# White Paper on Managing System Integrity in lieu of Class Location Change-out

**INGAA Pipeline Safety Committee**
**January 9, 2004**

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**Managing System Integrity in lieu of**
**Class Location Change-out**

The new rule on Integrity Management of Gas Transmission Pipelines in High Consequence Areas is expected to be promulgated before the end of 2003. High Consequence Areas consider, by definition, all Location Class 3 and 4 areas. Due to the intense analysis, assessment, testing and mitigation requirements of this rule, change-out of pipe, reduction of pressure or pressure testing when the Class Location changes is redundant and should be eliminated. This paper discusses the opportunity for rule change in 49 CFR Part 192.611 to eliminate this redundancy and provides justification on a technical basis for this change.

49 CFR Part 192.609 "Change in Class Location: Required Study" provides for a study "whenever an increase in population density indicates a change in class location for a segment of an existing steel pipeline operating at a hoop stress that is more than 40% of SMYS, or indicates that the hoop stress corresponding to the established maximum allowable operating pressure for a segment of existing pipeline is not commensurate with the present class location". The study will determine the present class location, a review of as-built conditions compared to current practices, physical condition as ascertained from available records, the operation and maintenance history, the MAOP and corresponding hoop stress, and the actual area affected by the population density increase.

Once the study is complete the operator must confirm or revise the MAOP as provided in 49 CRF Part 192.611. In this paragraph of the regulations, the operator must take one of three actions "if the hoop stress corresponding to the established maximum allowable operating pressure of a segment of pipeline is not commensurate with the present class location, and the segment is in satisfactory condition".

The three options provided are:

1) If the segment involved has been previously tested in place for a period of not less than 8 hours, the maximum allowable operating pressure is 0.8 times the test pressure in Class 2 locations, 0.667 times the test pressure in Class 3 locations, or 0.555 times the test pressure in Class 4 locations. The corresponding hoop stress may not exceed 72 percent of SMYS of the pipe in Class 2 locations, 60 percent of SMYS in Class 3 locations, or 50 percent of SMYS in Class 4 locations.
2) The maximum allowable operating pressure of the segment involved must be reduced so that the corresponding hoop stress is not more that that allowed by this part for new segments of pipelines in the existing class location.

3) The segment involved must be tested in accordance with the applicable requirements of subpart J of this part, and its maximum allowable operating pressure must then be established according to the following criteria:
   a. The maximum allowable operating pressure after the re-qualification test is 0.8 times the test pressure for Class 2 locations, 0.667 times the test pressure for Class 3 locations, and 0.55 times the test pressure for Class 4 locations.
   b. The corresponding hoops stress may not exceed 72 percent of SMYS in Class 2 locations, 60 percent of SMYS in Class 3 locations, or 50 percent of SMYS in Class 4 locations.

It is clear that the intent of this section is two fold. First, the authors intended that some additional safety factor is necessary in higher class location areas (i.e. 0.60 design in Class 3 areas) and second, if one integrity assessment technique was used (in this case pressure testing to a factor above MAOP), the safety factor need not be as conservative as the requirements for new pipe. An interesting note is that the authors did not require periodic integrity assessments but instead believed that a one-time assessment combined with an appropriate safety factor was adequate for the life of the facility. See Table 1 for design factor and assessments comparisons.

**Integrity Assessment Table for Class Location Areas**

| Class Designation | Design Factor | | | |
|---|---|---|---|---|
| | 0.5 | 0.6 | 0.72 | 0.8 |
| Class 1 | | | Grandfather with actual high or 1.1 MAOP pressure test | Grandfather with actual high or<br>1.25 MAOP pressure test and One other assessment |
| Class 2 | | 1.25 MAOP pressure test | 1.25 MAOP pressure test or<br>1.1 MAOP pressure test and one other assessment | 1.25 MAOP pressure test and two other assessments<br>( Duke Waiver) |
| Class 3 | 1.5 MAOP pressure test | 1.5 MAOP pressure test or<br>1.25 MAOP pressure test and one other assessment | 1.25 MAOP pressure test and one other assessments | Not under consideration |

Current Regulation

Proposed Regulation

The 0.72 column is the same as the regulations for Liquid pipelines.

Non-HCA is equivalent to class 2

Table 1
Design Factor and Assessment Comparison

The new ASME B31.8S standard was developed for the management of integrity for gas pipelines. This standard is heavily referenced by OPS in the proposed rulemaking and rightfully so as it is the premier body of work in this area and is based on technical expertise and science. This standard requires a determination of integrity of all threats and requires set periods for reassessment. The periods for reassessment are based on a number of factors including the operating pressure as a percent of hoop stress. Pipelines operating above 50 percent of SMYS must be assessed at intervals not to exceed 10 years. Pipelines operating above 30 percent of SMYS but at or below 50 percent of SMYS must be assessed at intervals not to exceed 15 years, and Pipelines operating at or below 30 percent of SMYS must be assessed at intervals not to exceed 20 years.

