

# Gas Operations Research Pipeline Integrity and Safety

CEC Natural Gas R&D Workshop  
July 16, 2015



A  Sempra Energy utility

**Edward Newton**  
Research & Materials Manager  
Gas Engineering



# Operators Perspective - System Threats



## Distribution

- Damage Prevention
- Improving Design of Fittings & Joints
- Data & Information Management
- Improving Distribution Risk Models

## Transmission

- Damage Prevention
- Reliable Anomaly Detection & Sizing
- Tools for Difficult-to-Inspect Systems
- Improving Transmission Risk Models



# Pipeline Safety & Integrity

**Damages are still the highest Risk for both Transmission and Distribution**

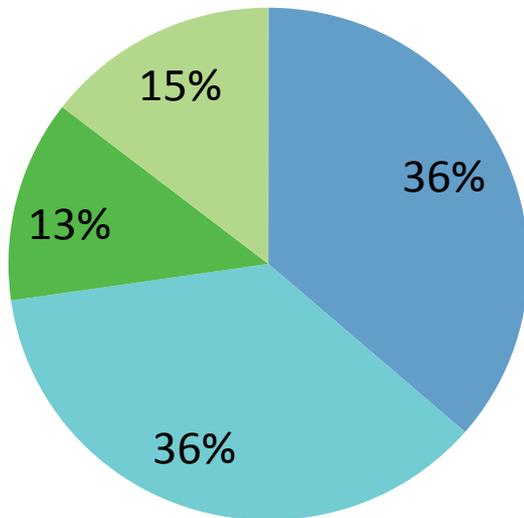


**Know what's below.  
Call before you dig.**

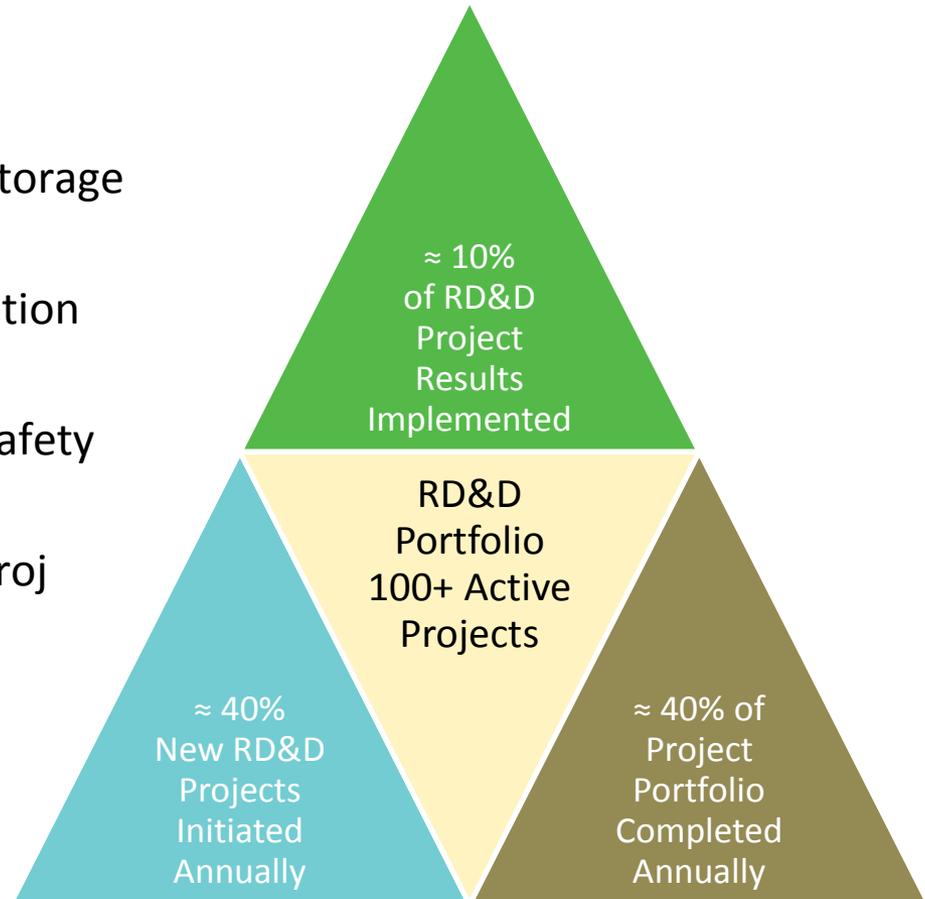


# RD&D Budget & Results

## Gas Operations RD&D Budget (2.75MM/Yr)



- Trans/Storage
- Distribution
- Env & Safety
- Prgm/Proj Mgmt



# Damage Prevention

## Description

Demonstrate accuracy of fiber optics-based damage prevention systems on pipeline rights-of-way.



## Drivers & Benefits

Monitor ROW and prevent damage from third-party excavations near pipelines.

## Status & Results

- Algorithms developed by fiber optics vendors used to detect events on the ROW have improved significantly in accuracy over the years. Minimizing false alarms will enhance operational effectiveness and reliability.
- Two competing fiber optics systems were installed and tested at PSE&G's test track site in New Jersey. The tests included detecting the presence of excavating equipment and vehicles
- Fiber optics system demonstration planned over 3 mile section of a new 30" line under urban street in late 2015.

2012 Initiate

