

Structural Integrity
Associates, Inc.®

FOSSIL | COMBINED CYCLE PLANT SERVICES



Engineered solutions for Ensuring the Safe and Reliable Performance of Fossil Plant Systems, Equipment, and Materials.



ABOUT STRUCTURAL INTEGRITY

Structural Integrity Associates, Inc. (SI) is a leading engineering and consulting firm dedicated to the analysis, control, and prevention of structural and mechanical failures. The company was founded in 1983 in San Jose, CA, and has since opened branch offices throughout the United States and Canada, as well as established overseas affiliates.

We are able to integrate a full scope of services, from inspection and condition assessment, to monitoring and remaining life analysis, repair or remediation, and ultimately, total risk management of critical equipment and structures.

Our history is one of innovation marked by a creative multi-disciplined approach to component evaluation and repairs, as well as development of increasingly sophisticated tools reflecting a unique blend of technical expertise with the latest computer and expert system technologies.

Over the years, Structural Integrity has established itself as an innovative and responsive resource for answering virtually any challenge in the analysis, control, and prevention of failures in critical plant equipment.

CORPORATE SNAPSHOT

- **Employee-owned company founded in 1983 in San Jose, CA**
- **Branch offices throughout the United States and Canada, as well as overseas affiliates**
- **280+ employees providing consistent innovation and service**

FOSSIL PLANT SERVICES

Structural Integrity's Fossil Plant Services provides technical support to the fossil power generation industry, assisting utilities and plant owners with the management of critical plant assets. These assets include boilers, heat recovery steam generators, high energy piping systems, turbines, generators and the balance of plant equipment. Our philosophy is to provide a fully integrated multi-discipline approach providing the highest quality, best value solution. These services are provided through the focused application of materials knowledge, engineering expertise, and specialized nondestructive examination technologies.



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Structural Integrity's approach to effectively manage high temperature high energy piping (HEP) systems is to employ a fully integrated, multi-disciplined approach. All the necessary technical disciplines are used to develop and implement a program intended to help ensure safe and reliable operation of your critical plant systems. Our HEP programs help answer three important questions that are fundamental to any component management program, and effectively minimize the overall risk associated with HEP at your plant.

1. WHERE SHOULD WE EVALUATE?

VINDEX

Structural Integrity has developed Vindex, a semi-quantitative approach to selecting and prioritizing which welds to evaluate. The Vindex analysis uses stress information, materials knowledge, inspection data, fabrication process information, and other readily accessible data. The output from the analysis provides a list of the system welds in a rank ordering of the potential for damage and shows the welds that are the highest contributors to overall risk.



2. HOW SHOULD WE EVALUATE?

ADVANCED NDE TECHNIQUES

Structural Integrity uses advanced nondestructive evaluation techniques that are specifically designed to detect and quantify the damage mechanisms associated with high energy piping systems. These techniques are capable of detecting damage at an early stage (as compared to traditional inspection methods), which allows for longer re-inspection intervals and extended time to develop corrective action plans.

3. WHAT SHOULD WE DO NOW?

RUN/REPAIR/REPLACE ANALYSIS

Structural Integrity uses state-of-the-art analytical tools including fracture mechanics, life consumption analysis and risk optimization to predict future serviceability and facilitate run/repair/replace decisions. We provide recommendations for re-inspections and repairs as necessary and can assist in the performance of the repair activities. Our comprehensive program is also integrated with a database to help you manage all the piping program data.



Boiler Tube Failures (BTFs) are the number one cause of forced outages in power plants worldwide. Failures occur despite the fact that in almost all cases it is understood why they occur and how they can be prevented. The vast majority of these failures are repeat failures, because in all too many cases, the response to a BTF is to treat the symptoms and not the **ROOT CAUSE**.

BTF FACTS

- BTF forced outages cost the power industry millions of dollars every year
- Most BTFs are repeat failures which can be prevented
- Structural Integrity, has brought together the necessary resources to attack BTFs at their source: identifying the root cause, implementing remedial action, avoiding future failures, and providing a comprehensive BTF Reduction Program.

ONCE A BOILER TUBE FAILS, CERTAIN KEY QUESTIONS MUST BE ANSWERED:

- What is the damage mechanism responsible for the failure?
- Does the damage extend to other tubes and, if so, to how many and where?
- What has been the failure history?
- What were the conditions of operation at the time of the failure?
- If the failure involves the water-touched surfaces, what is the water treatment regime for the unit and have there been significant disruptions in that regime?

The **condition assessment** of un-failed tubing is also a key component to the BTF Reduction Program. Temperature, pressure, metallurgical condition (i.e., wall loss, swelling, microstructure, etc.), and mode of unit operation are all considered and analyzed.

