

# Erosion-Corrosion in Slurry Service

by  
Stefano Chiovelli  
Syncrude Canada Ltd



---

---

---

---

---

---

---

---

## Outline

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



---

---

---

---

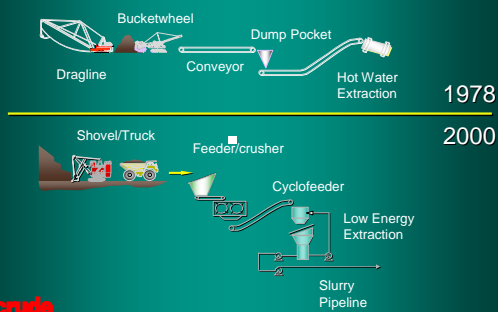
---

---

---

---

## Mining Scheme Comparison



---

---

---

---

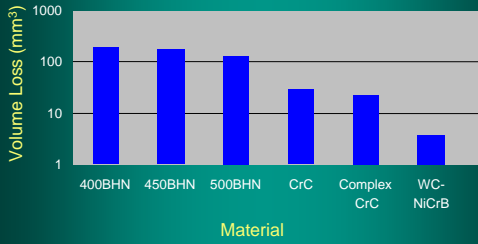
---

---

---

---

## Wear Resistant Materials Used at Syncrude



Syncrude

---

---

---

---

---

---

---

---

## 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.

Syncrude

---

---

---

---

---

---

---

---

## Variables Influencing Erosion-Corrosion

| Pipe           | Solid Phase                 | Liquid Phase             | Operation                  |
|----------------|-----------------------------|--------------------------|----------------------------|
| Composition    | Particle size               | Dissolved O <sub>2</sub> | Laminar/ turbulent         |
| Microstructure | Distribution                | Velocity                 | Homogeneous/ Heterogeneous |
| Hardness       | Particle hardness           | Temperature              | Rolling bed                |
|                | Particle shape (angularity) | pH                       |                            |
|                | Density                     | Conductivity             |                            |
|                |                             | Chlorides                |                            |
|                |                             | Viscosity                |                            |

