Detection and Assessment R&D

Bill Amend - Southern California Gas Co.

Representing the
Materials Committee of
Pipeline Research Council International, Inc.

Pipeline R&D Forum
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Today's Briefing

- Committee structure and operations
- Program objectives
- Key projects
- Where do we go from here?

Committee Operations

- **Organization**
  - Committee Chairman
  - Four Program Chairmen
  - Project ad-hoc committees and chairmen
  - PRCI staff support
- **Program/Project Development**
  - Program review / Idea brainstorming (January)
  - Solicitation of planning summaries from contractors
  - Selection of projects (May)
  - Development and approval of proposals (September)
  - Contract funding

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Committee Budget

Program	2004 = $3MM
Assessing and managing in-service damage	**$994K**
Reducing the cost of pipeline construction through new materials and welding processes	$1132K
Maintenance welding	$445K
Integrity issues in advanced materials design	$422K

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Materials Committee Mission

"Improve the performance and integrity of new and existing energy pipelines

and lower the costs of pipeline construction, operation and maintenance

through research, development and implementation of material, joining and inspection technologies"

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Assessing and Managing In-service Damage

Program Statement:

Enable a 25% reduction in the frequency, consequences and associated costs of all types of in-service degradation and damage

by developing improved approaches to damage assessment, damage remediation and the overall framework for damage management by 2006.

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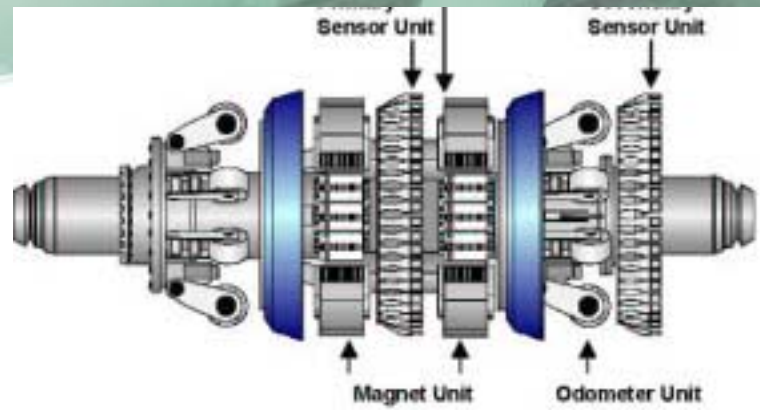
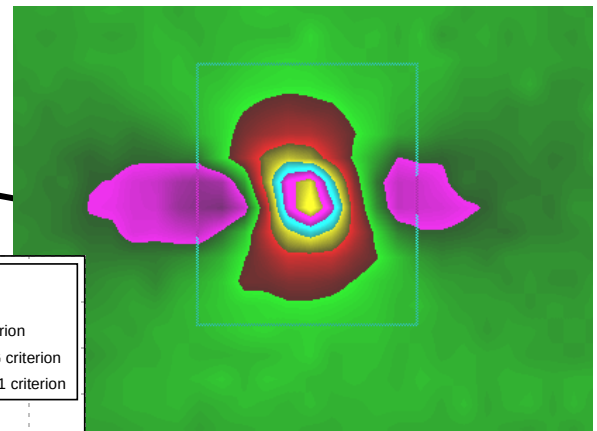
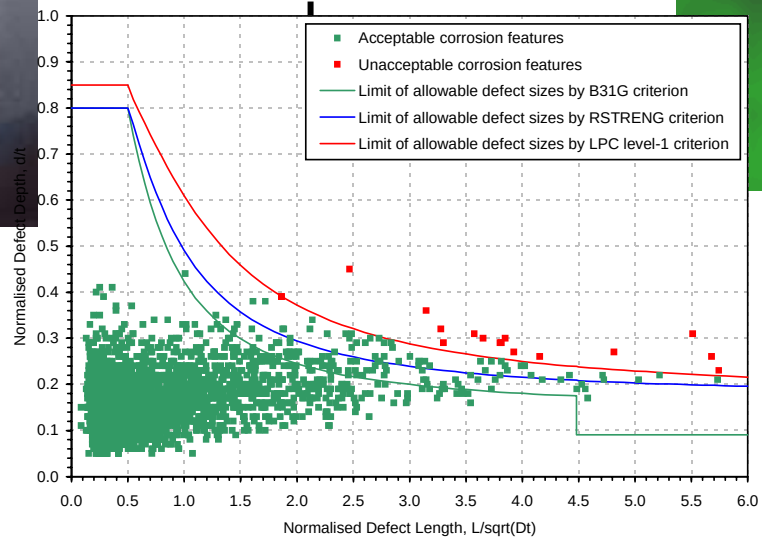
Assessing and Managing In-service Damage

