## THE CO2 CORROSION MECHANISM

CO2 is naturally present in the ground, but it is also injected into wells as a method to increase oil recovery. The CO2 reacts with ground water (H2O), to produce carbonic acid (H2CO3):

$$CO2(g) \leftrightarrow CO2(aq)$$

$$CO2(aq) + H2O(I) \rightarrow H2CO3(aq)$$

For the production of Carbonic Acid, the rate constant is K=1.70E-3 (at 25C, 1atm), so the reactants are favoured and only a small amount of CO2 is converted into H2CO3.

Carbonic Acid (H2CO3), which is diprotic dissociates into Bicarbonate (HCO3-) and then can dissociate into Carbonate (CO32-).

H2CO3(aq)+ e- 
$$\rightarrow$$
 H+(aq)+ HCO3-(aq) (K=2.5E-4,E°=-0.21V), at 25C, 1atm

HCO3-(aq)+ e- 
$$\rightarrow$$
 H+ (aq)+ CO32-(aq) (K=5.61E-11,E°=-0.61V ), at 25C, 1atm

The third cathodic reaction also includes the reduction of hydrogen ions that are present in the ground water.

$$2H+(aq)+2e-\rightarrow H2(g)$$
 (E°=0.00V), at 25C, 1atm

The selectivity of the cathode reaction is determined by certain environmental factors.

The anode reaction is the dissolution of iron metal at the pipe surface into iron ions.

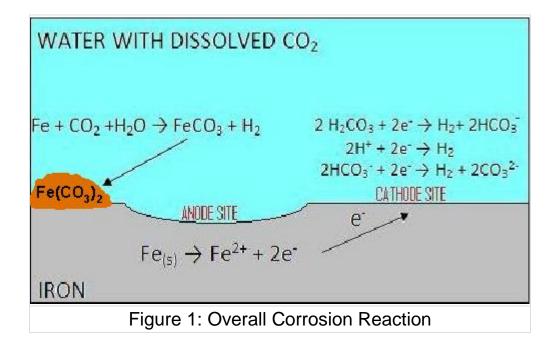
Fe(s) 
$$\rightarrow$$
 Fe2+(aq)+ 2e- (E°=0.44V), at 25C, 1atm

The overall electrochemical reaction of CO2 corrosion is given by,

$$Fe(s) + CO2(aq) + H2O(I) \rightarrow FeCO3(aq) + H2(g)$$

Where FeCO3 can further react to form a precipitate.

$$FeCO3(aq)+CO32-(aq) \rightarrow Fe(CO3)2(s)$$



Source : http://co2corrosionchem409.wikispaces.com/Corrosion+Mechanism