



U.S. Department of Transportation  
Pipeline and Hazardous Materials  
Safety Administration



# **PHMSA – 2009 New Pipeline Construction Workshop**

## **Materials & Inspection**

**PHMSA**  
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**April 23, 2009**



# Materials & Inspection Observations

- 1. Positive Observations**
- 2. Pipe Manufacturing Findings**
- 3. Quality Materials**
- 4. Quality Assurance / Inspection**
- 5. Problem Identification – In Service Pipelines**
- 6. Conclusions**



## Positive Observations (Data Driven)

- **Parallel construction – existing pipelines and power lines**
  - Few incidents
- **Pipeline Safety Cooperation**
  - Operators worked with PHMSA to ensure pipeline safety
- **MAOP Rule/Special Permit**
  - Finding low yield strength pipe
- **DCVG Surveys**
  - Used on many recent projects
  - Finding coating and pipe damage
- **Workshops**
  - API & INGAA



# Pipe Manufacturing Findings



# Pipe Manufacturing

- **Quality Issues – pipe** (remains under investigation)
  - Chemical composition
  - Low and variable yield strength
  - Laminations and Inclusions
  - Pipe bevel ends – high/low



# Pipe Manufacturing

- **Low Yield Strength**
  - Yield Strength <62Ksi for X70 pipe
  - Maximum ID: 109% of normal
  - Not an isolated project concern
- **Out of Spec Chemical Composition**





