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## An Overview of PRCI's Research Program

Christina Sames

*Pipeline Research Council International, Inc.*

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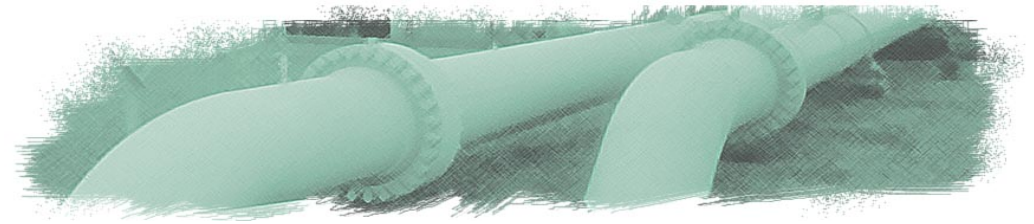
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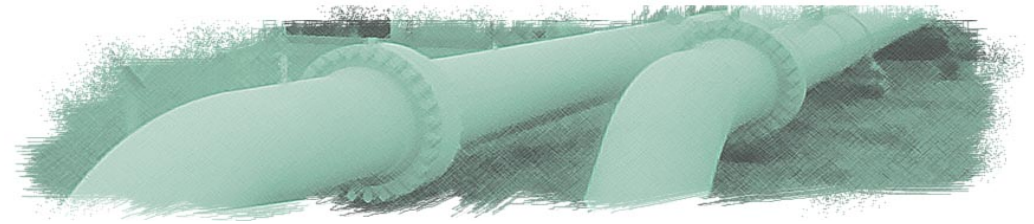
# An Overview of PRCI's Research Program

Christina Sames  
Pipeline Research Council International, Inc.  
API 2004 Pipeline Conference



**PRCI**

*Technology for Energy Pipelines*



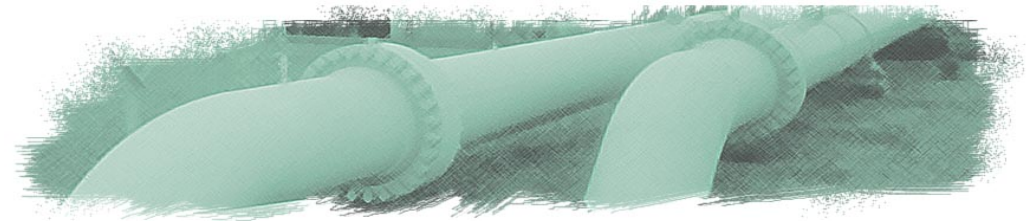
# Today's Briefing

- ➔ **Overview of PRCI**
- ➔ **2003/2004 Focus**
- ➔ **Project Highlights**
- ➔ **Future Focus**



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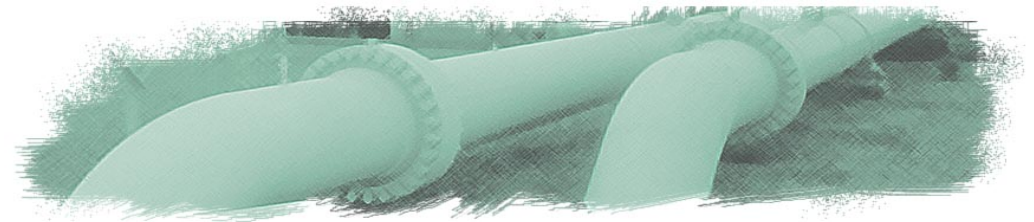
# **Pipeline Research Council International, Inc. (PRCI)**

