Erosion-Corrosion in Slurry Service

by

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Syncrude Canada Ltd

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Outline

- Introduction
- What is Erosion-Corrosion
- Case Study
- Conclusions

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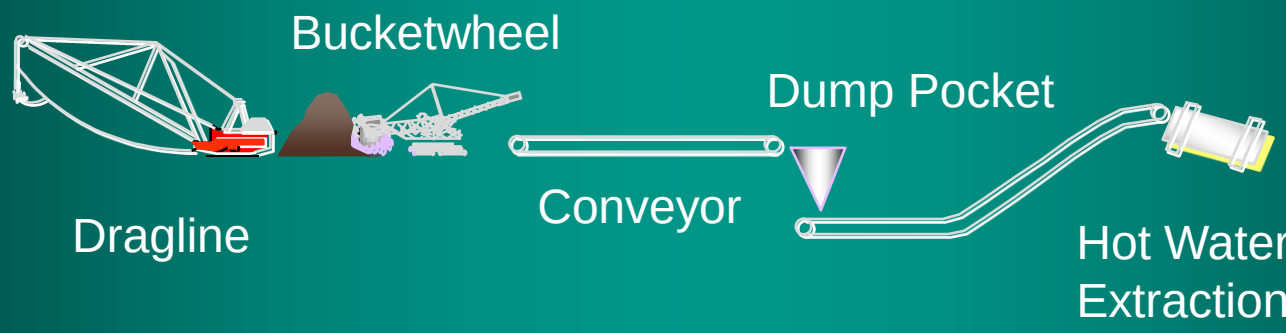
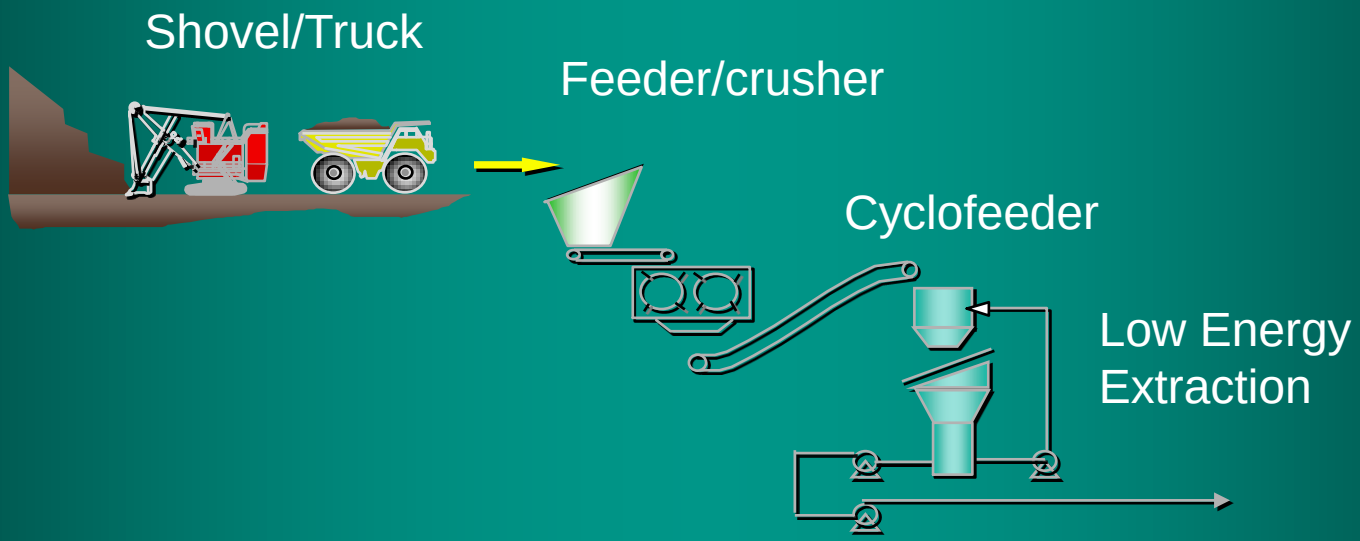
Mining Scheme Comparison



