

## **“Interim Guidelines for Confirming Pipe Strength in Pipe Susceptible to Low Yield Strength” dated September 10, 2009**

“Pipeline Operator” must remove all pipe joints expanded in excess of 1.50% in diameter, with elastic loading included (i.e., taking into account the pressure on the pipe at the time of measuring the deformation), or the commensurate adjusted expansion without elastic loading on the pipe when expansion is verified in the field without pressure on the pipe.

“Pipeline Operator” must also comply with the following requirements for operations of Class 1 pipe above 72% specified minimum yield strength (SMYS) and for all other pipe in the alternative maximum allowable operating pressure (MAOP) special permit pipeline:

1. Unless already completed, “Pipeline Operator” must run a deformation tool through all pipeline segments on the pipeline. “Pipeline Operator” must use a high resolution deformation tool in lieu of a geometry tool to address the threat of low strength, expanded pipe.
  - a. The deformation tool must include multi-finger sensors that contact the pipe internal diameter and have an accuracy of +/- 1% or less to identify expanded pipe and dents. The results of all deformation tool run results for expanded pipe and dents must be analyzed and submitted to the appropriate PHMSA Regional Director. All pipe exhibiting an indicated diameter greater than 0.60 % or 0.75% (based upon pipe diameter 42” or  $\geq 36$ ” per API 5L) above the nominal pipe diameter must be noted on the report of potential deformations. Expanded pipe is defined as pipe exhibiting an indicated diameter greater than 0.60 % or 0.75% (based upon pipe diameter 42” or  $\geq 36$ ” per API 5L) above the nominal or actual rolled pipe diameter.
  - b. “Pipeline Operator” must ensure that all deformation tool results are not masked by the approach used to calculate and compare expanded versus non-expanded pipe and the percentage of expansion. “Pipeline Operator” must employ procedures to review and compare deformation tool results with other pipe joint diameters to ensure an entire pipe joint is not expanded.
    - i. Pipe joints on both sides of expanded pipe joints greater than 0.60% or 0.75% (based upon pipe diameter 42” or  $\geq 36$ ” per API 5L) expansion must be documented (tabulated and graphical plot of pipe joint expansion) and compared to ensure that accurate minimum and maximum diameters are used in pipe expansion calculations.
    - ii. Results of deformation tool runs must be compared with excavation measurement results in accordance with Item 3 and expansions over 0.60% or 0.75% (based upon pipe diameter 42” or  $\geq 36$ ” per API 5L) must be adjusted based upon these actual excavation measurements.

- c. "Pipeline Operator" must review with the appropriate PHMSA Regional Director, the deformation tool reports. This analysis must consider pipe properties and property distributions, hydrostatic test pressures and reported test behavior, and pipe end to center variations in expanded pipe. Based on local pressure and expected behavior, any expansion exceeding the diameter by more than 1.5% with elastic loading (or the commensurate adjusted expansion with elastic loading on the pipe, when expansion is verified in the field without pressure on the pipe) must be investigated by excavation to determine actual expansion, wall thinning and, if necessary, to verify pipeline special permit segments: tensile strength, yield strength, elongation, chemical composition, carbon equivalent/Pcm, hardness, Charpy – shear area and absorbed energy with full Charpy curves, and drop weight tear test (DWTT) properties ("properties test").
  - d. "Pipeline Operator" must review with the appropriate PHMSA Regional Director all pipe expansions above 1.00% with elastic loading (or the commensurate adjusted expansion with elastic loading on the pipe, when expansion is verified in the field without pressure on the pipe). This review must include deformation tool result diagram sheets (tabulated and graphical plot of pipe joint expansion) of pipe expansions above 1.00% and the deformation tool diagram sheet (tabulated and graphical plot of pipe joint) for pipe on both sides of the pipe expanded above 1.00%. The pipe expansion calculation data, pipe diameter, pipe wall thickness, grade, class design factor and pipe mill test reports must be detailed for all expanded pipe above 1.00% expansion with elastic loading.
2. Pipe joints with expansions  $\geq 1.5\%$  with elastic loading must be removed and confirmed for strength serviceability as follows:
- a. Perform "properties test" in the transverse direction. "Pipeline Operator" must take 2 sets at 3 locations along the pipe section for "properties test" of each removed pipe joint.
    - i. The expanded pipe joint should be mapped to identify expanded pipe minimum and maximum wall thicknesses with at least 10 thickness readings mapped showing location on the pipe.
    - ii. One (1) set of "full Charpy curves" are only required, instead of two (2) sets, at each of the three (3) locations for "properties test" noted above, unless the results of the first test are substandard, then a second test will be required.
    - iii. At least one of the three "properties test" locations must be in the expanded section or sections of a pipe joint.
  - b. If expanded pipe properties tests in Item 2.a. above do not meet special permit requirements, "Pipeline Operator" must:
    - i. Perform "properties test" on at least two (2) expanded pipe joints, over 1%, with elastic loading and two (2) non-expanded

pipe samples from the steel/pipe supplier of expanded pipe (same OD, wall thickness, Grade, weld seam, steel supplier, pipe manufacturer and rolling campaign) to confirm pipe properties. The non-expanded pipe joints may be from in service or spare pipe inventory.