THE STRUCTURAL INTEGRITY BTF REDUCTION PROGRAM INCLUDES:

- A careful review of plant operating and water chemistry data
- Review of historical information including operating and maintenance history
- A metallurgical examination of tubing samples
- Nondestructive examination of the tubing in the area of interest
- Installation of thermocouples, strain gauges, or flow monitoring devices at selected sites

Structural Integrity is committed to supporting our clients in their efforts to reduce tube failures. This is reflected in our expert metallurgical laboratory services, structured boiler tube lifing models, and advanced nondestructive examination technologies.





The reliable operation of the power industry's fossil-fired steam generators require critical pressure part components, particularly boiler tubing, to be properly maintained throughout the life of the unit and, when problems occur, that the appropriate corrective action be taken. In support of Structural Integrity's Boiler Tube Failure Reduction Program (BTFR), we offer engineering services to characterize boiler tube condition and predict future serviceability. With our multi-discipline teams, the boiler tubing assessment projects flow seamlessly into our BTFR Program.

BOILER TUBING ASSESSMENT PROJECTS INCLUDE:

WATERWALL TUBES

- Evaluations of boiler waterwall tubes suffering from waterside corrosion issues including hydrogen damage, caustic gouging, and corrosion fatigue cracking.

SUPERHEATER AND REHEATER

- Evaluations of superheater and reheater tubing operating at elevated temperatures for evidence of creep damage (long-term overheating) using NDE techniques and engineered lifing models, including risk models for financial analysis.

DISSIMILAR METAL WELD (DMW)

- Engineering evaluation and examination of superheater and reheater dissimilar metal welds to detect weld degradation due to creep-fatigue, oxide notching and carbide coarsening using specialized NDE techniques and lifing models tailored to the specific boiler design and weld type.

SPECIALIZED NDE TECHNOLOGIES

- Examination of hard to reach areas of low temperature superheater and reheater sections for internal wall loss due to corrosion pitting or external wastage caused by soot blower erosion, abrasion and fly ash erosion using specialized NDE technologies.

COMPREHENSIVE BOILER INTEGRITY MANAGEMENT

- Through a partnership with Diamond Technical Services (DTS), a full-service assessment and management program is developed and implemented to include pre-outage preparation and engineering, outage inspections and evaluations, and post-outage fitness-for-service analyses.



Through extensive knowledge of header design, in-service performance, and damage mechanisms, Structural Integrity can provide expert guidance with boiler header assessments. We provide overall header assessments that include review of operational and maintenance data, comprehensive header inspections, analytical life assessment including Finite Element (FE) stress analysis, crack growth prediction, on-line monitoring of damage progression/crack growth, weld repair and engineering re-design.

HEADER GIRTH WELD CRACKING

Over the last several years, Structural Integrity has assisted in the assessment of numerous leak-type failures of header girth welds. Many of these have been associated with mid-wall initiated creep damage. Several have been at welds perforated with tube bore holes. We have developed advanced Linear Phased Array and Focused Phased Array ultrasonic techniques to detect and quantify the creep damage, and perform serviceability assessments.

LIGAMENT CRACKING

Calculating the life of a header with ligament cracks requires accurate knowledge of the extent of cracking, the operating temperatures and applied stresses. Structural Integrity provides accurate crack detection and sizing utilizing specialized linear phased array ultrasonic techniques. FE stress analysis and creep-fatigue crack growth calculations are performed to make run/repair/replace decisions. On-line monitoring can be implemented for improved crack growth predictions and to benchmark predictions against inspection results. If the cracking is severe, repair welding and re-design options can be developed.

STUB TUBE WELDS

Tube stub to header welds are evaluated using magnetic particle examination for OD cracking and advanced ultrasonic techniques to identify sub-surface cracking. FE stress analysis can be performed to evaluate re-design options to minimize future cracking.

HEADER SEAM WELD CRACKING

Similar to the longitudinal seam welds in high energy piping systems, header longitudinal seam welds are also susceptible to failures due to creep. To evaluate these welds, we use a protocol of advanced NDE technologies based on industry guidelines (including EPRI and Materials Properties Council High Energy Piping programs) and bolstered with our own internal research.





Structural Integrity Associates, Inc. takes a multi-disciplinary approach to turbine and generator assessment.