Develop

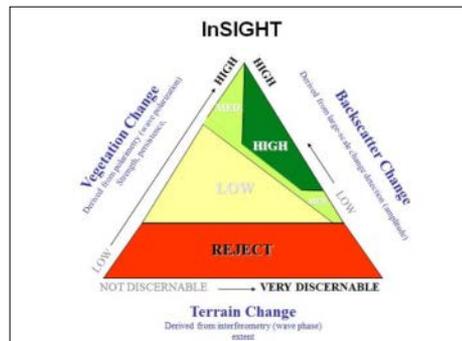
Commercialize

2015 Deploy

# MDA Geospatial

## Description

Evaluate use of satellite imagery for terrain related risk assessments and alerts near pipelines.



## Drivers & Benefits

- Use of radar satellite imagery and data analysis to enable terrain-related risk assessments and alerts of geo-hazards along transmission pipelines.

## Status & Results

- Wide-area deformation mapping was completed using MDA's proprietary InSAR processing algorithms. Low coherence due to high seasonal changes in vegetation, combined with the small existing slide and flow area sizes, led to challenges in detecting deformation.
- A risk index tool, called InSIGHT (Information Status In Geo-Hazardous Terrain), will interpret data.
- PRCI has picked up next phase of project.



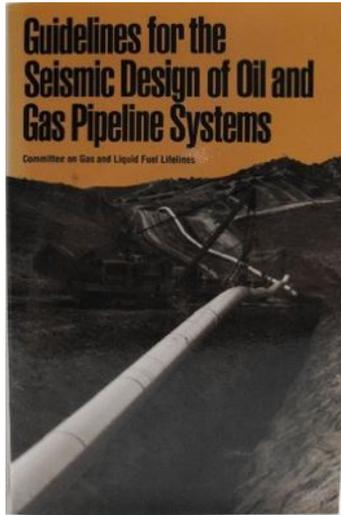
# Seismic Design Guidelines (PRCI)

## Description

Update the 2004 PRCI seismic design and guidelines based on new studies and data.

Update seismic guidelines that consider:

- Advancements in the level of understanding of seismic hazards
- Approaches to developing performance requirements for pipelines exposed to rare natural hazards, and strain-based design and analysis methods.



## Drivers & Benefits

- The PRCI seismic design and assessment guidelines have been widely used since being published in 2004 and are used by the California State Lands Commission for assuring adequate design of on-shore and near-shore pipelines.
- Update guidelines with recent developments, such as:
  - Improvements in wave propagation, probabilistic and reliability methods, liquefaction assessment, buoyancy effects, and defining design fault displacements.

