

# ICMS partners

## **CESCOR s.r.l.**

a company with deep experience in Cathodic Protection and Corrosion Risk Assessment



## **ENI E&P**

the ENI branch for Oil and Gas Exploration and Production



## **Antea s.r.l.**

a software house, the author of INSPECTION MANAGER

# ICMS - Integrated Corrosion Management System

The screenshot displays the ICMS software interface. At the top, there is a menu bar with 'File', 'Edit', and 'Help'. Below it is a toolbar with icons for file operations and help. The main window has tabs for 'General', 'Fc,int', 'Foc', and 'Galvanic Corrosion'. The 'General' tab is active, showing the 'ICMS Session' section with fields for Session Type, Operator, Session Date, Component Id, and Configuration Version. A 'Start' button is located below these fields. To the right of the session information is a risk matrix. The matrix has a vertical axis labeled 'Fc' (0 to 10) and a horizontal axis labeled 'Foc' (0 to 10). The matrix cells are color-coded according to a legend at the top: Safe (white), Low (grey), Moderate (green), High (blue), Severe (yellow), and Critical (red). A red diamond cursor is positioned at the intersection of Fc=1 and Foc=2. Below the matrix is the 'General Values' section, which contains a table with the following data:

Description	Name	Value	Unit
Design Life	DL	10	y
Facility	Facility	Flowlines	
Fluid type	FluidType	Formation Water	

ICMS can evaluate the likelihood of the corrosion event (i.e. the corrosion factor) and the magnitude of the consequence corrosion event (the overall consequence factor).  
The Corrosion risk is assessed by the combination on the risk matrix of the two factors mentioned above.

# Types of facilities considered

ICMS can evaluate/calculate corrosion for these facilities:

- Production wells;
- Water injection wells;
- Gas injection wells;
- Flowlines and trunk lines;
- Process plant units:
  - Piping,
  - Vessels,
  - Heat exchangers,
  - Above ground tanks;
- Oil and gas pipelines,
- Sealines.

The facilities excluded are:

- Offshore platform jackets;
- Buried tanks (external).

# Features - The assistant

The screenshot displays the ICMS software interface. At the top, there are tabs for 'General', 'Fc.int', 'Foc', and 'Galvanic Corrosion'. The main window is divided into several sections:

- Output Values for Fc:** A tree view on the left showing various corrosion parameters. 'Internal corrosion factor ... FcintCalc' is selected.
- Input values for FcintCalc:** A table with columns for Description, Name, Value, and Unit. A blue box labeled '1' highlights this table. The table contains the following data:

Description	Name	Value	Unit
Water wetting factor	Fww		
Heat stable amine salt concentration	HSAS		%
Metildiethanolamine concentration	MDEA		%
Monoethanolamine concentration	MEA		%
Material Group	MaterialGroup	...oy steel	
Material Type	MaterialType		
Fluid pressure	P		bar
Bubble point pressure	Pbp		bar
Presence of sand	PresenceOfSand	No	
Gas production flow rate	Qg		m3/d
Flow rate of gas at actual T and P	Qgact		m3/d
Glycol flow rate	Qgly	0	m3/d
Oil production flow rate	Qo		m3/d
Water flow rate	Qw		m3/d
- Icms Assistant:** A panel labeled '2' with an information icon and the text: 'Input parameter Fww was not set. (calculating CRco2)'. A blue box highlights this panel.
- Icms Warnings:** A table with columns for Name and Warning. It lists three warnings:

Name	Warning
CRmic	CRmic doesn't exist for this Fluid Type.
Fcamine	Fcamine doesn't exist for this Fluid Type
Fcmic	CRmic doesn't occur.

**ICMS assistant (2) is a very useful and easy tool that helps the user.**

The assistant guides the user, step by step, in the input values insertion process (1) by suggesting which are the missing values and the range of each value.

# Features – The graphic interface

Input values for Fcint

Description	Name	Value	Unit
inspection monito...	CRim		
Sand corrosion r...	CRsand		mm/y
Chlorination	Chlorination	▼	
Diethanolamine c...	DEA		%
Design Life	DL	10	y
Diameter	Diameter		inch
Facility	Facility	Gas injection wells ▼	
Crack corrosion f...	Fccrack		
Fluid type	FluidType	...rbons and multiphase systems ▼	
Water wetting f...	Fww	🔑	
Heat stable amine...	HSAS		%
Metildiethanolamine concentration	MDEA		%
monoethanolamin...	MEA		%
Material Group	MaterialGroup	Carbon steel AND Alloy steel ▼	
Material Type	MaterialType	▼	
Fluid pressure	P	33	bar
Bubble point pres...	Pbp	33	bar

**The graphic interface is very simple.**

It is designed for use by plant personnel, so that corrosion risk analysis is not dependent on external consultants

