

Pipeline Research Council International, Inc.

Government/Industry Pipeline R&D Forum Anomaly Remediation/Repair Technical Track PRCI Overview

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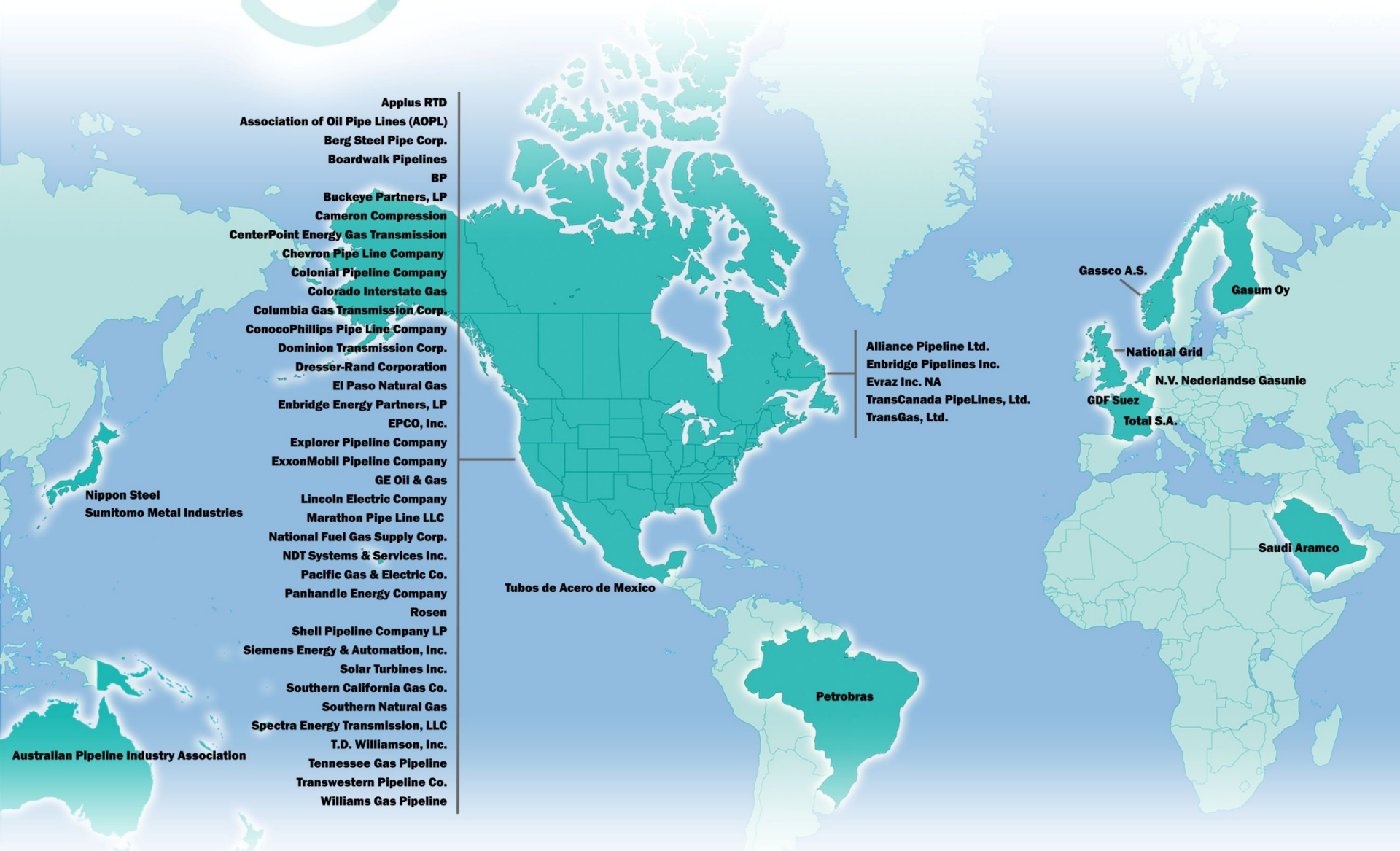
Overview

2

- **PRCI – Mission & Membership**
- **The PRCI Research Cycle/Process**
- **Ongoing Research Related to Pipeline Repair**



