UPES

EVALUATION OF CHEMICAL INJECTION METHODS FOR HYDRATE MITIGATION

Presentation By:

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OBJECTIVES

I. Understanding Thermodynamic Inhibition as a Hydrate Mitigation Technique with the help of a Case Study.

II. Analyzing the results for the Case Study to understand Kinetic Inhibition as a Hydrate Mitigation Technique.

III. Analyzing the results for the Case Study to understand Anti- Agglomerants as a Hydrate Mitigation Technique.

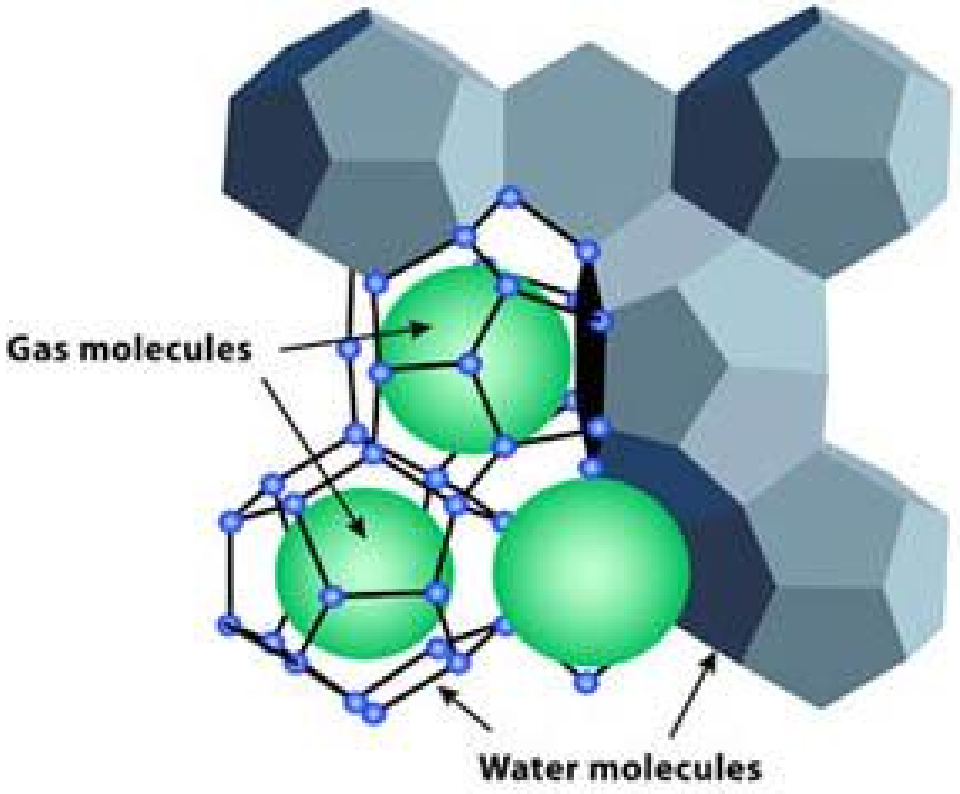
IV. Conclusion

I. CASE STUDY

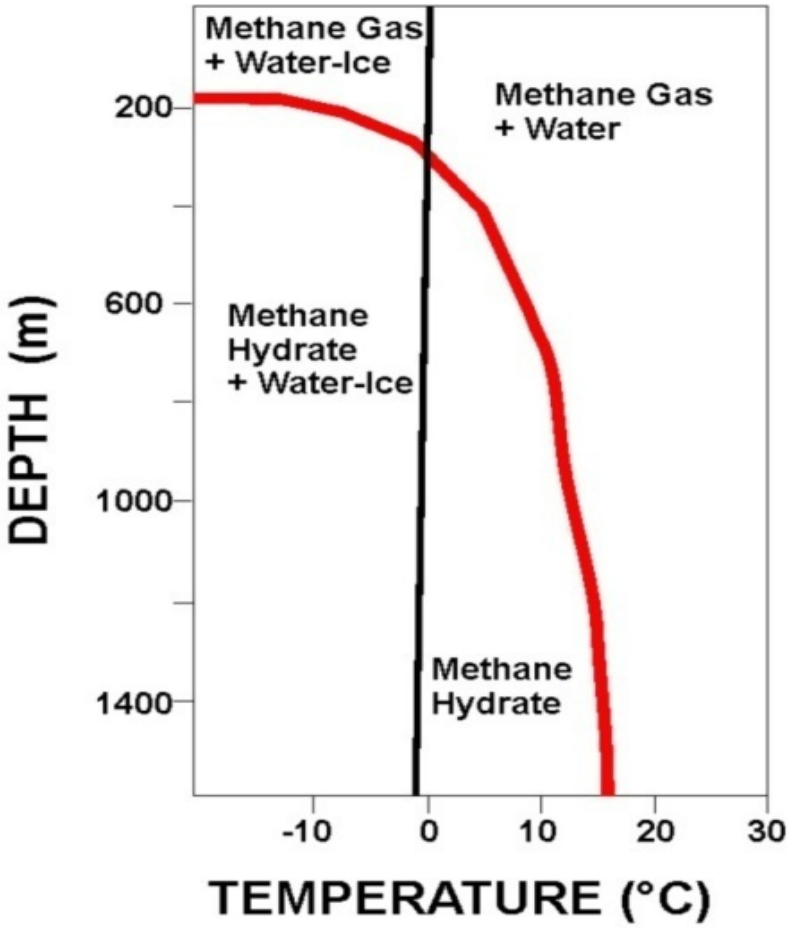
- Polarrev Field, Arctic.
- MEG was chosen as the Inhibitor.
- Used because of its lower cost, lower viscosity and lower solubility in liquid hydrocarbons, and lower vapour pressure giving reduced gas-phases losses.
- 100% pure MEG.
- The total amount of produced water at standard conditions is 518.4 m3/day.