1978

2000



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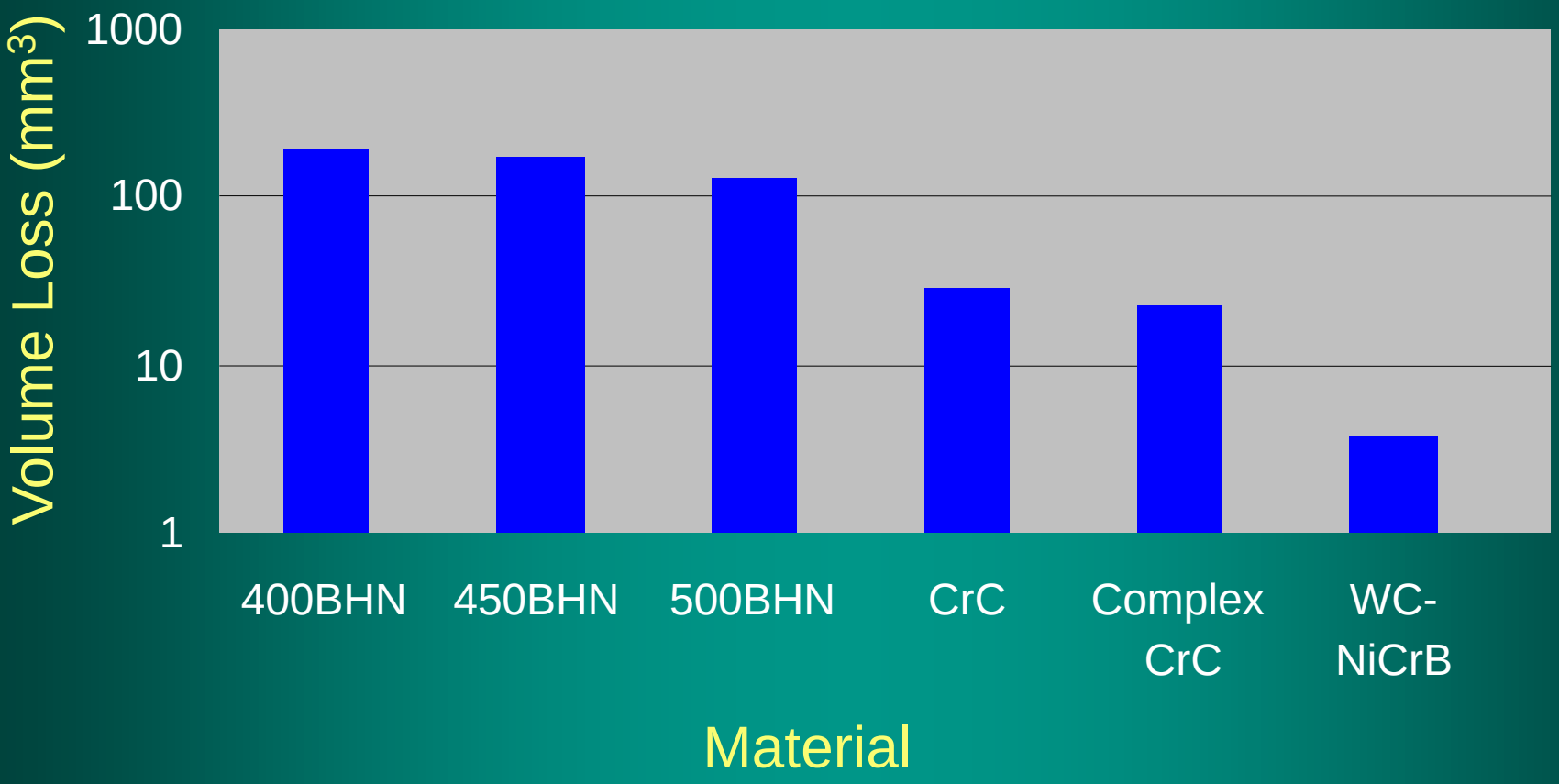
Wear Resistant Materials Used at Syncrude



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What is Erosion-Corrosion:

"A conjoint action involving corrosion and erosion in the presence of a moving corrosive fluid or material moving through the fluid, leading to accelerated loss of material." **

** NACE Corrosion Engineer's Reference Book Third Edition Robert Baboian, Editor.

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Variables Influencing Erosion-Corrosion

