

PUMPS & PIPES
NORWAY



Norway Pumps & Pipes and Equinor Technology Innovation Challenge Workshop

Venue: Arkivenes Hus, Room AH 406, Richard Johnsens gate 12, 4021 Stavanger

Date and Time: Tuesday 27.08.2019, 08:30-15:00.

Norway Pumps & Pipes together with Equinor Technology Innovation invite you to a professional workshop, where the aim is to bring together groups of professionals, who may not otherwise can interact, to transfer knowledge and technologies across industries. We believe that the solution to a problem or challenge may well be in “The Other Guy’s Toolkit”. In this workshop two challenges will be presented; one from oil & gas, and another from medicine in addition to discussions on potential technology transfer. Please see the attachments for a brief description of the challenges, and concerning IPR rules.

Agenda

- 08:30-8:45 Attendees arrival and registration.
- 08:45-09:00 Welcome to the workshop.
- 09:00-09:15 Radical ideation methodology of Equinor.
- 09:15-09:30 Medical challenge description: *Non-invasive imaging for assessing plaque stability, and plaque burden.* (A brief description of the challenge is given on page 4.)
- 09:30-10:30 Individual and groups ideation sessions.
- 10:30-11:00 Plenum discussions of proposed solutions.
- 11:00-11:30 Conclusions and discussion on potential technology transfer/adaption.
- 11:30-12:15 Lunch.
- 12:15-12:30 O&G Challenge description: *How can we better understand the build-up of paraffins in pipelines, how can it be predicted and monitored and remediated?* (A brief description of the challenge is given on page 5.)
- 12:30-13:30 Individual and groups ideation sessions.

13:30-14:00 Plenum discussions of proposed solutions.

14:00-14:30 Conclusions and discussion on potential technology transfer/adaption.

14:30-15:00 Discussion on technology transfer/adaption across industries and way forward.

* Coffee and fruits will be served during the workshop session and there will be bio-breaks too.

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IPR rules

Background IP – presentations at the meeting and existing IPR prior to the meeting:

- Each party will keep ownership to their background IP.
- The parties are possibly conducting research and development on a broad scale and might already be working on similar ideas and concepts to those presented in the workshop. To avoid any risk of confusion over ownership, the parties shall not share any confidential information or trade secrets. Share only nonconfidential information which focus on high-level descriptions.

Foreground IP – results of the meeting:

- The goal is to inform one another about their toolbox and challenges, and new ideas can arise.
- Ideas to be described in a general manner, technology development may be followed up externally in separate projects.
- Minutes of meeting: Such new ideas shall be described in the minutes of meeting, please note the name of the contributors.



How to assess plaque stability and burden by non-invasive imaging?

- **Cause of problem**

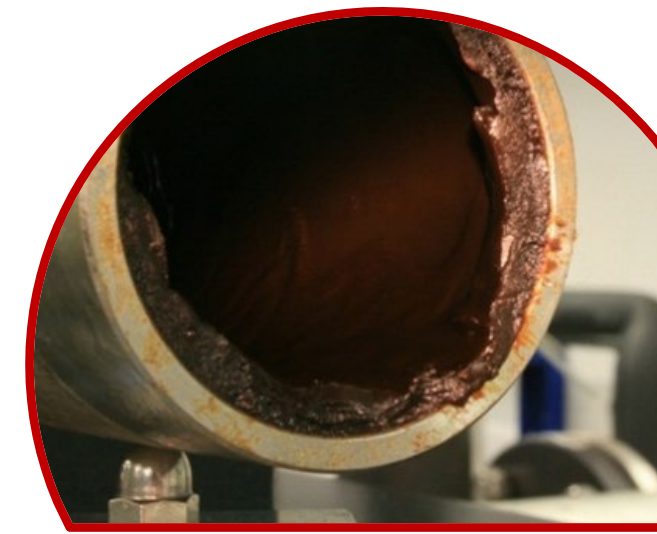
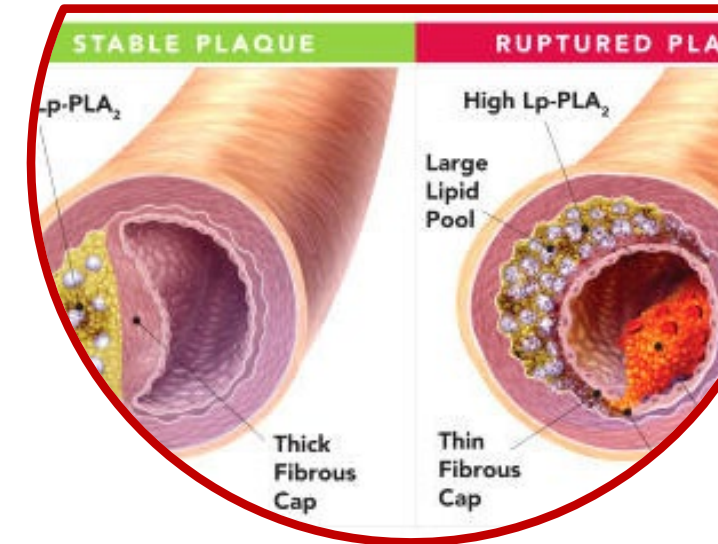
- The exact cause is not known. Risk factors include abnormal cholesterol levels, high blood pressure, diabetes, smoking, obesity, family history, and an unhealthy diet. Plaque is made up of fat, cholesterol, calcium, and other substances found in the blood.

