



Distribution Polyethylene Pipelines Managing Construction Quality

Presented by:

Ed Newton

Southern California Gas
Company

San Diego Gas and Electric





PE Pipeline Construction Quality

Presentation overview

- About the Company
- Construction Stats
- Construction Compliance Audits
- Elements of Pipeline Construction Quality
- Pipeline Construction “Process” Perspective
- Dr. Deming on Quality
- Case Study: Saddle Heat Fusion Special Cause Variation

- Sempra Energy – parent company
 - ✧ Fortune 500 energy services holding company
 - ✧ Nearly \$8 Billion in revenues in 2009
 - ✧ 29 million customers
 - ✧ Holdings:
 - ✧ SoCalGas
 - ✧ SDG&E
 - ✧ Generation facilities
 - ✧ LNG facilities
 - ✧ Pipeline & Storage facilities

➤ SoCalGas/SDG&E Regulated Natural Gas Utilities

- ✧ 140/129 years
- ✧ 24k (20k/4k) square miles
- ✧ 24 (20.5/3.5) million customers
- ✧ 6.5 (5.7/0.8) million gas meters
- ✧ 625 (500/125) communities
- ✧ Diverse terrain: coastal, desert, mountain regions



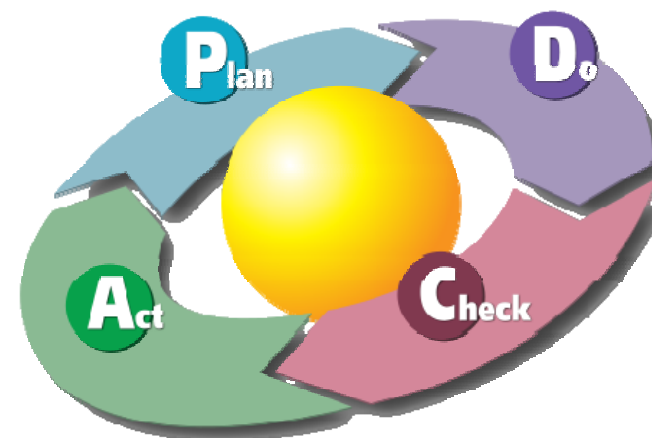


Construction Stats

- 60,457 (52k/8k) miles of PE mains and services
- Annual Increase in PE Pipe Inventory \approx 1,725 mi/yr
 \approx 9MM ft (average from last 10 years)
- Trained Construction Utility Employees
 - ✧ \approx 1,350 Construction Employees Operator Qualified
 - ✧ \approx 900 Qualified PE Fusers
- Trained Construction Contractors
 - ✧ Install the majority of New and Replacement PE Pipe
 - ✧ SoCalGas - 8 “Signatory” contractors
 - ✧ SDG&E - 4 “Applicant” contractors

Construction Compliance Audits

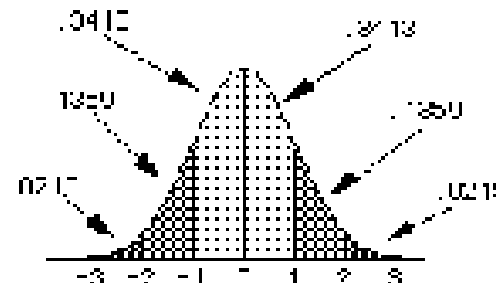
- SoCalGas “Signatory” contractors
 - ✧ Contractual 97.5% Compliance on Audit Results
 - ✧ Inspection form
 - ✧ Audit (the “check” step in the Shewhart Plan–Do–Check-Act cycle)
 - ✧ Provides feedback to Engineering, Training, Contractors
- SDG&E “Applicant” contractors
 - ✧ Provision mandated through state assembly bill
 - ✧ Applicant Designers
 - ✧ Initial training + annual requalification. Training cards issued.
 - ✧ SDG&E title block, designing to SDG&E standards
 - ✧ Gas Engineering review prior to release to construction
 - ✧ Applicant Installers
 - ✧ Trench inspection required
 - ✧ 100% visual inspection of all system joints
 - ✧ Pressure test chart witness/signature required
 - ✧ System left pressurized with air at 40 psig.
 - ✧ SDG&E crew performs tie-in
 - ✧ Performs 1 hr re-test prior to energizing



Quality Doesn't Start at the Job Site

➤ Pipeline Construction Quality begins with the various elements needed to perform the work

- ✧ Good quality pipe and component materials
- ✧ Good quality equipment and tooling
- ✧ Robust procedures
 - ✧ Understand normal variation
 - ✧ Understand & Manage Process Parameters
- ✧ Effective Training Programs
 - ✧ Operator feedback
 - ✧ Continuous Improvement
- ✧ Integrate Approved Materials with Design Process
- ✧ Material/Equipment Evaluation Check List





Sample of Material & Equipment Evaluation & Implementation Check Sheet

Material & Equipment Evaluation & Implementation Checklist

Name of Material/Equipment:

Reference the Gas Standard (SoCalGas 107.0004 or SDG&E G7008) for detailed description of the line items below.

