Overview of CO2 Corrosion Models for Oil and Gas Wells and Pipelines - A Literature Summary	
CO2 Model Name	
Predict	NACE Corrosion 2002 Paper No. 02233: Overview of CO2 Corrosion Models for Wells and Pipelines Rolf Nyborg Institute for Energy Technology N-2027 Kjeller, Norway "The model includes very strong effects of oil wetting and protective corrosion films, and this tends to give very low corrosion rates for many situations. Low corrosion rates are typically predicted when the water cut is below 50 % for highly persistent oils and 5 % for not persistent oils. The model has a very strong pH dependence on the corrosion rate, due to both effect of protective corrosion films and effect of H+ mass transport limitations. This tends to give low corrosion rates when the pH value is higher than 4.5 to 5."
Predict	NACE 2010 Paper No. 10371: CO2 CORROSION MODELS FOR OIL AND GAS PRODUCTION SYSTEMS Rolf Nyborg Institute for Energy Technology P.O. Box 40, N-2027 Kjeller, Norway "The model includes very strong effects of oil wetting and variation in pH, and this tends to give very low corrosion rates for many situations. Low corrosion rates are typically predicted when the water cut is below 50 % for highly persistent oils and 5 % for not persistent oils. The model has a very strong pH dependence on the corrosion rate, due to both effect of protective corrosion films and particularly effect of H+ mass transport limitations. This tends to give low corrosion rates when the pH value is higher than 4.5 to 5.

TABLE 4. MAXIMUM MEASURED AND PREDICTED CORROSION RATES

Maximum measured and predicted corrosion rate mm/y		Oil line 3	Oil well 5	Gas line 3
Measured		1.1	4.6	4.1
Model A	DW95	0.8	4.1	10
Model B	Norsok M-506	1.5	4.1	8
Model C		1.1	7.3	5.9
Model D	Hydrocor	0.4	4.2	4.3
Model E		0.6	1.7	4.5
Model F		0.9	2.0	4.3
Model G	Predict	0.1	0.3	4.9

