Sustainable, Simple, Innovative and Effective

Ryan Flickinger – KCI Technologies, Inc.
Nicky Davis – KCI Technologies, Inc.
Russ Brown-Utility Service Group
What is Ice Pigging?

A patented innovative **sustainable** pipe cleaning technology to improve water quality and asset management.
Infrastructure Sustainability

Environmental Sustainability

Sustainable Asset Management

Economic Sustainability

Social Sustainability
Sediments

Associated problems:

- Turbidity
- Taste & Odor Issues
- Customer complaints
Deposits

Associated problems:

- Loss of capacity
- Increased pumping costs
Biofilms

Associated problems:

- Legionella
- Higher chlorine dosing
- Increased THMs
Why?

Cleaning pipes improves customer service & reduces costs:

• Reduce discolored water complaints
• Improve water quality compliance
• Reduce biofilm deposits
• Reduce THM production
• Remove iron and manganese build up
Why?

Cleaning pipes improves customer service & reduces costs:

- **Asset management**
  Preventative maintenance extends the useful life of pipes

- **Residual demand**
  Dirty pipes require a higher residual

- **Pumping costs**
  Sediment build up reduces the pipe capacity in turn increasing the pumping costs
Traditional Cleaning Techniques

Cleaning devices: 
Flushing, air scour and jet washing

Operational problems

- Inefficient
- High Water Usage
- Customer service affected
  Long interruption to supply
Traditional Cleaning Techniques

Cleaning devices:

- Pigs
- Swabs

Operational problems:

- Incompatible with pipe bends and changes in diameter

- Requires Excavation
  Excavate to launch and receive pigs

- Customer service affected
  Long interruption to supply
Project Planning

○ Desktop Study
  – Look at construction and/or as built plans
Project Planning

Detailed Site Visit

- Obtain detailed plans from client
- Identify suitable insertion/discharge points – Waste water disposal?
- Check mains fittings & record necessary tools
- Access? – Traffic management
- Request flow and pressure data
- Night or day operation?
Project Planning

Firm/Price Quote

- Full detailed report
- Advise if enabling works are required
- Highlight traffic management issues
- Ensure client is aware of water/ice disposal issues
- Include draft copy of proposed schedule
How does it work?

Ice Pigging harnesses the characteristics of a semi-solid material

- An ice pig is a semi-solid material that can be pumped like a liquid
- But behaves like a solid once the pig is formed in the pipe
Controlling the semi-solid state

To maintain the correct consistency of the Ice Pig during an operation a freezing point depressant is used.

- NSF approved additives (NaCl) as freezing point depressants
- Additional chlorine maybe added
Water flow rate
240 gal/min
Ice Pigging in Practice:

Custom built equipment
Ice Pigging in Practice:

Custom built equipment
Ice Pigging in Practice:
Ice Pigging in Practice:
Less than 1.25 miles

<2km
What comes out:

Actual Samples
Project Reporting

ICE PIGGING

JOB INFORMATION:
Client: Bristol Water
Date: 28th November 2011
Location: Cheddar Reservoir
Insertion Point: Cheddar TW
Discharge Point: Ashridge Reservoir
Pipe Length: 2.076 km
Pipe Diameter: 300 mm
Material: AC
Volume of Ice: 15,000 L
Ice Fraction: 85%
Total water used:

ONSITE PROCEDURE:
Pre-Clean Readings
Immediate Post-Clean Readings
Change

Conductivity (μS/cm)
1.5
0.6
0.9

Temperature (°C)
4
4
0.0

Pressure (bar)

Turbidity (NTU)

TimeLines:
Arrive
Main sourced by Client
Main Operated
Ice out
Main Returned to Service

Minimum Hour Rate [l/s] 2.2
Lowest Temperature Reached [°C] -2.3
Ambient Air Temperature [°C] 15.6°

RESULTS SUMMARY:

Sediment Data:

<table>
<thead>
<tr>
<th>#</th>
<th>Flow Rate (l/s)</th>
<th>Temperature (°C)</th>
<th>Conductivity (μS/cm)</th>
<th>Sample Mass (g)</th>
<th>Sediment Mass (g)</th>
<th>Sediment Mass (%)</th>
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<td>97.3</td>
<td>22</td>
<td>0.25</td>
<td>0.06</td>
</tr>
</tbody>
</table>

RESULTS:
Sediment Removed (kg) 43.5±
Sediment Removed per km (kg) 20.9±

The above values are calculated from samples taken every 30 seconds on site. For each sample the flow rate and the sediment densities are assumed to remain constant within that 30-second period. From this we can calculate the total amount of ice/ice and therefore can estimate the total mass of sediment over the sampling period.

