

News about corrosion and the corrosion industry produced quarterly for members of NACE International in the Calgary area



NACE Teacher Camp fosters Careers in Materials Science!!

ASM and NACE have been offering annual workshops to excite educators about teaching materials science in their classrooms for many years. Interest in the camps has grown over the years, and in 2012 we expect to provide the experience to more than 25 teachers.

ABOUT THE WORKSHOP

This free five-day workshop combines innovative classroom instruction and laboratory experiences to show teachers how to engage their students using simple, low cost/no cost experiments that they can integrate into existing lesson plans.

These teachers thus become better equipped to help their students learn more about materials science and to discover career opportunities in science. And they also share their experience with their colleagues, hence expanding the impact of this important opportunity.

SPONSORSHIPS COVER MOST OF THE COST

We seek corporate sponsors for the Teacher Materials Camp in order to help our two organizations with the costs for promotion, instructors, materials, logistic and accommodation/meals for this very valuable and well-appreciated camp.

Financial contributions already received from NACE Foundation, NACE Calgary, ASM and ASM Calgary, will be combined with contributions from the industry.

FOR INFORMATION ABOUT THE TEACHER CAMP AND/OR SPONSORSHIP OPPORTUNITIES CONTACT...

Jana Haggins
membership@nacecalgary.ca
403 237-1221



"I really enjoyed everything! I have been teaching for 18 years and even though I've seen or used a few of the demos, I was able to learn and apply info in new ways. I now have many more demos/labs to do in the classroom."

"Labs were all very good, easy to follow, great for students."

"Whether you are a Jr. or Sr. high teacher, there was information applicable, appropriate and fun for everyone."

Message from the Chair - Thane Schaffer

We want your ideas!!



In 2011, NACE Calgary provided seven events for members...

- Non-Metallics Mini Symposium
- Rocky Mountain House Satellite Seminar
- Golf Tournament
- ILI Tradeshow and Social Event
- Year End Dinner and Appreciation Event
- Overview of ERCB's Revised Directive 077 Technical Event
- MRO175/ISO 15156 Technical Event

Nearly 800 members and colleagues participated in these events.

Most of the events included a sponsorship opportunity. The success of those events was enhanced by the generous contributions of a number of sponsors who stepped forward and provided altogether more than \$20,000 dollars to support event costs, thus making the events more affordable, as well as countless prizes and recognition items.

We are tremendously grateful to our sponsors, and feel that we couldn't offer the programs we do, at the cost we do, now and in future, without their generous support and commitment to NACE Calgary and corrosion engineering.

The Executive Committee is exploring new ways in which we can provide our sponsors with an easier way to consider how they can support and receive recognition for sponsorships. We'll provide more information about this as it develops.

In the meantime, in this issue alone, we are recognizing contributions of several sponsors to recent events. Please join us in acknowledging their great support!

[Click here](#) to email me with your suggestions for sponsor recruitment and recognition. I will bring your ideas to our next Executive meeting, and will respond directly to everyone who emails me with information on what we are planning as a result.

Thanks!

Thane D. Schaffer

Thank you Rocky Mountain House sponsors!!!!

The NACE Calgary Rocky Mountain House Satellite Seminar was a great success, thanks to good planning, great presenters, and the outstanding support of event sponsors.

NACE Calgary thanks the following sponsors for their amazing support:

- Weatherford - lunch, booth, lanyards;
- multi-chem - booth, pens;
- pipe•tech - booth;
- Baker Hughes - lunch;
- Champion - coffee, pens.



Weatherford

multi-chem®

pipe•tech
CORPORATION LTD.

**BAKER
HUGHES**

**Champion
Technologies**

Nominate a colleague for a NACE Award!

NACE INTERNATIONAL AWARDS PROGRAM

NACE International has several annual awards including:

Distinguished Service Award:

for service to NACE as an elected or appointed member at the section, area, or association level.

Technical Achievement Award:

for technical achievement having a significant impact on the practice of corrosion control or enhancing the corrosion profession.

NACE Fellow: recognition of distinguished contributions in the fields of corrosion and its prevention; Fellows serve as advisors to the association.