# Feature - Technical help

**Output Values for Fc**

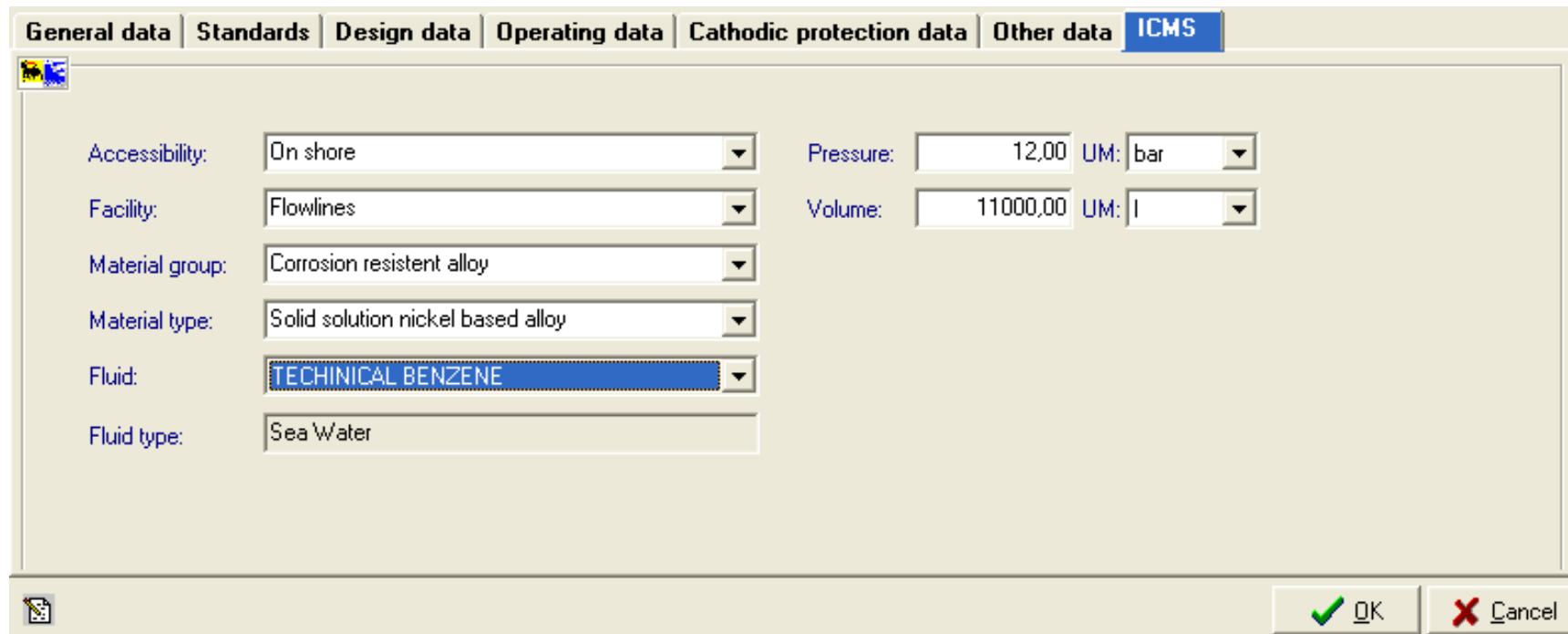
Description	Name	
[-] Internal corrosion factor	Fcint	
[-] Corrosion factor determin...	Fclmf	
[-] Residual thickness	tres	
Actual design corrosi...	tca	
[-] Internal corrosion factor ...	FcintCalc	
[-] Corrosivity Class	CorrosivityClass	
CO2 partial pressure ...	pCO2	
H2S partial pressure i...	pH2S	
[-] Amine corrosion factor	Fcamine = Fcamine do...	
[-] Amine corrosion rate	CRamine	
Corrosion rate multi...	Famine	
Base amine corrosi...	vAmine	
[-] Residual thickness	tres	
Actual design corr...	tca	

ICMS provides, for each output parameter, a technical document.

These documents are provided by Cescor .

They allow the user to understand the calculation process and to verify the results.

# Features – IM integration



The screenshot displays the 'ICMS' tab of a software interface. The interface has a tabbed menu at the top with the following options: 'General data', 'Standards', 'Design data', 'Operating data', 'Cathodic protection data', 'Other data', and 'ICMS'. The 'ICMS' tab is currently selected. Below the menu, there are several data entry fields:

- Accessibility: On shore
- Facility: Flowlines
- Material group: Corrosion resistant alloy
- Material type: Solid solution nickel based alloy
- Fluid: TECHNICAL BENZENE
- Fluid type: Sea Water
- Pressure: 12,00 UM: bar
- Volume: 11000,00 UM: l