**A collaborative technology  
development organization  
*Of, By, and For*  
the energy pipeline industry**



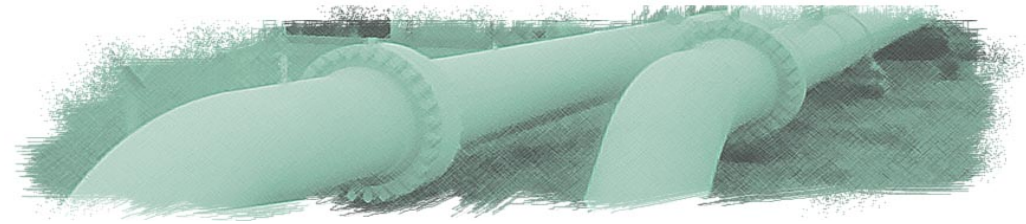
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## **A PRCI Snapshot**

- ➔ **Established in 1952 by 15 North American natural gas companies to address long-running brittle fractures.**
- ➔ **Not-for-profit corporation since 2000**
- ➔ **Current membership:**
  - 33 national & international pipeline companies
  - 300,000 miles of natural gas & hazardous liquid pipelines
  - AOPL
  - GTI



# Who We Are



EXPLORER PIPELINE COMPANY



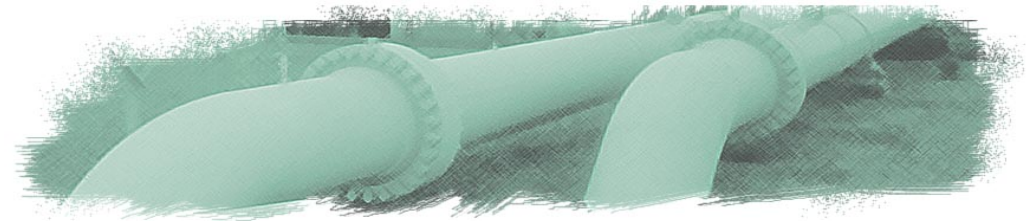
Buckeye Partners, L.P.





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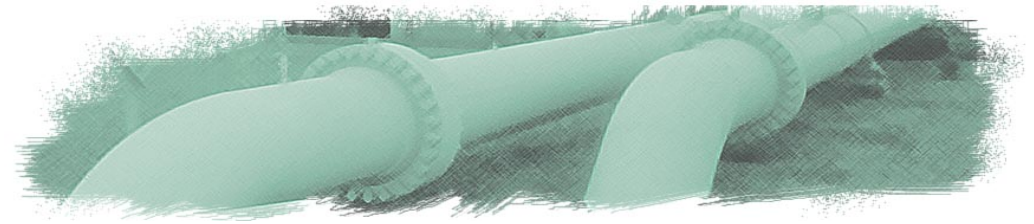
## **How Does it Work?**

- ➔ Pipeline member technical experts plan & manage the technical agenda**
- ➔ One Member/One-Vote on the Board & Technical Committees**
- ➔ Members Have Free Access to All PRCI Technology**
- ➔ More Than \$185MM Contributed Since 1952**



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## **PRCI Technical Committees**

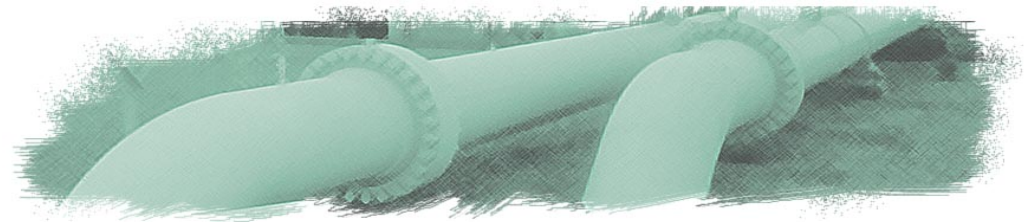
- ➔ Corrosion and Inspection**
- ➔ Design, Construction, and Operations**
- ➔ Materials**
- ➔ Measurement**
- ➔ Underground Storage**
- ➔ Compressor and Pump Station**