## Status & Results

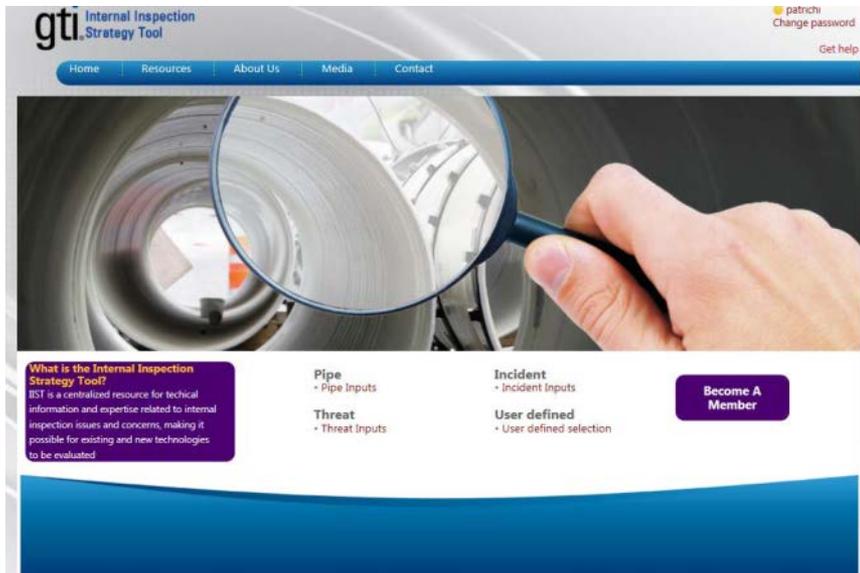
- Guidelines to be published in 2016.



# Inspection Technology Strategy Tool (OTD)

## Description

Develop an Inspection Technology Strategy Tool that combines the info, docs and datasets owned by GTI, INGAA, PRCI, and OTD to create a software tool / relational database.



## Drivers & Benefits

- Industry needs improved and advanced inspection tools
- Vendors need to understand the market for new inspection tools
- Operators need to understand the capabilities of existing tools to develop inspection programs Status & Results

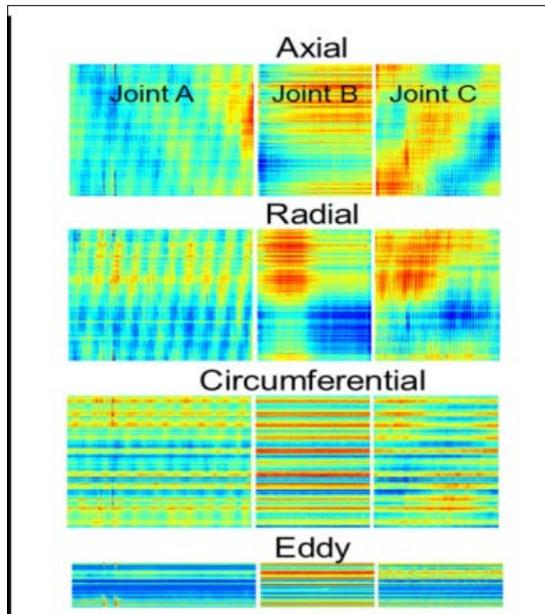
## Status & Results

- Assessed ability of existing inspection technologies to detect/quantify typical defects that would fail a hydrotest.
- Quantified failure frequencies for individual and interactive threats based on pipe vintage, dia., W.T., coating type, seam type, etc.
- Quantified mileage of pipe that cannot be assessed with existing inspection technologies.

# ILI Technology Improvements (PRCI)

## Description

Improve the performance of existing tools and develop new tools for key threats.



## Drivers & Benefits

- Evaluate the use of ILI technologies to supplement operator data when records are either limited or unknown.
- Provide a validated method for using ILI technology to determine the properties of pipe where information may be absent or uncertain.

## Status & Results

- This is an on-going multi-year program with multiple phases/tasks.