LEADING PIPELINE RESEARCH WORLDWIDE



- Applus RTD
- Association of Oil Pipe Lines (AOPL)
- Berg Steel Pipe Corp.
- Boardwalk Pipelines
- BP
- Buckeye Partners, LP
- Cameron Compression
- CenterPoint Energy Gas Transmission
- Chevron Pipe Line Company
- Colonial Pipeline Company
- Colorado Interstate Gas
- Columbia Gas Transmission Corp.
- ConocoPhillips Pipe Line Company
- Dominion Transmission Corp.
- Dresser-Rand Corporation
- El Paso Natural Gas
- Enbridge Energy Partners, LP
- EPCO, Inc.
- Explorer Pipeline Company
- ExxonMobil Pipeline Company
- GE Oil & Gas
- Lincoln Electric Company
- Marathon Pipe Line LLC
- National Fuel Gas Supply Corp.
- NDT Systems & Services Inc.
- Pacific Gas & Electric Co.
- Panhandle Energy Company
- Rosen
- Shell Pipeline Company LP
- Siemens Energy & Automation, Inc.
- Solar Turbines Inc.
- Southern California Gas Co.
- Southern Natural Gas
- Spectra Energy Transmission, LLC
- T.D. Williamson, Inc.
- Tennessee Gas Pipeline
- Transwestern Pipeline Co.
- Williams Gas Pipeline

Nippon Steel
Sumitomo Metal Industries

Australian Pipeline Industry Association

Tubos de Acero de Mexico

Petrobras

Alliance Pipeline Ltd.
Enbridge Pipelines Inc.
Evraz Inc. NA
TransCanada PipeLines, Ltd.
TransGas, Ltd.

Gassco A.S.

Gasum Oy

National Grid

N.V. Nederlandse Gasunie

GDF Suez

Total S.A.

Saudi Aramco

PRCI Membership Drives Research

4

- **39 Energy Pipeline Operating Companies**
 - 26 Natural Gas Transmission; 11 Liquid
 - 2 Operators - both Liquid and Natural Gas Transmission
- **World-wide Research Organization**
 - 27 U.S. Companies
 - 12 Non-U.S. (Brazil, Canada, Europe, Saudi Arabia)
- **14 Associate Members**
 - U.S.; Canada; Mexico; Japan