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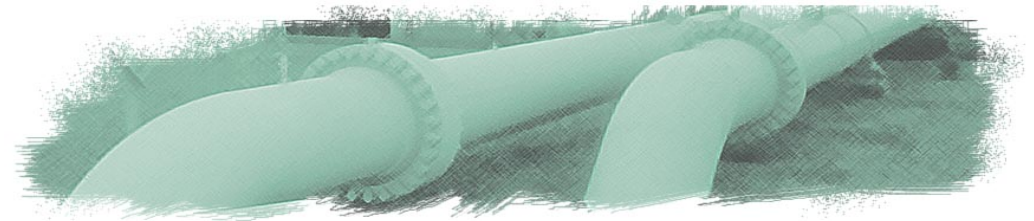
## R&D Budgets

<u>Program (\$MM)</u>	<u>2003</u>	<u>Co-fund</u>	<u>2004</u>	<u>Co-funds</u>
Design, Const. & Ops.	\$1.6MM	\$1.0MM	\$2.0MM	\$1.5MM
Materials	3.0	0.6	3.0	1.8
Corrosion & Inspect	3.8	0.5	3.7	3.1
Compressor & Pump	1.4	1.9	1.3	0.9
Underground Storage	0.6	0.7	1.0	1.5
Measurement	<u>0.7</u>	<u>0.3</u>	<u>1.0</u>	<u>0.4</u>
<b>Total</b>	<b>\$11.1MM</b>	<b>\$5.0MM</b>	<b>\$12MM</b>	<b>\$9.2MM</b>
	<b>2003 total \$16.1MM</b>		<b>2004 total \$21.2MM</b>	



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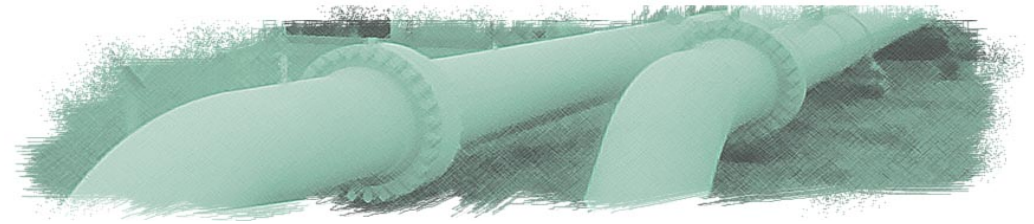
## **PRCI Committees**

- **Corrosion and Inspection**
  - ILI for mechanical damage, cracks, & geometry, direct assessment, coatings & inspection tools, SCC, MIC
- **Design Construction and Operations**
  - Implementing new integrity standards, reliability based design, preventing 3<sup>rd</sup> party damage, human factors, abnormal external loads, wrinkles/ripples
- **Materials**
  - Stronger steels, (X100 and beyond), repair & assessment tools, new welding and inspection processes, processes to lower construction costs



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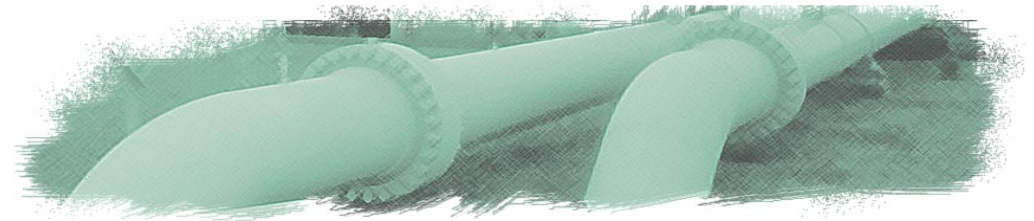
## **PRCI Committees**

- **Compressor and Pump Stations**
  - Flexibility, Life Extension & Reliability, Engine Efficiency and Environmental Compliance
- **Measurement and Metering**
  - Reliability and Accuracy, Wet Gas Solutions, Product/Pipe Compatibility and Integrity
- **Underground Storage**
  - Cavern Safety, Productivity, & Deliverability
  - Cavern Expansion