INSPECTION SERVICES ARE PROVIDED FOR THE FULL RANGE OF TURBINE AND GENERATOR COMPONENTS, INCLUDING:

- Turbine and generator rotors, solid and bored
- Turbine disk bore/keyways and rim blade attachment dovetails
- 4-pole nuclear generator rotor shafts for under-coupling cracking
- Generator retaining ring inspection
- Generator rotor tooth-top dovetail ultrasonic inspection
- Turbine main inlet sleeves and nozzle chambers
- Turbine and valve casings (crack sizing)
- Shaft extensions, blades, tenons, shroud, tie wires, erosion shields, babbitted bearings, and other components

LIFE ASSESSMENT ANALYTICAL SERVICES INCLUDE:

- EPRI SAFER-PC analysis of rotor forgings based on rotor bore and/or solid rotor inspection results
- EPRI LPRimLife analysis of rotor disk rim dovetails (LPRimLife software was developed for EPRI by Structural Integrity)
- EPRI RRing-Life analysis of generator retaining rings (RRing-Life software was developed for EPRI by Structural Integrity)
- ANSYS finite element stress analysis of shafts, turbine disks, and other components
- Financial Risk Optimization



STRUCTURAL INTEGRITY'S APPROACH TO CONDITION ASSESSMENT, ALSO INCLUDES MATERIAL CHARACTERIZATION SERVICES:

- In-place replication metallography
- Alloy identification
- Miniature sample removal for hardness testing, chemical analysis, metallography, and materials properties characterization (miniature sample punch testing)
- Full metallurgical laboratory services as applicable based on material sample availability

MACHINING SUPPORT

- Full rotor bore machining services including plug removal, honing surface preparation, corrective machining, plug manufacturing, and plug reassembly



HRSG/COMBINED CYCLE PLANTS OVERALL PLANT HEALTH ASSESSMENT

Increasingly, the US and world energy policy, environmental considerations, and economic factors are influencing the mix of current and future power generation technologies. Specifically gas plants, predominately combined cycle HRSG's, are being relied upon for peak power demands and for critical base-loaded generation. Therefore, combined cycle plant safe operation, availability and reliability are more critical than ever. Structural Integrity has developed service offerings to assist with the reliability, availability and maintenance of critical plant assets.

We have a team of world-class experts with the knowledge and experience to address the most critical issues that will affect the safe and reliable operation of your plant. If you own, operate, or maintain a combined cycle plant, we can help you manage key issues that will affect the overall health of your plant:

■ **Grade 91 High Energy Piping**

- Overall program development using a risk ranking approach to help you better manage your budget, implementation of site evaluation, and execute any needed repair welding

■ **HRSG Inspection and Design Audits/Assessments**

- Identify design and operational discrepancies and challenges
- Inspection planning
- Design/operating audits

■ **Damage Due to Thermal Transients**

- Attenuator piping cracking
- Header and harp damage

■ **HRSG Tube Failure Prevention and Analysis**

- Structural Integrity specializes in identifying the damage mechanism, root cause investigation, and identifying the most effective solution.
- In-house metallurgical laboratory
- HP evaporator assessment focusing on internal deposits

■ **Level One Plant Assessment**

- Cycle chemistry, FAC, and thermal transients
- Review of plant operations, design and maintenance to help prevent forced outages
- Flow Accelerated Corrosion is the number one tube failure mechanism in combined cycle plants
- Cycle chemistry is a major influence on FAC and tube failures

■ **Grade 91 Steel Vendor Qualification Program**

- Initial design review
- Control of material procurement
- Creation of construction and installation specifications



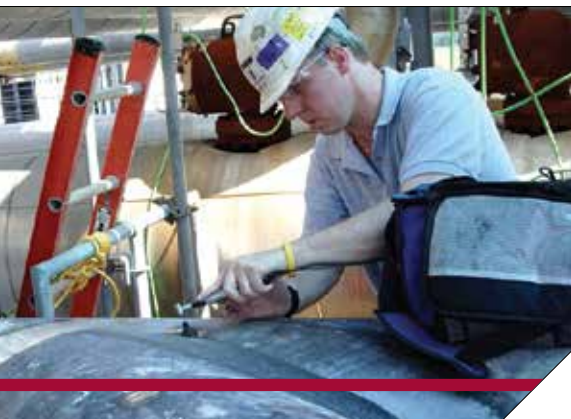


Deficiencies in the processing of Grade 91 and other Creep Strength-Enhanced Ferritic (CSEF) steels have been implicated directly in several well-publicized failures, forced outages, construction extensions, and premature component replacements worldwide. Recent inspections at many U.S. electric generating facilities detected an alarming number of improperly processed welds and components, and called into question the future reliability of similar critical components throughout the industry.

THE IMPACT OF DEFICIENT MATERIAL CAN BE SEVERE:

- System failures can be catastrophic
- Replacement material is difficult to procure
- Refurbishment of major components requires a serious disruption of plant operation.