Pipe	Solid Phase	Liquid Phase	Operation
Composition Microstructure Hardness	Particle size Distribution Particle hardness Particle shape (angularity) Density	Dissolved O2 Velocity Temperature pH Conductivity Chlorides Viscosity	Laminar/ turbulent Homogeneous/ Heterogeneous Rolling bed

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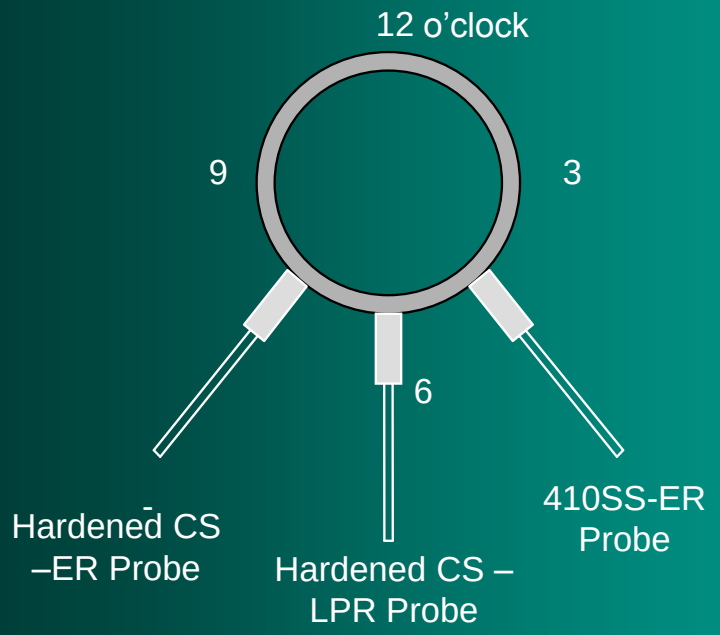
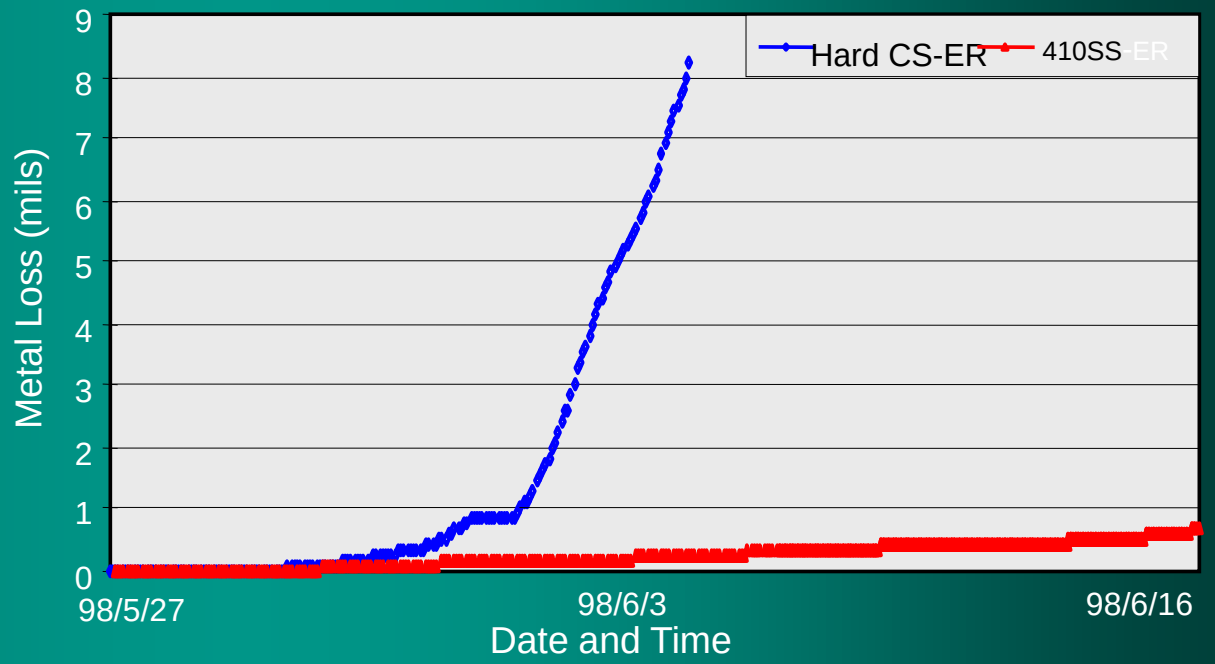
Location of Corrosion Probes in Carbon Steel Pipe Spools