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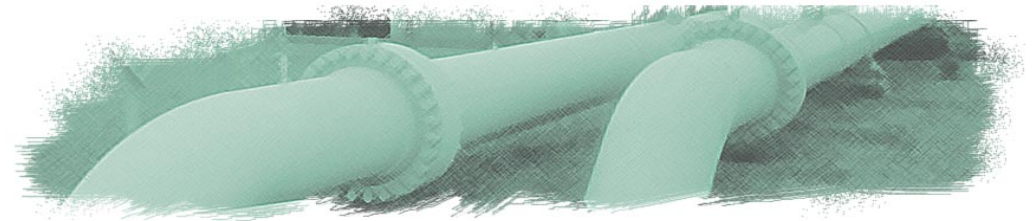
# Corrosion and Inspection Programs

- ➔ **7 Programs, ~ \$11MM in 2003/04**
  - Locate Mechanical Damage
  - Enhance Integrity of Non-piggable Pipelines
  - Protect Shielded Pipe and Enhance Environmental Corrosivity Models
  - Identify and Prioritize Locations for Internal Corrosion Inspection, Monitoring, and Mitigation
  - Optimize Integrity Assessment Intervals
  - Improve SCC detection, assessment and management
  - Improve CP System Effectiveness



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## **Corrosion and Inspection Projects**

### **➔ Locate Mechanical Damage**

- Details of Defect Induces in MFL Signals

Total funding: \$2.2M

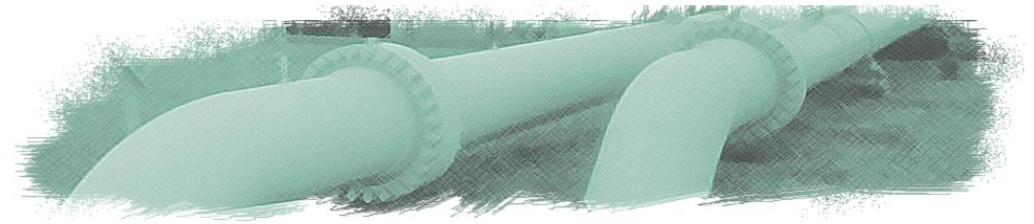
Model MFL signal responses to determine stress fields and detect mechanical damage

Completion: 2005



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## **Corrosion and Inspection Projects**

### **➔ Improve CP System Effectiveness**

- Develop Quantitative Relationships Required to Define Mitigation Levels Necessary to Prevent Corrosion**

**Total funding: \$500K**

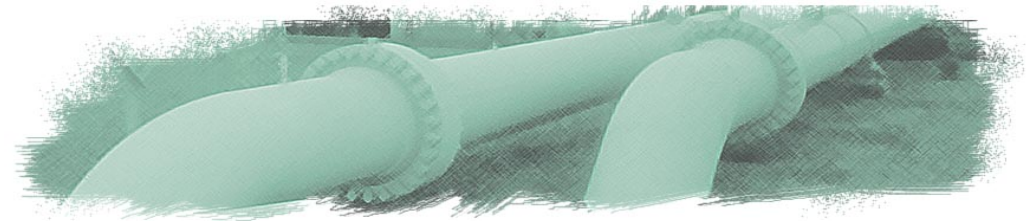
**Model distribution paths of AC in confined corridors and suggest mitigation strategies**

**Completion: 2005**



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## **Design, Construction, and Operation Programs**

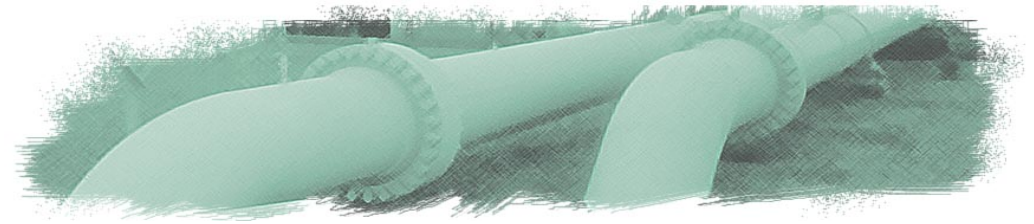
### **➔ 7 programs and ~ \$6MM in 2003/2004**