- Managing Corrosion
- Managing SCC
- Managing Mechanical Damage / Geotechnical Hazards
- Integrity Management Framework



Damage Assessment Methodology





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Damage Assessment and Management

Corrosion Objectives

- To develop a comprehensive and self-consistent suite of easy-to-use methods for assessing the structural significance of corrosion defects, covering the full range of situations found in service

- To ensure that these methods can readily be interfaced with ILI and other inspection data as part of the overall damage management process

Damage Assessment and Management

Corrosion

- **Structural significance – remaining strength**

  (12 completed projects, 6 active projects, $300,000/yr)

  - RSTRENG
  - Combined US-European database of test results
  - Improved methods based on plastic collapse
  - Closely spaced defect clusters
  - Older materials with low toughness/ductility
  - Corrosion at seam and girth welds
  - Co-existing corrosion and SCC
  - Influence of secondary loading
  - Cyclic pressure loading, higher strength steels

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Damage Assessment and Management

SCC Management

- **Prevent SCC:**
  - Ranking susceptibility to crack initiation
  - Effects of operating practices
- **Assess significance:**
  - Crack acceptance criteria
  - Crack growth and coalescence
  - Effect of pressure fluctuations on crack growth
- **Detect/categorize:**
  - ILI, DA, dig site selection

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Damage Assessment and Management

Mechanical Damage Management

	DC & O	Materials	C & I
Mitigate by design	10	2	-
Monitor, prevent	6	3	-
Detect, characterize	-	3	8
Structural significance	6	7	1
Remediate, repair	-	5	-
Failure trends	4	5	-
Damage management	1	5	1

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Damage Assessment and Management

Mechanical Damage Management

- Resistance to external damage
- Mechanical damage at welds
- Mechanics and kinetics of delayed failure
- Gap analysis - outstanding issues

Damage Assessment and Management

Integrity Management Framework

- Damage management for operating pipelines – gap analysis
- Safe use of low-toughness pipe
- Properties of pipe and welds
  - Seam weld properties in early-generation pipelines
  - In-situ property determination
  - Pipe property database
- Reliability of girth welds

Future Funding Requirements for On-Going Research

- Integrity of corroded seam and girth welds = $100K for 2005
- Improved remaining strength assessment for corroded pipelines = $50K for 2005
- Direct assessment approaches for mechanical damage = $50K for 2005

Current and Future Needs

- **How to Optimize Assessment Intervals?**
  - What is a meaningful corrosion or cracking rate?
  - What is the most appropriate assumption for the shape (aspect ratio) of growing corrosion or cracking?
  - Do different steels show different corrosion rates?
  - How accurate/reliable is ILI data on flaw size?
  - Should mechanical damage be included with corrosion?