2014 Initiate

Develop

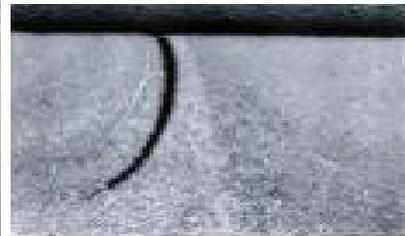
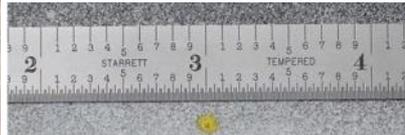
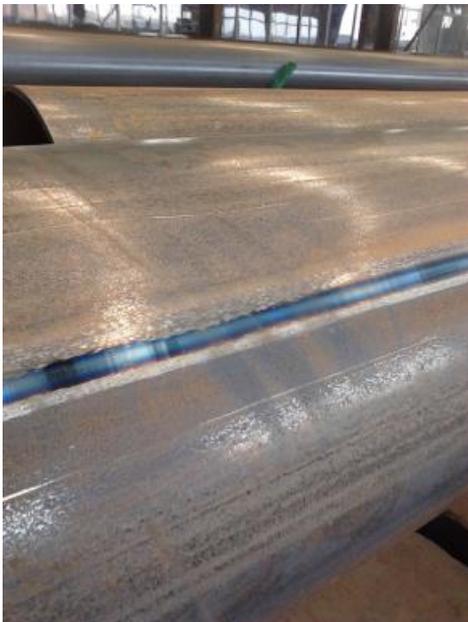
Commercialize

2017 Deploy

# ERW Pipe Integrity Management (PRCI)

## Description

Develop document that provides operators with guidance on integrity management of longitudinal seam pipe.



## Drivers & Benefits

- Inspection of longitudinal seams for flaws and eliminate potential for pipe failures.
- Determine factors that contribute to failure and improving models for assessing fitness for service when flaws are identified.

## Status & Results

- Multi-year research Program just getting underway.

2014 Initiate

Develop

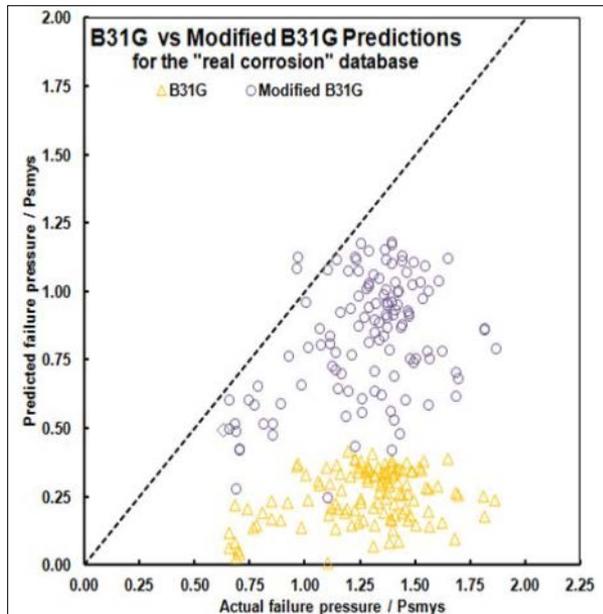
Commercialize

2017 Deploy

# Corrosion Assessments Model (PRCI)

## Description

Reduce model driven uncertainty in failure pressure and remaining life predictions for assessments.



## Drivers & Benefits

A large conservative bias in predicted steel pipe failure pressure can lead to inspection digs and local repairs that were not necessary.

## Status & Results

The analysis found that using AYS instead of SMYS is the fundamental cause of model error contained in B31G.

2013 Initiate

Develop

Commercialize

2016 Deploy

# Threat Interactions for Risk Analysis (OTD)

## Description

Develop a methodology for calculating the risk associated with a superimposed set of threats (21 Threats from ASME B31.8S) as well as a process for addressing unknown threats



## Drivers & Benefits

Increase the level of understanding related to threat interactions with a specific focus on risk determination for integrity management programs. Improve pipeline integrity and enhance public safety.