24” diameter carbon steel pipe spool



Comparison of ER-Probe Data From Tailings Line #2



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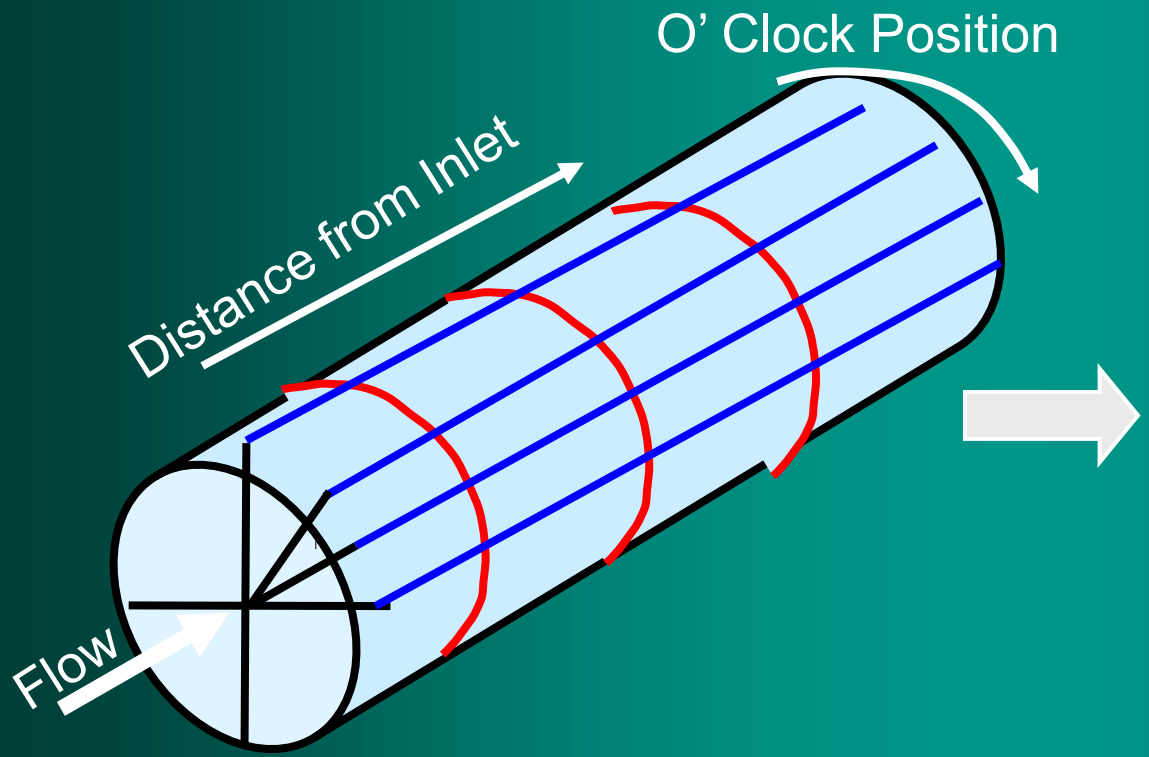
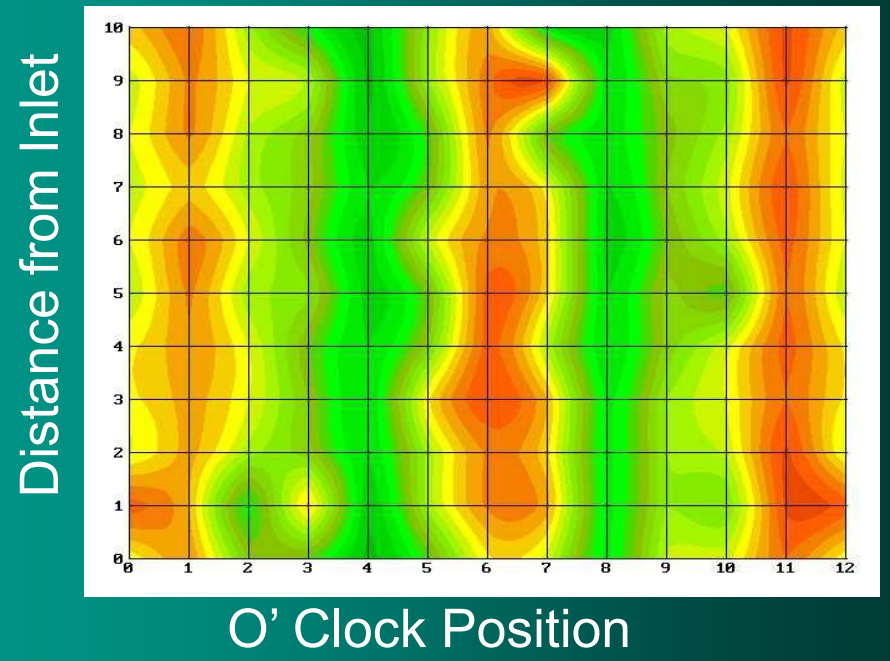
Test Spools: Installed August 04, 2001