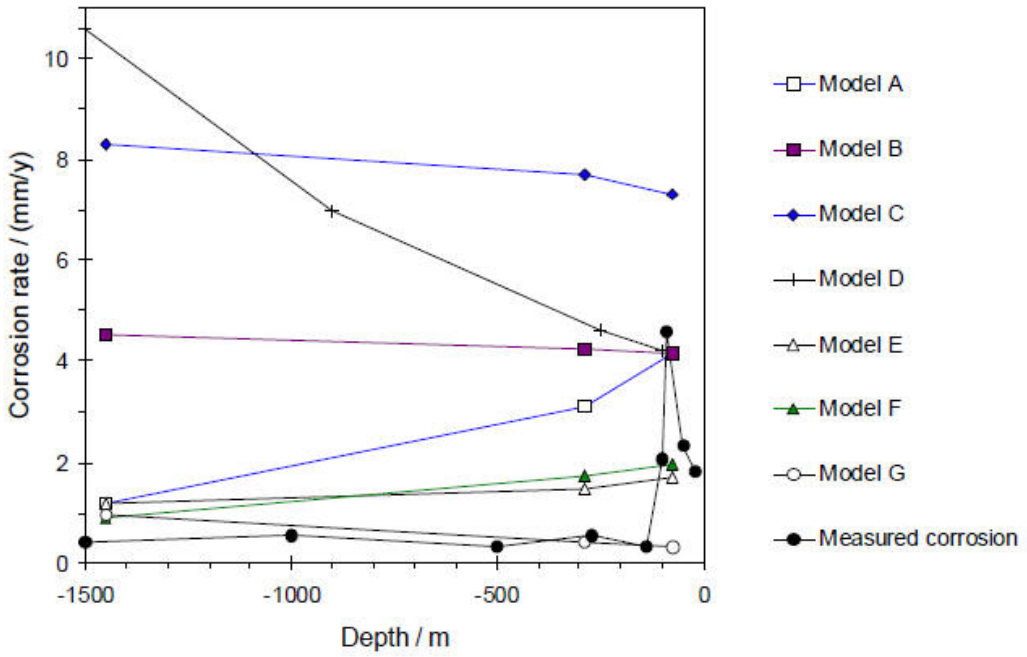
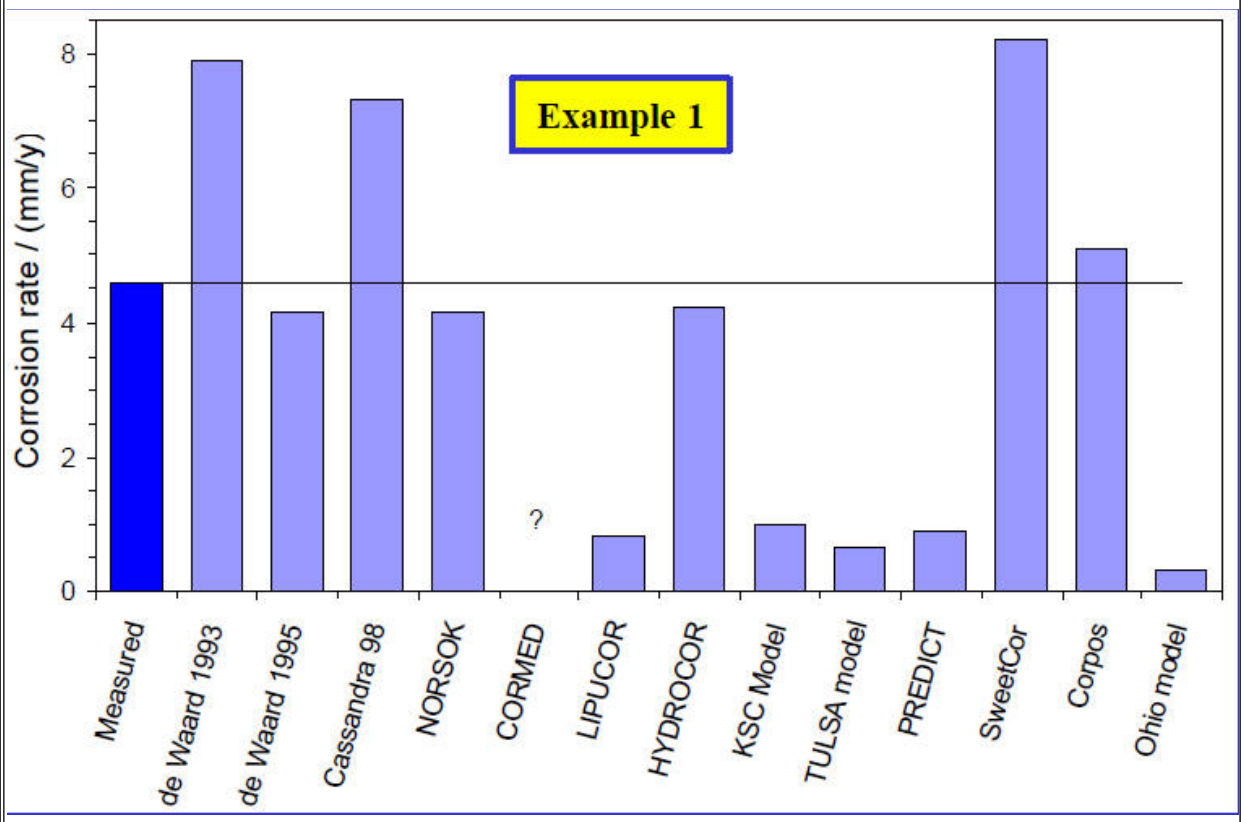


FIGURE 2 - Predicted and Measured Corrosion Rates at Different Depths in Oil Well 5