- ii. Submit remediation plans or a technical justification (fitness for service plan) to PHMSA on how reduced strength pipe meets 49 CFR § 192.105.
  - c. If the deformation tool run in Item 1 above shows no expanded pipe above 1.5% expansion or the pipe “properties test” in Item 2. b. above shows no reduced pipe properties, “Pipeline Operator” must excavate two (2) expanded pipe joints with expansion above 1% with elastic loading to determine if there is wall loss or thinning that is detrimental to safe operations, prior to operating at the alternative MAOP. Any wall loss that would reduce the pipe segment operating pressure in accordance with §§ 192.103, 192.105 192.111, 192.112 and 192.619 must be remediated. If these excavations show wall loss below nominal wall thickness, “Pipeline Operator” must continue to excavate and remediate expanded pipe joints above 1% with elastic loading until there are no detrimental wall loss pipe joints in service.
  - d. “Pipeline Operator” must give the appropriate PHMSA Regional Director one week’s notice of all field activities to run deformation tools, conduct excavations, remediation and to perform laboratory “properties tests”.
3. All deformation tool results, for an initial run on a “pipeline segment”, must be confirmed with at least two calibration digs to validate anomaly sizes and tool accuracy. Tool inaccuracies after validation must be considered into expanded pipe evaluations and remediation. A “pipeline segment” is the pipe in a continuous run of a deformation tool.
  4. “Pipeline Operator” must not use the “one class bump” for class change locations where expansions exceeded 1.0% with elastic loading until completion of a “fitness for service” plan and acceptance by PHMSA.
  5. The interim guidelines contained herein must be reviewed with PHMSA, Director of Engineering and Emergency Support and appropriate PHMSA Regional Director at the completion of the investigation, pipe properties testing, and “fitness for service” plan for technical soundness (including a determination of the proper pipe grade to meet §§ 192.103, 192.105, 192.111, 192.112 and 192.619 in determining the alternative MAOP or MAOP of the pipeline segment).

**“Pipeline Operator” must perform the following actions, described in Items 6 through 10 below, where deformation tool runs indicate expansion greater than 1.5 % or in pipeline segments with low strength pipe.**

6. Conduct a re-inspection and remediation of the pipelines with deformation and high resolution magnetic flux leakage (MFL) tools to evaluate for metal loss and expansion anomalies:
  - a. Within 36 months of operating above 72% SMYS up to 80% SMYS on any given pipeline segment with expanded or remediated pipe.
  - b. Schedule subsequent in-line inspection with high resolution MFL tools (ILI) and close interval survey re-inspections for the pipelines based on failure pressure ratios (FPRs) calculated after the first re-inspection, but not to exceed 5 year intervals.
  - c. Manage plain dents (in accordance with ANSI B31.8 and § 192.933) not to exceed 6% total strain in pipe body and 2% strain contiguous with weld for future ILI, deformation and geometry tool runs.
7. Pipeline operations:
  - a. Pipeline may be operated up to the alternative MAOP (80% SMYS), after successful completion of the following interim guidelines:
    - i. “Properties tests,” and a technical review including review of pipe test pressures to confirm that pipe property results meet API 5L specifications and 49 CFR Part 192 requirements for the alternative MAOP or MAOP. The “properties tests” must show conformance with API 5L and alternate MAOP or MAOP criteria.
    - ii. “Fitness for service” plan review outlining how integrity threats to the pipeline would be treated to operate at the alternate MAOP or MAOP, based upon pipe “properties test” and any effects of elevated test pressure due to pipe elevation differences may have had on pipe expansion.
    - iii. The technical documentation of all “properties test” findings or “fitness for service” plans must be submitted by “Pipeline Operator” to PHMSA, Director of Engineering & Emergency Support and the appropriate PHMSA Regional Director for review. PHMSA must approve all submittals prior to implementation of alternative MAOP; any operating pressures above 72% SMYS.
  - b. For pipeline operations, “Pipeline Operator” must run:
    - i. ILI initially within 3 years of operating at the alternative MAOP and on a maximum 5 year interval thereafter. Anomalies must be evaluated and remediated based upon alternative MAOP or MAOP conditions,
    - ii. Conduct close interval surveys (CIS) and remediate pipe in each pipeline segment in accordance with 49 CFR Part 192 on a periodic basis, not to exceed 3 months of running ILI tools.