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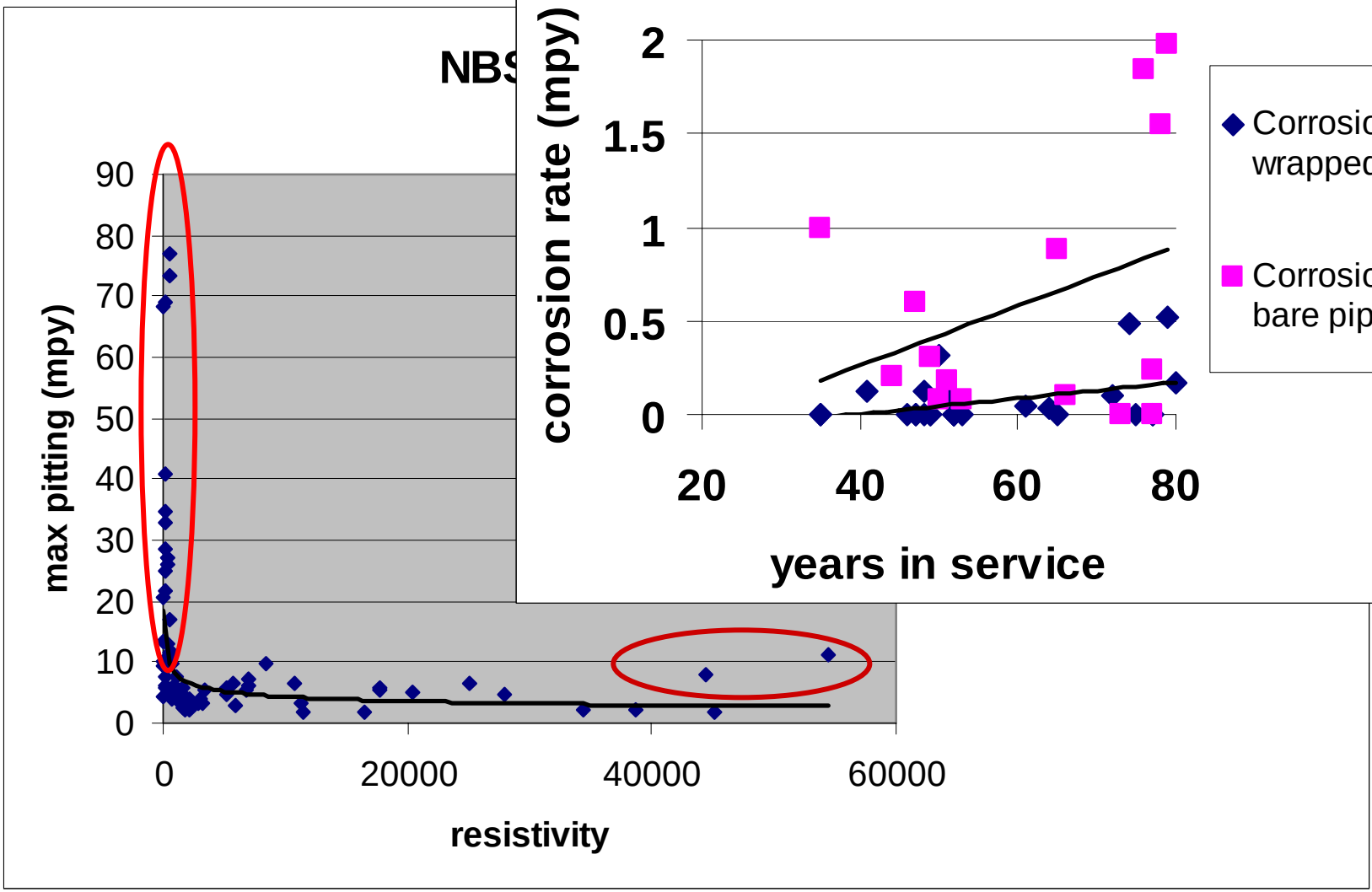

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Current and Future Needs

- **Data and procedures to support probabilistic analysis of integrity and risk**
  - What to do in the absence of detailed historical information?
  - “User friendly” procedures

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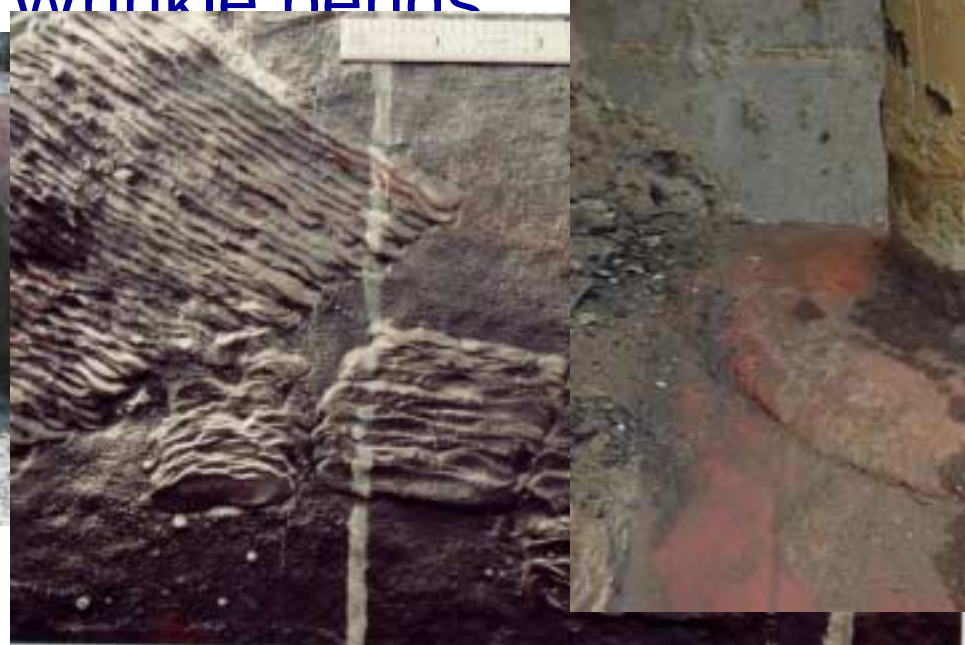
- **Improved ability to assess fittings and early generation pipeline feature**
  - Branches and fittings
  - Miter bends
  - Wrinkle bends