PRCI Research Development & Implementation

5

6 Technical Committees in Two Research Programs:

Pipelines

Design, Materials & Construction

Operations & Integrity

Corrosion

Facilities

Compressor and Pump Stations

Measurement

Underground Storage

Long Term Research Initiative

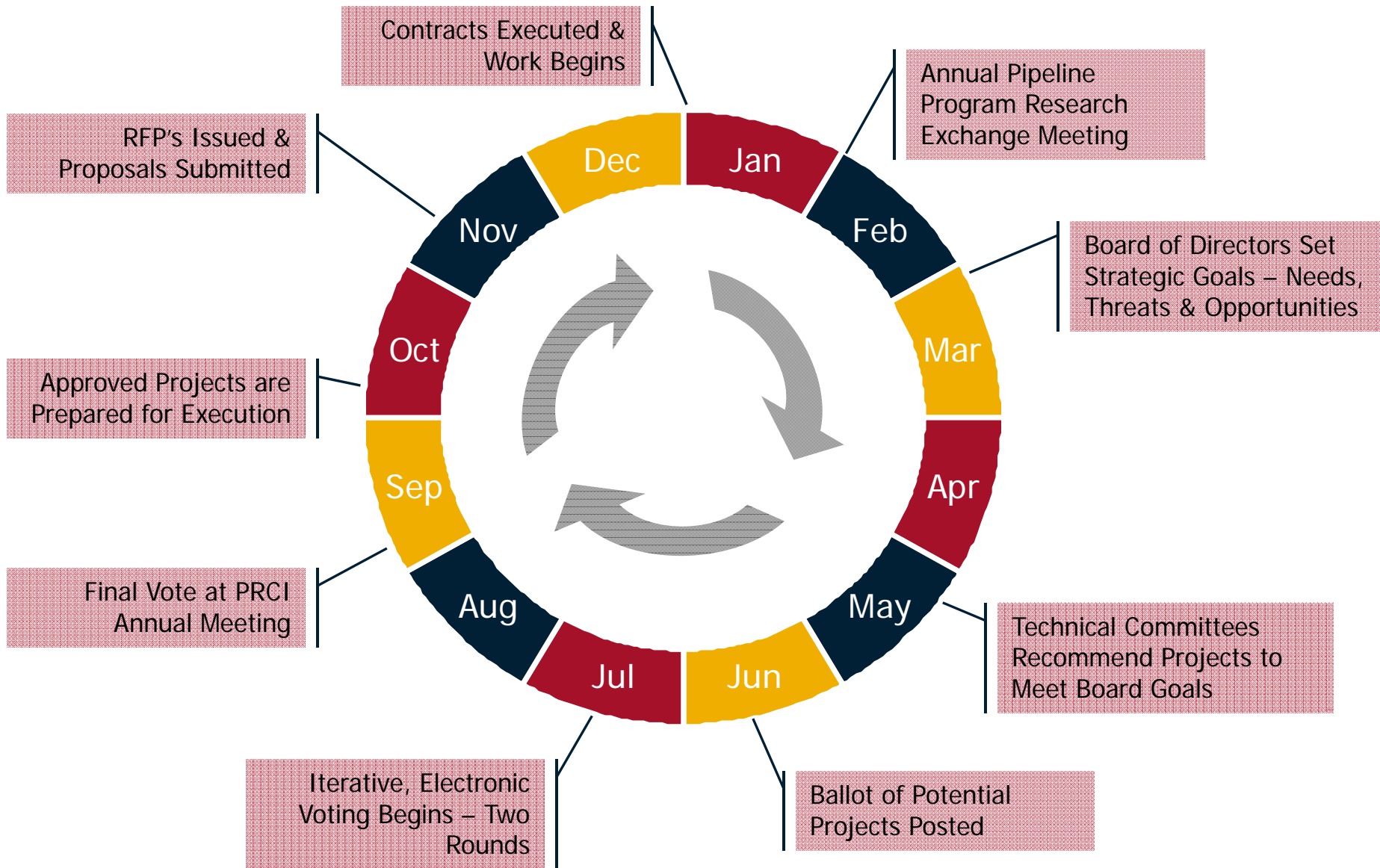
PRCI Research Development & Implementation

6

- **Research Project Development**
 - *Annual process - ballot voting and project funding*
 - *Approximately \$10 + MM annual funding commitments*
 - *Includes membership allocations and other funding sources*

 - **Success through Collaboration**
 - *Within the membership*
 - *Other organizations*
 - Industry groups and trade organizations
 - PHMSA
 - Other co-funding sources with interest
- 

PRCI Annual Planning Cycle





Design, Materials & Construction

		Timing	
		Not-immediate	Immediate
Importance/ Impact	High		
	Low		

Design, Materials & Construction

		Timing	
		Not-immediate	Immediate
Importance/ Impact	High	<p>Modeling tools for Rapid Dent/Gouge Analysis/Evaluation (off shore) (need DOT & Broad Industry Involvement) PL Damage Response Guidelines linked to US/Intl Codes Offshore leak test Design Guidelines: Internal corrosion new PL Discriminate between Mfgr & Constr defects Guideline: Mechanized welding Repair/AUT</p>	<p>Rapid Dent Gouge Analysis (On shore) HDD and Crossing Design – Analysis & Regulatory Alternatives RBDA based response to 3d party construction encroachments Increase Efficiency of on-shore PL constr Increase Utilization Factor to 80% - Scientific Based Approach Alternative/Composite Material Repair Methods Gaps in Guidelines for Strain Based Design (need compressive strain limit, strain demand) (2)</p>
	Low		<p>CO2 Transport PL & Mechanical Validate R-STRENG Model in >X80 Design Guidelines: High Temp/Pressure PL</p>

