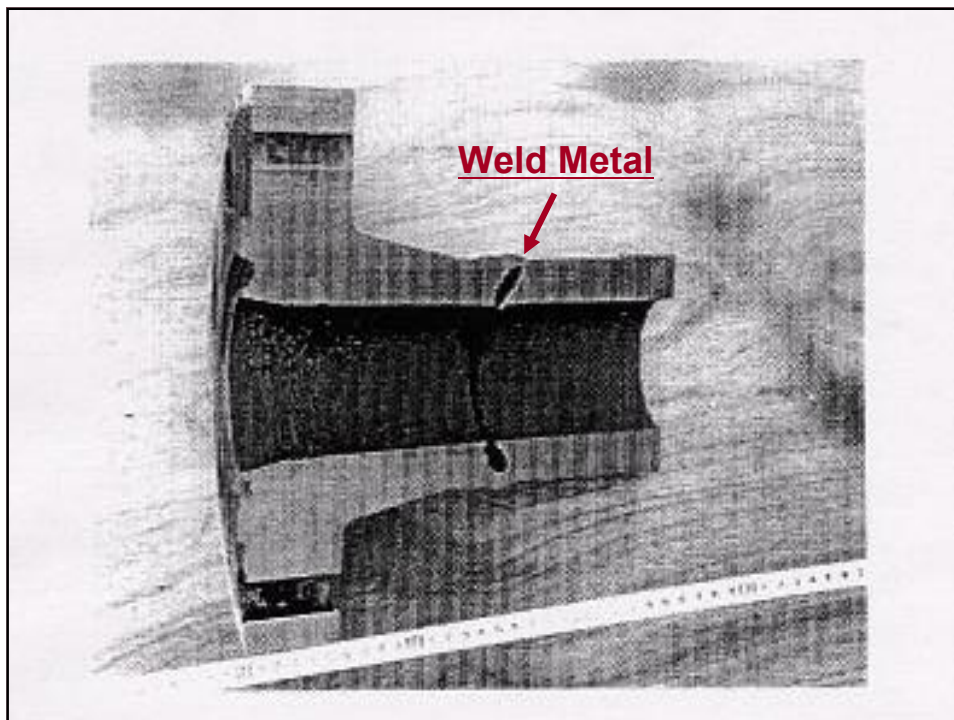
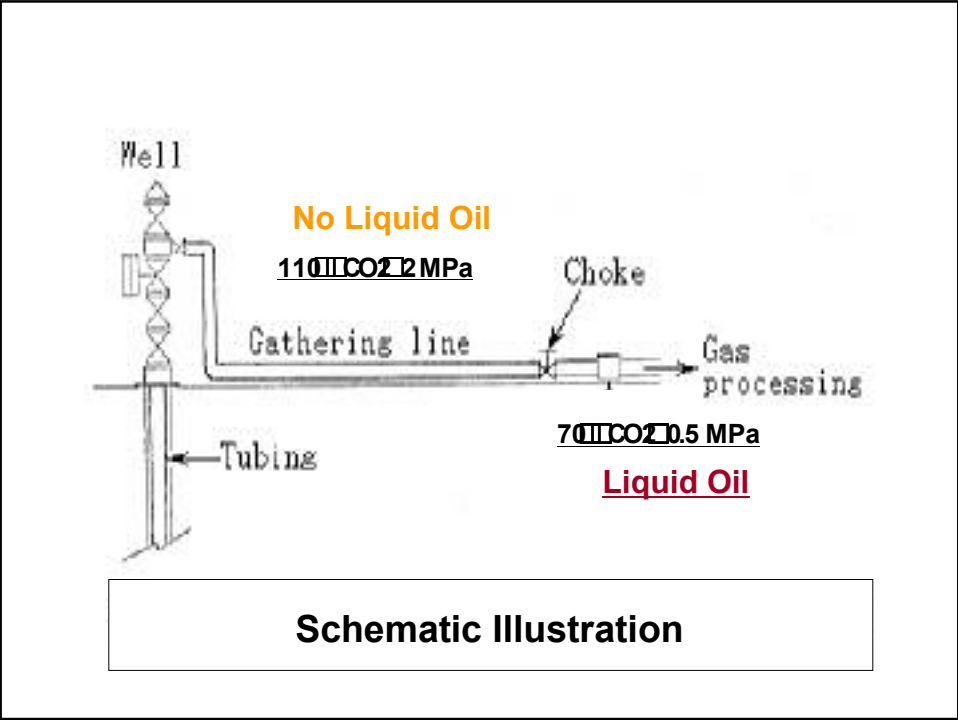