Lack of proper heat control can damage CSEF materials. Possible sources of damage include excessive welding pre-heat, un-monitored heating to straighten or align parts, or errors in PWHT temperatures.

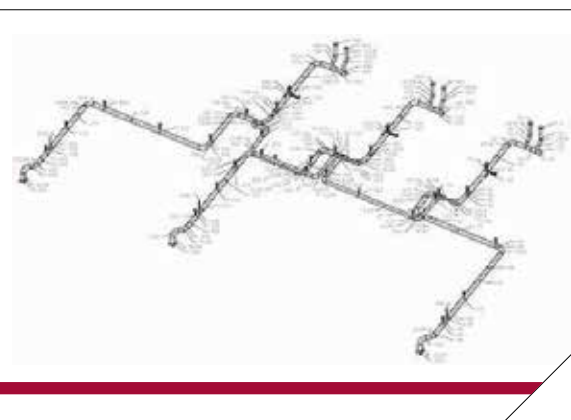


Consistent with our proven leadership in the power generation industry, Structural Integrity has formed a partnership with EPRI to provide a focused resource for technical expertise in CSEF metallurgy, assessment methodology, materials characterization, and applicable predictive technologies.

As a service to the industry, Structural Integrity has developed a comprehensive "Life Cycle" asset management program specifically for CSEF materials.

CSEF/GRADE-91 PROGRAM OVERVIEW

- VINDEX - Know where to look.
 - SI has developed the Vindex program for use in determining where to inspect for maltreated Grade 91 material based on a vulnerability index.
- Inspection / Assessment
 - Structural Integrity provides a number of diagnostic tools to find damaged Grade 91; field hardness mapping will find areas that fall below specifications and follow-up linear phase array UT exams can locate cracks in hardness deficient zones.
- Life Assessment / Life Optimization
 - Structural Integrity has developed a comprehensive lifing program, which allows plant managers to make run/repair/replace decisions on deficient Grade-91 material and components.



If you are considering the use of these materials in an upcoming project, or if these materials already are installed at your plants, Structural Integrity can help ensure that future problems are minimized and the service life of the components is optimized.

Structural Integrity Associates, Inc. offers a comprehensive portfolio of products and services for development, critical assessment, improvement and ongoing support of FAC programs throughout the power industry.

FAC PROGRAM INCLUDES:

- Assessment and optimization of cycle chemistry in conventional fossil and combined cycle units
- Review of drawings and system walkdowns reviews and system walkdowns for fossil plants and combined cycles
- Predictive assessments of FAC risk and prioritization of inspection locations and activities
- FAC damage screening with guided wave ultrasonics
- Remaining thickness assessments by ultrasonic testing
- Data management/integration with other piping programs
- Laboratory assessments
- Guidance on FAC damage repair options and approaches
- Periodic operating reviews and FAC program refinements
- Technical and programmatic training/workshops at all levels of the organization





Cycle Chemistry is one of the most important controllers of availability and performance in fossil and combined cycle plants.

CYCLE CHEMISTRY FACTS

- Influences about 50% of the boiler tube failures in conventional fossil plants
- Influences about 70% of the HRSG tube failures in combined cycle plants
- Influences/controls every one of the main damage mechanisms in the steam turbine except liquid droplet erosion, controls single-phase FAC and has a major influence on two-phase FAC
- Has a major influence on condenser tube and feed water heater tube failures.

CYCLE CHEMISTRY ASSESSMENTS FOCUS ON THESE BASIC QUESTIONS:

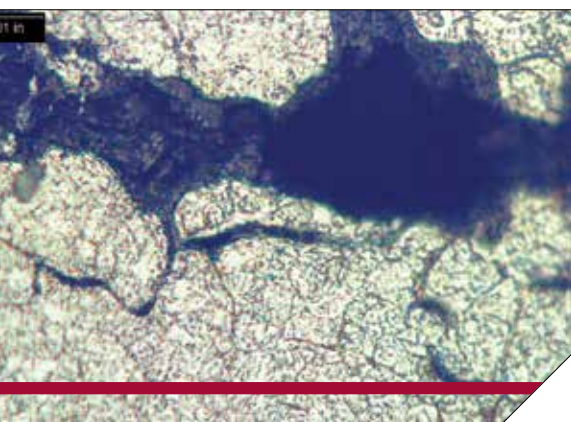
- How good is your cycle chemistry on a worldwide basis?
- Is your cycle chemistry optimized to prevent the major damage mechanisms?