2012 Award Nominations

[Click here](#) for more information and to nominate a NACE member for one of these awards.

NACE NORTHERN AREA DISTINGUISHED SERVICE AWARD

This award is given to individuals in recognition of their contributions to NACE International at the Section and/or Area levels. Relevant contributions are of the following nature:



- Long term service on a Section executive or the Northern Area Board.
- Active in organizing meetings, conferences, and events.
- Active in promoting and increasing membership in NACE.
- Active in promoting the goals and objectives of NACE (education, certifications, committee and standards).
- Any other contributions which enhance and publicize the role of NACE International in the corrosion community.

[Click here](#) for more information and to nominate a NACE member for this award.

NACE Calgary Non-Metallics Mini Symposium a Maxi Hit!!!

Highlights:

- Approximately 90 in attendance
- Eight timely presentations
- Networking during breakfast, lunch and coffee breaks
- Positive feedback

Thanks to our great sponsors for their support of this successful event!...

BREAKFAST



LUNCH



resources & energy

COFFEE



SHERWIN-WILLIAMS.

LANYARDS



Weatherford

PENS/PAPER



Plan now to attend...



NACE Edmonton and Calgary sections have agreed to work together to host the popular and growing OSHOW forum on alternate years. This year, the forum will take place in Edmonton on November 14-15.

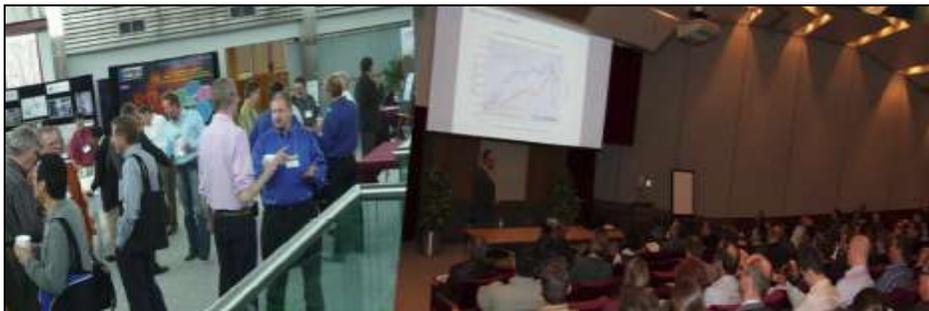
The OSHOW offers...

- An open forum on integrity management, materials, corrosion, safety, and risk related to oil sands and heavy oil production.
- An opportunity to review state of the art technologies, best practices, lessons learned from past experience related to equipment design, construction, operation, inspection, maintenance and process performance.
- The chance to form working groups to address industry challenges, advance standards and identify new areas for research initiatives.
- A great opportunity for information sharing and networking.

Areas of focus include: Mining and Extraction, In-Situ Recovery, Upgrading, Water Systems, and Asset Integrity Management Systems.

For further information regarding **event details/registration**, contact Beth Daniel... beth.daniel@encana.com - 403-645-4289

For **sponsorship/booth opportunities**, contact Kevin Reaville... kevin.g.reaville@conocophillips.com - 780-920-2776



Events/Courses

ASM/NACE CALGARY TECHNICAL DINNER

March 21, 2012
5:30 p.m. - 8:00 p.m.
Calgary Petroleum Club

CORROSION 2012

Salt Lake City, Utah
March 11-15, 2012

NORTHERN AREA 2012 EASTERN CONFERENCE

Toronto, Ontario
October 28-31, 2012



PIPELINE COATING APPLICATOR TRAINING

Nisku, Alberta
April 30-May 4, 2012

For information on several upcoming NACE Calgary courses, click here!



A **technical session on SAGD** on March 9, 2012 at the Calgary Chamber of Commerce.

A full day **trade show on Internal Coatings** on April 27, to include 2-3 speakers.

A **Satellite Seminar** in October.

A **one-day symposium** at the end of November.

Watch for more details. If you need more information right now, contact Matt Stroh, program@nacecalgary.ca.

