Case Study: ConocoPhillips Pipeline / Pipeline Leak Detection
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Phillips 66 Pipeline LLC is a wholly owned subsidiary of Phillips 66. Phillips 66 Pipeline LLC operates more than 12,000 miles of pipelines in the United States. In addition, the company owns or operates 42 finished-product terminals, eight LPG terminals, five crude oil terminals and one petroleum coke exporting facility. Phillips 66 Pipeline LLC transports both raw and finished petroleum products, including crude oil, propane and refined products such as gasoline, diesel and jet fuel. The company also stores motor fuels at terminals where tanker trucks pick them up for delivery to local retail outlets.
Agenda

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2. Application Description
3. FLEXIM Solution
4. Customer Benefits
ConocoPhillips Pipeline is mandated by the DOT as well as internally by Senior Management to provide a means of determining small leaks throughout their pipeline system. Accomplishing this with inline meters would be prohibitive, and require pipeline shutdown.

ConocoPhillips is interested in testing an Ultrasonic Clamp-On solution, because of the low investment cost and because it is not necessary to shutdown portions of the pipeline.

ConocoPhillips provided FLEXIM the opportunity to prove our technology on an approximate 60 mile pipeline segment between Sweeney, TX and Pasadena, TX, with an initial order if successful of approximately 100 meters.
Application - Measurement Point

- The test is to consist of (4) total FLEXIM HPI meters, (2) meters at each site (Sweeney & Pasadena), flowing diesel or jet product batches. One meter at each site will be placed in a “bad” metering location (directly after an elbow on a down comer, left photo), as well as one meter at each site being placed in a “good” metering location (after a tube bundle flow conditioner in front of a custody quality reference turbine meter, right photo).

- The meters are to be compared meter-to-meter, site-to-site to determine how they track to each other and to the reference meters, and for their repeatability.
The installation detail for each meter is shown below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Outer Diameter</th>
<th>Wall Thickness</th>
<th>Pipe Material</th>
<th>Medium</th>
<th>Diesel</th>
<th>Jet</th>
<th>Kinem.Viscosity</th>
<th>Density</th>
<th>Medium Temperature</th>
<th>Fluid pressure</th>
<th>Transducer Type</th>
<th>Sound Path</th>
<th>Transd. Distance</th>
<th>Damping</th>
<th>Storage Rate</th>
<th>Profile corr.</th>
<th>Physic. Quant.</th>
<th>Unit Of Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasadena A</td>
<td>10.81&quot;</td>
<td>0.358&quot;</td>
<td>CS</td>
<td>AllLiquids</td>
<td>Diesel</td>
<td></td>
<td>1.00 mm2/s</td>
<td>0.00 g/cm3</td>
<td>23 C</td>
<td>3.77 bar</td>
<td>M</td>
<td>2 NUM</td>
<td>5&quot;</td>
<td>120 s</td>
<td>00:10:00 AVG</td>
<td>ON</td>
<td>Volume(norm.)</td>
<td>[bbl/h]/[bbl]</td>
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<tr>
<td>Pasadena B</td>
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<td>120 s</td>
<td>00:10:00 AVG</td>
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<td>Volume(norm.)</td>
<td>[bbl/h]/[bbl]</td>
</tr>
<tr>
<td>Sweeney A</td>
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<td>0.358&quot;</td>
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<td>AllLiquids</td>
<td>Diesel</td>
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<td>0.00 g/cm3</td>
<td>32 C</td>
<td>5.86 bar</td>
<td>M</td>
<td>2 NUM</td>
<td>5.25&quot;</td>
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<td>ON</td>
<td>Volume(norm.)</td>
<td>[bbl/h]/[bbl]</td>
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<td>0.358&quot;</td>
<td>CS</td>
<td>AllLiquids</td>
<td>Diesel</td>
<td></td>
<td>1.00 mm2/s</td>
<td>0.00 g/cm3</td>
<td>32 C</td>
<td>6.87 bar</td>
<td>M</td>
<td>2 NUM</td>
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<td>ON</td>
<td>Volume(norm.)</td>
<td>[bbl/h]/[bbl]</td>
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Solution - Installation

- The solution provided for this test was the 7407 HPI Dual Beam meter with M transducers and PermaLoks.
- Solid coupling pads were used.
- The meters were in compliance with the area classification and carried FM Class I, Division II approval.
- Typical Installation shown below.
Solution - Performance

- Graph below shows a 16-day period for all meters including the turbine reference meters.
Solution - Results

- Based on the results of the testing, ConocoPhillips has agreed that the FLEXIM meter will be the meter of choice for Single-Product applications.
- The Multi-Product testing is ongoing, and no conclusions have yet been made.
- At the conclusion of the testing, at least a portion of the meters is expected to be ordered by ConocoPhillips.
- A 0.5% overall accuracy has been averaged in the testing to date.
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- ConocoPhillips has numerous locations throughout their system that are without measurement currently, where the FLEXIM meter will be the ideal solution.
- The needed retrofits can be achieved with minimal investment by ConocoPhillips using the FLEXIM meter, and without any pipeline shutdown.
- If all meters were purchased, the estimated value of the project is approximately $1.5 to $1.7 million. This is, however, a fraction of the cost to ConocoPhillips if they were to implement this project with conventional inline meter technology.