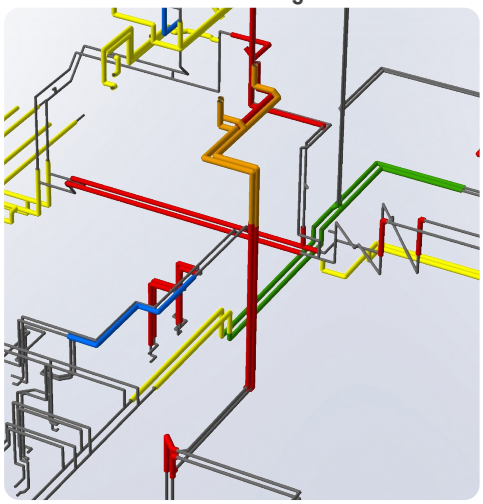
Structural Integrity Associates, Inc.®

LIFE CYCLE MANAGEMENT (LCM)
FOR AGING PIPING

Risk Ranking



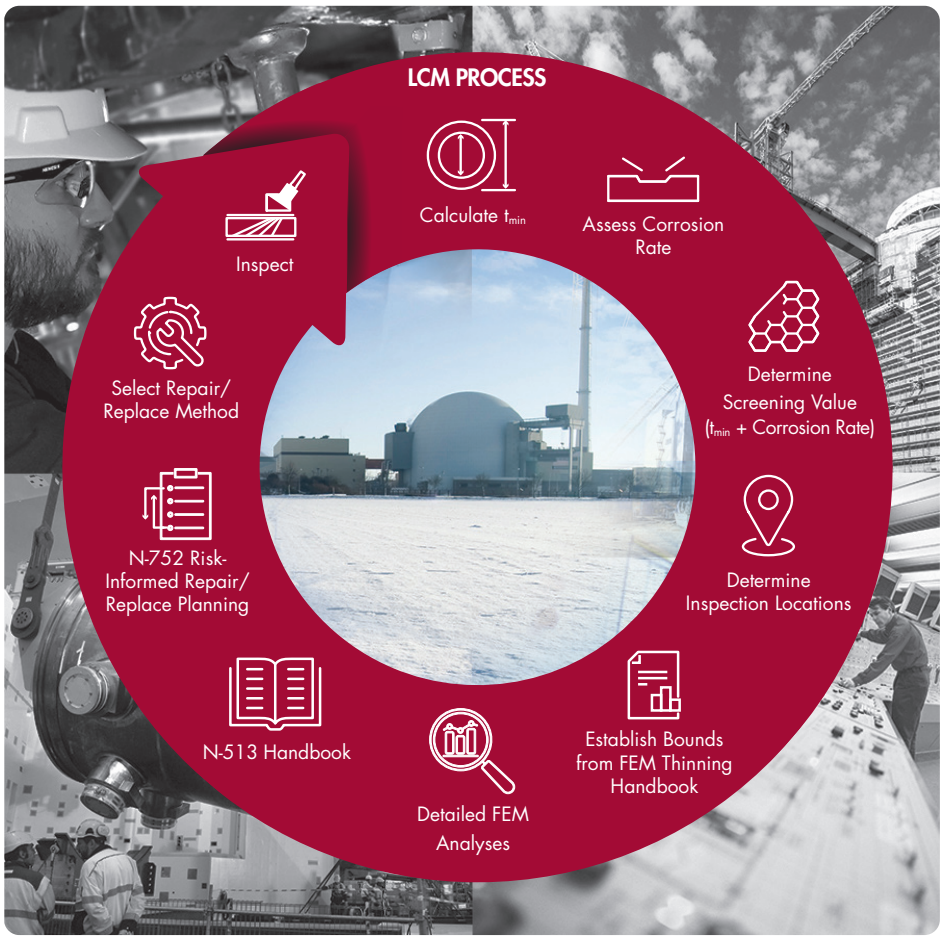
Low Risk — High Risk

When routine piping inspections (FAC, MIC, etc.) identify unexpected degradation, the results may present a threat to generation or regulatory compliance. Addressing such problems typically requires emergent engineering support, which comes at significant cost and organizational burden.

SI's Life Cycle Management approach provides an alternative in the form of a proactive, comprehensive strategy for piping system management. The process combines specialized engineering methods with advanced corrosion predictions to forecast potential degradation and easily disposition findings.