- iii. "Pipeline Operator" must operate in accordance with the "interim guidelines of this document" until PHMSA has developed "go-forward" guidance on expanded pipe removals based upon technical input from research and industry. If the PHMSA technical and safety evaluation of pipe expansion issues results in "go-forward" guidance that differs from the requirements above, "Pipeline Operator" must implement the PHMSA "go-forward" guidance for the alternative MAOP or MAOP *pipeline segments*.
8. For expanded pipe only not meeting 49 CFR § 192.105 and special permit requirements, implement enhanced corrosion anomaly response and repair criteria:
    - a. Anomaly Response Time: Repair Immediately
      - Any anomaly within a *pipeline segment* operating up to 80% SMYS with either: (1) a failure pressure ratio (FPR) equal to or less than 1.15; (2) an anomaly depth equal to or greater than 50% wall thickness loss.
      - Any anomaly within a *pipeline segment* operating up to 72% SMYS with either: (1) a failure pressure ratio (FPR) equal to or less than 1.25; (2) an anomaly depth equal to or greater than 50% wall thickness loss.
      - Any anomaly within a *pipeline segment* operating up to 67% SMYS with either: (1) an FPR equal to or less than 1.30; (2) an anomaly depth equal to or greater than 50% wall thickness loss.
      - Any anomaly within a *pipeline segment* operating up to 60% SMYS with either: (1) an FPR equal to or less than 1.40; (2) an anomaly depth equal to or greater than 50% wall thickness loss.
      - Any anomaly within a *pipeline segment* operating up to 56% SMYS with either: (1) an FPR equal to or less than 1.45; (2) an anomaly depth equal to or greater than 50% wall thickness loss.
      - Any anomaly within a *pipeline segment* operating up to 50% SMYS with either: (1) an FPR equal to or less than 1.5; (2) an anomaly depth equal to or greater than 50% wall thickness loss.
    - b. Anomaly Response Time: Repair Within One Year
      - Any anomaly within a *pipeline segment* operating at up to 80% SMYS with either: (1) an FPR equal to or less than 1.25; (2) an anomaly depth equal to or greater than 40% wall thickness loss.
      - Any anomaly within a *pipeline segment* operating at up to 72% SMYS with either: (1) an FPR equal to or less than 1.39; (2) an anomaly depth equal to or greater than 40% wall thickness loss.
      - Any anomaly within a *pipeline segment* operating at up to 67% SMYS with either: (1) an FPR equal to or less than 1.50; (2) an anomaly depth equal to or greater than 40% wall thickness loss.
      - Any anomaly within a *pipeline segment* operating at up to 60% SMYS with either: (1) an FPR equal to or less than 1.67; (2) an anomaly depth equal to or greater than 40% wall thickness loss.

- Any anomaly within a *pipeline segment* operating at up to 56% SMYS with either: (1) an FPR equal to or less than 1.80; (2) an anomaly depth equal to or greater than 40% wall thickness loss.
  - Any anomaly within a *pipeline segment* operating at up to 50% SMYS with either: (1) an FPR equal to or less than 2.0; (2) an anomaly depth equal to or greater than 40% wall thickness loss.
- c. Anomaly Assessment Methods:
- “Pipeline Operator” must use the most conservative anomaly repair method and take into account the lowest pipe properties for all pipe in a “category” when evaluating an anomaly. “Category” is based upon diameter, class location, steel source, pipe manufacturer, wall thickness, and grade.
9. “Pipeline Operator” must review and document all areas along the pipeline to ensure pipe loadings at all crossings meet combined stress limits for all equipment, farm machinery, roads, highways, and railroads to maintain Special Permit design factors based upon the lowest pipe strengths for that pipe grade, wall thickness, design factor, maximum loadings, and depth of cover. “Pipeline Operator” must add a provision in its Operations and Maintenance Manual for annual reviews to account for combined stresses.
10. “Pipeline Operator’s” Operations and Maintenance Procedures must include the interim guidelines of this document within three months of operating at the alternative MAOP. Documentation must be certified and submitted by an officer of “Pipeline Operator” to the PHMSA, Director of Engineering and Emergency Support and the appropriate PHMSA Regional Director.