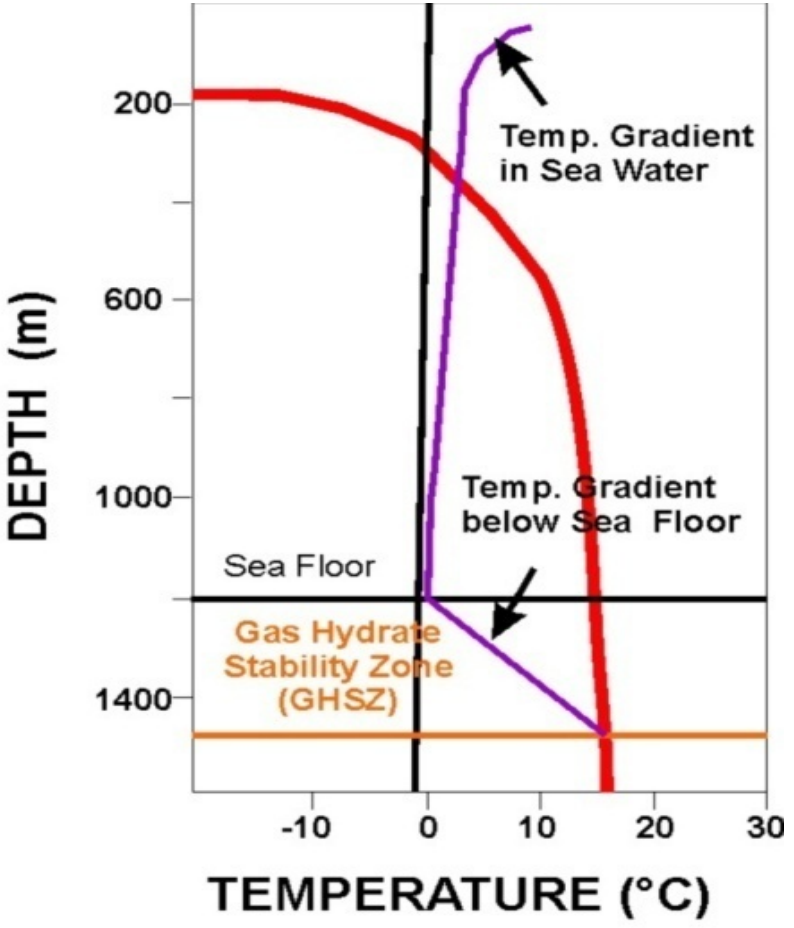
I.I. NATURAL GAS HYDRATES

- Formation
- Structure
- Characteristics
- Potential
- Problems



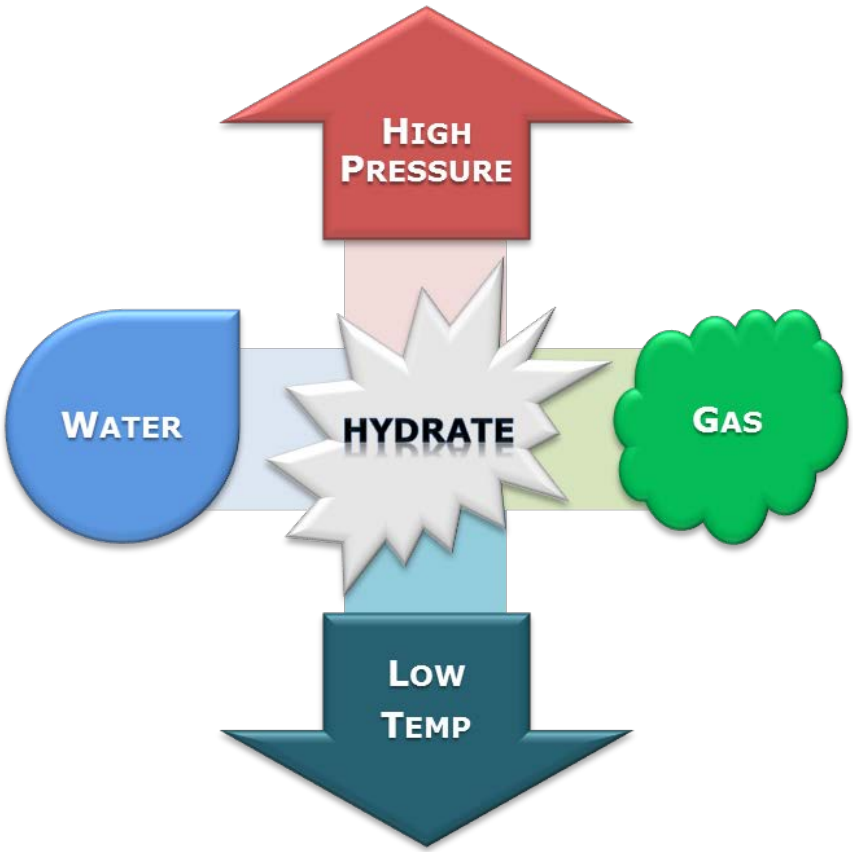
I.I.a. FORMATION





I.II. MITIGATION METHODS

- Pressure Control
- Temperature Control
- Remove Supply of Water
- Inject Chemical Inhibitors



I.III. THERMODYNAMIC INHIBITORS

- Commonly use are Methanol and Monoethylene Glycol.
- May be recovered and re-circulated.
- Economics of recovery is not favorable in most cases.
- Different chemicals used as per temperature conditions of the area.

I.III. THERMODYNAMIC INHIBITORS (Contd.)

ADVANTAGES	DISADVANTAGES
• Proven track-records • Well understood technology • Effective technology • Both oil and gas production • Can be used at all water cuts • Recoverable • Reduced risk of corrosion	• High concentration required • Discharge limitations • Toxic in large amount • Large amount of heat required for regeneration • High CAPEX • High OPEX

I. CASE STUDY

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- 100% pure MEG.
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I. CASE STUDY (Contd.)

- The amount of MEG required to treat the water phase is 51%.
- The inhibitor losses to the hydrocarbon liquid phase is assumed to be 35% of the amount of ethylene glycol required to treat the water phase i.e. 17.85% wt.
- Thus, the total amount of MEG required is 68.85% wt.