# Pipe Manufacturing

- Low yield strength pipe; 56Ksi to 62Ksi for X70 pipe

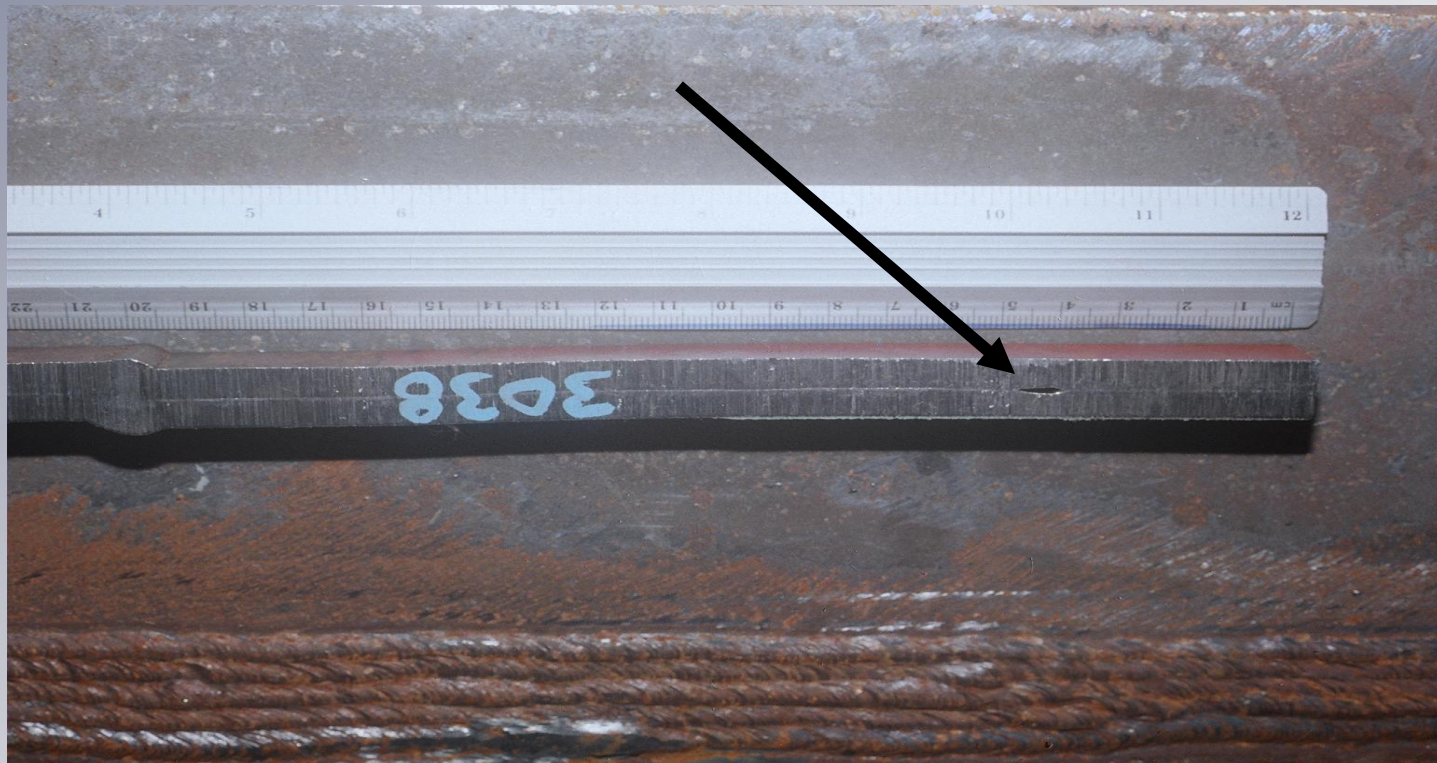






# Pipe Manufacturing

- Laminations and Inclusions







# Pipe Manufacturing

- Pipe bevel ends – high/low and flat spots





## Pipe Manufacturing

- Pipe bevel ends – high/low







# Pipe Manufacturing

## Pipe End Conditions – High Low





## **Pipe Manufacturing – Attendant Problems X-70 and X-80 Pipe Grades**

- **More susceptible to hydrogen cracking than lower pipe grades**
- **Hydrogen is present in the coating of all E XX10 electrodes**
- **Three conditions must be present in the weld to initiate hydrogen cracking:**
  - **Source of hydrogen,**
  - **Micro-structure susceptible to the effects of hydrogen, and**
  - **Stresses in the weld.**



# Quality Materials





## Possible Causes

- **Factors found to contribute to low and variable yield strength pipe**
  - **Wrong heat chemistry from steel supplier**
  - **Pipe test locations for yield/ultimate tensile strengths at steel and pipe mills**
  - **Plate/coil ordered under strength based on the type pipe rolling process**
  - **Incorrect plate/coil rolling process**
  - **Improper plate/coil cooling rates**
  - **Plate/coil switch at pipe mill**



## Pipe Manufacturing – API 5L

- Section 6.1 – Chemical Properties
- Section 9.3 – Testing of Mechanical Properties -
  - Is one test per heat adequate for high grade microalloyed steel?
  - Should additional requirements be included in API 5L based upon type steel grade, plate or coil?
- Section 9.10 – Retests



## Pipe Manufacturing – API 5L

- **Section 9.11.3 - Diameter – Tolerances for Pipe Ends**
  - **44<sup>th</sup> Edition - Tolerances for pipe ends of large diameter pipe such as 36" and 42" (pipe >24" to 56") has a tolerance of +/-63 mils on welded pipe.**
  - **43<sup>th</sup> Edition - Tolerances for pipe ends of large diameter pipe such as 36" and 42" (pipe >24" to 56") has a tolerance of -1/32" to +3/32" on welded pipe.**



# Pipe Manufacturing – API 1104

- **Section 7.2 – Alignment**
  - The alignment of abutting ends shall minimize the offset between surfaces.
  - For pipe ends of the same nominal thickness, the offset should not exceed 1/8".
  - Mechanized welding units can not space high/low variations around the pipe.



# Quality Assurance / Inspection





# Pipe Manufacturing - Inspection

- **API Monogram Certification**
- **Steel Supplier/Manufacturer**
- **Pipe Mill**
- **Purchaser**



## Pipe Manufacturing – Inspection

- Did the “**rolling mill/purchaser**” set up procedures to properly monitor and test the incoming coil/plate for mechanical and chemistry properties?
- Was inspection used by the “**purchaser**” at the steel mill and pipe rolling mill?
- Are there problems with the **API 5L** standard for high grades/microalloyed steel?



