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MORE PRODUCTION - LESS RISK

September 13-17, 2010
Alberta, Canada

MYTHBUSTERS!

Steam Heating System Design

Episode

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Background

- Sulfur needs to be maintained within narrow temperature range to preserve flow
- Most common approach is steam heating
- Steam transfers heat to sulfur via jacketing
- Someone must design how…
  - Steam is transported to the heating system
  - Steam is routed through the system
  - Condensate is removed from the system

→ *Steam system design is often left to industry myths instead of engineering design*

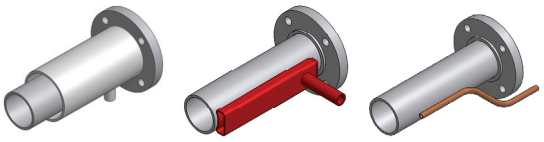
Stakes

- Process performance
- CAPEX savings
- OPEX savings
- Less maintenance/repair events

Agenda

- **Three common myths**
  - Myth
  - Basis for myth
  - Real-life example that illustrates myth
  - Evaluation
  - Lessons learned

Steam jacketed systems for liquid sulfur lines



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Myth

If the sulfur lines are flowing, my heating system must be working.

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Basis for myth

- If it's flowing, it's not plugged
- Thermodynamics: hot piping will lose heat to cooler surroundings
- As process loses heat, its temperature can drop below sulfur freezing point, causing plugging
- Flowing process loses more heat than no-flow

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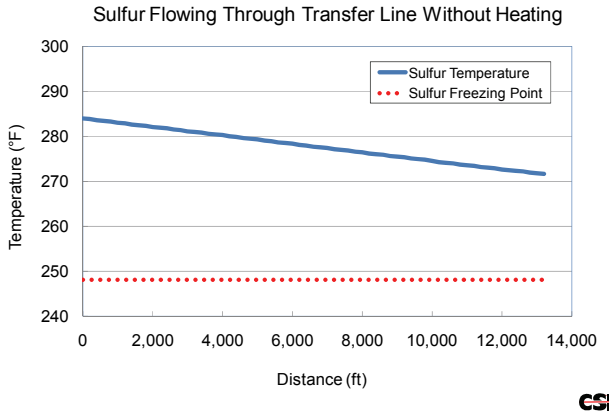
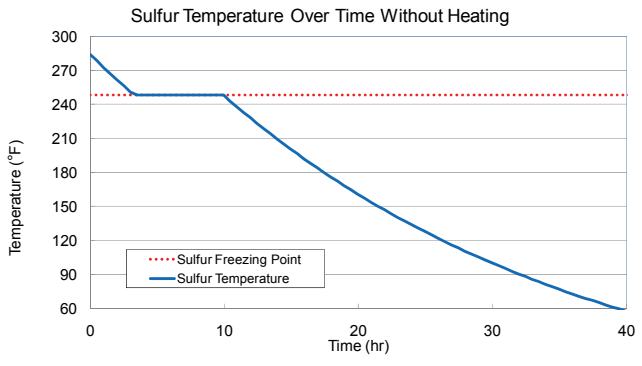
Real-life example #1

- 2.5 mile sulfur transfer line in Kazakhstan
- Design/install enough tracing to keep sulfur molten at end of line
- Minimize heat input to sulfur prior to forming unit
- Design details:
  - 8-in NPS
  - 2.5-in mineral wool
  - Ambient conditions: -40°F/ 25mph wind
  - 3 fps flow rate
  - Sulfur enters line at 284°F

Evaluation: flowing



Evaluation: no-flow



Real-life example #2

- Consider this heating piping system…

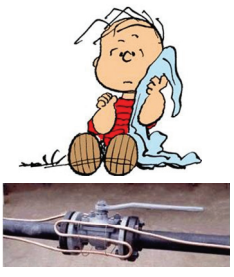
Myth

If the sulfur lines are flowing, my heating system must be working.

MYTH BUSTED!

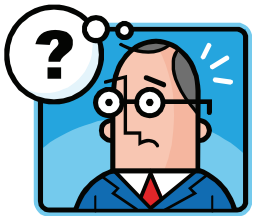
Lessons learned

1. Flowing, insulated sulfur lines do not need heat
2. Real design requirement is no-flow and melt-out



Myth

Condensate must be trapped after every JP spool.



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Basis for myth

- Water seeks its own level
- Gravity causes water to run downhill
- Concern that condensate which drains out of spool and into jumper will prevent free flow of steam into next JP spool

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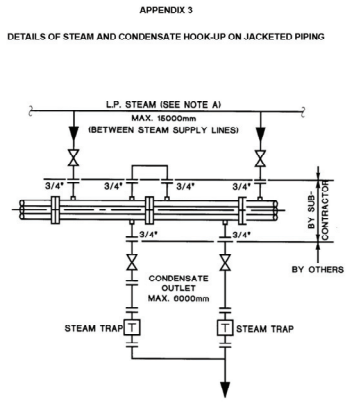
Real-life example



- Taken from JP specification for 640-spool project
- Requires 1 trap per spool

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Evaluation: steam video

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Myth

Condensate must be trapped after every JP spool.

MYTH BUSTED!

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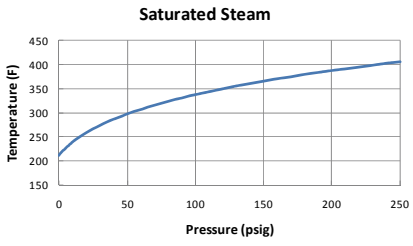
Lessons learned

1. Condensate does not stop steam flow
2. Real limitation on trap frequency (circuit length) is steam pressure



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Lessons learned

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3. Removing the “trap every spool” requirement can save lots of traps and $ w/o impacting performance

	Trap Qty	CAPEX $	OPEX $/Yr
1 trap / spool	640	$624,000	$85,333
CSI design	148	$144,300	$19,733
Δ	**492**	**$479,700**	**$65,600**

Assumptions: $975 CAPEX/trap; 3 year trap life; $400 replacement cost including labor.

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Myth

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A jacketed heating system will work with any type of standard steam trap.

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Basis for myth

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- All traps share same basic objective:
  - Trap steam
  - Remove condensate
- Many types of traps
- Differences can be complicated
- Many have not taken the time to understand the differences or implications

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Real-life example

- New Alberta SRU
- Extensive freeze-ups during first winter
- Found 34 disc traps failed closed due to debris
- Found 19 disc traps failed open due to high back pressure
- Changed 550 traps to inverted bucket traps
- No issue during next winter

Trap styles

Inverted Bucket

Thermodynamic (disc)

Float

Thermostatic

Trap requirements

	Remove condensate
	Continuously purge entrained air
	Accommodate condensate return back pressure

Trap recommendations

Type	Performance	Recommendation
IB		**Recommended**– No special considerations
Float		**Acceptable if** consider air purging
Disc		**May be acceptable if** consider condensate return pressure correctly
TS		**Not acceptable**– Condensate can back up in jacketing/tubing

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Myth

A jacketed heating system will work with any type of standard steam trap.

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Summary

1. Design liquid sulfur lines for no-flow/melt-out
2. Design steam circuits using engineering rather than rules-of-thumb to save traps, $, and issues
3. Choose inverted bucket or float/thermostatic steam trap for maximum robustness

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Thank you!

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