

# Assessment of Process Heaters

Stress Engineering Services, Inc. (SES) is an employee owned professional engineering consulting company founded in 1972. Stress Engineering successfully completes over 3,000 projects per year for more than 800 clients worldwide. Our engineers have an average of 23 years experience; many of which have worked directly for oil companies in plants.

## TUBE LIFE ASSESSMENT PROGRAM:

- "SES Tube Life" software considers corrosion, creep and carburization
- Design codes - API 530, ASME (Larson-Miller) corrosion and creep (OMEGA)
- "In-service" assessment code - API 579 (Omega creep model)
- Calculations - deterministic or probabilistic
- Deterministic - simple, relatively quick tube life estimates
- Probabilistic - more rigorous analysis, more accurate tube life estimates



## BENEFITS OF THE HEATER PROGRAM:

- Predicts tube failures which benefits turnaround planning tube inspection / replacement
- Increases reliability / availability - reduces likelihood of tube failure (safety and cost)
- Increases profits by:
  - Demonstrating additional tube life
  - Optimizing upper tube metal temperature limits for increased throughput
  - Deferring tube replacement (lost production, labor, materials)
- Allows temperature and corrosion rate sensitivity analysis to examine effect on tube life
- Integrates into your RBI program

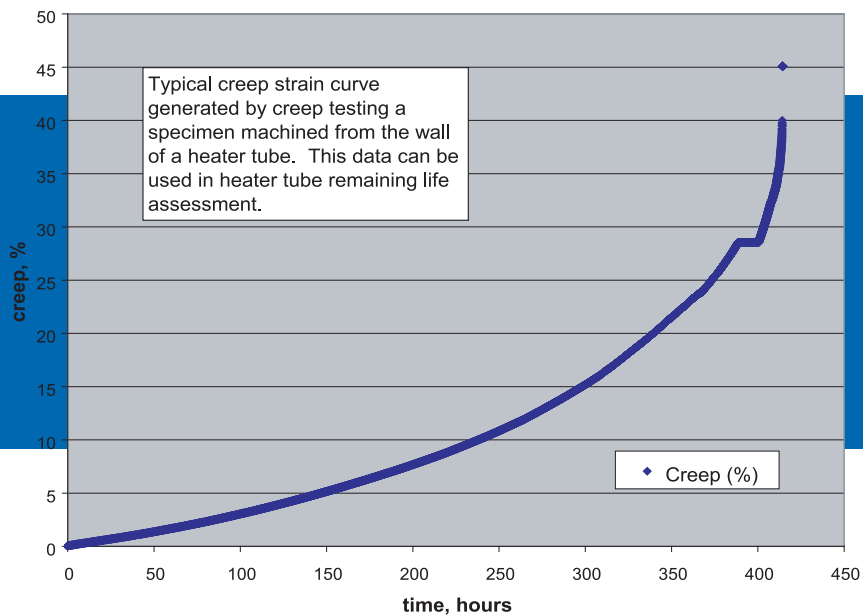
## PLANT-WIDE CALCULATIONAL ASSESSMENT PRIOR TO SHUTDOWN:

- Allows focus of time & money on heaters with critical remaining tube life

## CALCULATIONAL ASSESSMENT OF SPECIFIC HEATERS PRIOR TO SHUTDOWN:

- Allows tube replacement planning
- Allows tube inspection planning





## METALLURGICAL ASSESSMENT DURING SHUTDOWN:

- Tube sample removal
  - Creep-rupture testing - API 530
  - Creep testing - API 579 (Omega creep model)
  - Through-wall metallography, metallurgical examination, carburization, steam-side oxide examination (steam raising service)
- Field metallurgical replication, hardness and strapping
  - Assessment of microstructural condition of tubes
  - Assessment of fitness for continued service
- Failure analysis

## FIELD METALLURGICAL REPLICATION USES:

- |                      |           |
|----------------------|-----------|
| ● Reactors           | ● Welds   |
| ● Pressure vessels   | ● Spheres |
| ● Piping and headers |           |



## CFD & PROCESS HEATERS:

- Applications for CFD in Fired Heaters:
- Burner design for improved flame shape and NOx performance.
- Heater design to eliminate flame impingement and hot-spots.
- Understand burner-burner interactions to improve burner design and positioning.
- Advanced Process Control



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