# Problem Identification In Service Pipelines



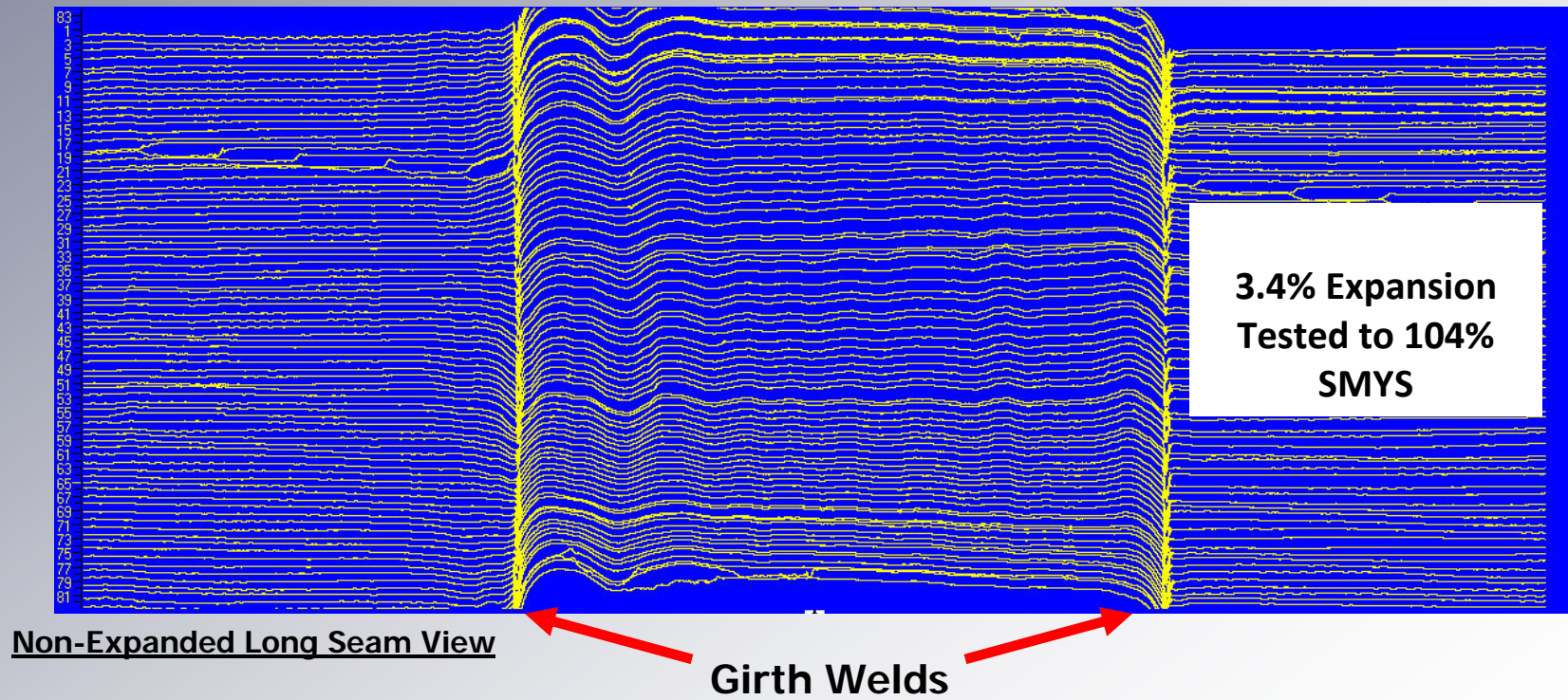
## **Problem Identification Low Yield Strength Pipe**

- **100% SMYS Hydrotest of in place/in service pipe**
- **Running of Deformation Tools after Hydrotest**
  - **calibrated to find expanded pipe**



# Deformation Tool – expanded pipe

## Expanded Joint - Deformation







## Conclusions

- Pipe Manufacturing
- Coating
- Welding
- Construction





**Questions**

**Thank you**