UT Thickness Measurements on Carbon Steel Pipe Spool





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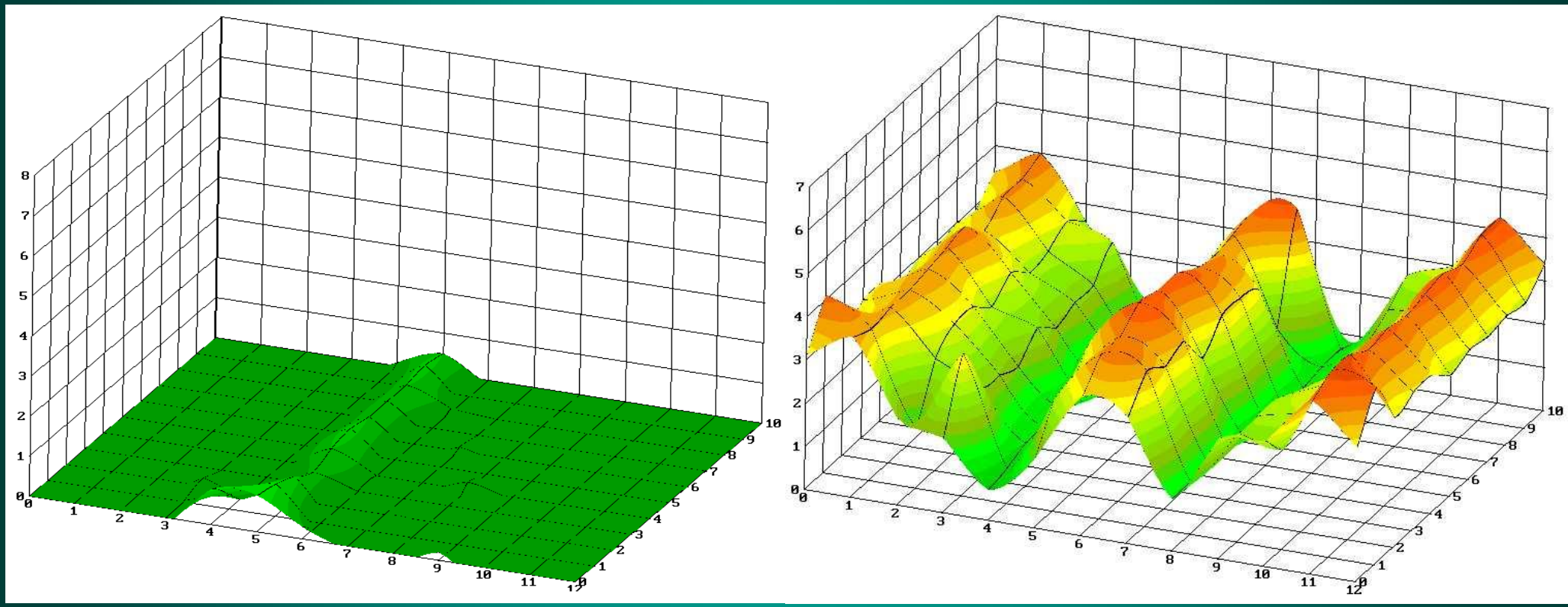
3D Thickness Plots of Ferrite/Martensitic Stainless Steel and X-70 Control Spool



