

Fluid Catalytic Cracking Unit (FCCU)

Life Extension & Turnaround Support

Stress Engineering Services has been helping clients solve FCCU problems for over a quarter of a century, working on scores of jobs for dozens of clients across the U.S.

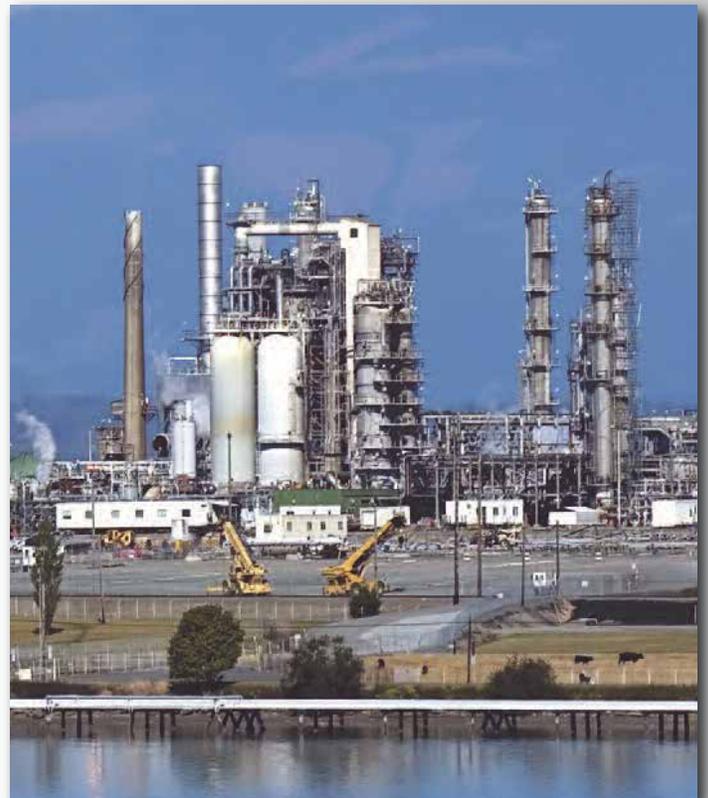
Under pressure to keep FCCU units operational after many years of service, there are key questions that eventually face all refinery operators:

Is the reactor, the regenerator and other high temperature equipment fit for continued operation, or will they need to be replaced, and when? How do I keep the "CAT" running safely until the next turnaround?

Once turnaround time arrives, the question quickly changes to:

What do I need to do to inspect, repair and/or replace to bring the unit back into service on time?

The answers to these questions are the foundation of the Fitness-for-Services (FFS) and Turnaround work that Stress Engineering Services (SES) routinely performs for clients to assess and extend the useful life of critical equipment. Our core business is helping clients assess equipment before and during turnaround to assure the best possible reliable and safe operation, and remaining life of their FCCU.

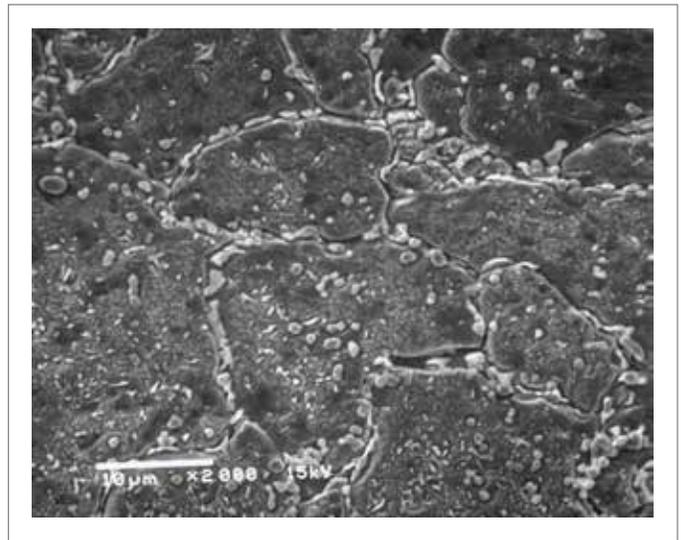


No Simple Answers

The range of remaining life questions is complex because they involve a number of material degradation mechanisms ... all a function of the operating history (pressure, temperature, thermal cycles, exposure time, process upsets, weld quality) and material properties. All of these process conditions interact and impact the service life of the equipment or component. With more than 80 FCCU assessments completed and more than 60 engineers/technicians coming from refineries, chemical plants and power stations, SES has the staff, experience and tools to help you address the key technical issues you face during turnaround.