For Your Information...

Featuring some of the worst corrosion related failures recorded around the world, along with historical references and lessons learned.

Assembled by *Thaier Al-Issa, M.Eng. P.Eng.*

This newsletter features a Canadian case of **Crude Oil Pipeline Rupture - Enbridge Pipelines Inc., near Hardisty, Alberta - 17 January 2001.**

Case – 6: Enbridge Pipelines Inc., 864-millimetre Line 3/4, Mile Post 109.42, Near Hardisty, Alberta - 17 January 2001.

“At 0045 mountain standard time on 17 January 2001, a rupture occurred on the Enbridge Pipelines Inc. 864-millimetre outside diameter Line 3/4 at Mile Post 109.42, 0.8 kilometres downstream of the Hardisty pump station near Hardisty, Alberta. The rupture occurred in a permanent slough that was fed by an underground spring. Although the line was shut down at the control centre in Edmonton, Alberta, within minutes of the rupture, the exact location of the rupture was not found until 1415 Mountain Standard Time. Approximately 3800 cubic metres of crude oil was released and contained within a 2.7-hectare section. As of 01 May 2001, 3760 cubic metres of crude oil had been recovered.” (<http://www.tsb.gc.ca/eng/rappports-reports/pipeline/2001/p01h0004/p01h0004.pdf>)



Enbridge Liquids Pipelines

“Incident failure analysis:

The failed joint of pipe was sent to the Canspec Group Inc. (Canspec) laboratory in Edmonton for analysis and determined that multiple cracks had initiated on the outer pipe surface along the corner formed between the pipe body and the edge of the electric resistance weld (ERW) longitudinal seam. Minor pitting corrosion was present at the crack-initiation point of the area that exhibited the maximum crack depth. The cracks had coalesced after approximately 1 mm growth to form one single crack front. Canspec determined that the crack had continued to grow by fatigue until the pipe could no longer support the normal internal operating pressure of the pipeline. The Supervisory Control and Data Acquisition (SCADA) records indicate that the pressure at the time of failure was 3916 kilopascals (kPa). Canspec also determined that the failure site was located in a mildly corrosive slow groundwater discharge area.

The section of the 864 mm line in which the rupture occurred had been manufactured in 1967 by Canadian Phoenix of Calgary, Alberta, using the ERW process according to pipe standard API5LX52 of March 1967. This section of line had been installed and hydrostatically tested in 1968 to a minimum pressure of 5040 kPa. The pipe had been coated with spiral-wrapped polyethylene tape. The tape had bulged along the ERW seam of the failed joint of pipe and exhibited minor wrinkling at other locations along the joint. The bulge reached a maximum height of 13.7 mm about 4 m from the rupture and tapered away at the upstream and downstream girth welds.

The failed joint of pipe was located in a field sag bend with the ERW seam located at the three o'clock position. The failure initiation point occurred near one end of the bend. Data from an in-line inspection completed in 1994 indicated that the bend was a three-degree bend; construction markings under the tape coating also indicate a three-degree bend. (<http://www.tsb.gc.ca/eng/rapports-reports/pipeline/2001/p01h0004/p01h0004.pdf>)

“Analysis:

Since the exterior flash of the ERW seam had not been ground-flush with the pipe, the tape coating tented over the seam providing a narrow channel into which groundwater could seep.

The longitudinal seam was located at the three o'clock position where soil stresses are at a maximum. Repeated freeze/thaw cycles, possibly combined with minor pipe settlement, exacerbated the coating disbondment. Although the pipe was cathodically protected, the disbonded tape coating shielded the pipe from the cathodic protection current. Groundwater provided a corrosive environment that contacted the pipe steel and allowed a corrosion cell to be set up.

Pitting corrosion that occurred intermittently along this corner increased the stress concentration factor. A corrosive environment would have lowered the threshold stress intensity factor for crack initiation and propagation. The cyclic pressures due to batch operations provided the necessary stress levels for cracking to initiate and propagate.

