Redefining the Leak Management Process

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Director, Leak Management & New Technology
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Topics for Discussion Today

- PG&E’s Journey ~ Redefining the Leak Management Process
- Advances to Leak Detection
- PG&E Utilization of Advanced Leak Detection:
  - The Super Crew Process / Concept
- Operational Benefits
PG&E Company Profile

- Pacific Gas and Electric Company, incorporated in California in 1905, is one of the largest combination natural gas and electric utilities in the United States.
- The company provides natural gas and electric to approximately 15 million people throughout a 70,000-square-mile service area in northern and central California.
- Service area stretches from Eureka in the north to Bakersfield in the south, and from the Pacific Ocean in the west to the Sierra Nevada in the east.

Gas Pipeline Key Statistics

- 5,800 miles of gas DOT transmission pipeline
- 6,750 miles of pipeline > 60 psig
- Approx. 84,000 miles of gas distribution pipe
- 4.3 million natural gas customer accounts.
- Deliver 970 BCF/year (2.6 BCF/daily average)
Launching a breakthrough Leak Management Process
Advanced Leak Detection ~ What Makes it So Special?

Picarro Surveyor™, a very Powerful Leak Detection instrument

- 1,000 times more sensitive (PPB)
- Fast & Efficient – mobile / computer application (flight)
- Distinguishes between natural occurring methane to pipeline gas
- Finds more gas leaks
- Pinpoints “Hard-to-Locate” leaks
- Quality Control / Training
- Leak Cluster Identification
- Job Planning efficiency (economics of scale)
- Special surveys
- Verifiable, Traceable & Complete records
- Redefining the way we view leak detection & correction protocols
Lessons Learned

- Long distance migration downward in stable conditions

- Good understanding of atmospheric airflow is critical.
Advanced Leak Detection Technology is a Game Changer

1,000x Higher Sensitive allows detection at greater distances

FID works here: 1PPM

CRDS works here: 1PPB
Coverage by the Picarro Surveyor™

Combined surveys
Coverage: 89% of services
99% of main
Capturing Critical Information

- **Atmospheric Conditions**
  - Weather conditions impacts results
  - Wind information is critical

- **Leak Indication Search Areas (LISA)**

- **Field-of-View areas**
How did PG&E Utilize this Powerful Tool?

Process Re-engineering

Super Crew Process / Concept!
Team’s Key Objectives
(33 member cross-functional team)

- Completely redefine a new leak survey & repair model
- Increase system safety by finding & fixing more leaks
- Maximize operating efficiencies
- Improve system capitalization rates
- High quality documentation
- Strengthen reputation in the communities
- Delight customers by not coming back
- Knowledge transfer outside of Super Crew
- Develop strategic plan for 2014 & beyond
More effective leak detection technology drives step-change in survey and repair goals

**Advanced survey technology that finds many more leaks per shift...**

<table>
<thead>
<tr>
<th></th>
<th>Today</th>
<th>With Picarro</th>
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<tbody>
<tr>
<td>Services surveyed per hour</td>
<td>10-11</td>
<td>500</td>
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<tr>
<td>Leaks found per service</td>
<td>~3.4%</td>
<td>~6.4%</td>
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<tr>
<td>Leaks found per hour</td>
<td>0.4</td>
<td>32</td>
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<tr>
<td>Proportion of leaks found Grade 1, 2+, 2</td>
<td>18%</td>
<td>27%</td>
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</tbody>
</table>

...creates opportunity for more effective gas leak repair model

- Increase safety and “fix” an entire neighborhood at once with multiple crews
- Increase capacity as pre-staged crews will be more effective and fix more leaks/day
- Decrease leak rechecks and customer calls as more issues resolved
- Increase replacement rate as we identify more leaks on same pipe

**Project goals:**
- Find 1.5-2x as many leaks
- Average cost per leak reduced by 50%
- Increase rate of pipe replacement from 40% → 60%
Project is end-to-end redefinition how PG&E operates leak management

<table>
<thead>
<tr>
<th>Old model</th>
<th>New PG&amp;E Model</th>
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<tbody>
<tr>
<td>Traditional surveyors walk the lines over 12 months</td>
<td>Picarro does 1 year of division survey in ~ 4 weeks</td>
</tr>
<tr>
<td>Work goes into queue: Spaghetti process of 15+ back-office systems out to M&amp;C crews</td>
<td>Tightly compressed process Find and fix leaks with SuperCrew in 3 week window</td>
</tr>
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→ Tremendous inefficiency results from piecemeal nature of work

→ Vast economies of scale from fixing a year’s worth of leaks in a neighborhood

Getting the new model right was a complicated endeavor

- **Different scale than today:** Step-change in volume and speed of work moving through system
- **Cross-functional team:** Need all functions involved for smooth handoffs in tight process
- **Measurement mindset:** Track metrics on everything to ensure new process is driving performance

Permanent team of A-level talent critical to our success in defining how we operate in the future and take on leadership of process
Summary — The Super Crew model works

- **Increased safety:** Found & fixed more leaks (1.81 times more), faster and more accurately than ever before
- **Superior economics:** Lower unit cost in every work category (up to 50% unit cost savings), higher capitalization rate (exceeding integrity management goals for pipe replacement)
- **More Reliable:** Safe operations, including QC; and strong compliance culture
- **Scalable:** Opens up opportunities to reduce cost across Gas Ops — overhead, engineering, and construction all benefit
- **Created Capacity**
- **Garnered** strong political and regulatory support
- **Grassroots approach to customer satisfaction**
new Currents video posted last week
Questions?
Contact for more information:

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Appendix
Super Crew roll-out to cover ~230k services in remainder of 2014

<table>
<thead>
<tr>
<th>Activity</th>
<th>2014</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sacramento</td>
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<tr>
<td>North Bay</td>
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<td>Diablo</td>
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<td>Stockton</td>
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<td>San Jose</td>
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<td>Peninsula</td>
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<td>Mission</td>
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<td>Sierra</td>
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<tr>
<td>North Valley</td>
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Division stops survey
Super Crew starts survey
Super Crew begins survey

<table>
<thead>
<tr>
<th></th>
<th>Division stops survey</th>
<th>Weeks of Survey</th>
<th>Total services</th>
</tr>
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<tbody>
<tr>
<td>Sacramento</td>
<td>NA</td>
<td>April</td>
<td>69.4K</td>
</tr>
<tr>
<td>North Bay</td>
<td>May</td>
<td>June</td>
<td>23.9K</td>
</tr>
<tr>
<td>Diablo</td>
<td>May</td>
<td>June</td>
<td>45.9K</td>
</tr>
<tr>
<td>Stockton</td>
<td>June</td>
<td>July</td>
<td>21.0K</td>
</tr>
<tr>
<td>San Jose</td>
<td>July</td>
<td>Aug.</td>
<td>23.3K</td>
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<tr>
<td>Peninsula</td>
<td>July</td>
<td>Aug.</td>
<td>10.8K</td>
</tr>
<tr>
<td>Mission</td>
<td>July</td>
<td>Aug.</td>
<td>19.5K</td>
</tr>
<tr>
<td>Sierra</td>
<td>Aug.</td>
<td>Sep.</td>
<td>8.8K</td>
</tr>
<tr>
<td>North Valley</td>
<td>Aug.</td>
<td>Sep.</td>
<td>8.4K</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>22</strong></td>
<td><strong>231.1K</strong></td>
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