## Status & Results

- Computer program completed.
- GTI available to customize program for individual users.

# Leak-Rupture Boundary (OTD)

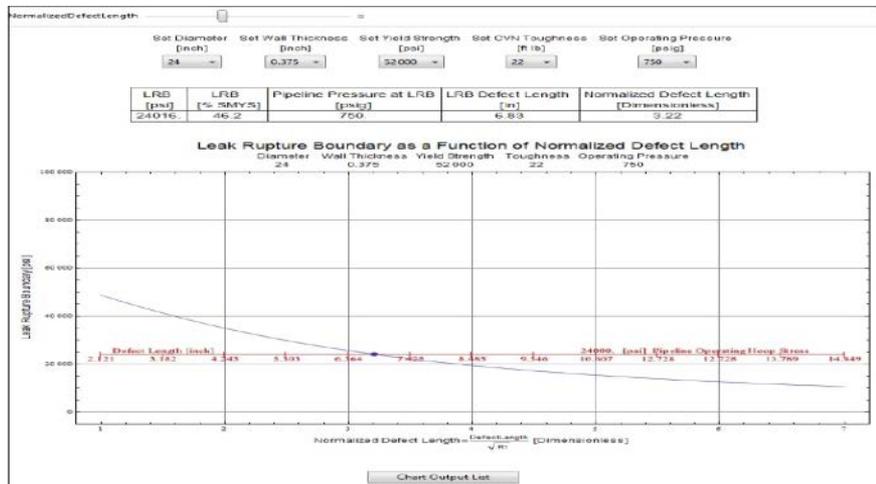
## Description

Develop a user-friendly Leak-Rupture Boundary (LRB) Calculator.

Determine the boundary between failure by leak and failure by rupture based on material types.

## Drivers & Benefits

- Provide regulators and operators with information based on sound engineering principles that allows the selection of the most appropriate integrity management process.



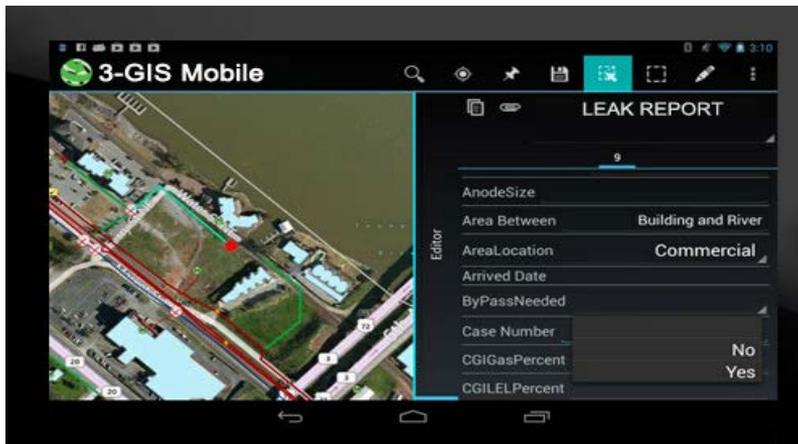
## Status & Results

- Developed Leak-Rupture calculator.
- Found YS, toughness, W.T., and dia. of a pipe segment can be used to predict the LRB.
- Research indicated that the boundary could range from slightly below 20% SMYS for rare pipe materials to well over 30% SMYS for many others.

# Leak Survey Tracking

## Description

Assess the functionality of electronic pipeline leak survey tracking systems. These systems will; eliminate paper maps and automate the uploading of field data collected during leakage surveys.



## Drivers & Benefits

Automating compliance activities will ensure data accuracy for reporting and audits. Improve pipeline integrity and enhance public safety.

## Status & Results

- Completed field testing of 2 of 3 electronic leak survey tracking systems.
- Third field test to be completed by end of Aug. 2015.