Although the performance of metal loss in-line inspection tools has been proven for over a decade, such is not the case for crack detection in-line inspection tools. The May 1999 failure revealed certain limitations with the elastic wave crack detection tool. The September 1997 and October 2000 in-line inspections during which a more advanced crack detection tool was used suggested that the tool is sensitive in locating indications but that there are difficulties during data analysis in differentiating among those indications.

The staged approach to data analysis and reporting would have helped to target those locations between Edmonton and Regina most susceptible to cracking. However, since the pipeline was not inspected until October 2000, it is not clear whether the fatigue crack at MP 109.42 could have been identified and repaired before failure considering the time required for the first stage of data analysis. The timing of the October 2000 in-line inspection appears to have been based on how best to allocate resources taking into consideration the inspection and repair history of the 864 mm pipeline and Enbridge's commitment to inspect all segments of that line.

It can be difficult for data analysts to distinguish between the corner geometry created by the untrimmed external flash of an ERW seam and certain defects immediately adjacent to that seam.”

(<http://www.tsb.gc.ca/eng/rapports-reports/pipeline/2001/p01h0004/p01h0004.pdf>)

"Findings as to Causes and Contributing Factors

- The tape coating tented over the untrimmed weld flash of the electric resistance weld (ERW) longitudinal seam and shielded the pipe from the cathodic protection current, allowing a corrosive environment to contact the pipe metal.
- The combination of a corrosive environment, the geometry of the ERW longitudinal seam, the corrosion pitting coincident with that seam and the cyclic stresses due to normal pipeline operating pressures allowed cracking to initiate.
- The cyclic stresses due to normal pipeline operating pressures allowed the fatigue crack to propagate until the pipe wall could no longer support those pressures and the pipe ruptured.
- Although the subsequent analysis of the October 2000 in-line inspection data identified the failure site as a high-priority location, because of the time required for data analysis and reporting, this information had not been received by Enbridge at the time of the failure."

(<http://www.tsb.gc.ca/eng/rapports-reports/pipeline/2001/p01h0004/p01h0004.pdf>)