I. CASE STUDY (Contd.)

- Injection of MEG= $1.15*10^6$ kg/day.
- Cost of MEG is USD 1.26/kg.
- Total Cost= $1.26*1.15*10^6$

  = 1, 450, 840 USD/Day

II. USING KINETIC INHIBITORS IN ABOVE CASE

- Say, we used Poly N-vinyl Pyrrolidone.
- 100% Pure.
- The total amount of produced water at standard conditions is 518.4 m3/day.
- The amount of PNP required to treat the water phase is 0.46%.
- The inhibitor losses to the hydrocarbon liquid phase is assumed to be 30% of the amount of PNP required to treat the water phase i.e. 0.138% wt.

II.I. KINETIC INHIBITORS

- New and evolving technology.
- Requires extensive tests and optimisation to the actual system.
- Works by slowing down the kinetics of the nucleation.
- Low-Dosage-Hydrate-Inhibitors.
- Usually polymers or copolymers.

II.I. KINECTIC INHIBITORS (Contd.)

ADVANTAGES	DISADVANTAGES
• Effective Operation under severe temperature conditions. • Increased stabilization from reduced requirement for pipeline depressurization during cold standby. • Low costs. • Low toxicity due to lower injection amounts.	• Their performance under shut-in conditions. • Hydrate formation at the top of a pipeline under stratified flow.

II. USING KINETIC INHIBITORS IN ABOVE CASE

- Say, we used Poly N-vinyl Pyrrolidone.
- 100% Pure.
- The total amount of produced water at standard conditions is 518.4 m3/day.
- The amount of PNP required to treat the water phase is 0.46%.
- The inhibitor losses to the hydrocarbon liquid phase is assumed to be 30% of the amount of PNP required to treat the water phase i.e. 0.138% wt.

II. USING KINETIC INHIBITORS IN ABOVE CASE

- Thus, the total amount of PNP required is 0.598% wt.
- Injection of PNP = 3.12*10^3 kg/day
- Total Price= $ 7.01* 3.12*10^3

  = $ 21,861.95/day

III. USING ANTI- AGGLOMERANTS IN ABOVE CASE

- Say, we used Sodium Hydroxide.
- 100% Pure.
- The total amount of produced water at standard conditions is 518.4 m3/day.
- The amount of NaOH required to treat the water phase is 0.284%.
- The inhibitor losses to the hydrocarbon liquid phase is assumed to be 30% of the amount of NaOH required to treat the water phase i.e. 0.0852% wt.

III.I ANTI- AGGLOMERANTS

- New and evolving technology.
- Requires extensive tests and optimisation to the actual system.
- Works by stopping the agglomeration of Gas Hydrate Crystals.
- Low-Dosage-Hydrate-Inhibitors.
- Usually polymers or copolymers.

III.I ANTI- AGGLOMERANTS

ADVANTAGES	DISADVANTAGES
• Low Dosage. • Effective at Severe Conditions. • Effective During Extended Shut-ins. • Total System Approach to Ensure Products are Compatible with Production System.	• Require liquid hydrocarbon phase and water cut < 50-75%. • Do not protect gas phase. • May not be effective at temperatures below 38°F.

III. USING ANTI- AGGLOMERANTS IN ABOVE CASE

- Say, we used Sodium Hydroxide.
- 100% Pure.
- The total amount of produced water at standard conditions is 518.4 m3/day.
- The amount of NaOH required to treat the water phase is 0.284%.
- The inhibitor losses to the hydrocarbon liquid phase is assumed to be 30% of the amount of NaOH required to treat the water phase i.e. 0.0852% wt.

III. USING ANTI- AGGLOMERANTS IN ABOVE CASE

- Thus, the total amount of PNVP required is 0.3692% wt.
- Injection of PNVP = 1.92*10^3 kg/day = 1776.09 m^3/day
- Total Price= $ 1.63* 1.92*10^3

  = $ 3,129.6/day

IV. CONCLUSION

- Using Low- Dosage- Hydrate- Inhibitor in place of Thermodynamic Inhibitors is economical and environmentally safer.
- It might be so that we need to develop different AA’s for different crudes.
- KI’s have limited usage as they only work down to certain sub-coolings.

THANK YOU!