2014 Initiate

Develop

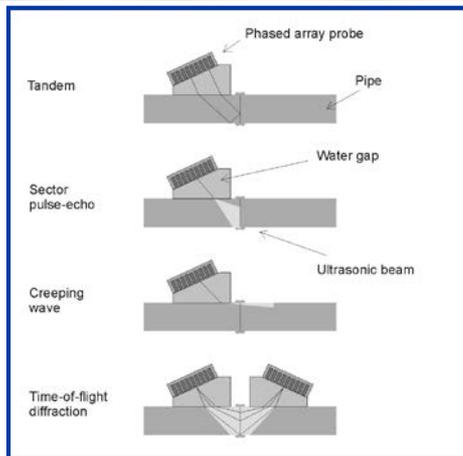
2015 Complete

2016 Deploy

# Butt Fusion – NDE (NYSEARCH)

## Description

Develop a NDE technique using Phased Array Ultrasonic (PAUT) techniques to assess the integrity of Butt Fusion and Electrofusion polyethylene pipe connections.



## Drivers & Benefits

Provide a portable, easy to use NDE tool for PE installers to ensure Butt Fusion and Electrofusion joints provide long-term performance.

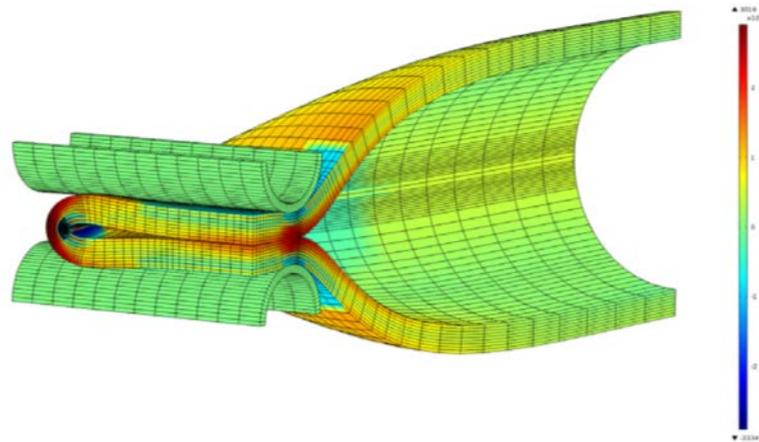
## Status & Results

- PAUT techniques for BF joints have been developed.
- 4" – 8" MDPE/HDPE pipe samples with embedded flaws and "cold fusion" joints have been prepared.
- Completed NDE measurements of "cold fusion" joints, MDPE/HDPE
- Currently developing flaw acceptance criteria by testing BF joints with embedded flaws.

# Mitigation of Aldyl-A Squeeze-Off Stresses

## Description

Assess the stresses produced by squeeze-off operations and the mitigation of these stresses with the use of a reinforcement clamp.



## Drivers & Benefits

Improve pipeline integrity and enhance public safety.

## Status & Results

- Completed development of a FEA modeling to assess squeeze off stresses and impact of reinforcement clamp.
- Laboratory tests underway to validate FEA model.
- A field guidelines will be developed to ensure proper installation of reinforcement clamps to mitigate post squeeze-off stresses.

2013 Initiate

Develop

Complete

2016 Deploy

# Keyhole Riser Replacement

## Description

Use of PE pipe splitting and extraction process to remove Anodeless risers through a 7" diameter Keyhole in pavement.



## Drivers & Benefits

Trenchless methods of performing buried asset repair/replacements reduces overall costs to ratepayers.

## Status & Results

- Equipment and tooling developed and initial testing validated performance.
- Field testing is planned for 2016.

2012 Initiate

Develop

Commercialize

2017 Deploy

# Flash Fire Suppression System (OTD)

## Description

Develop an automated, Portable Flash Fire Suppression System (PFFSS) for use in confined spaces and in excavations during gas maintenance and repair operations.



