

# Distribution Polyethylene Pipelines Managing Construction Quality

#### Presented by:

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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

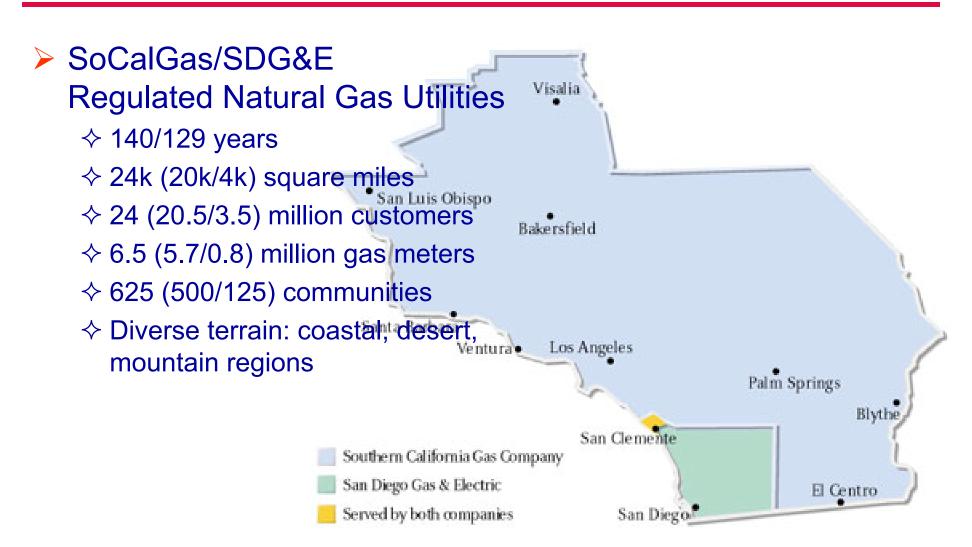


### **Company Stats**

- 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



### **Company Stats**





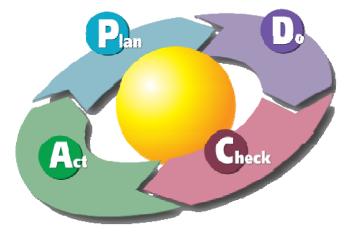
#### **Construction Stats**

- 60,457 (52k/8k) miles of PE mains and services
- Annual Increase in PE Pipe Inventory ≈1,725 mi/yr
   ≈ 9MM ft (average from last 10 years)
- Trained Construction Utility Employees
- 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









#### **Construction Compliance Audit Form**

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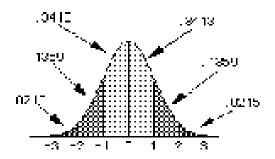
#### Quality Doesn't Start at the Job Site

## 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

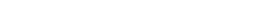


- Operator feedback
- **Continuous Improvement**
- Integrate Approved Materials with Design Process
- ♦ Material/Equipment Evaluation Check List





#### 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	Mate	erial/Equipment Review and Research	49 49	
	а	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	Mate	erial/Equipment Data	(c) 1111 %	
	а	Identify potential suppliers	NO	
	ь	Prepare and submit Data Request	NO	
	c	Compile and compare information received	NO	
3	Eco	nomic Assessment		
	а	Cost/Benefit Assessment	NO	
4	Valid	dation Testing	50 10 10 10	
	а	Identify Suppliers whose product meets min, acceptable requirements	NO	
	ь	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	Man	ufacturer's Quality Assessment	800 V00	
	а	Perform Supplier Assessment (Letter, Site Visit, etc.)	NO	
	b	Partner with Supply Management to initiate procurement process	NO	

#### Material & Equipment Evaluation & Implementation Checklist

		and open for a more for more don pocuments		
	а	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	d Trials and / or Pilot Programs		
	а	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	200	
	а	Update MSP, AM and/or QCII following field trials	NO	
	ь	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	
Fil	ng Ins	structions: Upon completion, this form should be printed, signed and It should then be filed as hard-copy or scanned into PDF		ic filing.
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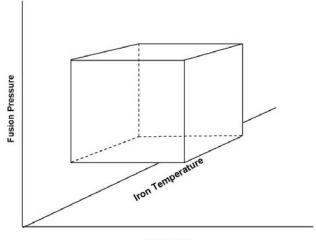


# Pipeline Construction "Process" Perspective

- 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



- ♦ 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



**Heating Time** 



### **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

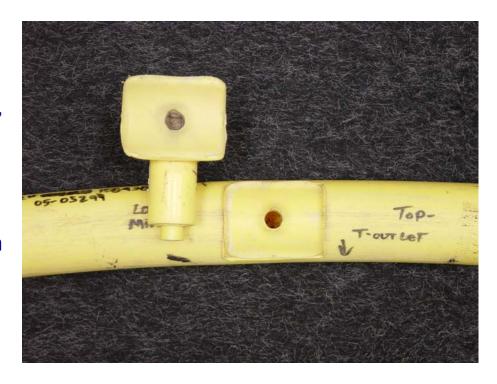


Sempra Energy utilities

## Case Study: Saddle Heat-Fusion Special Cause Variable



- 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?