- Prevention of 3<sup>rd</sup> party damage
- Implementing integrity standards
- Reliability-based design alternatives
- Determination of maximum safe surface loads
- Leak detection and notification
- Prevention of critical pipeline strains
- Solutions for adverse crossings



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## **Design, Construction, and Operation Programs**

### **➔ Prevention of 3<sup>rd</sup> party damage**

#### **– Detection & Monitoring:**

**Develop acoustic monitoring for mechanical damage, satellite imagery for unauthorized encroachment and ground movement, and software to detect changes in radar images**

**Total funding: \$1.7M**

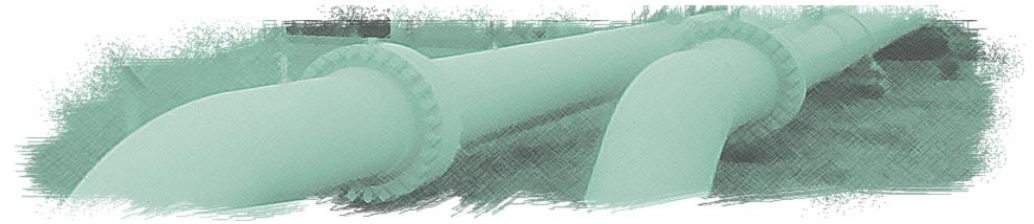
**Completion: 2004**





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## **Design, Construction, and Operation Programs**

### **➔ Leak Detection and Notification**

– Liquid Release Detection:

Parametric based model to lower the leak detection threshold for liquid pipelines

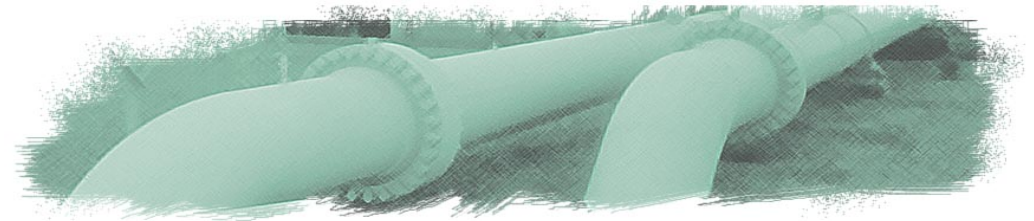
Total funding: \$400K

Completion 2005



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## **Design, Construction, and Operation Programs**

### **➔ Prevention of Critical Pipeline Strains**

- Pipe – Soil Interaction: \$700K in 2003/2004

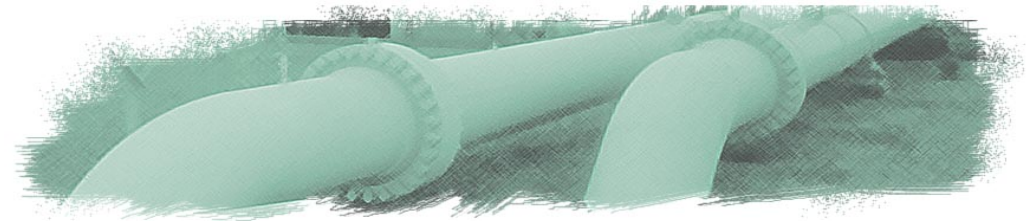
Models and methods for addressing pipe-soil interaction effects in design and mitigation (including frozen soils)

Completion: 2004



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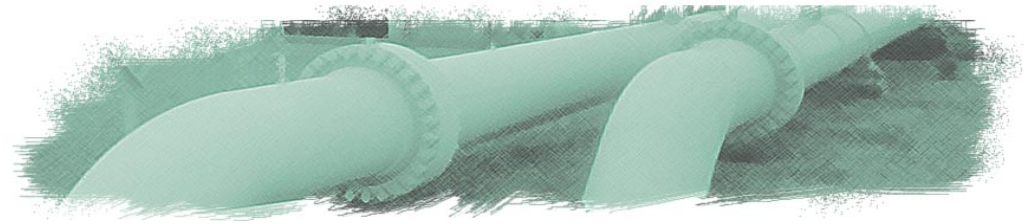
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## **Materials Programs**