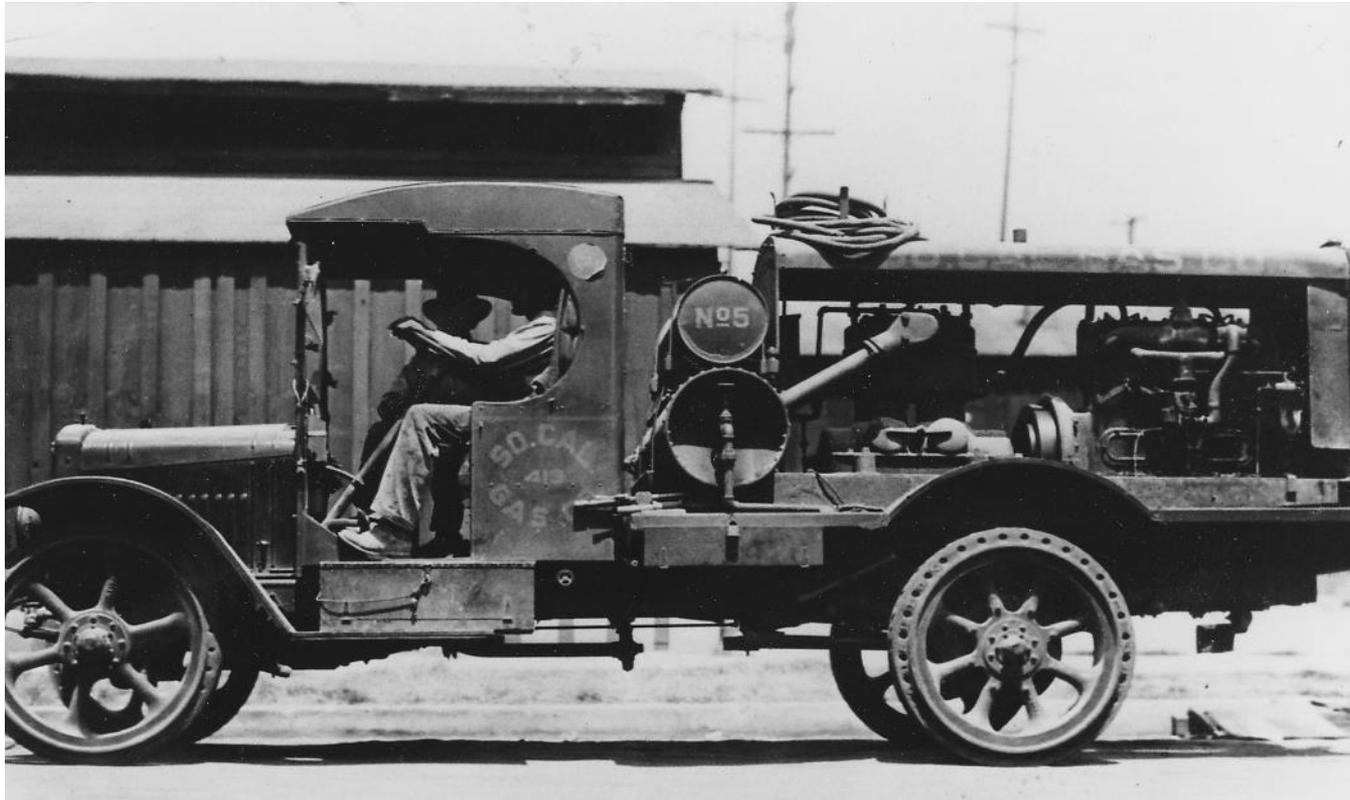
## Drivers & Benefits

Flash fires can cause serious burns in short periods of time. Enhance public and worker safety.

## Status & Results

- Prototype PFFSS was developed and tested in a bellhole. It was found to adequately detect and suppress NG flash fires in less than ¼ second.
- Further evaluations and enhancements to the PFFSS with commercial partner is planned.

# Thank You



**Ed Newton**

**Tel: (213) 244-4239**

**Cell: (213) 219-0373**

**E-mail: [ENewton@SempraUtilities.com](mailto:ENewton@SempraUtilities.com)**