

Long-Term Environmental Vision for Ultra-Deepwater Exploration and Production Research Forum

SUBSEA PROCESSING AND SEABED DISCHARGE OF PRODUCED WATER



John Vicic

Shell International Exploration & Production

EPT-RPD Deepwater Technology

Bellaire Technology Center

Houston, Texas USA



NOVEMBER 20, 2008



SUBSEA PROCESSING AND SEABED DISCHARGE OF PRODUCED WATER

DEEPWATER PRODUCTION CHALLENGES- STAGE SETTING

- SMALL TO MEDIUM REMOTE DEEPWATER OIL AND GAS FIELDS UP TO 100 MM BBL OR SO - COST OF A TRADITIONAL HOST OR TOPSIDE FACILITIES AND PROCESSING MAYBE PROHIBITIVE**
- EXTREME OFFSETS OR LONG TIEBACKS FOR REMOTE ASSETS OR S2B- PRODUCTION ISSUES, PIPELINES AND FLOW ASSURANCE**
- KNOWLEDGE OF DEEPWATER SEABED CONDITIONS AND AQUATIC LIFE**
- ESTABLISHED REGULATORY AND HSSE STANDARDS**
- OIL/HYDROCARBON IN WATER CONTINUOUS MONITORING**
- DEGASSING AT SEABED**
- DISSOLVED SOLIDS MANAGEMENT**
- EOR**
- ENVIRONMENTALLY SOUND PRODUCED WATER HANDLING**

GLOBAL SUBSEA PROCESSING APPLICATIONS



SUBSEA PROCESSING AND SEABED DISCHARGE OF PRODUCED WATER

BACKGROUND: SEVERAL OPERATORS INCLUDING SHELL HAVE EXPLORED THE POTENTIAL DEVELOPMENT OF SEABED PROCESSING WITH DISCHARGE OF PRODUCED WATER THAT STALLED DUE TO APPARENT ROADBLOCKS FROM A NUMBER OF CAUSES.

- **LACK OF DEFINED PROCEDURES AND REGULATORY STANDARDS FOR SEABED DISCHARGE OF PRODUCED WATER**
- **CLEAR KNOWLEDGE OF THE DEEPWATER SEABED ENVIRONMENT AND AN UNDERSTANDING OF PROCESS IMPACT**
- **LACK OF REGULATORY/HSE INVOLVEMENT AND FEEDBACK FOR DEVELOPMENT OF PROCEDURES, STANDARDS, AND PROCESS EQUIPMENT QUALIFICATION**
- **A COMPLETE UNDERSTANDING OF RISKS, GAPS, AND MITIGATION STRATEGIES ON HOW TO DEVELOP AND IMPLEMENT THIS PROCESS SUBSEA WITHOUT HARM**
- **QUALIFIED AND MATURE SUBSEA EQUIPMENT TECHNOLOGY TO TREAT PRODUCED WATER**
- **RAM OF MONITORING AND MEASUREMENT SYSTEMS**

SUBSEA PROCESSING AND SEABED DISCHARGE OF PRODUCED WATER

***CASE FOR ACTION:* SEABED PROCESSING INCLUDING SEPARATION, FILTRATION, DEGASSING, MONITORING, SOLIDS AND SAND REMOVAL WITH DISCHARGE TO SEABED OFFERS TECHNICAL AND BUSINESS OPPORTUNITIES IN DEEPWATER RESERVOIRS.**

TECHNICAL DRIVERS:

- **IMPROVED FLOW ASSURANCE**
- **ENHANCED IOR**
- **MITIGATION OF CORROSION DAMAGE ON PIPELINES/FACILITIES**
- **LESS DIRECT PERSONNEL EXPOSURE TO HSE RISK**
- **FALL-BACK OPTION FOR SEABED SEPARATION WITH A DISPOSAL WELL-TYPE 2**
- **LOWER MATERIALS USAGE (PIPELINES) AND LESS CARBON FOOTPRINT**