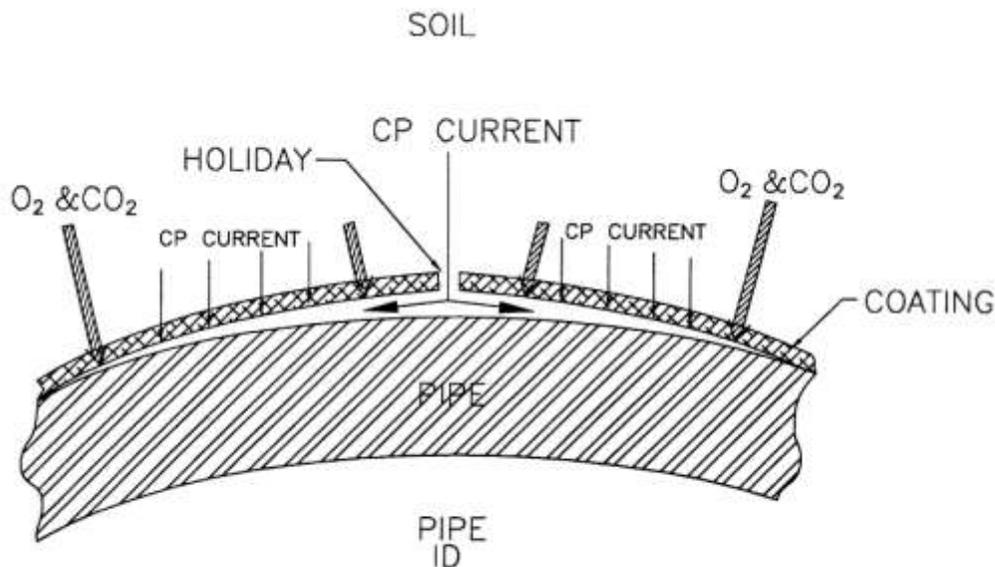
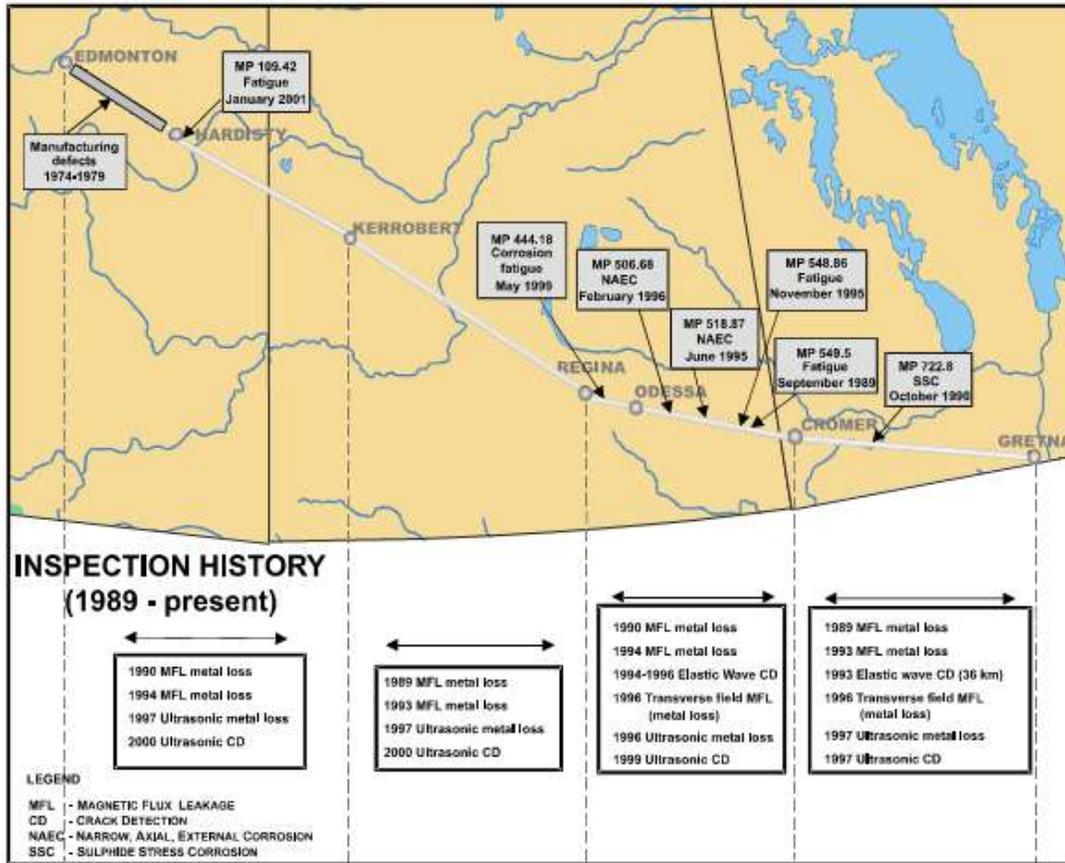


Figure 4. Schematic Showing CP Current Flow And Gas Diffusion Through Coating.

(NACE, Corrosion 96, Paper 208)



(For more details, please refer to TSB Pipeline Investigation Report - Report Number P01H0004) (www.tsb.gc.ca)

References:

- <http://www.tsb.gc.ca/eng/rapports-reports/pipeline/2001/p01h0004/p01h0004.pdf> downloaded 24/12/2011
- http://www.enbridge.com/MediaCentre/~~/media/Site%20Images/Illustrations/Maps/ENB_Liquids_map_ashx downloaded 24/12/2011
- J. A. Beavers and N. G. Thompson, *CORROSION BENEATH DISBONDED COATINGS: A REVIEW*, Cortest Columbus Technologies, Inc., Corrosion 96, Paper 208
- http://www.tsb.gc.ca/eng/publications/reflexions/pipeline/2002/numero-issue_3/pipeline-numero-issue-3-sec1.asp

NACE
CALGARY SECTION
NEWS

NACE News is produced four times a year by the Executive Committee of NACE Calgary Section.

To provide feedback, or to submit an article or story idea, email: nacenews@nacecalgary.ca.