Evaluation Guideline Checklist Items	Completed	Remarks
1 Material/Equipment Review and Research		
a Review Request & Business Case	NO	
b Research material history	NO	
c Identify and review Regulatory, Industry & Company requirements	NO	
d Evaluate potential impact to existing infrastructure	NO	
e Identify potential safety and/or environmental concerns	NO	
f Identify potential impact on Pipeline Integrity	NO	
g Identify potential operator qualification requirements	NO	
h Develop a project and communication plan	NO	
2 Material/Equipment Data		
a Identify potential suppliers	NO	
b Prepare and submit Data Request	NO	
c Compile and compare information received	NO	
3 Economic Assessment		
a Cost/Benefit Assessment	NO	
4 Validation Testing		
a Identify Suppliers whose product meets min. acceptable requirements	NO	
b Develop a product qualification plan	NO	
c Submit Test Request Form & Test Plan to EAC	NO	
d Prepare test samples	NO	
e Review test results and identify products that pass validation testing	NO	
5 Manufacturer's Quality Assessment		
a Perform Supplier Assessment (Letter, Site Visit, etc.)	NO	
b Partner with Supply Management to initiate procurement process	NO	

Material & Equipment Evaluation & Implementation Checklist

6 Material Spec (SAP/MSP), AM, and QCII Documents		
a Create and publish MSP / SAP Desc	NO	
b Create and publish AM	NO	
c Create and publish QCII	NO	
d Create or modify existing Gas Standard(s)	NO	
e Partner with Training Staff	NO	
7 Field Trials and / or Pilot Programs		
a Coordinate and manage field evaluations	NO	
b Create client feedback survey form	NO	
c Provide response to user questions	NO	
d Monitor usage and quality/training issues	NO	
8 Roll-out and Implementation		
a Update MSP, AM and/or QCII following field trials	NO	
b Coordinate w/Spec. Author(s) to finalize Gas Standard(s)	NO	
c Coordinate w/Training Staff to finalize Operator Qualification	NO	
d Coordinate w/Supply Management to code materials in SAP	NO	
e Update Planning System (CMS CUs, Dwgs, etc.)	NO	
f Archive support documentation	NO	

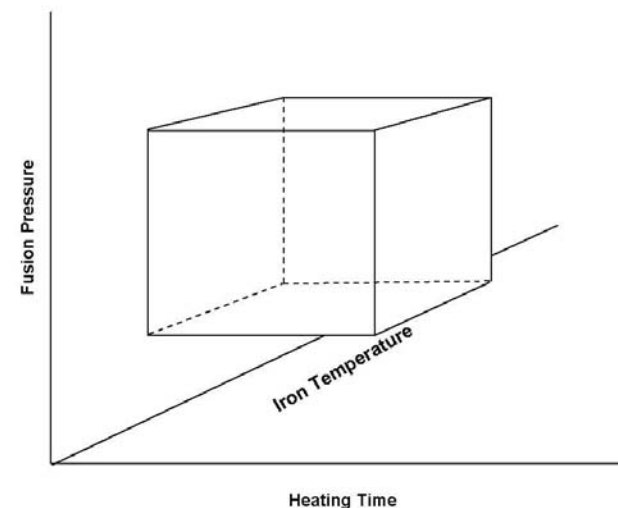
Filing Instructions: Upon completion, this form should be printed, signed and dated. It should then be filed as hard-copy or scanned into PDF format for electronic filing.

Material Evaluator Signature: _____ Date: _____

Supervisor / Manager Signature: _____ Date: _____

Pipeline Construction “Process” Perspective

- Utilities “manufacture” piping systems
 - ✧ World Class Principles can be applied in the development of installation procedures processing “window” concept
 - ✧ For a robust processes aim for process center
- Pipeline Integrity Philosophy
 - ✧ Shift from “detection” to “prevention” mentality
 - ✧ Similar to “Six-sigma philosophy”
 - ✧ Understand and Design for normal process variation
 - ✧ Differentiate between common and special cause variables
 - ✧ Focus on eliminating special cause variations
- Champion incremental, continuous improvement efforts





Quality Philosophy

- **“You can not inspect quality into the product; it is already there”** *Dr. W. Edwards Deming*
- **“Cease dependence on inspection to achieve quality. Eliminate the need for massive inspection by building quality into the product in the first place. ”**
Dr. W. Edwards Deming

Case Study: Saddle Heat-Fusion Special Cause Variable

- Problem: saddle knocked off main during relatively minor impact
- Rare and unusual event. Visual evidence suggested the fusion was performed properly
- Attempt to duplicate the problem
 - ✧ First time – Little information gathered, could not duplicate, chalked up to an isolated case
 - ✧ Second time – Quarantined all equipment and materials used, obtained soil samples, documented installation conditions
- Achieved exact duplication of problem
- Confirmed “special cause” to be dust contamination from the job site soil sample
- Discovery lead to changes in surface preparation technique to improve resistance to dust contamination and removal of oxidized PE layer
- Confirmed existing Company heater adapter configuration requirements.





Surface Preparation Demonstration

- Application of scraping cleaning techniques already used for electrofusion process
- Subsequent benefit realized in example where pipe O.D surface was heavily soiled due to rare soil condition near a refinery
- Surface preparation video





Additional benefits from Improved Saddle Fusion Procedures

- Increase in long-term performance of saddle joints
- Less variation in laboratory testing
- General shift in long-term mode of slow crack growth (SGC)
 - ✧ Significant increase in test time along with shift in SCG location from the fusion interface to through pipe wall crack growth
- Much better visual quality of fusion joints
- Installers are more confident in fusion quality and recognize the improvement over the old abrasion method
- Scrapping method added to ASTM F2620.





Questions?