



**PRESENTATION ON**

**Application of FRP Pipes & Other Composites in Oil & Gas Sector: Opportunities and Challenges**

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**S.K. Dewri, Chief Engineer, ONGC,**  
**Institute of Engineering & Ocean Technology, Mumbai**



# OUTLINE OF PRESENTATION

- Why composite materials?
- Properties & Benefits of composite materials
- Composite material applications in Oil & Gas Sector
- Composite material applications in ONGC – Onshore & Offshore
- Opportunities & Challenges
- Conclusions

# WHY COMPOSITE MATERIALS?

Primary reasons for their use:

- Highly superior in corrosion resistance compared to carbon steel and other metallic materials
- Long service life of 25 – 30 years
- Light in weight
- Life cycle cost effectiveness

# TYPICAL PROPERTIES OF REINFORCEMENTS IN COMPOSITES

| Fiber Type | Relative Density (g/cc) | Tensile Strength (GPa) |
|------------|-------------------------|------------------------|
| E-Glass    | 2.54                    | 3.45                   |
| S-Glass    | 2.40                    | 4.58                   |
| Carbon     | 1.76                    | 4.03                   |
| Steel      | 7.86                    | 1.50                   |
| Aluminium  | 2.7                     | 0.62                   |

# BENEFITS OF COMPOSITE MATERIALS

- High strength to weight ratio
- Light weight
- High impact & fatigue strength
- Electrical insulation
- Ease of transportation & installation
- Tailor made properties
- Minimal repair requirement
- Ease of maintenance & repair



## APPLICATIONS IN OIL & GAS SECTOR

- Pipelines and Piping for different applications
- Secondary Structures
- Downhole Well Tubing/ Casing
- Accommodation Modules
- O/G & U/G Mobile Storage Tanks
- Pressure Vessels
- Sucker Rod System for oil wells





## APPLICATIONS IN OIL & GAS SECTOR

Pipelines and Piping applications in Onshore

- Effluent Water Transfer
- Produced Water Transfer
- Injection Water Transfer
- Oil Flow Lines
- Gas Flow Lines
- Multi-phase Flow Lines
- Fire Water Service
- Potable Water Service



## APPLICATIONS IN OIL & GAS SECTOR

### Spoolable Pipe Applications in Onshore

- 2-1/2" to 6-1/2"
- 750 to 2,500 psi
- 29°F to 140°F or 180°F
- 50 million feet  
(15.3 million meters) installed