Structural Integrity's engineers are well established as world leaders in identifying the key aspects of cycle chemistry control in feed water, boiler water and steam circuits. We can help operators with below average cycle chemistry and below average related performance to reach good or excellent performance with associated long-term savings of around \$1,000/MW/yr.

STRUCTURAL INTEGRITY'S FOCUSED SERVICES

- Assessment of current cycle chemistry
- Optimization of feed water and boiler water treatments
- Optimization of HRSG cycle chemistry
- Elimination of FAC
- Guidance on fundamental level of instrumentation needed for every plant
- Identification of all cycle chemistry damage/failure mechanisms
- Plant personnel training and workshops



Structural Integrity's Technical Support Unit (TSU) provides advanced non-destructive examination services (NDE) to the nuclear and fossil power industry. We use the latest in phased array ultrasonic technology combined with materials knowledge, engineering expertise, and new technologies exclusive to us such as Guided Wave Testing (GWT). TSU-NDE offers integrated solutions for asset management. Our areas of expertise include:

CONVENTIONAL TECHNIQUES:

- Liquid Penetrant (PT)
- Magnetic Particle (MT)
- Remote visual
- Replication
- Hardness testing
- Alloy identification

SPECIALIZED TECHNIQUES:

- Time-of-Flight-Diffraction (TOFD)
- Annular Phased Array UT (APA)
- Linear Phased Array UT (LPA)
- Eddy Current
- Boresonics
- Disc rim blade attachments
- Micro TOFD

ISI PROGRAM DEVELOPMENT

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- High energy piping
- Headers
- Tubing

NDE DEVELOPMENT:

- Procedural
- Technique
- Equipment
- Development qualification

LONG RANGE GUIDED WAVE ULTRASONIC INSPECTION OF PIPING

Guided Wave Ultrasonic Testing (GWT) inspections allow for the rapid and full inspection screening of above ground and buried piping as well as boiler tubing. GWT for long distance screening speeds inspection time and reduces costs in difficult to access locations by eliminating the need for insulation removal, scaffolding, and surface preparation on the entire length of pipe.

TYPICAL USES OF GUIDED WAVE TESTING ARE:

- Detect corrosion under insulation (CUI)
- Internal corrosion direct assessment locations for plant piping
- Locating piping girth welds under insulation
- Detect pipe wall thinning
- Screen boiler tubes for wastage

SPECIFICATIONS

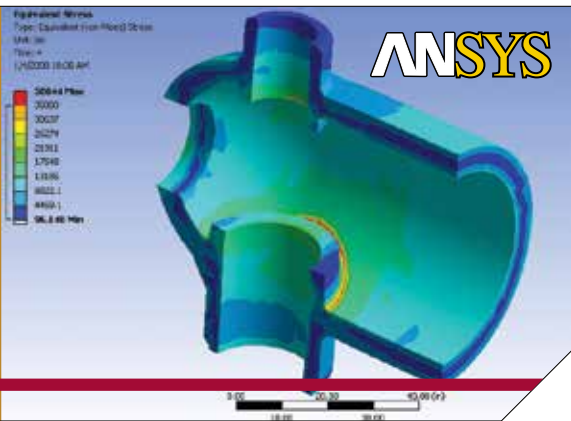
GWT can inspect pipes and tubes ranging from 2 to 60 inches OD, and can be performed with fluid temperatures up to 300°F without removing the pipe from service.

100% of the pipe is inspected (within the diagnostic length of a test). Typical ranges in each direction:

- Ideal conditions - 260 feet
- Typical 30-year old pipe with little internal or external corrosion - 120 feet
- Typical 30-year old pipe with some general corrosion - 75 feet
- Typical pipe wrapped in factory applied foam - 50 feet
- Heavily corroded pipe
- Ability to read through bends and branches

GWT provides information on feature position and approximate size. Corrosion anomalies are verified with a 100% B-Scan UT where accessible.





Structural Integrity Associates, Inc. provides a range of analytical services to support inspection planning, serviceability assessment, remaining life prediction, and repair/replacement design of critical fossil plant equipment. These services employ finite element stress analysis, fracture mechanics, on-line monitoring, probabilistic analysis, and financial risk optimization tools.

FINITE ELEMENT STRESS ANALYSIS

Structural Integrity performs thermal transient, linear elastic, elastic plastic, and inelastic creep stress analysis for engineering design, root cause analysis, and life assessment of plant equipment. Typical components we evaluate include piping systems, boiler headers and drums, valves, turbine steam chests, casings, and rotors. Dynamic analysis of piping systems and other components is performed to evaluate water/steam hammer and other dynamic events. FE modeling of welding processes is performed to evaluate residual stresses due to weld overlay and other repairs.

