

CURRICULUM VITAE
BRENT M. SABA, PE-ME/MT

401 Saint Louis Street, Madisonville, LA 70447
phone: (225) 405-4015 email: BrentSaba@smpes.com

EDUCATION:

LOUISIANA STATE UNIVERSITY, Baton Rouge, LA, Dec 1994
Major: BS-Mechanical Engineering, GPA: 3.0/4.0
Minor: Mathematics

LOUISIANA STATE UNIVERSITY, Baton Rouge, LA, May 2003
Masters of Science in Mechanical Engineering, Specializing in
Metallurgy/Corrosion Science/Fracture Mechanics, GPA: 4.0/4.0
Thesis Title: "Evaluation of Mechanical Fitness for Service of
High Temperature Hydrogen Attacked Steels"

LOUISIANA STATE UNIVERSITY, Baton Rouge, LA, Fall 2020 to Fall
2023; Non-Matriculating status. Retook Multidimensional Calculus,
Advanced Engineering Mathematics, French II-IV, and Italian I:
GPA: A+; Intermediate French Conversation GPA: A

LOUISIANA STATE UNIVERSITY, Baton Rouge, LA, Currently
enrolled in Mechanical Engineering PhD program.

EXPERIENCE:

(1/95-1/99) *Factory Mutual Engineering*, Dallas, TX, Norcross, GA, and
Baton Rouge, LA; servicing Texas, Louisiana, and Mexico; field
technical consultant in the areas of rotating, stationary, and electrical
equipment, including NB-AI & State Authority in boiler, pressure
vessel, and water heater inspection and repair.

(1/99-3/01) *PPC Mechanical Seals*, Baton Rouge, LA; field technical
consultant for seals and rotating equipment, and new product design
engineering and testing.

(3/01-3/06) *CF Industries, Inc.*, Donaldsonville, LA; senior plant/
metallurgical engineering concentrating in fixed and rotating
equipment, and plant-wide metallurgical/corrosion issues.

(4/04-present) *Saba Metallurgical & Plant Engineering Services, LLC*
(*SMPES, LLC*), Baton Rouge, LA; owner-principal engineer;
performing world-wide services for advanced techniques in finite
element analysis (FEA), specializing in high temperature and/or high-
pressure services using non-linear elastic-plastic methods,
computations fluid dynamics (CFD), and fluid-structure-interaction
(FSI). Engineering projects of process and mechanical equipment for
design, failure analysis and fitness-for-service; ASME/API/TEMA
new designs and re-rates as well as general Code issues; metallurgical
failure analysis, product laboratory testing,
materials/corrosion/metallurgical/weld procedure and troubleshooting
services; expert witness; also process-design and vibration analysis
support; www.smpes.com

CERTIFICATIONS: Registered Professional Engineer-Mechanical: Louisiana (No. 29082)
Registered Professional Engineer-Metallurgical: Louisiana (No. 29082)
Registered Professional Engineer-Mechanical: Iowa (No. 24383)
Registered Professional Engineer-Mechanical: Indiana (No. 11800404)
Registered Professional Engineer-Mechanical: Texas (No. 130510)
Registered Professional Engineer-Mechanical: Mississippi (No. 30148)
Registered Professional Engineer-Mechanical: Arkansas (No. 18951)
Registered Professional Engineer-Mechanical: Montana (No. 60820)
Registered Professional Engineer-Metallurgical: Nebraska (No. E-18637)

PREVIOUS CERTS: National Board (NB) Commissioned Boiler and Pressure Vessel Authorized Inspector (AI) and “A” (Shop Inspection) Endorsement Qualified; State of Louisiana/Texas/Oklahoma/Arkansas Boiler Inspector; Certified Welding Inspector (CWI), API 510 (Vessel Inspector), 570 (Piping Inspector), and 653 (Tank Inspector); Vibration Analyst Category III

PUBLICATIONS AND PRESENTATIONS

- Co-authored paper “Fracture Mechanics Evaluation of 0.5Mo Carbon Steel Subjected to High Temperature Hydrogen Attack” presented and published at the International Conference on Advances in Materials and Processing Technologies (AMPT July 2003, Dublin, Ireland).
- Completed research grant and publication in Bioengineering publication with Dr. Gulshan Sunavala (LSU-Shreveport) and Dr. Kevin McCarthy (LSU-Shreveport): “Strategic Debulking of Femoral Stems”
- Presented paper “Comparison of FEA Results to Physical Laboratory Results for F2077 IBFD Testing and Select F717 Vertebrectomy Plate Testing” (ASME Validation and Verification Conference, May 2012, Las Vegas, NV).
- Authored paper on influencing effects of N and nitriding on ferrous-based metals.
- Authored gas seal article published in January 2001 *Pumps and Systems* magazine.
- Lectured advanced training short courses on “Materials Selection and Corrosion” and “Seal Failure and Root Cause Analysis”.
- Authored paper on current environmental issues and their effect on corrosion in a black liquor recovery boiler.
- Presented lecture at local ASME Chapter on FEA and API 579 and Div. 2 Evaluations.
- Presented paper “ASME Cyclic Creep Evaluation of Critical Piping Component using CREEP Subroutine and ORNL Test Data” at 2016 Simulia International Conference.
- NASA Tech and Machine Design articles on spinal implant FEA evaluations.
- Guest speaker at Louisiana State University for Welding Engineering II course in 2019.