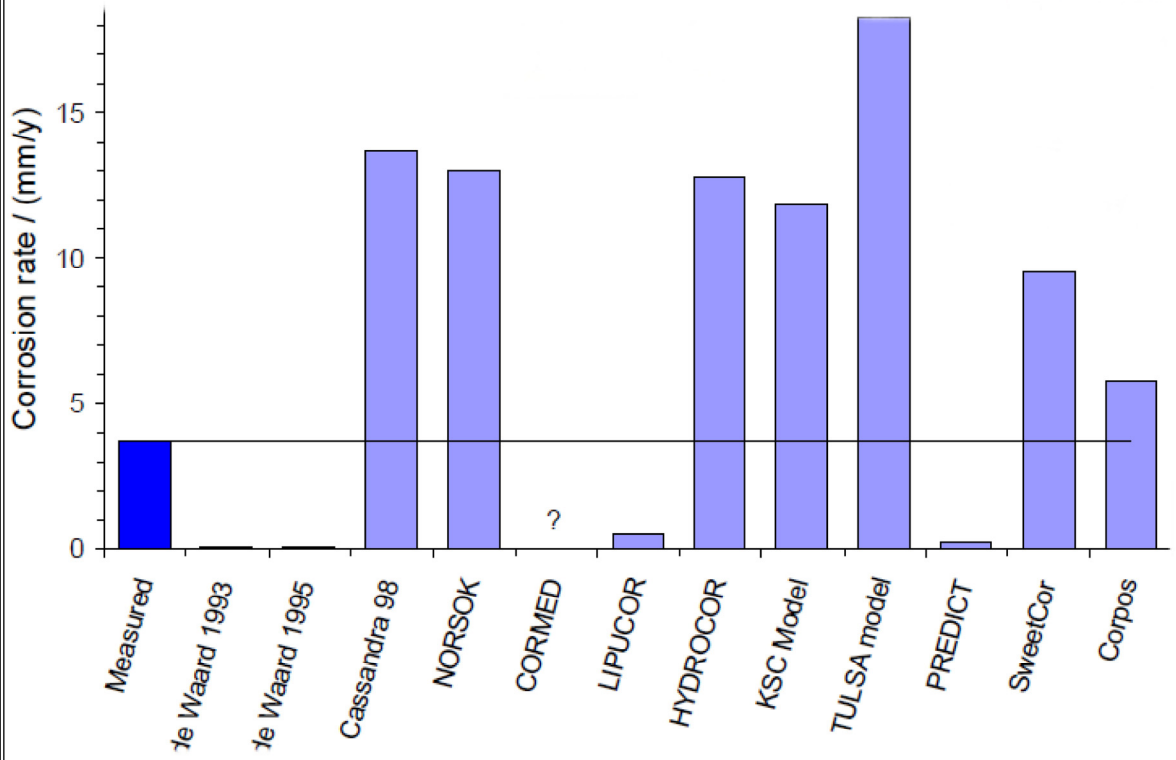
Predict

11th International Conference on Fracture 2005 (ICF11),Volume 1 of 8,ISBN: 978-1-61782-063-2
Turin, Italy, 20-25 March 2005
G.Gabetta
Eni, San Donato Milanese, Italy

Paper No. 4173: CORROSION AND FITNESS FOR SERVICE



Example 2



Predict

The 16th Nordic Corrosion Congress, 20-22nd May 2015, Stavanger, Norway
Paper No.24: Avoiding Common Pitfalls in CO2 Corrosion Rate Assessment for Upstream Hydrocarbon Industries
Seyed Mohammad Kazem HOSSEINI

Project 3 is a subsea pipeline designed to carry sweet multiphase fluid. The project document indicates that NORSOK M506 was initially used for prediction of CO_2 corrosion rate. For the purpose of verification of the reported results, ECE5.0, Cassandra 98 and Predict 6.0 have been used in this survey. Table 2 compares the unmitigated corrosion rates obtained by all four models.

Table **2** Summary of corrosion modeling results for project 3

	NORSOK M506	BP Cassandra	ECE 5.0	PREDICT 6.0
Total wall-loss (mm)in unmitigated condition	**7.41**	3.97	3.68	0.85

Table 2 also indicates that while ECE5.0 and Cassandra 98 give reasonably close predictions, Predict 6.0 estimate a very small wall-loss. This can be attributed to the strong dependence of the latter model to the oil wetting effect. The model also gives strong credit for pH so that at high pH, namely above 4.5-5, **the model underestimates corrosion rate**. The strong dependence of this model to the pH is also correlated to the effect of protective corrosion films and particularly effect of H+ mass transport limitations [3]. In summary, **one may conclude that neither NORSOK M506 nor Predict 6.0 is the best corrosion models for prediction of CO2 corrosion rate in the case of project 3.**

ECE

NACE Corrosion 2002 Paper No. 02233: Overview of CO2 Corrosion Models for Wells and Pipelines

	Rolf Nyborg Institute for Energy Technology N-2027 Kjeller, Norway The Electronic Corrosion Engineer model developed by Intetech is based on the de Waard 95 model, but with a module for calculation of pH from the water chemistry and bicarbonate produced by corrosion, and new correlations for the effect of oil wetting. The oil wetting correlation is based on a compilation of tubing corrosion data from a light crude oil field.