**Effects of inhibition on
Preferential Corrosion of Weldment
in sweet gas gathering line**

by

Y. Tomoe (Teikoku Oil, Subsidiary of
INPEX Holdings)





Experimental

- Corrosive Conditions $\square\square\square\text{Cl}^-\square 500\text{ ppm}$

	Temp. (\square)	CO ₂ (MPa)	Acetic Acid (ppm)	Aromatic Solvent
Up-stream	110	2.0	600	Same as inhibitor
Down-stream	70	0.5	300	4 %

Weld Metal

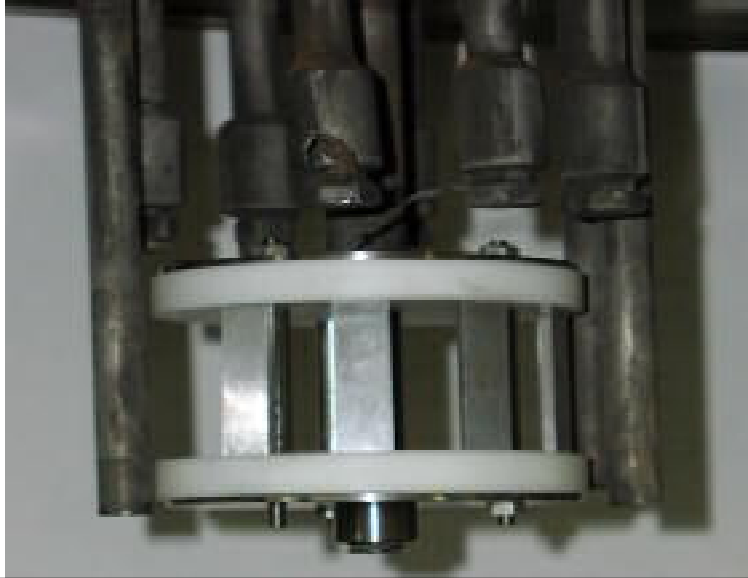
	Metal	C	Ni	Cr	Mo
		□	□	□	□
Weld Metal	C-Steel	0.09			
	0.5 Mo	0.06			0.5
	2Cr-1Mo	0.03		2.22	1.01
Base Metal	55	0.22			

Inhibitor

- **Imidazoline** Type Inhibitor
(Oil Soluble, Water Dispersible)

	Inhibitor Conc(ppm)	Solvent Conc.	Test Period (Days)
110□	0	0 (ppm)	10
	250	250	
	500	500	
70□	0	0 (%)	7
	500	4	

Dynamic Weight Loss Test



Other Tests

Electrochemical Study

- Corrosion Potential
- Polarization Resistance (R_p)

Observation of Microstructures

Surface Roughness Profile

C-Steel Weld Meta□110□



0 250 500 □□□□

0.5Mo Weld Meta□110□



0 250 500 ppm

2Cr-1Mo Weld Meta □ 110 □



0 250 500 

C-Steel Weld Meta □ 70 □



0 500 

0.5Mo Weld Meta□70□



0 500 μm

2Cr-1Mo Weld Meta□70□

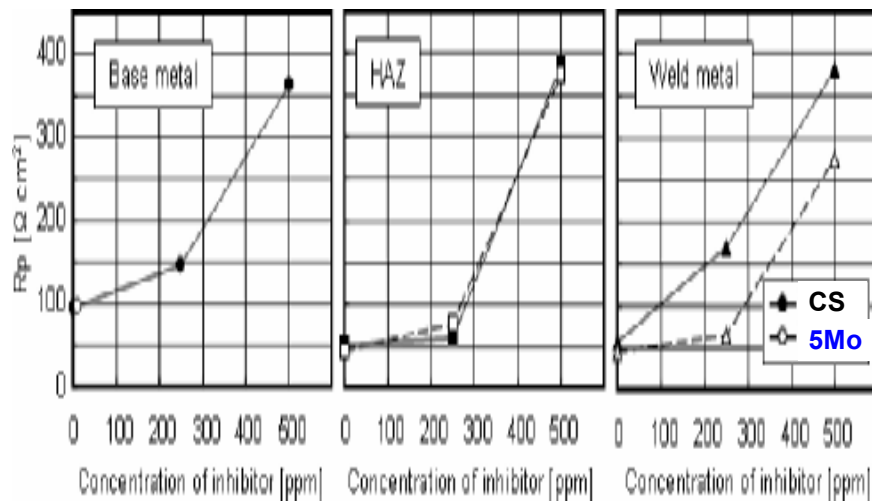


0 500 μm

Summary of WL Test Results





Temp.	Inhibitor	C-Steel	0.5 Mo	2Cr-1Mo
110	0 (ppm)	HAZ B. Metal	HAZ B. Metal	HAZ B. Metal
	250	W. Metal Localized	W. Metal Uniform	W. Metal Uniform
	500	(97 %)	(96 %)	(96 %)
70	0	W. Metal	HAZ B. Metal	HAZ B. Metal
	500	F. Edge (90 %)	▣▣▣▣ (77 %)	▣▣▣▣ (87 %)

