“AGA and its members are dedicated to the continued enhancement of pipeline safety.

As such, we are committed to proactively collaborating with public officials, emergency responders, excavators, consumers, safety advocates and members of the public to continue to improve the industry’s longstanding record of providing natural gas service safely and effectively…”

From: AGA’s Commitment to Enhancing Safety
“RESOLVED, That the Board of Directors of the National Association of Regulatory Utility Commissioners… encourages regulators and industry to consider sensible programs aimed at replacing the most vulnerable pipelines as quickly as possible along with the adoption of rate recovery mechanisms that reflect the financial realities of the particular utility in question; and be it further.”

“RESOLVED, That State commissions should explore, examine, and consider adopting alternative rate recovery mechanisms as necessary to accelerate the modernization, replacement and expansion of the nation’s natural gas pipeline systems…”

From: National Association of Regulatory Utility Commissioners
States with Accelerated Infrastructure Replacement Programs
The Landscape

- Increasing public concerns regarding pipeline safety
- Increasing public interest and passion regarding climate change
- Increasing desire for energy efficiency
- Abundance of domestic natural gas supplies

Publicly available maps of methane emissions

From: EDF.Org website
Infrastructure Replacement vs. Repair

- Safety and emissions management require a mix of repair and replacement
- Companies rely on IMP and DIMP plans to guide repair/replace decisions
  - Decisions are based upon risk management principles and compliance
  - Leak history is a major driver of replacement decisions
  - Multi-state companies must consider local priorities
- Leak repairs are performed under O&M plans
- Repairs focus on potentially hazardous leaks
  - Non-hazardous leaks are more common and monitored, rather than repaired
- Regulations may change
  - Timely repair of non-hazardous leaks to reduce emissions may be required
  - Changing priorities requires supporting replacement of leak-prone materials
Legislation, Regulation & Recommendations

- Pipeline Safety Act of 2011 and the next reauthorization
- NTSB safety recommendations
- AGA’s *Commitment to Enhancing Safety*
- Distribution integrity management programs (DIMP)
- Transmission integrity management programs (IMP and IMP2)
- GAO and Inspector General studies
- Mapping and communications enhancements
- Emergency response enhancements
- Automatic shutoff valves and remote control valves
- Data quality and analysis improvements
- Leak detection enhancement
- Safety management systems
Let’s Look at the “Average” U.S. Utility

- These data taken from utilities’ annual reports to PHMSA
- The “Average” utility has <900 miles of mains
- Not shown are inventories of transmission lines, service lines, meter sets, pressure reduction and other equipment
Infrastructure Replacement

Let’s look at one class of asset – The national cast iron main inventory (1985-2011)
Infrastructure Replacement

What will it take to replace the remaining US cast iron main inventory?

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Cost per mile</th>
<th>Cast Iron Mains (Miles)</th>
<th>Avg. Replacement cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4&quot;</td>
<td>$1,584,000 - $2,112,000</td>
<td>14,518</td>
<td>$26,764,075,800</td>
</tr>
<tr>
<td>4&quot; to 12&quot;</td>
<td>$1,848,000 - $3,696,000</td>
<td>17,224</td>
<td>$47,740,104,720</td>
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<tr>
<td>&gt;12&quot;</td>
<td>$3,696,000 - $5,016,000</td>
<td>1,877</td>
<td>$8,178,516,324</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>33,619</strong></td>
<td><strong>$82,682,696,844</strong></td>
</tr>
</tbody>
</table>

Can the $83 Billion replacement of US cast iron main be spread over the 71 million US gas customers?

No - The cast iron inventory is not uniformly distributed about the country.