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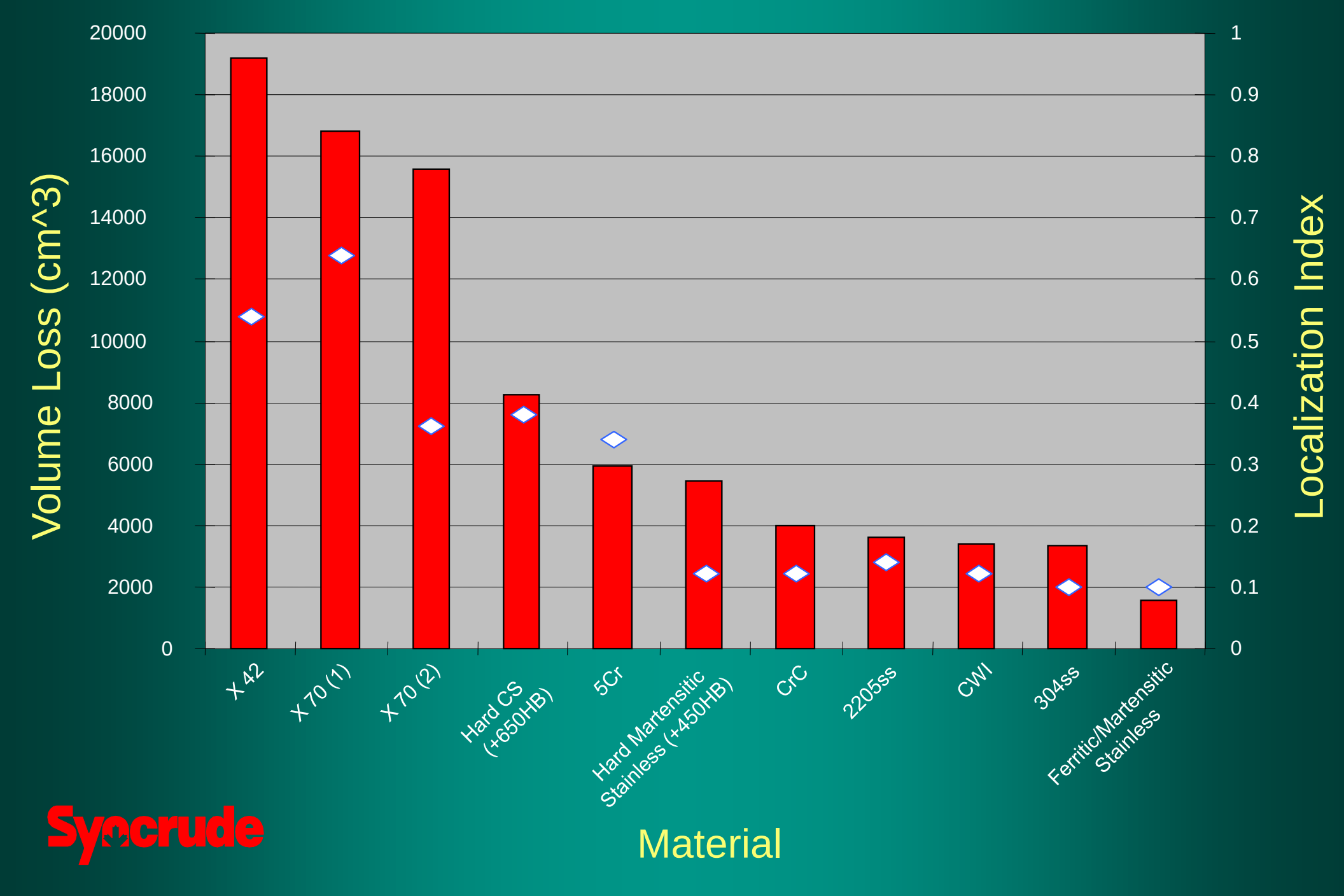
August 04 - January 15, 2002


Volume Loss (cm^3)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Localization Index
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
X 42
X 70 (1)
X 70 (2)
Hard CS (+650HB)
5Cr
Hard Martensitic Stainless (+450HB)
CrC
2205ss
CWI
304ss
Ferritic/Martensitic Stainless
Material
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2 Wt% @ 5m/s

