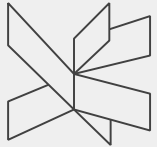
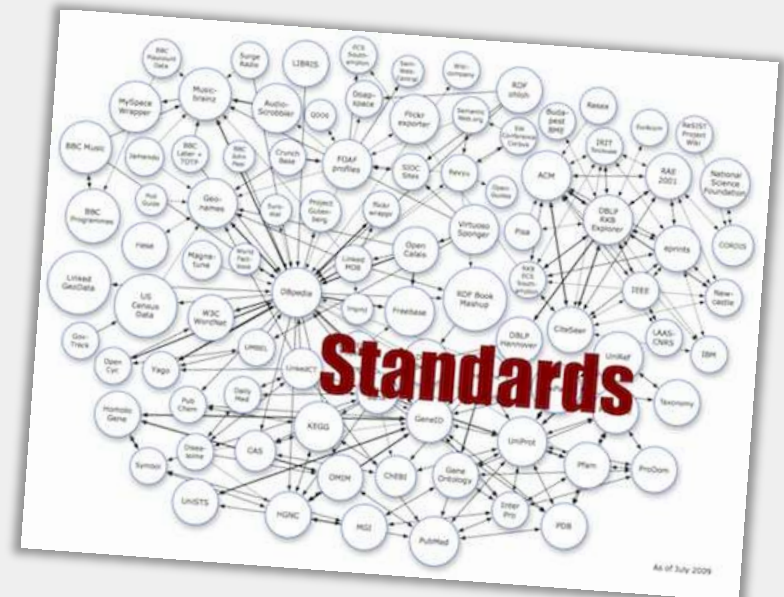


Gør tanke til handling
VIA University College



Current and Future Standards for MIC Management

Dr. Torben Lund Skovhus
VIA University College, Denmark



Agenda

- Why standards?
- Current standards on MIC
 - Some challenges...
- Future standards on MIC
 - Our current plan...
- Opening up for comments, suggestions and discussion



Why standards?

Standards are published documents that establish specifications and procedures designed to ensure the reliability of the materials, products, methods, and/or services people use every day. Standards address a range of issues, including but not limited to various protocols that help ensure product functionality and compatibility, facilitate interoperability and support consumer safety and public health.



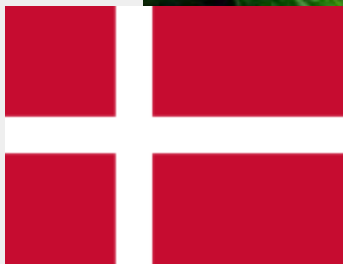
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Why standards?

- Pros and cons



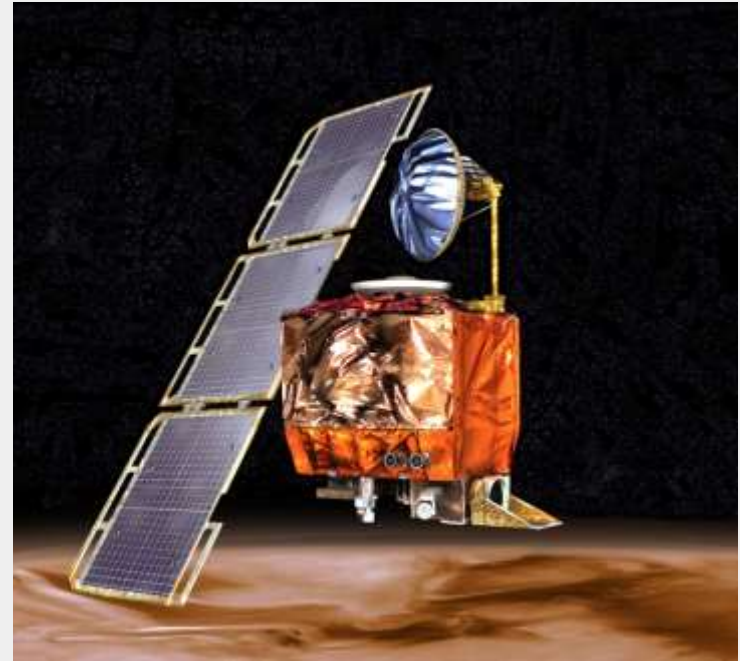
Why standards?

- Pros and cons



Why standards?

Nov. 10, 1999: Metric Math
Mistake Muffed Mars
Meteorology Mission



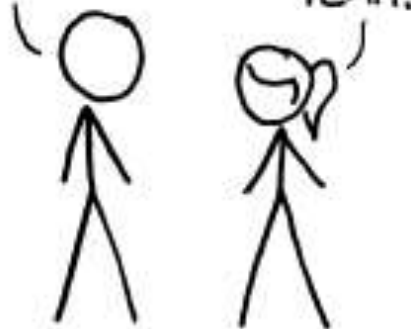
1999: A disaster investigation board reports that NASA's Mars Climate Orbiter burned up in the Martian atmosphere because engineers failed to convert units from **English to metric**.