*From: Managing the Reduction of the Nation’s Cast Iron Inventory, AGA White Paper, 2013*
Let’s Look at a Large Northwest Utility

- Multi-state operation
- >13,000 miles of main and ~700,000 service lines – nearly all plastic or protected steel
- Leak hazards greatly mitigated
- Emissions greatly reduced
- Ongoing integrity and geo-hazard programs
Let’s Look at a Northeast Mega-Utility

- Multi-state operation
- Millions of customers
- Old metro areas
- >11,000 miles cast iron and unprotected steel main
- 500 miles of gas transmission lines
- >1800 pressure regulating stations
Replacement of Cast Iron Mains

Three scenarios – Inventories and customer bases from three utilities

Cost to replace cast iron ranges from $1.3-$5.2 Billion, $569-$16,462/customer

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Mileage</th>
<th>Cost per mile</th>
<th>Avg. Cost per mile</th>
<th>Replacement Cost/Diameter</th>
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<td>109.80</td>
<td>$3,696,000 - $5,016,000</td>
<td>$4,356,000</td>
<td>$478,308,188</td>
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</table>

Total Replacement Cost: $5,204,322,715

No. of Customers: 608,781
Cost/Customer: $8,549

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Mileage</th>
<th>Cost per mile</th>
<th>Avg. Cost per mile</th>
<th>Total Cost</th>
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<tbody>
<tr>
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<td>4&quot; to 12&quot;</td>
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<td>$853,748,280</td>
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<td>$3,696,000 - $5,016,000</td>
<td>$4,356,000</td>
<td>$122,621,400</td>
</tr>
</tbody>
</table>

Total Replacement Cost: $1,294,872,480

No. of Customers: 78,660
Cost/Customer: $16,462

From: Managing the Reduction of the Nation’s Cast Iron Inventory, AGA White Paper, 2013
Capital Spend at a Major Utility

- Service Replacements
- Main Replacements

Gas Infrastructure - Capital Investment

<table>
<thead>
<tr>
<th>Period</th>
<th>Service Replacements</th>
<th>Main Replacements</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2010 Actual</td>
<td>$200</td>
<td>$100</td>
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<tr>
<td>FY 2011 Actual</td>
<td>$250</td>
<td>$150</td>
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<tr>
<td>FY 2012 Actual</td>
<td>$300</td>
<td>$200</td>
</tr>
<tr>
<td>FY 2013 Actual</td>
<td>$350</td>
<td>$250</td>
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<tr>
<td>FY 2014 Actual</td>
<td>$400</td>
<td>$300</td>
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<tr>
<td>FY 2015 Budget</td>
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<td>$350</td>
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<tr>
<td>FY 2016 Plan</td>
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<td>$400</td>
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<tr>
<td>FY 2017 Plan</td>
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<td>$450</td>
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<tr>
<td>FY 2018 Plan</td>
<td>$600</td>
<td>$500</td>
</tr>
<tr>
<td>FY 2019 Plan</td>
<td>$650</td>
<td>$550</td>
</tr>
</tbody>
</table>
Challenges to Be Met

Customers
- Increasing rates and service disruptions
- Inconveniences due to construction work
- Questions regarding safety and priorities

Municipalities and Communities
- Coordinating and permitting utility and municipal works projects
- Public reaction to noise, debris, detours, and parking restrictions
Challenges to Be Met

Regulators and State Legislators

- Working with utilities, PHMSA, Congress, labor and public interest groups, each with varied perspectives and interests
- Effectively communicating with the public and other stakeholders
- Enabling accelerated modernization through cost trackers, surcharges, or other rate making mechanisms
- Balancing replacement timeframes and customer bill impacts
- Increasing safety inspections to meet increased field activities
- Ensuring universal participation in damage prevention programs
Challenges to Be Met

Utilities

- Managing existing infrastructure pending its replacement
- Communicating effectively with all stakeholders
- Prioritizing work on all assets based upon risk
- Fixing or monitoring leaks as appropriate
- Raising capital and working with regulators on appropriate program timeframes, cost recovery mechanisms and consumer impacts
- Staffing up a skilled workforce and management team
- Acquiring additional materials, equipment and vehicles
- Coordinating with municipalities regarding work permitting, permit costs, and pavement restoration issues
Thank you ... let’s talk

Art Shapiro
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