For more information please contact us on: 0115 954 800 466
Ice Pigging: Sustainability

Economic Benefits

• Extends service life of water main

• Requires NO excavation where suitable valves & hydrants exist

• Minimal manpower required

• Minimal water wasted

• Reduces energy costs

• Reduces disinfectant demand

• No damage to existing valves or hydrants, CANNOT get stuck
Ice Pigging: Sustainability

Social Benefits:

• Improves water quality taste and odor
• Reduces discoloration
• Minimal disruption to service
• Helps keep water rates affordable
• No excavation of customer’s property
Ice Pigging: Sustainability

Environmental Benefits:

- Reduces chemical costs
- Reduces energy use/carbon footprint
- Allows for capture of waste and proper disposal
- Less water wasted
- No need for excavation
Results of the process:

Before

After
Ice Pigging Benefits

Customer service improvements

- Water quality improvements: taste and odor, color, residual maintenance
- Lower risk to supply interruptions
- Improved water quality where flushing cannot generate enough flow
Smyrna, DE

- 6-8” Cast Iron & PVC
- Iron/Manganese Issues
- Prior Flushing not solving issue
Keene, NH

- 6-8” Cast Iron
- Iron/Manganese Issues
- Prior Flushing not solving the issue
U.S. Projects

- Perry, GA
- Destin, FL
- Smyrna, DE
- Keene, NH
- United Water, NJ
Summary of Case Studies

○ From a water owner’s perspective, ice pigging is a valuable tool in their arsenal of pipe cleaning methods, filling the void between UDF programs and hard pigging/swabbing/mechanical cleaning.

○ Ice pigging comes with key advantages over more traditional methods, primarily:
  – No excavation
  – No risk of pig getting stuck in line
  – No interruption to customer’s service and no water quality issues (ie only salt added)
  – Very low water usage rate
Main Cleaning Comparative Summary

Objective

- Adhered Deposits and Hard Scale
- Cohesive Deposits
- Loose Deposits

Technique

- Bulk Water
- Conventional Flushing
- UDF
- Ice Pigging
- Swabbing
- Pigging/Mechanical Scraping
### Comparative Cost Approximations Site-Specific and Vendor Costs May Vary Significantly!

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<td>UDF</td>
<td>$3,000 1st time $1,000 repeat</td>
<td>$2000</td>
<td>$0</td>
<td>$5,000 1st time $3,000 repeat</td>
<td>0.95</td>
<td>0.5 - 3</td>
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<td>Ice Pigging</td>
<td>Similar to UDF</td>
<td>Similar to UDF</td>
<td>$4,000 - $24,000</td>
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<td>1.7 – 5.5</td>
<td>3 - 7</td>
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<td>Swabbing</td>
<td>150% UDF</td>
<td>200-300% UDF</td>
<td>$26,000 - $42,000</td>
<td>$30,000 - $48,000</td>
<td>5.7 – 9.1</td>
<td>3 - 7</td>
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<tr>
<td>Pigging</td>
<td>150-200% UDF</td>
<td>200-300% UDF</td>
<td>$79,000 - $106,000</td>
<td>$85,000 - $111,000</td>
<td>16.1 – 21</td>
<td>≥10</td>
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</tbody>
</table>

Adapted from work conducted by Kennedy/Jenks Consultants and Confluence Engineering Group, LLC for San Francisco Public Utilities Commission (2011), information provided by Utility Service Group for ice pigging, and work conducted by members of Confluence Engineering Group for Woodinville Water District, WA (2008).

*Assumes labor rate of $100/hr. Cost significantly impacted by # persons per crew, number of loops per mile, etc.

**Assumes no rehabilitation or major system modifications.
QUESTIONS?