Weight Loss (g) in 2hr Test

0.0250
0.0200
0.0150
0.0100
0.0050
0.0000

X42
X70
650+HB CS
5Cr
F/M SS
450+HB SS
304SS
Duplex
CWI

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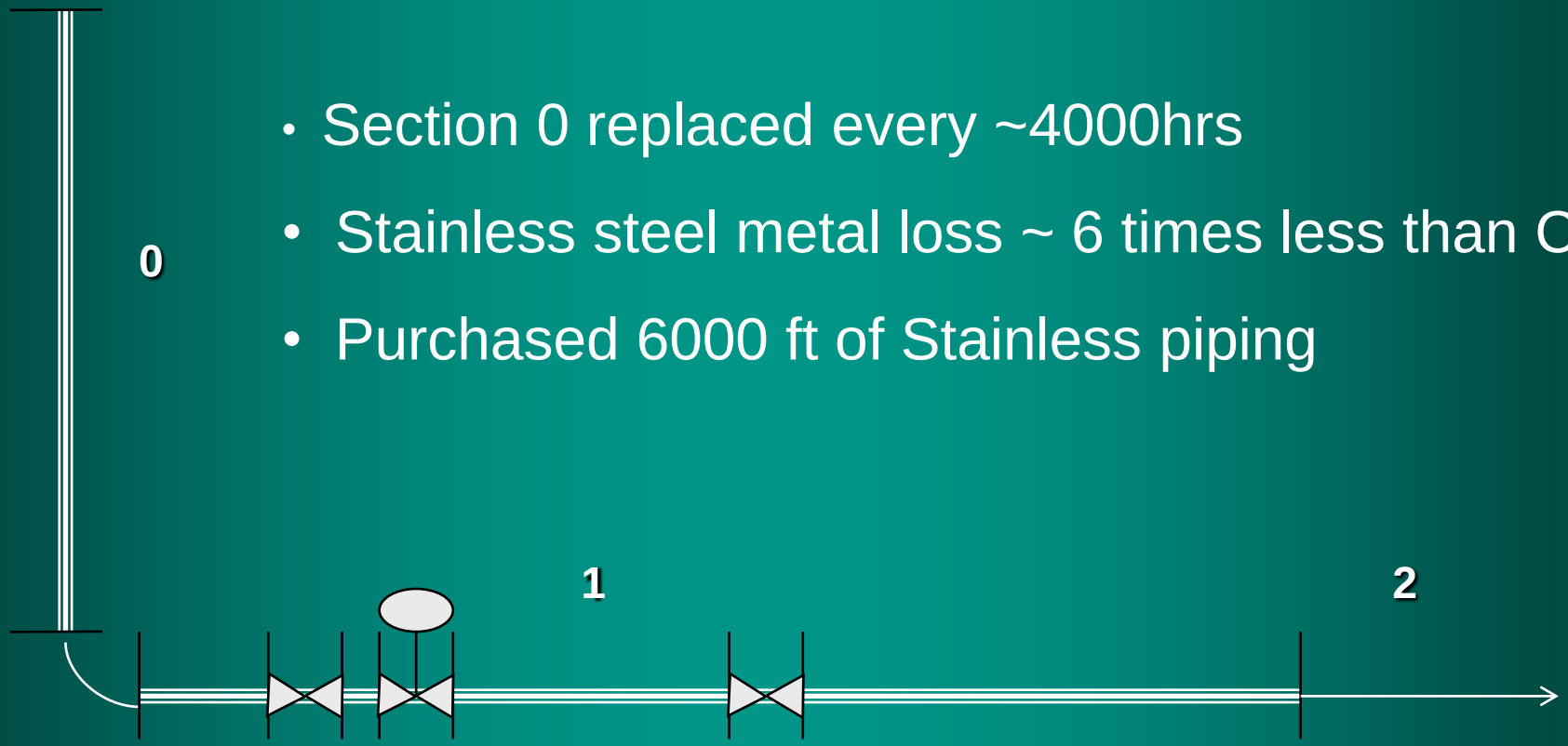
No CP
CP

700 foot Stainless Steel Test Section



- Section 0 replaced every ~4000hrs
- Stainless steel metal loss ~ 6 times less than CS
- Purchased 6000 ft of Stainless piping