The new standard allows for these assessments to be performed with the use of one of three tools. These tools are pressure testing, in-line inspection, and direct assessment. The use of one or more assessment technique is far superior to the anecdotal information that must be reviewed as required in 49 CFR Part 192.609.

In Section 609, the operator must review the design, construction, and testing procedures used during initial construction and compare them to current techniques. The integrity standard requires operators to not only review this information but to actually address all the threats to pipeline integrity. So not only is the design and construction threat reviewed (this is a stable threat), it is assessed as well and all the other threats are also assessed. These additional threats include the time dependent threats of internal corrosion, external corrosion, and stress corrosion cracking. They include the time independent threats of outside force damage, operator error, and third party damage. They also include the stable threats of manufacturing and equipment. Where 609 addresses one threat, B31.8S addresses all nine.

In Section 609, the operator must review the operating and maintenance history and determine the physical condition to the extent it can be ascertained from available records. The integrity standard goes far beyond this requirement. It requires that the physical condition be assessed through the use of a inspection with one of the approved methods, not just through available records. This is a far superior in that these assessment and their resulting examinations and evaluations prove the integrity of the pipeline. The standard also requires the selection and implementation of appropriate mitigative actions such as repair and prevention techniques.

With this background, it is proposed that a new section be added to paragraph 49 CFR Part 192.611(a) as follows:

(4) The segment of pipe must have its integrity managed in accordance with ASME B31.8S "Managing System Integrity of Gas Pipelines"

This simple phrase brings to bear all of the requirements of the integrity standard to the class change situation. This includes the gathering, reviewing and integrating of data; risk assessment; integrity assessment; responses to integrity assessments and mitigation (repair and prevention). It also requires that there be a written integrity management plan, a performance plan, a communications plan, a management of change plan, and a quality control plan.

With four instead of three options, the operator has more flexibility. For instance if the pipeline segment is operating at 72 percent of SMYS in Class 1 and the Location Class changes to Class 3, the operator can either lower the operating pressure to 50 percent of SMYS, or if the line was previously tested to the appropriate level, operate at 60 percent of SMYS, or retest the pipeline segment and operate at 60 percent of SMYS if the segment had not been previously tested to the appropriate level, or now, manage the pipeline in accordance with B31.8S and operate at 72 percent of SMYS. The operator can also choose to replace the pipe with new pipe that is appropriate for Class 3 operation.

If the operator replaces the pipe with 50 percent design pipe or lowers operation to 50 percent of SMYS, it will be 15 years until the next assessment is required. If the operator chooses to operate the pipeline at 72 percent of SMYS, assessment is required at 10 year intervals. Note also that Confirmatory Direct Assessment is required for all pipelines in HCA's not to exceed 7 years. So in fact the pipe operating at 72 percent of SMYS will have CDA at least once in between full integrity assessment. Full assessment every 10 years with confirmatory assessments in between will demonstrate that the pipeline is capable of continued operation at the higher hoop stress level.

The benefit to the operators of gas transmission pipelines in the US should be rather significant. It is estimated that $100 million is spent each and every year to replace perfectly good pipe with perfectly good pipe when the location class changes. This is an unnecessary burden to the operator and the ultimate consumers. In addition to the cost there is the interruption of gas service to replace pipe, environmental issues to contend with, inconvenience to the people who live and work near the pipelines and much more. The resulting cost savings will help to offset the cost of the new integrity management rule, as the operator will not be burdened with the redundant costs of both class change-out and performance of integrity management.

It is recognized that amending the regulations to provide for the fourth option described above using integrity management in lieu of a pipe change out will require a new rulemaking. The existing regulations do provide a mechanism for applying this approach until such a time as a final rule is promulgated. That approach is to apply 49 CFR 192.xxx, Risk Management. Several operators had demonstrated the utility of this provision in their Risk Management Demonstration Project Applications in using assessment and engineering analyses in lieu of change out of pipe. OPS and operators recognized the value of this more comprehensive approach in the late 1990s in the

additional assessment and engineering analyses that were undertaken more broadly across the system as compared to simply changing out several thousand feet of pipe. INGAA plans to prepare a guidance document that documents this work and provides the bases for applying the provisions of risk management until the rule change can occur.

Operators also have the option of using the waiver process as a means of applying for the use of integrity management in lieu of pipe change out. This waiver option is provided in the Statute in Section 60118. This is not a practical means for the broad application of the approach defined above, and as such it will be of limited utility and could be a regulatory burden.

In summary, the regulations have long recognized the value of testing and assessment combined with engineering analyses to assure the integrity of pipelines as population density increases along the right of way. The fundamentals of integrity management as embodied in ASME B31.8S provide the framework for applying integrity management in lieu of the redundant pipe change out. This will require a separate rulemaking. In the interim, operators have the option to apply the provisions of risk management found in the existing regulations through the waiver process to achieve this increased level of safety in a cost beneficial manner.