipment, Operations Mgr, Maintenance Mgr, T/A Mgr and Plant Metallurgist. David also worked as a consultant for 8yrs to ammonia and downstream facilities in Australia, New Zealand, SE Asia, Canada, United States and South America. This work included:

- Qualitative risk-based assessments on > 50 process plants
- Quantitative analyses & fitness for service assessments
- Facilitating the completion of plant reliability assessments on 14 process plants
- Condition assessment, remnant life studies on:
 - Hydrogen reformers, waste heat boilers, cooling water exchangers, synthesis loop converters, waste heat boilers & superheaters.
- Failure investigations in such areas as:
 - High temperature hydrogen attack & hydrogen embrittlement of vessels and piping
 - Stress relaxation cracking in alloy steels, stainless steels, Incolloys & Inconels
 - Creep & creep-fatigue; reformer components, boilers & so on.
 - Waste heat boilers and Superheaters
 - Stress corrosion cracking of duplex stainless steels in hot cooling water service & in low pH acid service
 - Corrosion failures of equipment in nitric acid, sulfuric acid & phosphoric acid service
 - CO2 corrosion & amine stress corrosion cracking in amine systems
- Auditing the manufacturing performance of plant, with particular focus on:
 - Critical controls management, including process controls, design / construction controls & inspection practices
 - risk management of critical plant
 - shutdown / turnaround management
 - root cause analysis and failure investigation