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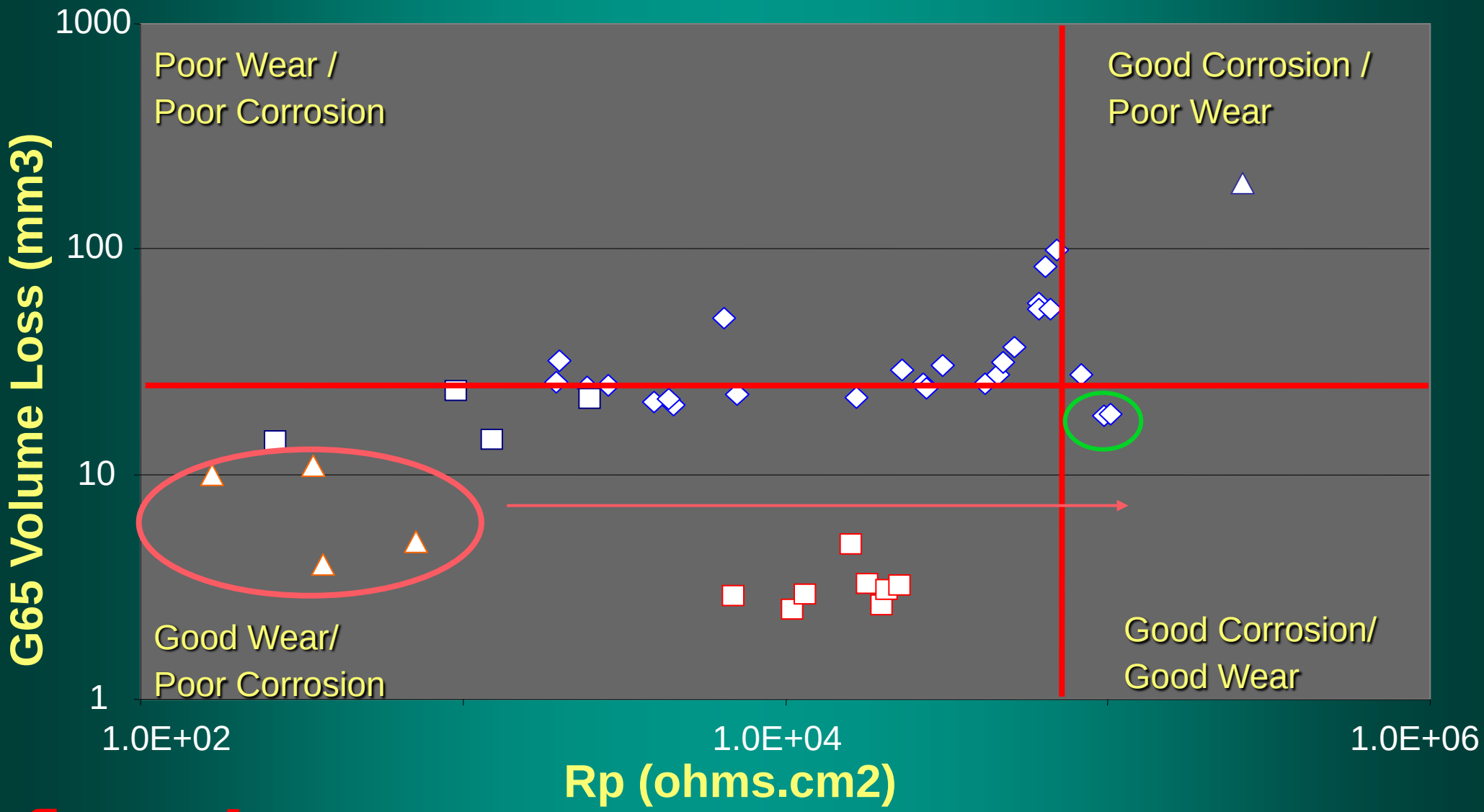
Abrasion / Corrosion



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CWI
Stainless steel
WC-MMC
Sintered WC
CrC Overlay

Conclusions

- Understanding how materials are affected by service environment is critical to maximizing equipment reliability and availability.
- Not all slurry environments are the same. This makes material selection a challenge. Testing is often required.
- Corrosion should always be considered in wet slurry environments.

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Acknowledgments

- Colleagues at Syncrude Research and Base Plant

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Questions?