Effect of Inhibitor (500 ppm)



Corrosion Potentials

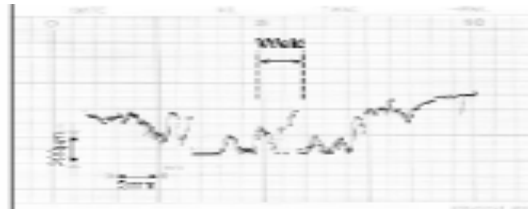
Without Inhibitor

Temp. (□)		E_{corr} (V vs. SCE)
70		- 0.660
		- 0.661
		- 0.662

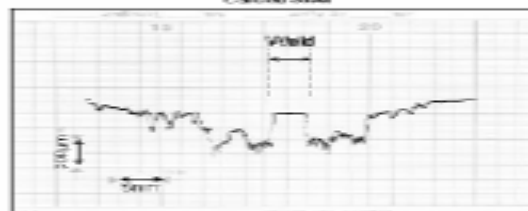
Inhibitor

Blank

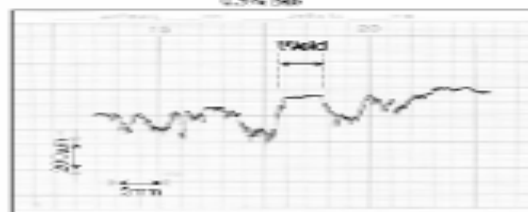
110 □



Carbon Steel



0.5% Ni

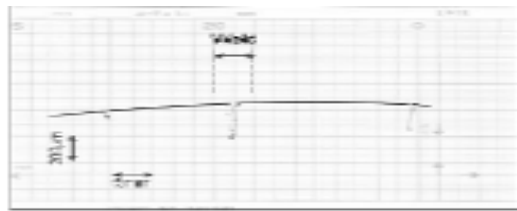


25% Cu-0.5% Ni

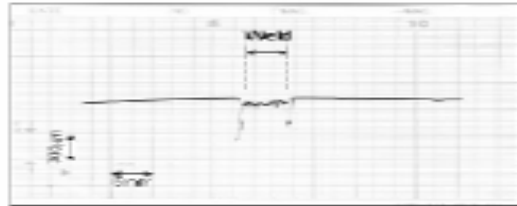
Inhibitor

250 ppm

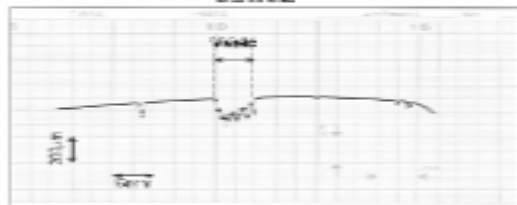
110



Carbon Steel



0.5% Ni

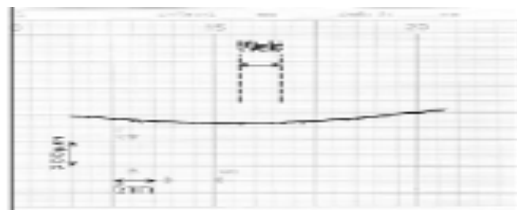


2% Cr-1% Ni

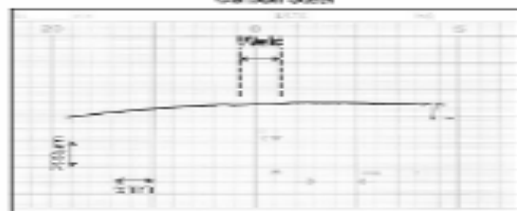
Inhibitor

500 ppm

110



Carbon Steel



0.5% Ni



2% Cr-1% Ni

Conclusions (1)

- At least **500 ppm** of the inhibitor is required to properly control the **PCW**
- The portion of selective corrosion varies with **inhibitor concentration**
- **0.5 % Mo** effectively controls the selective localized corrosion of the weld metal

Conclusions (2)

- Although **Cr** is a beneficial alloying element to mitigate CO₂ corrosion, **2%Cr-1%Mo weld metal selectively corrodes** with **insufficient concentration** of the inhibitor
- **Galvanic effects** on this preferential corrosion were not confirmed