First Things First

Much of the equipment currently in service is of 1940's and 1950's vintage, incorporating significant amounts of chrome alloys and austenitic stainless materials. This equipment degrades after years of service at high temperatures, losing ductility and toughness. More often than not the first turnaround task is to rapidly deploy a field team of technicians and metallurgists to take replicas on suspect areas ... and make a rapid assessment of material health per ASTM E1351. SES also has the capability to extract boat samples from components for a more detailed laboratory investigation.



Evidence of Carburization in Tube

Materials, Materials, Materials

All questions of service life in the FCCU involve materials. SES has a permanent, full-time staff of more than 25 metallurgists and materials engineers (most of them have extensive experience working directly for operating oil and chemical companies) located strategically in SES laboratories throughout North America (Houston, Cincinnati, New Orleans, Baton Rouge, and Calgary), all skilled at diagnosing the health of materials in refinery applications. This large, experienced staff is critical to our turnaround responsiveness.

SES can quickly organize teams of metallurgists and technicians to conduct the field FMR and, when needed, ship samples back to one of our laboratories when more sophisticated equipment or analysis is required. This approach enables us to quickly assess degradation mechanisms such as sensitization, sigma formation and carburization.

Expert API 579 FFS Assessment at All Levels

SES performs BPV Code and FFS evaluations from start to finish. We have performed every phase of assessment, from field verification of drawings through code calculations, MDMT calculations and detailed finite element analysis. SES engineers have been in the business of designing, redesigning, repairing, and (unfortunately, when necessary) condemning FCCU reactors, regenerators, plenums, over head vapor lines and other components for more than 25 years. We also



Conducting on-site Field Metallurgical Replication

offer extensive expertise in all aspects of FCCU unit mechanical integrity and high temperature creep testing and analysis. SES integrates all the above information into one turn key solution and path forward for the client.

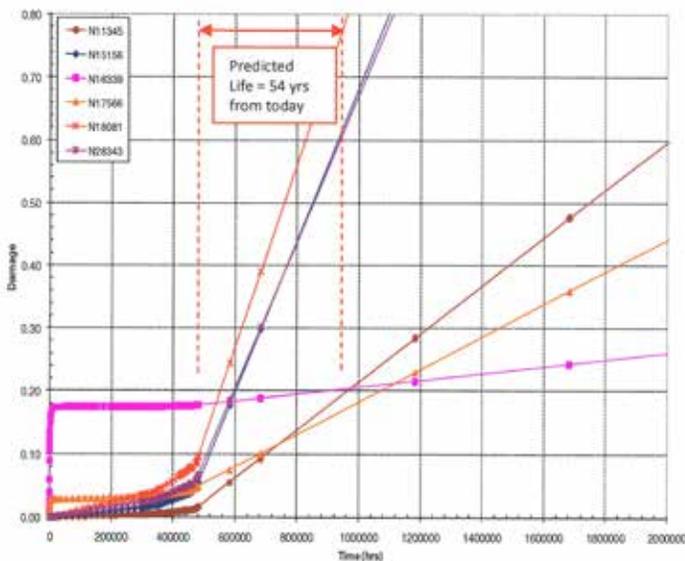


Creep Analysis of a Vessel Using Finite Element Analysis

It's All About Experience

We have been helping clients solve plant related FCCU problems for over a quarter of a century, working on scores of projects for clients around the world. Specific areas of expertise and experience include:

- Field Strain Gaging & Instrumentation
- Design
- Stress Analysis
- Fixed & Rotating Equipment Vibration Analysis
- New Creep Testing Lab and Remaining Life Prediction
- Field Metallurgical Replication (FMR)
- Failure Analysis
- Acoustic Emission Testing
- Weld Repair Procedures & Materials Engineering
- Metallurgical Assessment
- API 579 Level 1, 2 and 3 Assessments
- Defect Assessment
- Pressure Vessel Re-rating & Replace Documentation
- General Structural Evaluation
- Remediation of Hot Spots



Structural Management Programs

If reactor or regenerator replacement is planned, SES can and has provided structural engineering services needed to assess the impact of removal and replacement of components. Using advanced structural simulation tools it is possible to predict the load redistribution in the super structure when the connections to the vessel are severed, enabling you to develop a strict protocol for safe removal. The load redistribution can also be monitored in real time during the removal by applying instrumentation and strain gages to the structure before the connections to the vessel are severed, and closely watching the data that is streaming to data acquisition systems.



Remote Monitoring of Data During Testing

About Stress Engineering Services

Established in 1972, SES is employee owned. Our staff covers a score of engineering disciplines including mechanical, civil, electrical, metallurgical, materials, water chemistry, theoretical and applied mechanics. Over 80% of SES engineers hold advanced degrees, most are licensed P.E.'s and the average engineer has more than 15 years experience.

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