### **➔ 4 Programs, ~ \$9MM in 2003/04**

- Integrity Assessment and Management of in-service damage**
- New Materials and Welding Processes to Lower the Cost of New Pipeline Construction**
- Maintenance Welding Techniques**
- Advanced Material Design, Safety, and Integrity**



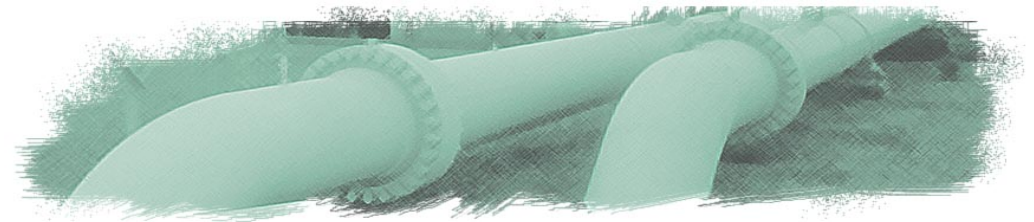
## Materials Projects

- ➔ **Integrity Assessment and Management for In-Service Damage**
  - SCC Crack Extension and Coalescence Modeling: Extend the SCC crack growth model to project SCC behavior over time under generalized loading conditions
  - SCC Avoidance in Ethanol Pipelines: Identify the primary factors and range of service conditions likely to cause SCC in ethanol pipelines



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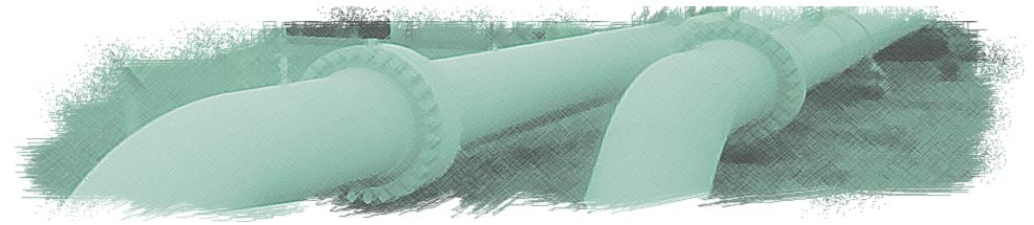
## Materials Projects

- ➔ **Integrity Assessment and Management for In-Service Damage**
    - Assessment of Remaining Strength of Corroded Pipe
- Guidance to assess remaining strength of corroded pipe subject to biaxial & cyclic loading, of corroded higher strength pipe (x80/100), & failure pressure of corrosion defects in low toughness pipe
- Total funding \$400K
- Completion 2005



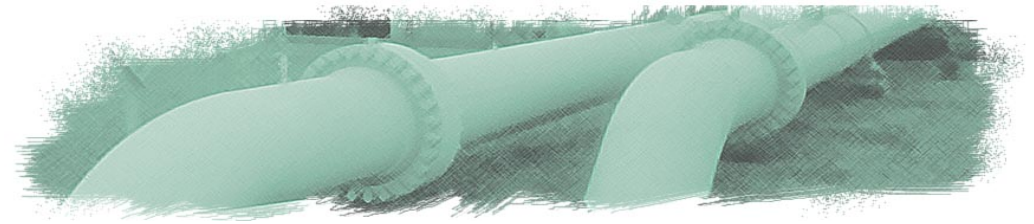
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## **Materials Projects**

- ➔ **New Materials and Welding Processes**
  - Improved Welding Methods for Pipelines
    - Multi-wire GMAW procedures for high speed, high deposition fill pass welding
    - Total funding \$500K
    - Completion 2005



## **Contact Details**

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**[www.prci.org](http://www.prci.org)**