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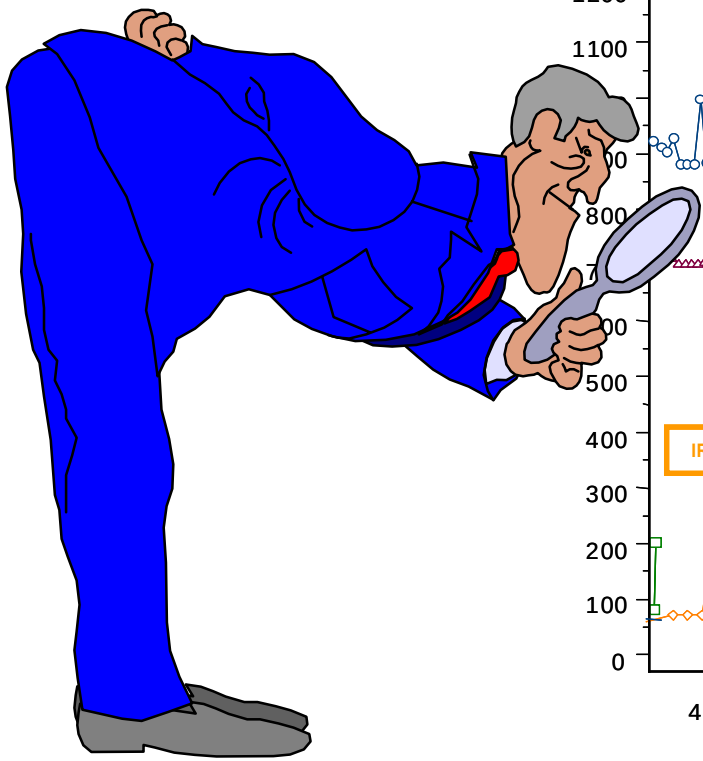
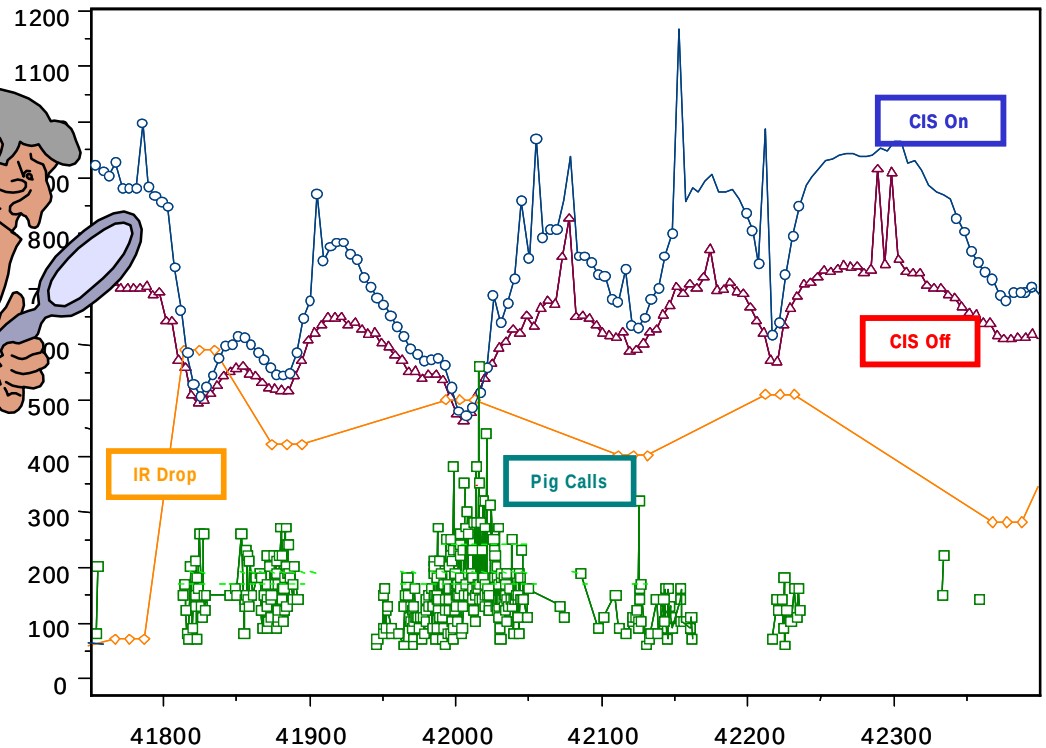
- **Improved indirect or remote flaw assessment to minimize need for exploratory excavations**





