TR 2019-53 – GM – Engineering Critical Analysis

TR Number	**19-53**
Primary	192.632
Secondary	192.3, 192.7, 192.18, 192.493, 192.607, 192.710, 192.712, 192.713, 192.933, 192.947
Purpose	Review and develop GM as appropriate in light of Amendment 192-125
Origin/Rationale	Amendment 192-125
Assigned to	Design

Note: *Revisions are shown in yellow highlight and red font.*

Section 192.632

~~*This guide material is under review following Amendment 192-125.*~~

[Editorial Note: The following is all new Guide Material and is therefore not underlined.]

1 PURPOSE

(a) The Engineering Critical Assessment (ECA) process is one of the available methods to reconfirm the MAOP of onshore steel transmission pipelines. This section ~~details~~ provides guidance for the requirements of §192.624(c)(3) known as “Method 3”.

(b) Definition: See §192.3 for the definition of Engineering Critical Assessment (ECA).

2 ECA ANALYSIS

(a) The integration and analysis performed for the ECA account for material properties and condition of the segment. Data from multiple sources can be integrated to quantify and predict in-service degradation and determine predicted failure pressure. The data could include the following.

(1) Material properties’~~,~~ destructive and non-destructive tests can provide information about the material characteristics and failure criteria.

(2) Direct examinations, assessments, and prior integrity assessments provide information about the condition of the segment at the time they were performed.

(3) Close interval surveys, coating surveys, and interference surveys provide information related to external corrosion.

(4) Prior incident cause analyses, pressure test leaks and failures, and other historical pipeline operating records can be used to confirm identified threats as well as provide condition information at the time they were reported.

(5) Comparison of multiple data sets taken over time. These can be the basis for calculating defect growth rates.

(6) Additional data or test types. These may be relevant based on threats identified for the segment.

(b) When traceable, verifiable, and complete material property records are not available, conservative assumptions must be used (§192.632(a)(1)) until data can be obtained as part of a material verification program (see §192.607). Conservative assumptions for material properties that cannot be verified by documents that are traceable, verifiable, and complete include the following.

(1) Pipe diameter should be assumed to be the largest commercially available based on the nominal size.

(2) Wall thickness should be assumed to be the thinnest commercially available based on the pipe diameter.

(3) Seam type for steel pipe NPS 4 and smaller should be assumed ~~as furnace butt-welded pipe with~~ to have a longitudinal joint factor (see §192.113) no greater than 0.6. For steel pipe larger than NPS 4, the operator should use a longitudinal joint factor no greater than 0.8.

(4) If the specified minimum yield strength (SMYS) or ultimate tensile strength (UTS) are unknown or records are not traceable, verifiable, and complete, assume 30,000 psi (§192.632(a)(2)(~~ii~~iv)). UTS values might not have been captured on historical material test records.

(5) At low temperatures, steel is more brittle with low impact toughness; at high temperatures, it is more ductile with greater impact toughness. Therefore, Charpy v-notch toughness values that correlate to lowest operational temperatures as shown in §192.712(e)(2) should be used.

(c) An operator also has the option to obtain data using field measurements or other methods.

(d) Asset data necessary for ECA analyses may be managed by multiple departments. Examples might include records generated by design, engineering, operations, corrosion, and integrity functions.

(e) The ECA should determine the threats applicable to the segment, identify factors and potential data sources relevant to the investigation, and consider interactions between threats. Examples might include the following.

(1) For external corrosion threats, consider coating and cathodic protection characteristics and condition, soil type, corrosion history and growth rates.

(2) For internal corrosion threat, consider quality of gas transported, corrosion monitoring history and growth rates.

(3) For mechanical and outside force threats, consider both static loads (e.g., soil overburden), dynamic loads (e.g., road or railway crossing), seismicity, potential for ground movement to cause additional strain (see guide material under §192.917).

(4) Other operational circumstances including pressure cycling and flow reversals may be relevant to threats identified for the segment.

3 DEFECT DETERMINATION

(a) Whether using previous pressure tests or implementing an assessment program, the operator may consider the following. In-service life of the pipeline segment, corrosion growth rates, time since last pressure test, and maximum pressure of that test can all affect the size of an assumed (non-measured) defect. ~~The~~ An assumed defect ~~will be~~ is the largest defect which could have survived the last pressure test plus its assumed growth since that pressure test.

(b) Similarly, if known defects exist, time since measurement could impact their current size.

(c) Operators may assess the pipe to measure the size of known defects. This can be done through Inline Inspection (ILI) or validated “Other Technology”.

(1) Use of “Other Technology” ~~might~~ requires advance notification to PHMSA (§192.632(b)(3)).

(2) If prior assessments are used, the predicted defect growth since that assessment must be accounted for (§192.632(b)(1).

4 INLINE INSPECTION

(a) Inline inspection (ILI) may be used to obtain information necessary to complete the ECA process. ILI tools can be beneficial in obtaining measurements across an entire length of pipe while other methods such as direct examination may be more effective for short sections.

(b) Tools used must be able to detect wall loss or other defects applicable to the identified threats (§192.632(c)). Multiple tools runs can be correlated to address applicable threats.

(c) See Guide Material Appendix G-192-14 and §192.632(c).

5 DEFECT ANALYSES

(a) Defect type and expected failure mechanism will inform the predicted failure pressure determination method used for the specific anomaly.

(1) Metal loss defects ~~typically~~ use ASME/ANSI B31G or R-STRENG. However, these calculations are not applicable if the ~~unless~~ depth exceeds 80 percent of wall thickness. See §192.632(a)(2).

(2) Cracks or crack-like defects require different calculations. See §192.712.

(3) If using software that provides multiple simultaneous calculations, apply operator policy or subject matter expertise to identify the result to record and use as the predicted failure pressure.

(b) Document assumptions, ~~and~~ evaluations, and decisions to conservatively address interaction between defects (§192.632(a)(3)).

(c) Apply ~~company~~ operator policy or subject matter expertise when determining whether defects are to be considered interacting.

6 REMAINING LIFE ESTIMATION

Remaining life estimation must be performed if cracks, crack-like defects, or susceptibility to cracking is found during the ECA through the review of records including the following (§192.712).

(a) Prior assessment records.
(b) ILI tool results.
(c) Leak or failure records.
(d) Manufacturing vintage with known susceptibility.

7 MAOP ESTABLISHMENT

~~Predicted failure pressure for both known measured defects and those that could remain in the pipe are analyzed. The lowest value is used in the calculation to establish segment MAOP under this ECA method.~~

The segment MAOP is established using the lowest predicted failure pressure calculated for all defects in the segment (§192.632(a)(4)).

8 RECORDS

(a) ~~Engineering Critical Analysis~~ ECA records must be retained for the useful life of the pipeline (§192.~~947~~632(e)).

(b) Assumptions and methodology of the ECA process should be incorporated with the results of the analysis (see §192.632).

(c) Records may be ~~stored electronically and kept readily available~~ maintained electronically, as paper copies, or according to operator procedures.