WORK SKILLS AND ACTIVITIES

- Knowledge and application of ASME Codes and Code Cases for I, II, III, IV, V, VI, VIII Div. 1 and 2, FFS-1, and IX, as well as NBIC, DNV, TEMA, ANSI K61.1, ASME B16.5, B31G, B31.1, B31.3, B96.1, numerous other ASME Codes, and API 510, 520, 570, RP578, 579, 581, 620, 650, 653, 941 and numerous other API Codes.
- Perform metallurgical failure analysis and equipment non-destructive testing.
- NDE methods utilized include PT (Colored, Fluorescent, Hi-Temp), MT (Dry, WFMT, AC and DC yokes), ET, RT, UT (A, B, C, SW, HTHA), Vacuum Box, AE, IR, PMI, Reformer Tube Creep Testing, Borescope, In-Situ Metallography, and Micro-Hardness (Tele-Brinell).
- Provide advanced metallurgical support in the areas of corrosion, fatigue, creep, cyclic creep, welding, material selection, etc., to a variety of industries (refinery, petrochemical, chemical, oil and gas, medical, and commercial, including direct support to medium level local engineering firms).
- Directing and overseeing critical repairs including reviewing WPS, PQR, WQR, defining NDE requirements and acceptance standards, defining heat treat requirements (bake-out, pre-heat, max interpass, and PWHT), and evaluating and preventing localized PWHT hazards using experience and FEA.
- Performing FEA/CFD/FSI/Fracture Mechanics-based III evaluations for equipment fitness-for-service according to ASME/API FFS-1.
- Provide advanced FEA (Simulia Abaqus) simulations for equipment designs
- Provide advanced CFD (CD-adapco Star CCM+) simulations for single and multi-phase flows (including particle flows and fluidized bed flows), heat transfer and temperature mapping for FEA solutions.
- Perform vibration analysis to provide input data in high cycle fatigue FEA studies.

SIGNIFICANT PROJECTS

- Complete FEA modeling analysis of a 1st Effect Caustic Unit, including the entire structure and all pertinent equipment, piping, and piping components. Equipment internal flow was causing entire structure to flex wildly, breaking bolts every few days. The FEA model recreated the existing problem, and strategic structural support added, and then re-analyzed. Unit is now up and running safely at minimal/acceptable vibration levels. (America)
- Using CFD and FEA, gasifier nozzle equipment, exposed to extreme temperatures were designed and optimized. With the established temperatures and known service conditions, the correct exotic materials were selected. No negative service conditions of this equipment has been reported back. (South Korea and India)

- CFD/FEA were used to redesign a chemical reactor experiencing low cycle thermal fatigue. Design was according to ASME Section VIII Div. 2 rules. Equipment is operating successfully with no crack indications. (America, Canada, and Brazil)
- Material selection guidelines were prepared for heater equipment suffering from local coastal saline atmosphere. Equipment is running with no degradable corrosion noted. (Netherlands)
- Two-phase splash effect (filling operation) CFD study was performed to evaluate potential for corrosive damage to the internal mist eliminator. Equipment is in operation with no indicated issues. (America)
- Advised metallurgical change for compressor wheel and evaluated increased material density's effect on rotational stress, using FEA. Original material wheel was corroding within months. New material has allowed compressor to run free of corrosion for several years, and is still running without replacement to this date. (America)
- Review of system flow conditions to provide strategic identification of areas in reformers to perform destructive testing of the reformer tubes. No indications were noted of any potential problems of these tubes up to the point of lab analysis; metallurgical failure analysis indicated that numerous cracks existed in the selected tubing up to 90% wall deep, and that failure was imminent. (America)
- Perform detailed CFD and FEA analysis on two separate FCCU Unit gasifier Regenerator air grid redesign. (America)
- Performed fracture mechanics studies of brick arches in an ammonia plant Secondary Reformer, comparing the damaged existing design versus the new proposed design. Study was able to reproduce the fracture signature that caused the original arch to fail and showed how the new design helped to prevent this failure. (America)
- Multiple large towers were evaluated (different jobs) for tower stability and/or local damage from PWHT of repair areas. Some jobs included evaluation of tower stability and/or local damage from large cutout of areas to be repaired. (World-Wide)
- Fluid flow through a new cyclone separator was modeled in CFD and coupled to the FEA model of the 3rd Effect Caustic structure of which it was to be attached. This fluid-structure-interaction (FSI) study helped identify beams on the structure that were in resonance with the forcing frequency of the flow through the cyclone and attached piping. (America)
- Performed fitness-for-service analysis of a new heat exchanger whose thick expansion joint hit a bridge upon delivery. Explicit FEA was used to simulate the impact. The damaged equipment with residual stresses were then evaluated in an implicit FEA model for cyclic-creep analysis. (America)
- Performed complete FEA modeling of a sulfuric acid unit. An existing fish-mouth nozzle suffered both spheroidization and graphitization, and had numerous patch repairs. Using the FEA model, a repair design was formulated for this nozzle. A temper bead technique was developed for the repair and hands-on training provided to the chief welder to make sure the welding followed the intended strict procedure. Both the repair and the new nozzle design were an outstanding success. (America)