CFD MODELING

3D modeling and analysis of internal/external flow in boilers, HRSGs, and piping systems. Evaluations are performed using COSMOS FloWork and ANSYS CFX.



FRACTURE MECHANICS

Critical flaw size, Leak Before Break (LBB) and crack growth evaluations for fatigue, corrosion-fatigue, stress corrosion, creep, and creep-fatigue are performed for serviceability assessment of flawed components. Evaluations are performed per API 579 / ASME FFS-1 and other industry standards.

REMAINING LIFE ASSESSMENT

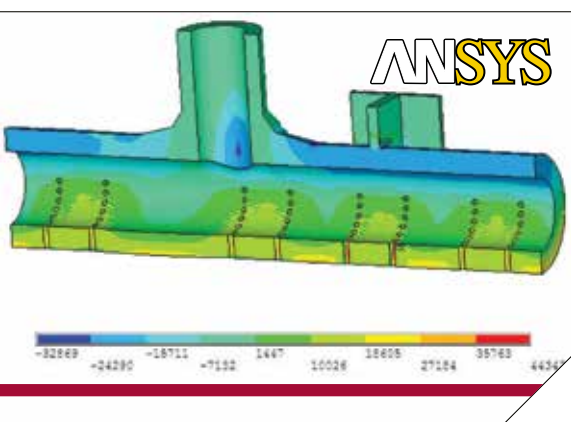
Structural Integrity's engineering experts have been key contributors to the development of component specific life assessment codes such as the EPRI BLESS codes for headers and piping, DMW-PODIS for tubing dissimilar metal welds, pc-SAFER for turbine rotors, RRing-life for generator retaining rings, and LP-RimLife for turbine disks. Structural Integrity is well versed in other assessment codes such as the MPC OmegaPipe code for high energy piping girth and longitudinal seam welds.

LIFE CONSUMPTION MONITORING

The rates of damage accumulation and crack growth in many plant components are strongly dependent on the detailed temperature/pressure histories of the equipment. Structural Integrity uses on-line monitoring of operating data to better define stress histories and improve creep-fatigue life assessment of components subjected to varying operating conditions such as that experienced under cycling service.

FINANCIAL RISK OPTIMIZATION (FRO)

FRO combines engineering based probability of failure with financial consequences in terms of repair and lost generation expenses to determine the optimum timing and Net Present Value benefit of proposed replacements or other maintenance actions.



Structural Integrity's engineering staff has extensive experience in evaluating the suitability of weldments from the design, process, and qualification perspectives.

- Structural Integrity staff has developed innovative welding techniques and repair procedures used successfully by conventional fossil and combined cycle plants.
- Structural Integrity's senior staff includes members of standards committees, subcommittees subgroups, and working groups of the ASME B&PV codes, including Sections I, II, III, V, VIII, IX and XI
- Our senior staff are also active in the AWS, API, and ASME B31 and National Board codes

WELDING ENGINEERING

- Review of corporate welding programs
- Selection and development of welding process
- Development of welding procedures and training
- Training of welding personnel
- Independent third party reviews
- Vendor shop audits/inspections to evaluate best practices and code compliance
- Weld overlay and temperbead welding procedures

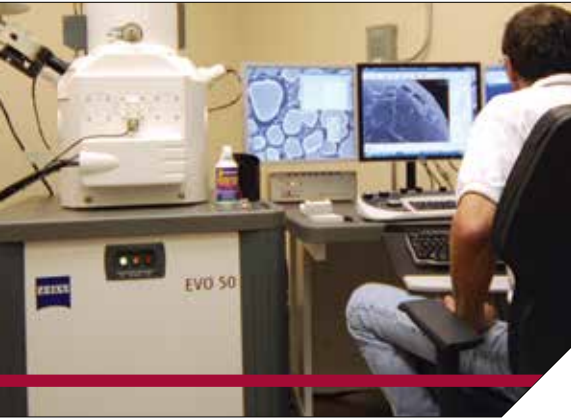
REPAIR WELDING SUPPORT & SERVICES

- Innovative specialty repairs
- Address the root cause of the welding failure
- On-site welding technical support

Structural Integrity can assist you with all of your welding engineering and weld repair needs. From process selection and procedure qualification to repair design and implementation, Structural Integrity has the qualified staff to address your needs.

In addition, through a partnership with Wachs Energy Services, we can offer state-of-the-art precision field machinery and weld repairs for the most challenging of circumstances and alloys.





Materials evaluation is essential for optimizing equipment life-management strategies.