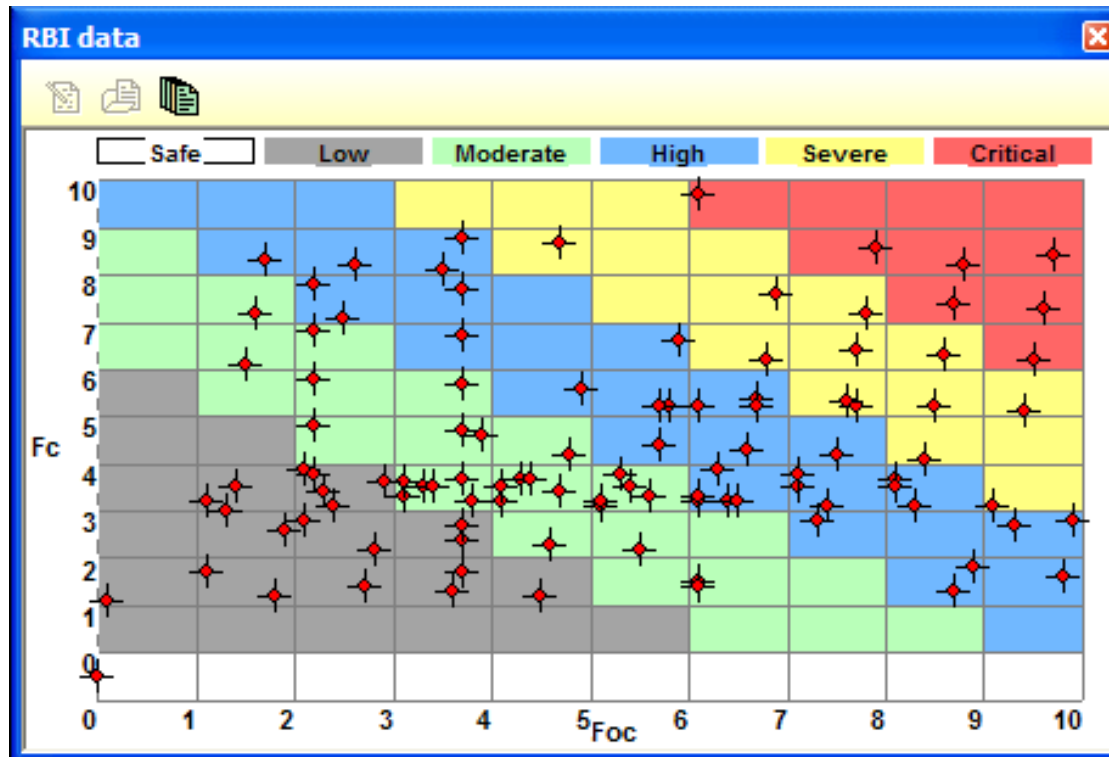
At the bottom right of the window, there are 'OK' and 'Cancel' buttons.

## ICMS is integrated into Inspection Manager.

In this way dynamic information coming directly from Inspection Manager are loaded into the RBI software.

Furthermore RBI output are stored in the Inspection Manager database for their presentation through its dynamic interface.

# Feature – easy IM report



From the graphic interface of Inspection Manager you can see the RBI situation of all of yours elements in a single matrix.

# Feature - Recommendation

General	Fc,int	Foc	Recommendation	Galvanic Corrosion
<b>Inspections</b>				
Inspection activities to be performed on the item under evaluation.				
<b>Co2Corrosion</b>				
1) Evaluate injection of corrosion inhibitor. Details of the treatment to be defined by corrosion experts.				
2) Evaluate use of corrosion resistant alloys.				
3) Evaluate installation of corrosion monitoring probes. Type of probes and locations to be defined by corrosion experts.				
4) Evaluate installation of cathodic protection by galvanic anodes.				
5) Evaluate application of internal coatings.				
<b>SSCCorrosion</b>				
1) Please check compliance of metallic materials to ISO 15156 requirements.				
2) Replace item with metallic materials complying with ISO 15156 requirements.				
<b>MicCorrosion</b>				
<b>OxyCorrosion</b>				
1) There is no Oxygen Corrosion				
<b>ErCorrosion</b>				
1) There is no Erosion Corrosion				
<b>Actions</b>				
Any action to be undertaken to reduce the corrosion risk.				
<b>Co2Corrosion</b>				
1) Perform ultrasonic thickness inspections. Measurements to be concentrated on the lower part of the vessel, where water settling is expected. Recommended frequency are summarised in the FIRST table. Different frequency can be evaluated case by case.				
2) In case of shut-in operations, perform visual inspections. Recommended frequency are summarised in the SECOND table. Different frequency can be evaluated case by case				
<b>SSCCorrosion</b>				
1) Perform inspections for crack detection with the aim to verify the piping integrity. Most convenient methods to be selected by NDT experts.				
2) In case of shut-in operations, perform visual inspections.				
<b>MicCorrosion</b>				
<b>OxyCorrosion</b>				

At the end of any ICMS session, the software automatically provides some security recommendations for the plant manager.

These recommendations are very useful to plan a safe operating for plant and to reduce the overall risk.