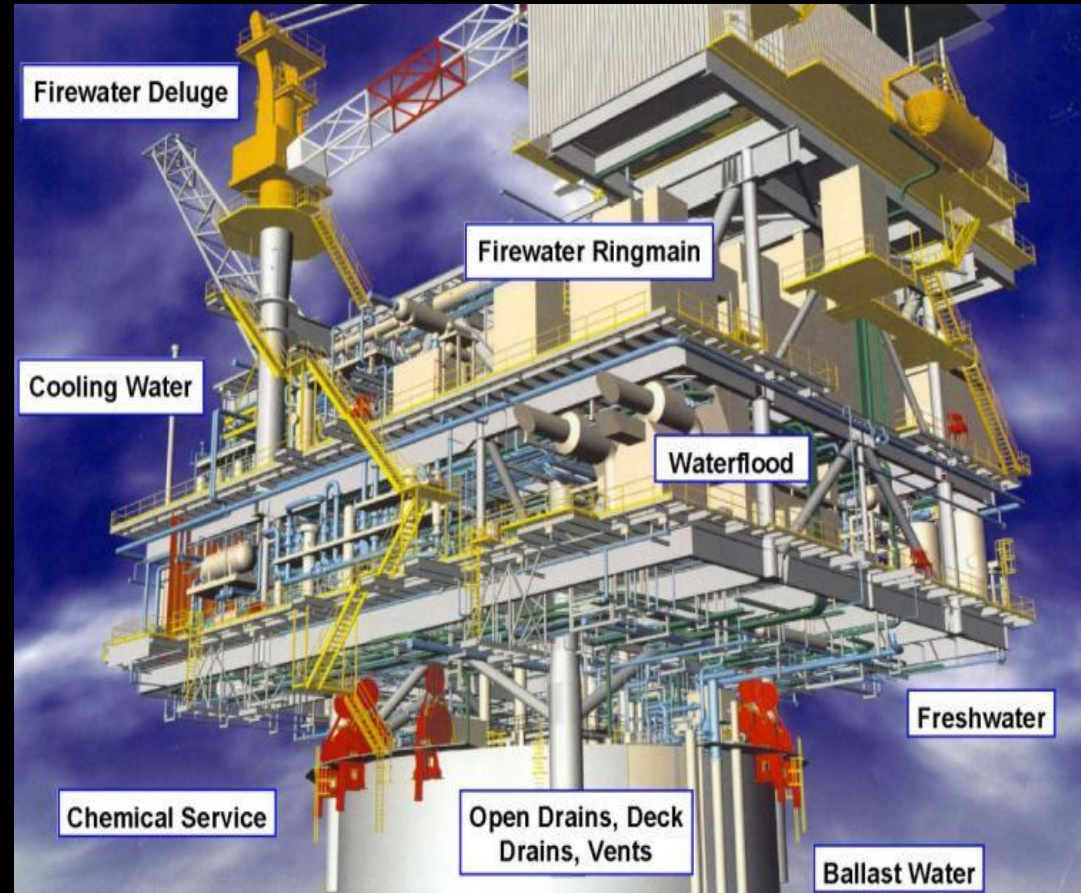




# COMPOSITE MATERIAL APPLICATIONS IN OIL & GAS SECTOR

Pipelines and Piping applications in Offshore

- Cooling Water
- Potable Water
- Sewer Water
- Fire Water
- Injection water
- Produced water
- Open drains
- Sea Water Lift Pump Column Pipe



# COMPOSITE MATERIAL APPLICATIONS IN OIL & GAS SECTOR

## Secondary Structures

- Grating
- Stair & Stair-tread
- Handrail
- Ladder & Cage
- Cable Tray





# COMPOSITE MATERIAL APPLICATIONS IN OIL & GAS SECTOR

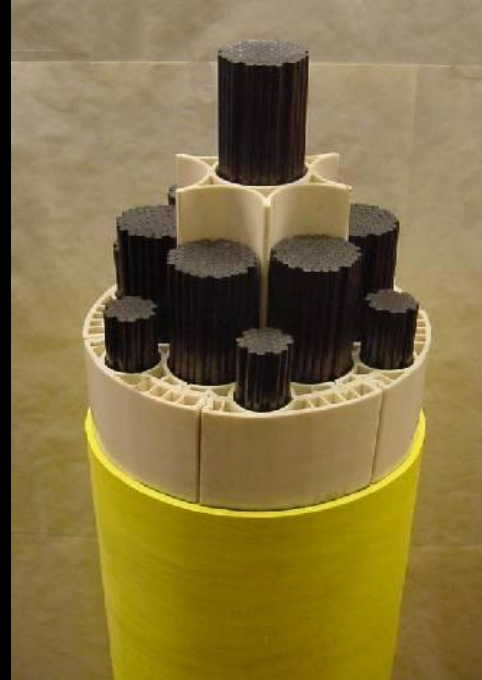
## Sucker Rod System

- Increases production
- Reduces downtime
- Reduces operating cost
- Competitively priced with steel
- Successfully tested > 800 Wells