Structural Integrity Associates, Inc. is well established as an industry leader in materials evaluation and failure analysis. Structural Integrity's metallurgical experts at the Materials Science Center in Austin, Texas, a state of the art laboratory, are well-equipped to tackle the toughest industry problems affecting material performance.

METALLURGICAL ASSESSMENTS

- Characterize the existing condition of materials
- Measure the effects of damage mechanisms such as thermal degradation, creep, oxidation corrosion, and embrittlement
- Predict future safe and reliable performance

FAILURE ANALYSIS

- Identify active damage mechanisms and influencing factors
- Identify and implement proper corrective actions, root cause analysis

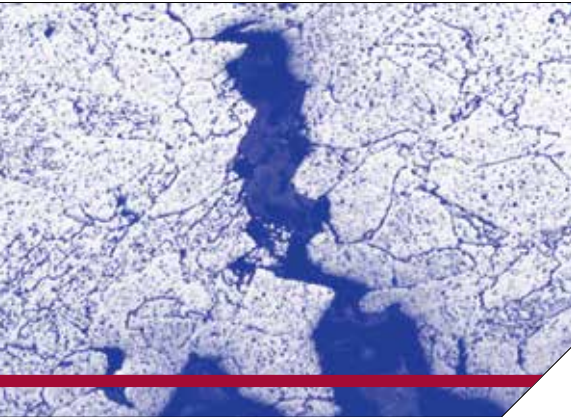
MATERIALS SELECTION

- Assist in the selection of materials prior to installation
- Better predict component lifespan and likelihood of equipment failure

LABORATORY CAPABILITIES

- Optical Metallography
- Scanning Electron Microscopy
- Quantitative Microstructural Analyses
- Fractography
- Scale and Deposit Analyses
- Chemical Analysis and Alloy Verification
- Cryo-cracking
- Heat Treating
- In-place Metallography and Replication
- Hardness Testing, bulk and microhardness
- Miniature Sampling
- Specialized Corrosion Testing
- Mechanical Testing
- Creep Testing, both full specimen size and impression creep testing

To view a virtual tour of our lab, go to www.structint.com/metallurigicallab



THE WEB-ENABLED COMPONENT ASSET MANAGEMENT SYSTEM

Common throughout the power industry is a need for user-friendly information management systems to store and manage critical data including component design, inspection records, engineering records, and analysis documentation. Recognizing that such systems must have secure network access, be scalable, and easy to use, Structural Integrity Associates developed an internet-enabled application called PlantTrack. This builds on the legacy TubeTrack software providing a validated solution to your data management needs.

PLANTRACK SIMPLIFIES THE RECORDING AND TRACKING OF EQUIPMENT CONDITIONS BY PRESENTING INFORMATION IN COMMON EVERYDAY WEB PAGE FORMATS.

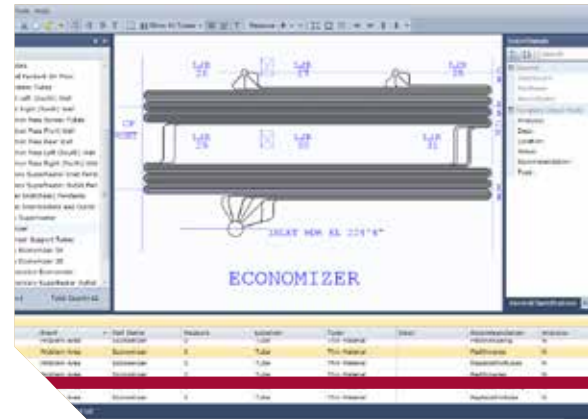
- Using a web browser, the user can surf the pages to view real-time component details including engineering specifications, analysis and inspection history details.
- Navigate your data graphically through interactive drawings and other graphic representations that facilitate use and bring greater meaning, particularly when used for tracking and trending conditions assessment data.
- One-stop shop for component information by allowing the linking of unlimited numbers and types of data files (pictures, documents, drawings, spreadsheets, etc.) to each of the component, analysis and inspection records.
- Develop reports detailing the part inventory, tests scheduled, tests performed and test engineer credentials

VERSATILITY

- PlantTrack is adaptable to all power plant equipment through user-created data fields and drop-down lists. No need to reprogram or pay for 3rd party modifications.
- PlantTrack can be used to house the information for a single unit, a single facility, or the entire fleet...there's no limit to the number and types of components defined.

PLANTRACK ADDITIONAL FEATURES

- Data queries can be tailored to meet user-defined criteria and data fields
- PlantTrack permits interfacing with other database tools, such as MS Access and Excel
- PlantTrack can be provided as a service via the worldwide web (www)
- PlantTrack can also be installed locally on a corporate intranet





A well-trained and well-informed engineering and operating staff is often the difference between a smooth-running, cost-effective plant, and a plant that is plagued by unplanned downtime and long outages. Training provides plant personnel with the key tools necessary for making more informed operating and maintenance decisions. Better decisions help avoid failures, make rapid and sound repairs, and improve productivity of the plant and personnel.