Syncrude

---

---

---

---

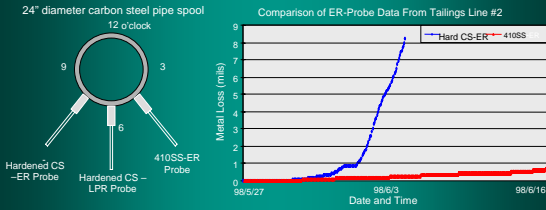
---

---

---

---

## Location of Corrosion Probes in Carbon Steel Pipe Spools



SynCrude

---

---

---

---

---

---

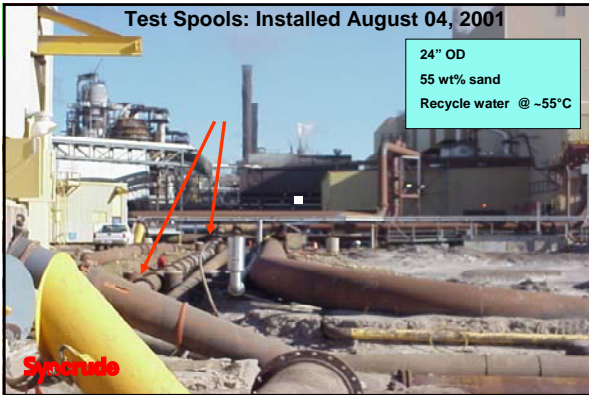
---

---

---

---

## Test Spools: Installed August 04, 2001




---

---

---

---

---

---

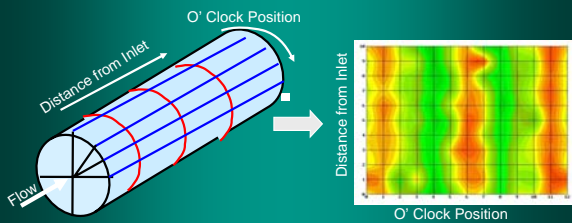
---

---

---

---

## UT Thickness Measurements on Carbon Steel Pipe Spool



SynCrude

---

---

---

---

---

---

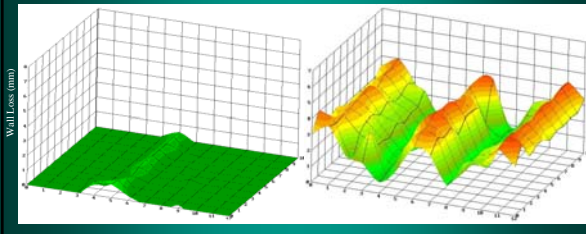
---

---

---

---

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



SynCrude

August 04 - January 15, 2002

---

---

---

---

---

---

---

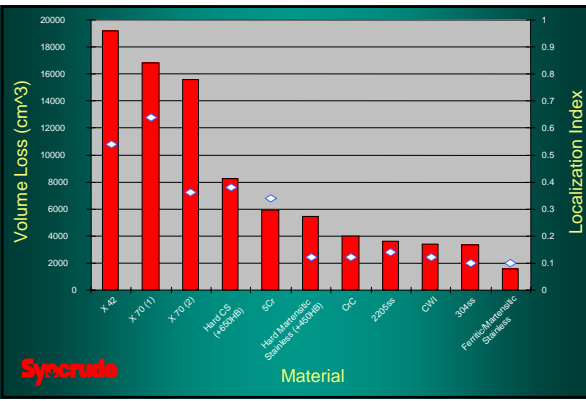
---

---

---

---

---



SynCrude

Material

---

---

---

---

---

---

---

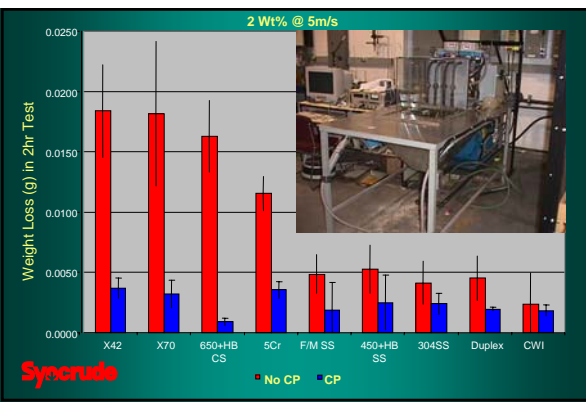
---

---

---

---

---



SynCrude

No CP CP

---

---

---

---

---

---

---

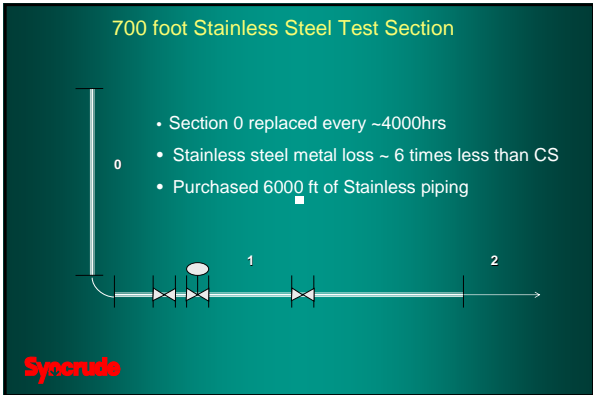
---

---

---

---

---




---

---

---

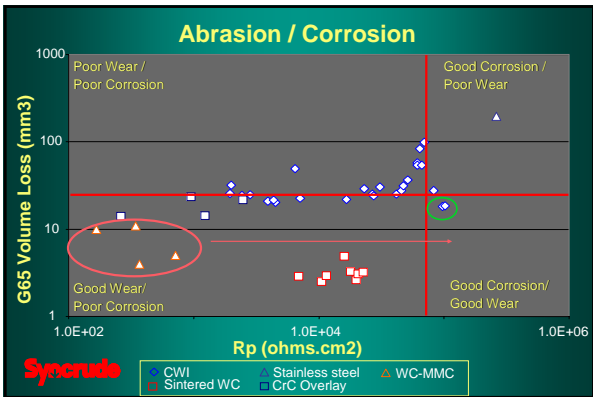
---

---

---

---

---




---

---

---

---

---

---

---

---

### 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.

**Syncrude**

---

---

---

---

---

---

---

---

## Acknowledgments

- ◆ Colleagues at Syncrude Research and Base Plant

■

Syncrude

---

---

---

---

---

---

---

---

■  
Questions?

---

---

---

---

---

---

---

---