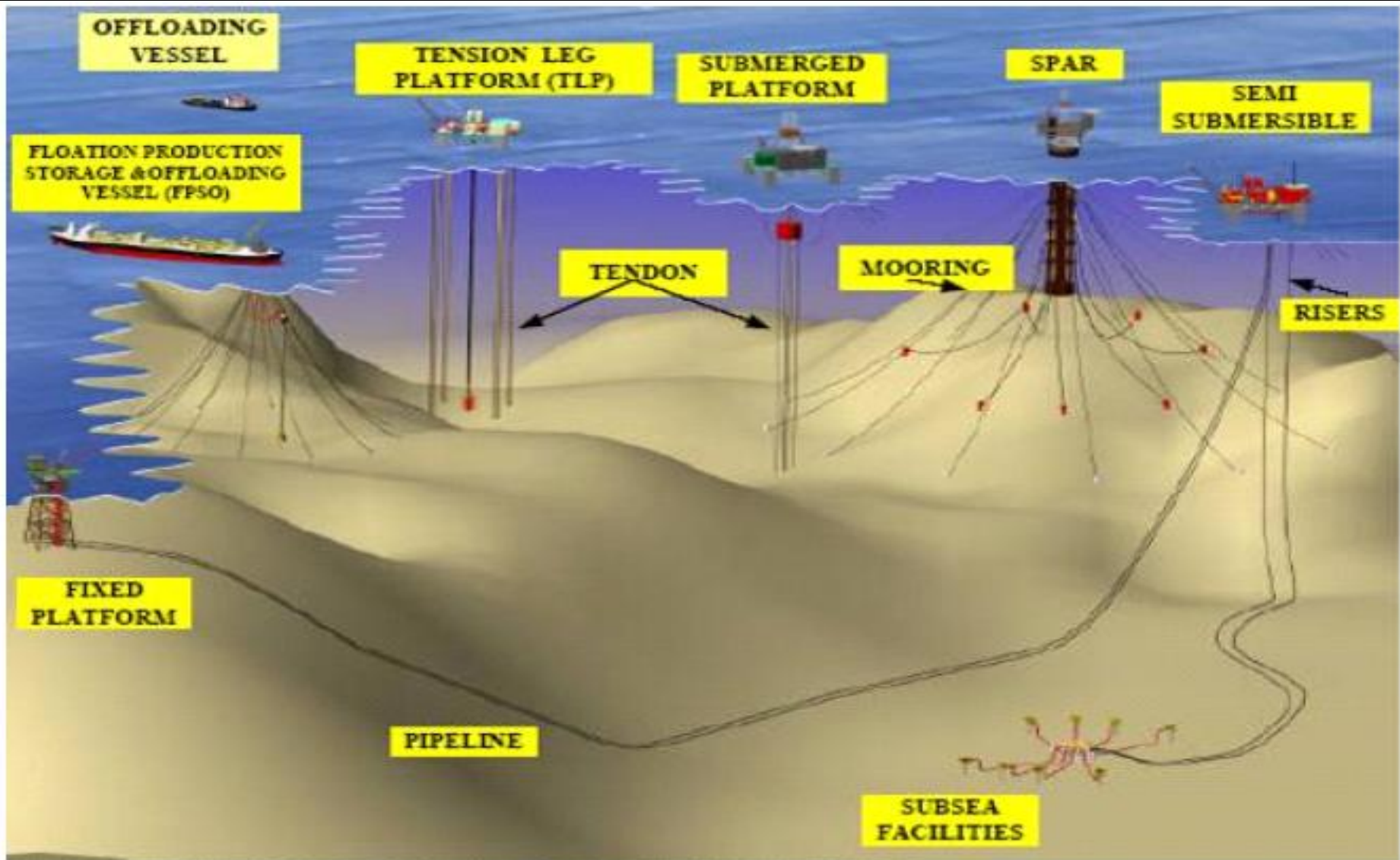
# ADVANCED COMPOSITE MATERIAL APPLICATIONS IN OIL & GAS SECTOR

- Tethers/ Tendons
- Risers
- Umbilicals
- Sub Sea Equipment Protection Covers



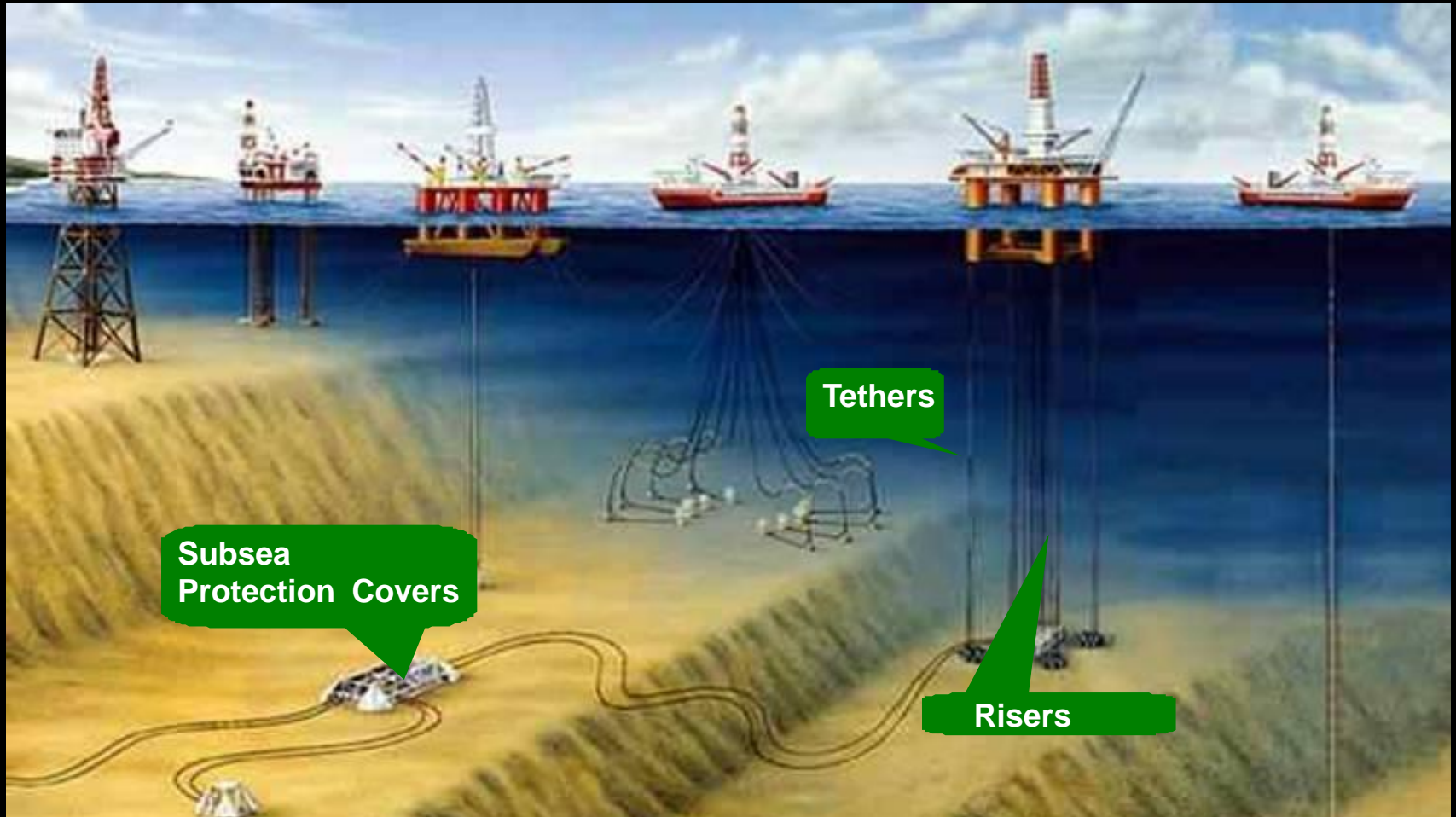


# Advanced Composite Material Applications in Oil & Gas Sector



Deepwater field development concepts and composite material application areas

# COMPOSITE MATERIAL APPLICATIONS IN ONGC







# COMPOSITE MATERIAL APPLICATIONS IN ONGC



- GRE line pipes for effluent water, produced water, fire water in onshore
- GRE hydrocarbon flow lines on pilot basis in onshore
- FRP fencing for well heads in onshore
- FRP underground petroleum storage tanks
- Composite wraps for pipe repairs



# COMPOSITE MATERIAL APPLICATIONS IN ONGC



Applications to be introduced:

- FRP/ GRE sea water lift pump column pipe for offshore
- GRE downhole tubing / casing in onshore
- FRP accommodation modules/ bunk houses in onshore

# OPPORTUNITIES

- GRE line pipes for oil field applications in onshore
- GRE piping for top side applications of offshore platforms
- Secondary structures for offshore platforms.
- Composite material wrap repairs for onshore and offshore line pipes & piping
- Advanced composite material applications for deep offshore oil field applications

# CHALLENGES

- Mindset and conservatism of the oil & gas industry
- The dominance of steel based structures throughout the industry
- Composites are perceived as new materials and there is limited knowledge on them within the industry
- Regulatory requirements
- Development of standards for new applications

# CHALLENGES

- Limitations in applications for HPHT conditions
- High cost of development & prototyping
- Minimal tolerance to failure of new technology
- Standard test methods and procedures need to be established for understanding the material especially for critical applications such as deep offshore

# CONCLUSIONS

- Composite materials have demonstrated their performance as new age versatile alternatives to carbon steel & metallic materials and have found acceptance for several applications in the Oil & Gas Sector.
- Composite materials are gradually overcoming the conservatism and reluctance of the oil & gas industry for more and more applications.
- Composite material pipes have emerged as the most widely used application for various services in the Oil & Gas Sector.
- Opportunities exist for several applications both onshore & offshore.



# CONCLUSIONS

- With hydrocarbon explorations getting into deeper waters, advanced composite materials have opened up more avenues in terms of light weight cost saving applications for the oil & gas industry.
- Limitations remain for applications of composite materials for HPHT applications . The sooner these challenges are addressed by the industry, the better.
- For deep water applications, the composite industry has to overcome challenges such as lack of reliable data base, reference values & standards for composites to facilitate design and simulation.



**THANK YOU**