Structural Integrity's course offerings were developed by experienced professionals who have accumulated decades of experience problem solving difficult run/repair/replace decisions in high pressure power plant environments. Some of the course instructors are members of various ASME and ASTM committees, and are very familiar with the state-of-the-art technology and requirements in these areas.



Any of the services Structural Integrity provides can be tailored into a specialized technical short course to meet the needs of a specific client, and can be presented on a generic basis or developed for a specific application. In addition, joint courses can be developed for several clients at a central location. In many cases, credit supporting Professional Engineer (PE) continuing education requirements may be obtained from Structural Integrity's courses.

COURSE DESCRIPTIONS

- Advanced NDE Techniques
- CSEF/Grade 91 Steel Programs
- Boiler Tube Failure Reduction Techniques
- High Energy Piping Program Management
- Cycle Chemistry
- Flow Accelerated Corrosion



For more information, please contact Fred DeGrowth (704) 949-8061

Expert Solutions provides engineering and expert opinions to utility, industrial, legal and insurance firms. Structural Integrity's Expert Solutions team consists of engineers and scientists with experience in site inspection, incident investigation, evidence collection, documentation, and preservation, identification and analysis of pertinent issues, and full-scale metallurgical analyses. Our staff has experience with preparing and delivering fact-based findings and opinions, reports, exhibits, and other demonstrative evidence that can be useful in deposition and/or trial settings.

EXPERT SERVICES

- Incident Investigation
- Review of Expert Reports
- Detailed Report Preparation
- Deposition and Trial Testimony
- Exhibit Preparation

EVIDENCE PRESERVATION

- Identification of Important Evidence Items
- Photo and Videographic Documentation
- Application of ASTM Standards
- Protection of Fracture Surfaces
- Preservation of Samples
- Collection of Pertinent Records
- Chain of Custody

GENERAL FAILURE ANALYSES

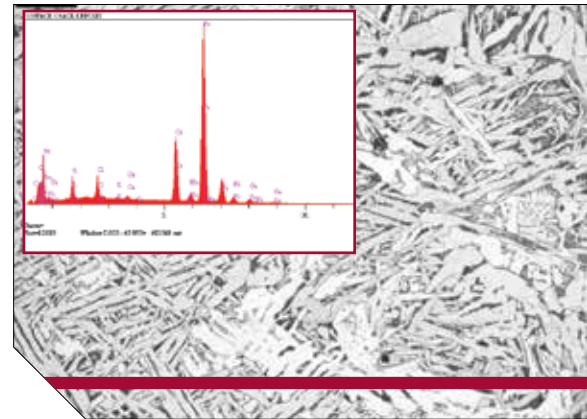
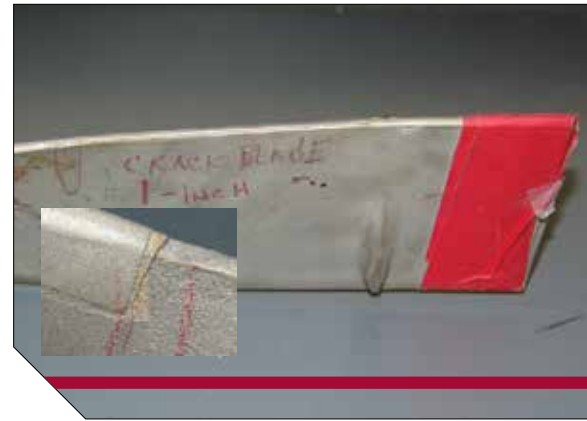
- Site Inspections
- Data Collection and Review
- Document/Drawing Review
- Evaluation of Procedures
- Evaluation of Maintenance History
- Analysis of Operational Variances
- Failure Analysis Project Oversight

MATERIALS EVALUATIONS

- Optical Metallography
- Scanning Electron Microscopy
- Quantitative Microstructural Analyses
- Fractography
- Scale and Deposit Analyses
- Chemical Analysis and Alloy Verification
- In-place Metallography and Replication
- Hardness Testing

ROOT CAUSE ANALYSES

- Application of Kepner-Tregoe Methods
- Application of PII Methods
- Event & Causal Factor Charting
- Barrier Analyses
- Fault Tree Analyses
- Common Cause Analyses



For more information, please contact Bastiaan Cornelissen (303) 503-0411



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