Armed with LCM, utility engineers can strategically plan and execute inspections with the confidence that the results will not lead to costly "emergency" situations.

- Reduce threat to generation
- Maintain regulatory compliance and margin
- Streamline inspection scope over time
- Minimize unplanned repair/replacement



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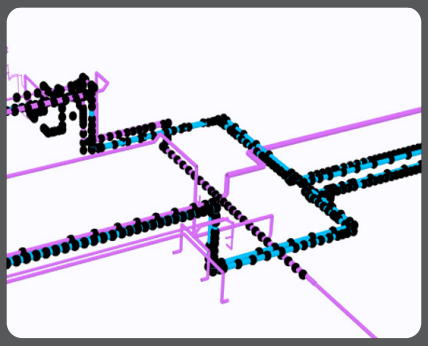
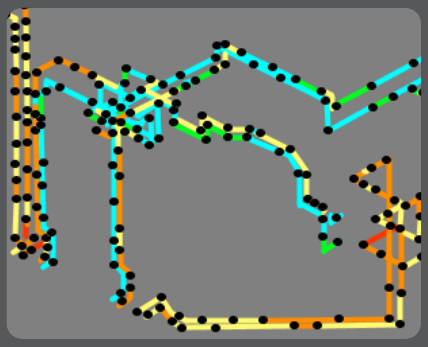
THE LCM PROCESS

Calculate t_{min}
- Code t_{min} values calculated at all possible locations (each node)
- Developed from simplified calculations or 3D pipe model / stress reports



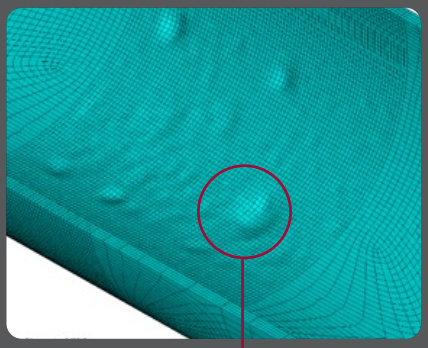
Assess Corrosion Rate
- SI-proprietary, probabilistic corrosion prediction model ("Extent of Corrosion")
- Considers piping layout, material, geometry, and operating chemistry history
- Predicts locations most likely to exhibit low margin and/or through-wall thinning

Determine Screening Value (t_{min} + Corrosion Rate)
- Combines stress margin results (t_{min}) with corrosion predictions (EoC distributions)
- Provides graphic visualization of risk/margin
- Enables strategic selection of "high-value" inspection locations

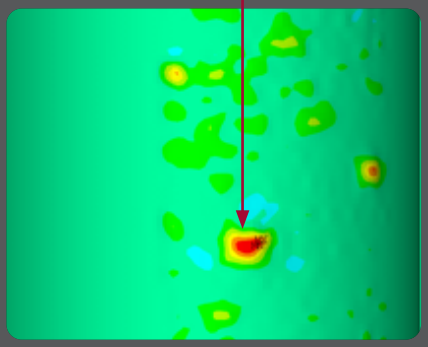


Determine Locations
- Initial locations dictated by program requirements, historical precedent, and/or experience
- Over time, selection improves (scope decreases) as informed by other steps in process

Establish Bounds from FEM Thinning Handbook
- Finite element model to evaluate postulated localized thinning (pitting)
- Provides additional margin beyond screening values (t_{min}) for all evaluated piping
- Generically applicable to systems with the same geometry and design pressure



Detailed FEM Analyses
- As-found wall thickness data can be directly evaluated to determine the true stress state of the degraded location
- Provides a precise representation of the remaining margin piping component
- Typical results demonstrate significant remaining life increases beyond traditional t_{min} calculations



N-513 Handbook
- Code Case N-513 provides methods for temporary acceptance of through-wall and part-wall flaws
- Handbook summarizes bounding N-513 results for rapid disposition of excessive thinning and/or through-wall leakage
- SIPE software provides web-based N-513 calculator

N-752 Risk-Informed R/R Planning
- Risk-informed reclassification of Class 2 and 3 piping to non-safety classes
- Scope limited to repair and replacement requirements

Select R/R Method
- Advance screening/selection of optimal method
- Eliminates guesswork, streamlines implementation if required

Inspect
- NDE personnel armed with criteria (screening values and/or thinning handbook results)
- Degradation dispositioned in the field
- Results are used to validate/update corrosion model and inform future inspections