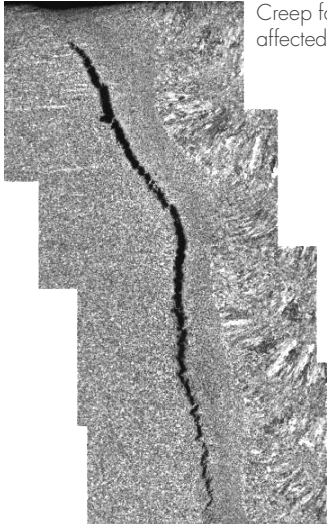


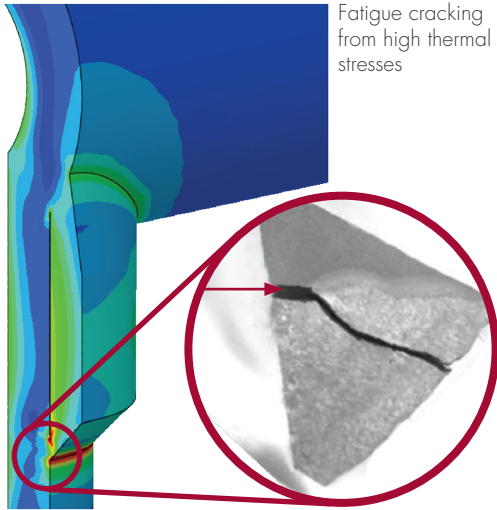


Structural Integrity
Associates, Inc.®

HIGH ENERGY PIPING (HEP) ONLINE DAMAGE TRACKING APP



Creep failure at a weld heat affected zone



Fatigue cracking from high thermal stresses

THE PROBLEM

High Energy Piping systems that operate at high temperatures are subject to creep and fatigue damage, which can ultimately result in cracking and steam leaks. Welds (girth, seam or saddle) are particularly vulnerable since they often are the “weak link”. Failures can be catastrophic, particularly in seam welds, so planned repair or replacement prior to failure is critical to safety and availability.

Fatigue damage is controlled by a combination of thermal transients and piping supports. Creep damage is controlled by a combination of operating temperature and stress, where the stress results from internal steam pressure and weight / thermal expansion of the piping system. Prediction of useful lifetime, therefore, requires tracking of thermal transients, pressure and temperature, as well as hanger/support movements. Typically this is accomplished with occasional hanger readings and with snapshots of typical operating data that are used to guide stress analysis of the piping system. In many cases infrequent hanger readings may be inadequate and so-called typical snapshots of operating data may not capture damaging conditions.

THE SOLUTION

Tracking creep and fatigue damage in real-time, based on SI’s algorithms that use actual operating data and available information on material conditions, combined with component geometry to provide accurate life consumption estimates. This allows trends in damage accumulation to be tracked to guide life management decisions, such as the need for targeted inspections, or more detailed “off-line” analysis of anomalous conditions.

For Creep and Fatigue damage tracking, existing online operating data for pressures, temperatures and flow rates are extracted from the data historian and combined with data from off-line inspections, such as actual material conditions (e.g. hardness levels) and actual geometries (e.g. diameters, wall thicknesses) to provide damage trends based on the “as-exists” condition of the piping system. The HEP Online Damage Tracking App continuously monitors key features of the system and continuously calculates Creep and Fatigue life consumption. Projections of remaining life are provided based on damage trends.

Because pipe hangers and supports play an important role in maintaining stresses within acceptable limits, the online monitoring system can be configured to track hanger position using local displacement transducers. This provides feedback and an early warning to hanger malfunctions or unusual pipe movement.

The quantitative information can then be used to plan for needed action, or allow for justification to reduce required inspection scopes, which were previously determined based on schedule, rather than on actual asset condition. Our software can be configured to provide email alerts when certain absolute damage levels are reached, or when a certain damage accumulation over a defined time frame is exceeded. In this way, the HEP Online Damage Tracking App can run hands-off in the background, and notify maintenance personal when action might be required.