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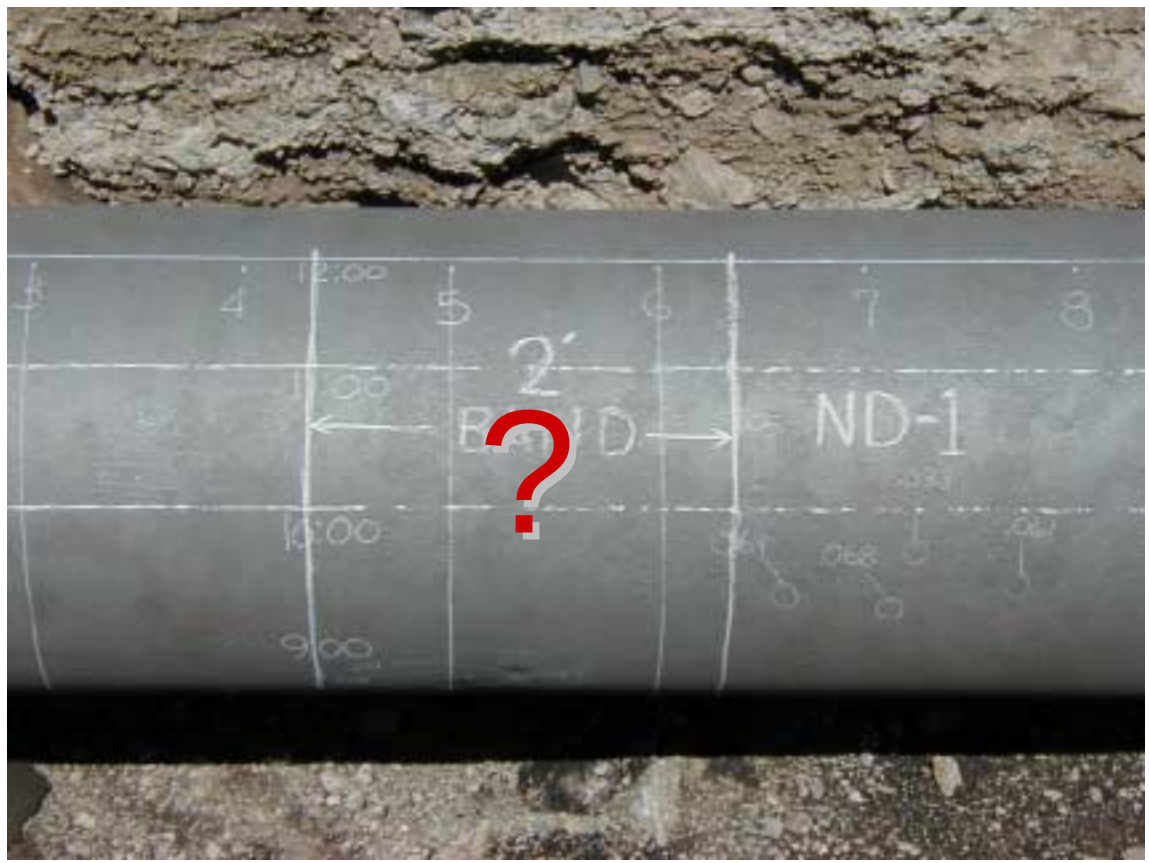
- **Cost effective options for assessment and repair of low stress (<30-40% SMYS) pipelines**



Contact Details

Bill Amend
Southern California Gas Company
213 244-5277
Bamend@SempraUtilities.com

Pipeline Research Council International Inc.

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