- **Effect of problem**

- Reduced blood flow to the working heart muscle results in too low supply of oxygen. Lack of oxygen results in damage to, or dysfunction of tissue; chest pain (angina) during exertion, reduced pump function and arrhythmias.

- **Existing solutions for problem control**

- Invasive: Coronary angiography and intra vascular imaging tools (intravascular ultrasound (IVUS), optical coherence tomography (OCT), near infra red spectroscopy (NIRS), fractional flow reserve (FFR)).
- Non-invasive: Coronary imaging with CT, combination of PET and CT. Only one commercial company (HeartFlow).



NEED: New methods that can easily determine the risk for myocardial infarction and stroke caused by plaque rupture by non-invasive methods!

How to predict, detect and clean paraffinic wax deposits in oil pipelines?

- **Cause of problem**

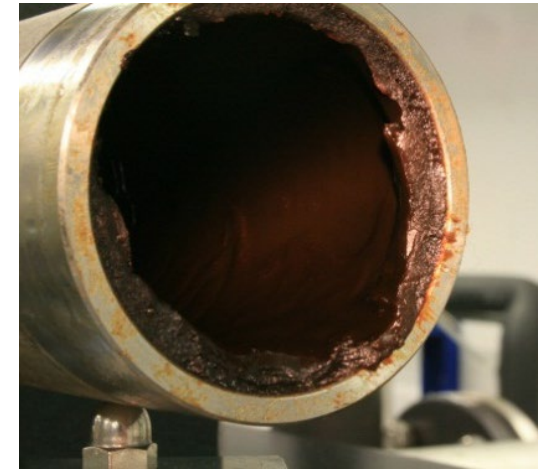
- Paraffinic wax is deposited on cold surfaces, like the inner wall of subsea steel pipelines, when there is a driving force for diffusion of wax molecules towards the surface. The main driving force is the temperature difference between the oil and the surface close to the pipe wall.

- **Effect of problem**

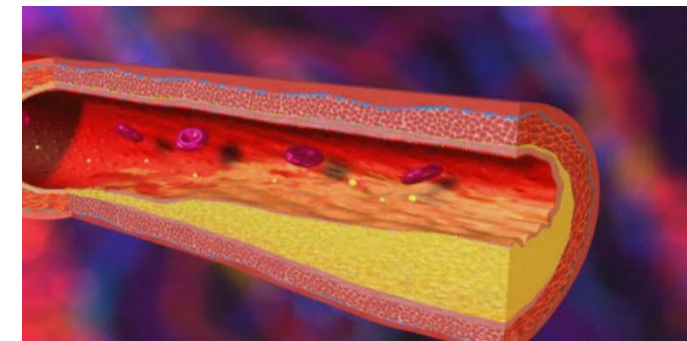
- Paraffinic wax causes restriction, and thereby increased pressure drop, reduced throughput (capacity), and may, ultimately, totally block the line.

- **Existing solutions for problem control**

- Paraffinic wax deposition is controlled either by preventive measures (heat conservation or chemical inhibitors) or by remediation measures (regular wax scraping, i.e. 'pigging').



Paraffin deposit in pipeline



Fat deposit in blood vessel