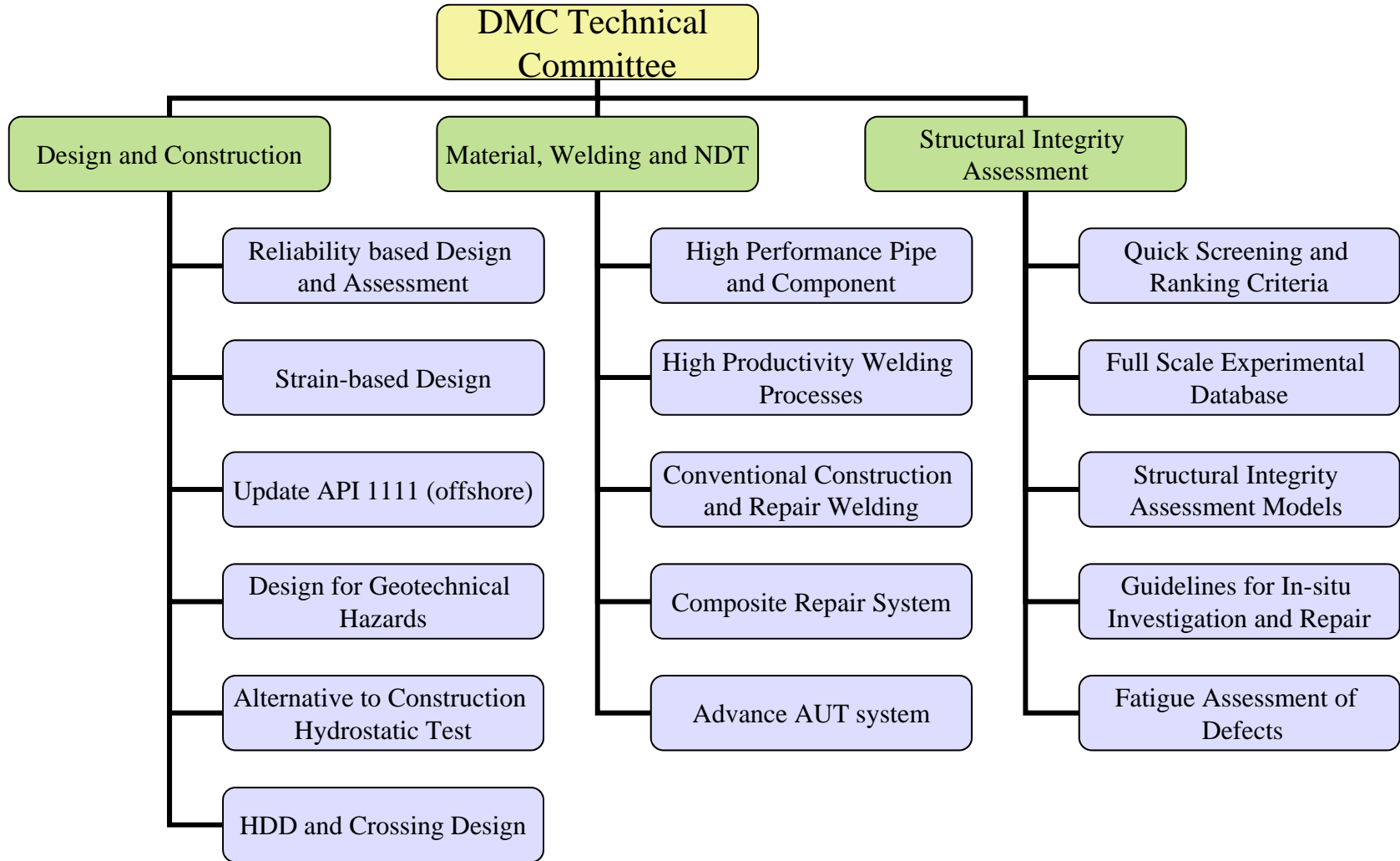
The Product & How it was Used:

2009 Board Identified Research Requirements & DMC TC Responses

10

Board Identified Research Requirements	Board Established Priority		Continuing Work on Ballot			Ballot Items for New Work	
	Importance	Timing	Project #	Existing Project Title	Start Year	New Project #	New Project Title / TC Response if No New Project is Recommended
Rapid Dent/Gouge Analysis (On Shore)	High	Immediate			2006	None Recommended	Existing prior funded projects (MD-2) provide the technical basis to progress on this; ~ 1 yr to readiness for DOT engagement in the approach.
HDD & Xing Design - Analysis & Regulatory Alternatives	High	Immediate				None Recommended	Existing draft PRCI guidelines partially address when/where use of HDD is appropriate.
RBDA Based response to 3d Party Construction Encroachments	High	Immediate	ABD-2-1	Reliability Based Design Assessment for Liquid Pipelines and Gas Facility Piping	2006	None Recommended	Existing PRCI Published Guideline believed to address this issue. In Canada, Annex O meets this need. Similar process needs to be completed in the US so that Class location changes can be supported by US Standards.
Increase Efficiency of On-shore PL Construction	High	Immediate	MATI-7	Alternative to Pre-Service Hydrotest	2007	CNST-2-1	Comprehensive Construction Improvement Program
			ENV-2	Near P/L Blasting Efficiency	2006		
Increase PL Utilization Factor to 80%-Science Based Approach	High	Immediate				None Recommended	A JIP is ongoing outside of PRCI targeting a new standard in this area.
Alternative/Composite Matl Repair Methods	High	Immediate	MATR-3-3 MATR-3-4	LT Testing Composite repair Systems	2008	MATR-3-5	Composites for Repair of Mech Damage
Fill Gaps in Strain Based Design Make Guidelines Usable	High	Immediate	ABD-1	Tensile Strain Limits for SBD	2006	ABD-3-1	Strain Demand ROW Characterization
			ENV-5	Strain Demand Soil Load Testing	2008	ABD-3-2	Strain Demand Seismic Loading
Modeling Tools for Rapid Dent Gouge Analysis/Eval (Off Shore)	High	Non-Immediate				SPDA-1-2	Guideline for Rapid Response to Offshore Mechanical Damage.
P/L Damage Response Guidelines linked to US/Intl Codes	High	Non-Immediate				None Recommended	Identified as a outcome of the MD projects. Limited by advance of technology believed to be 2 yrs in the future
Discriminate between Mfgr and Constr defects in existing P/L	High	Non-Immediate				None Recommended	Prior Kieffner work grouped mfg & constr defects together but once the line passed pressure test they were no longer considered. TC recommends individual evaluation of incidents in this area due to wide variance of possible circumstances.
Guideline: Mechanized welding Repair/AUT	High	Non-Immediate	MATI-9	Advanced AUT Systems Qualification	2008	MATH-5-1	Guidelines for Mechanized GMAU on Hi Strength P/L
						MATI-10-1	IWEX for Girth Weld Anamolies - New Technology
CO2 Transport - PL & Mechanical Equipt.	Low	Immediate				ALT-1-1	CO2 Comprehensive Research Program Development
Design Guidelines: High Temp/Pressure PL (i.e. P>10,000 psi;T>350F)	Low	Immediate				None Recommended	JIP on this subject (SAFEBCUC) develops good expertise among a few key contractors in this specialized design area. These firms are available to all owner builders. Also, there are two projects on the ballot advanced by the Corrosion TC (EC-3-7 and EC-3-9) that examine the performance of currently available coatings at temperatures above 150 degrees F. These projects deal with higher temperatures but temperature levels below the lower end of the high temperature regime.
Validate the R-STRENG Model for >X80 Pipe	Low	Immediate				Not Recommended	Draft Avantica Report confirms that R-Streng is OK for up to X-100 & 60% depth of defect. When deep defects are present (>60%), a more precise application of R-STRENG is needed. TC recommended course of action is to await the outcome and Final Report of the Avantica work.

Current Program - High Level View



Current Program Related to Pipeline Repair

12

■ Material, Welding and NDT

■ Welding:

- *Enhancements to Thermal Analysis Model for Hot Tap Welding; ECD Sep 2009*
- *Development of Criteria/Guidelines for Welding onto In-Service Chemical Pipelines; ECD Sep 2009: MAT -3-2*
- *Interpretation and Guidelines for Application of API 1104; ECD Sep 2009: API-1-2*

■ Facilitate the development/application of high performance materials/ components:

- *Design and performance of composite repair systems: MATR-3-3/4,5*
- *Fracture initiation in high strength steel line pipe - gap study: MAT-4-4*
- *Criteria for evaluating failure susceptibility due to axial cracks; ECD Sep 2009: MAT-8*

■ Structural Integrity Assessment

- Collect dent and gouge data from in-service pipelines and develop quick ranking process: MD-2-1, MD-2-2
- Develop full scale experimental database: MD-4-1 to MD-4-7 inclusive
- Develop guidelines for investigation and repairs: MD-5

Anomaly Remediation/Repair

Questions/Discussion