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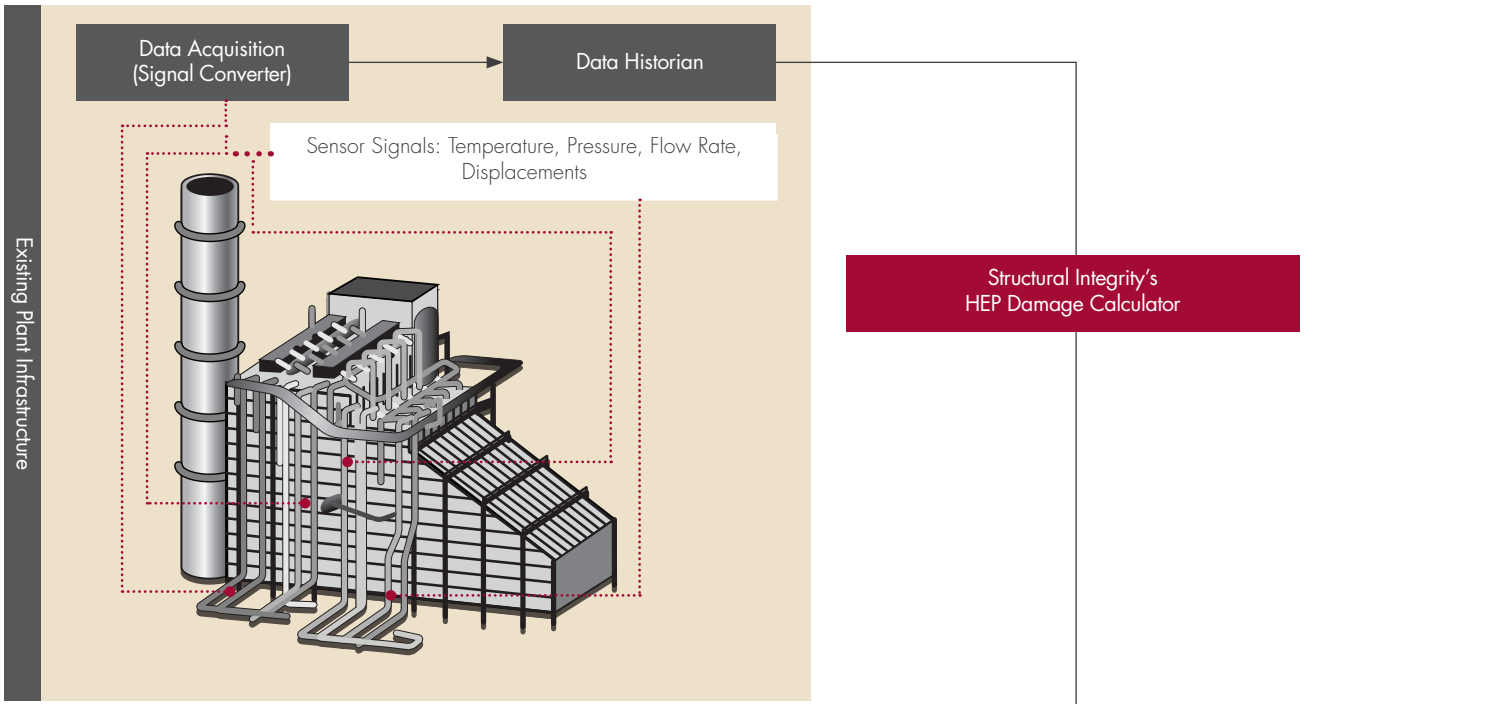
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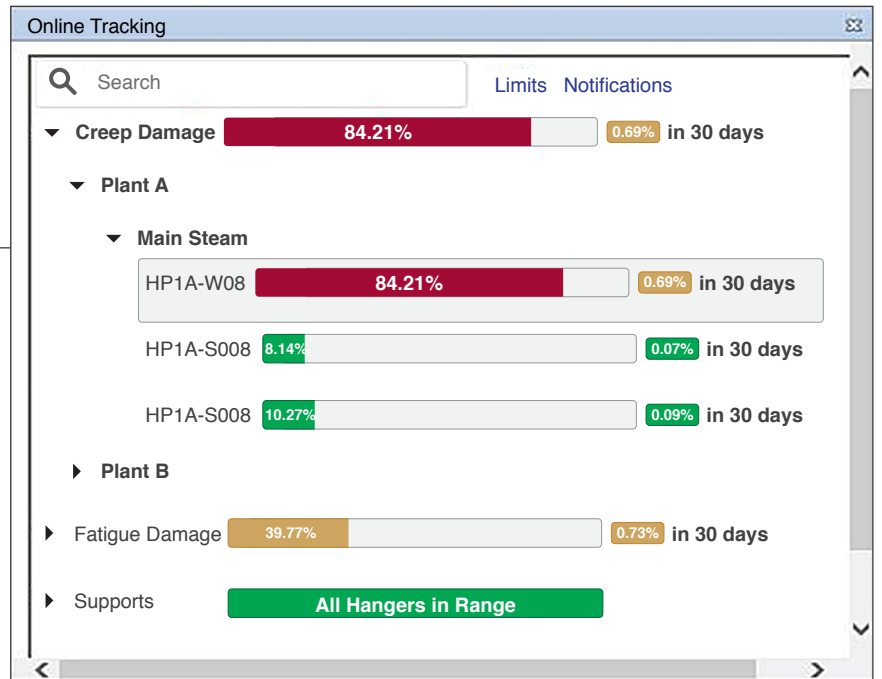


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HEP Online Damage Tracking App

Send Notification if user defined damage levels reached at certain locations



PlantTrack Online

Online provides a suite of real-time damage tracking applications for common plant components: piping, headers, tubing, attemperators, etc. These applications interface to common DCS / Historian systems allowing for easy implementation, including analysis of historical data where that exists.

PlantTrack Offline

Offline provides web-based graphical data management of design, configuration, inspections, failures, repairs, etc.