**METALLURGICAL/CORROSION FAILURE ANALYSIS AND INVESTIGATIONS:
PARTIAL LISTING**

- Polythionic acid SCC of startup heater
- Chloride SCC of reformer drain valves
- Amine SCC of exchanger head
- Spheroidization from long-term high temperature service
- Metal concentration cell pitting corrosion in copper slurry and cobalt fine slurry
- Weidmenstatten structure formation and cracking from improper bevel technique
- Hydrogen embrittlement/sulfide SCC of C-20 retainer exceeding NACE recommended hardness
- High Temperature Hydrogen Attack (HTHA) of synthesis gas piping and exchangers
- Sulfuric acid formation from mixture of high sulfur diesel fumes and moisture on warehouse roof
- Sulfuric acid formation from condensation in an improperly designed waste heat boiler economizer section
- Fatigue of PI pitot tube at attachment weld; fatigue of shim pack in pump coupling
- Worm-holing of stainless overlay in batch digester
- Mechanical and thermal depletion of surface resins in carbon steel face
- Hydrogen blistering of silicon carbide face
- Heat checking of silicon carbide, tungsten carbide, and stellite faces
- Sensitization of 304L heat affected zone resulting in selective groove pitting attack
- Creep of reformer tubes
- Brittle failure of vessel during hydrostatic test due to improper low temperature
- Metal dusting attack of process waste exchanger (also, material selection research for new severe metal dusting/carburizing/nitriding/HCN environment)
- Sigma-phase formation in 321SS pipe at improper high operating temperature
- Intergranular ammonia SCC of flash drum
- Hot cracking from sulfur migration and accumulation in grain boundaries over extended service life of equipment
- Delay hydrogen cracking resulting from improperly heated 1-1/4 Cr rods
- Reheat cracking resulting from high tramp index material subject to high stress load during PWHT cycle
- Laminations of bottom course of multi-course condensation tower
- Carburization of top head of high temperature resin drum
- CO₂ corrosion of exchanger tubes
- Weld defects of underground transport lines
- Electrical discharge pitting of carry-over current in brine solution of crude oil piping across electrically isolated flange connection.
- Quench cracking of a martensitic stainless steel medical instrument
- Warranty repair evaluation of a nitric acid reactor after only 4-days of service

INDUSTRY EXPERIENCE

- Acrylonitrile
- Aerospace
- Air Products
- Alternative/Green/Blue Fuels
- Alumina
- Ammonia and Fertilizers
- Carbon Black
- Caustic and Chlorine
- Commercial
- Cracking Catalyst
- Crude Product Transport Lines
- Electricity Generation and Distribution
- Formaldehyde
- Hydrogen
- MDI, Aniline, and Nitrobenzene
- Medical (Spine, Hip)
- Metal Reduction
- Methanol
- Military
- Mines and Quarries
- Offshore Piping Systems
- Nitric and Sulfuric Acid
- Pesticides
- Petroleum Refinery
- Pulp & Paper and Wood Products
- Resins (Polypropylene, Polyethylene)
- Rubber, PVC, and Specialty Plastics
- Sugar Refining

LINKS

Master Thesis: <http://etd.lsu.edu/docs/available/etd-0409103-160949/>

(The HTHA FFS technique in this thesis is represented in the 2019 ASME FFS-1 Code.)

Saba Metallurgical & Plant Engineering Services, LLC Website: www.smpes.com (website in re-development)

SMPES, LLC Medical Website: www.smpesllc.com (website in re-development)

Web Article: Validating requirements for surgical spinal implants with finite element analysis:
<http://www.techbriefs.com/component/content/article/2563>

Web Article: FEA on new and redesigned medical components can save time and money during FDA approval: <http://machinedesign.com/article/fea-on-new-and-redesigned-medical-components-can-save-time-and-money-during-fda-approval-111>