Where we don't want to end up...

HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)

SITUATION:
THERE ARE
14 COMPETING
STANDARDS.

14?! RIDICULOUS!
WE NEED TO DEVELOP
ONE UNIVERSAL STANDARD
THAT COVERS EVERYONE'S
USE CASES.



SOON:

SITUATION:
THERE ARE
15 COMPETING
STANDARDS.

<https://xkcd.com>

Why standards?

Activity 1

Knowledge
(for action!)

- MIC Genes
- Indicators
- Rates
- SOPs

Activity 2

**Devices/
Assays**



Activity 3

Models



Activity 4

GE³LS



*MIC into Standards
& Corrosion
Management
Frameworks*

**Interactions/input/feedback
between Researchers & End-users**

Current standards on MIC

TABLE 7.1

Published Standards on Oilfield Corrosion Management and Inspection

| Standard/Guidance Document | Source |
|--|----------------------------------|
| DNV-RP-F116, Integrity management of submarine pipeline systems (2015) | DNV GL |
| EFC 64, Recommended Practice for Corrosion Management of Pipelines in Oil & Gas Production and Transportation (2012) | European Federation of Corrosion |
| DNV-RP-G101, Risk Based Inspection of Offshore Topsides Static Mechanical Equipment (2010) | DNV GL |
| Guidance for Corrosion Management in Oil and Gas Processing (2008) | Energy Institute |
| Review of Corrosion Management for Offshore Oil and Gas Processing (2001) | Health and Safety Executive |

Skovhus, Enning & Lee (CRC Press 2017)

Current standards on MIC

TABLE 7.2

Published Standards with the Topic of Oilfield Microbiology and MIC

| Standard/Guidance Document | Source |
|---|-----------------------|
| TMO194-2014, Standard Test Method Field Monitoring of Bacterial Growth in Oil and Gas Systems (2014) | NACE International |
| TMO212-2012, Standard Test Method Detection, Testing, and Evaluation of Microbiologically Influenced Corrosion on Internal Surfaces of Pipelines (2012) | NACE International |
| A Practical Evaluation of 21st Century Microbiological Techniques for the Upstream Oil and Gas Industry (2012) | Energy Institute |
| SP0499-2007, Standard Practice Corrosion Control and Monitoring in Seawater Injection Systems (2007) | NACE International |
| TM0106-2006, Detection, Testing, and Evaluation of Microbiologically Influenced Corrosion (MIC) on External Surfaces of Buried Pipelines (2006) | NACE International |
| Technical Report Publication 31205, Selection, Application, and Evaluation of Biocides in the Oil and Gas Industry (2006) | NACE International |

Skovhus, Enning & Lee (CRC Press 2017)

Future standards on MIC

- Just another standard...?
- Where should it live (organization)?
- How do we make it work in the field?
- How does it link to existing standards?
- Influence *existing* channels or building *new* standards?
- Standardization could be on several levels (sampling, handling, transportation, lab-processing, method selection, data displaying, interpretation in models, etc..)



Future standards on MIC

Working with existing guidelines/standards:

| Standard | Focus |
|----------------------|--|
| NACE TMO212 (2018) | Standard Test Method: MIC on internal surfaces of pipelines |
| DNVGL-RP-F116 (2015) | Integrity management of submarine pipeline systems |
| DNVGL-RP-G101 (2010) | Risk Based Inspection (RBI) of offshore topsides static mechanical equipment |

Future standards on MIC

Working on new guidelines/standards:

| Standard | Focus | Approach |
|-------------------------|--|--|
| TG-561 (NACE) | <p>Title: Molecular Microbiological Methods – Sample Handling and Laboratory Processing</p> <p>Task: Develop a standard test method that may be used to perform DNA-based microbiological analysis of samples collected for corrosion monitoring and control</p> | <p>2nd meeting in the TG at NACE CORROSION 2019 Wednesday 8-10 am this week</p> <p>3 sub-groups have been working on sections over the past year</p> |



Future standards on MIC

Working on new guidelines/standards:

| Standard | Focus | Approach |
|----------------|--|--|
| DNV GL-RP-XXXX | Pipeline failure investigation protocol including advanced MIC diagnostics | Our project will develop a new approach for combining classical failure investigation protocols with modern genomics data and MIC diagnostics Industry input is needed... |



Thank you!

geno-MIC
microbiologically influenced corrosion



Thank you!

Genome Canada

Genome Alberta

Genome Atlantic

Alberta Innovates

InnoTech Alberta

Natural Resources Canada

Mitacs

Innovate NL

Baker Hughes, a GE Company

Bioclear Microbial Analysis

BP

DNV GL

Dow Microbial Control

Enbridge

Husky Energy

Kinder Morgan

Luminultra

NALCO Champion

OSP

PeroxyChem

Shell

Schlumberger

Suez

Suncor



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