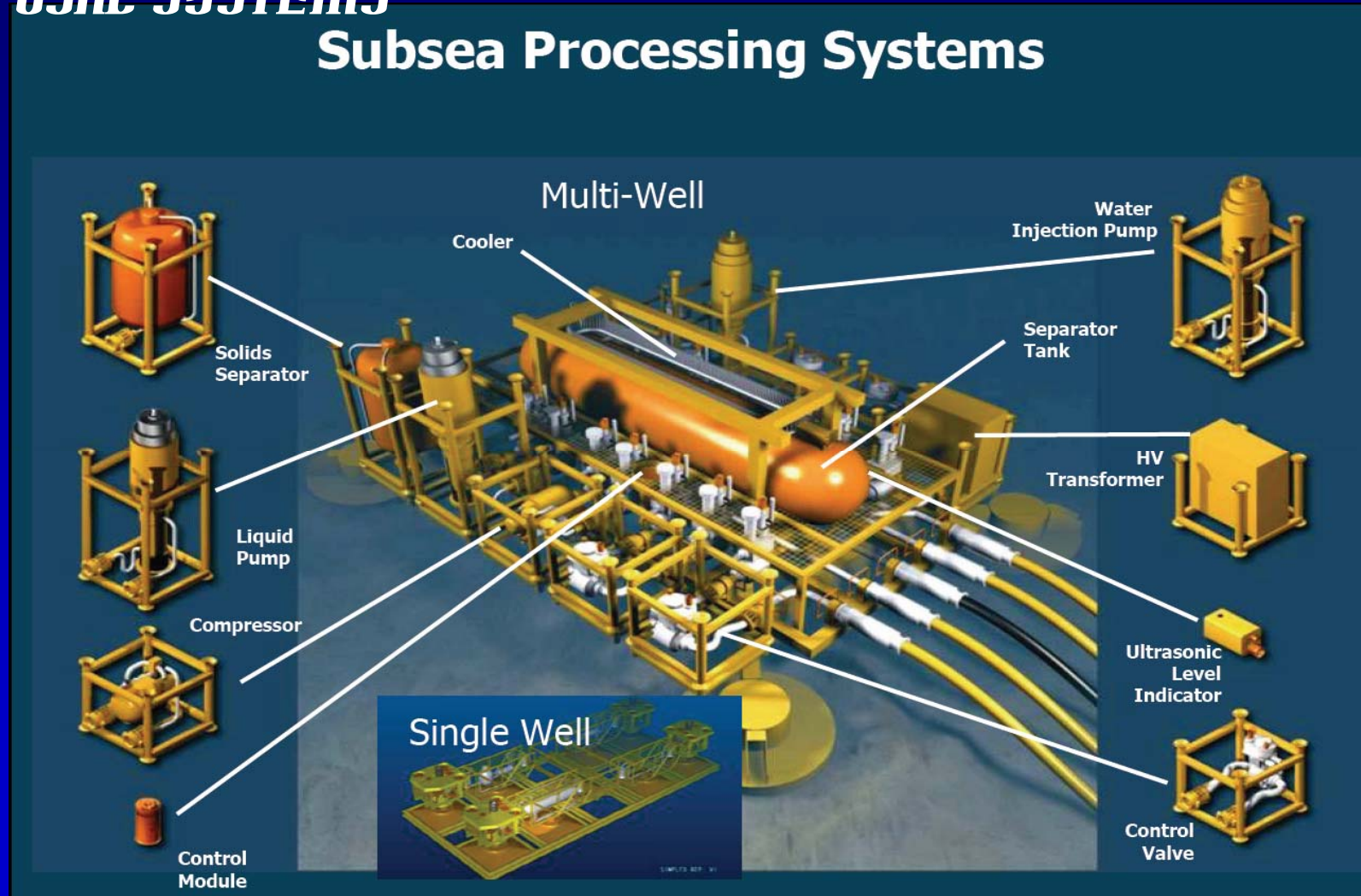
BUSINESS DRIVERS:

- **NO PIPELINES/RISERS FOR HANDLING PRODUCED WATER**
- **REDUCED TOPSIDES FACILITIES , DEBOTTLENECKING**

SUBSEA PROCESSING AND SEABED DISCHARGE OF PRODUCED WATER

EXAMPLE OF TYPE 2 SEPARATION & DISPOSAL SYSTEMS

Subsea Processing Systems



SUBSEA PROCESSING AND SEABED DISCHARGE OF PRODUCED WATER

POTENTIAL RISKS OF SEABED DISCHARGE

- EQUIPMENT STATUS: MATURITY, RELIABILITY, AVAILABILITY**
- DISCHARGE OF DISCRETE OR DISSOLVED HYDROCARBONS AT THE SEABED**
- FAILSAFE CONTINUOUS OIL/HYDROCARBON IN WATER MONITORING SYSTEMS**
- SEABED DEGASSING AND CONDITIONING OF PRODUCED WATER**
- MANAGEMENT OF DISCRETE AND DISSOLVED SOLIDS AND SAND WITH DISPOSAL**
- THERMAL EFFECTS AT THE SEABED FROM DISCHARGE OF PRODUCED WATER**
- EOR RESIDUES**
- IMPACT OF THE PROCESS ON MARINE ORGANISMS AND**

SUBSEA PROCESSING AND SEABED DISCHARGE OF PRODUCED WATER

PROPOSAL FOR ACTION:

- DRAFT PROPOSAL FOR SUBSEA PROCESSING AND SEABED DISCHARGE OF PRODUCED WATER HAS BEEN SUBMITTED FOR CONSIDERATION TO THE RPSEA ULTRA DEEPWATER PROGRAM FOR 2009. IDEALLY MULTI-OPERATOR, MMS, EPA, ACADEMIA AND EQUIPMENT SUPPLIERS WILL PARTICIPATE.**
- PROJECT WILL REVIEW AND EVALUATE EXISTING REGULATIONS, STANDARDS AND HSSE REQUIREMENTS THAT MAY GOVERN DEEPWATER SURFACE AND/OR SEABED DIRECT DISCHARGE OF PRODUCED WATER, DEFINE RELATIVE SEABED CONDITIONS, ENVIRONMENT, AND MARINE TOXICOLOGY.**
- DEVELOP A FRAMEWORK FOR MEETING OR DEVELOPING PERTINENT REGULATIONS PLUS OTHER ENVIRONMENTAL OR REGULATORY REQUIREMENTS TO GOVERN DEEPWATER SEABED SEPARATION, TREATMENT AND DIRECT SEABED DISCHARGE OF PRODUCED WATER.**
- EVALUATE THE STATE OF SEABED EQUIPMENT TECHNOLOGY FOR SEPARATION AND PURIFICATION. PART OF THE PROJECT GOALS ARE TO IDENTIFY ANY POTENTIAL SHOW STOPPERS AND HOW TO MITIGATE THEM.**