VERITAS-MSI
威瑞泰默賽

BLUEWAVES
GLOBAL ENERGY SERVICES LIMITED

• Process Plant Services • Total Asset Integrity Management • Consultancy Services

PRODUCED WATER TREATMENT &
DE-SANDING/MONITORING SOLUTIONS

Contents

- Who we are …….
- Technical Capabilities
- Provision of Produced Water Treatment & De-sanding/Monitoring Solutions

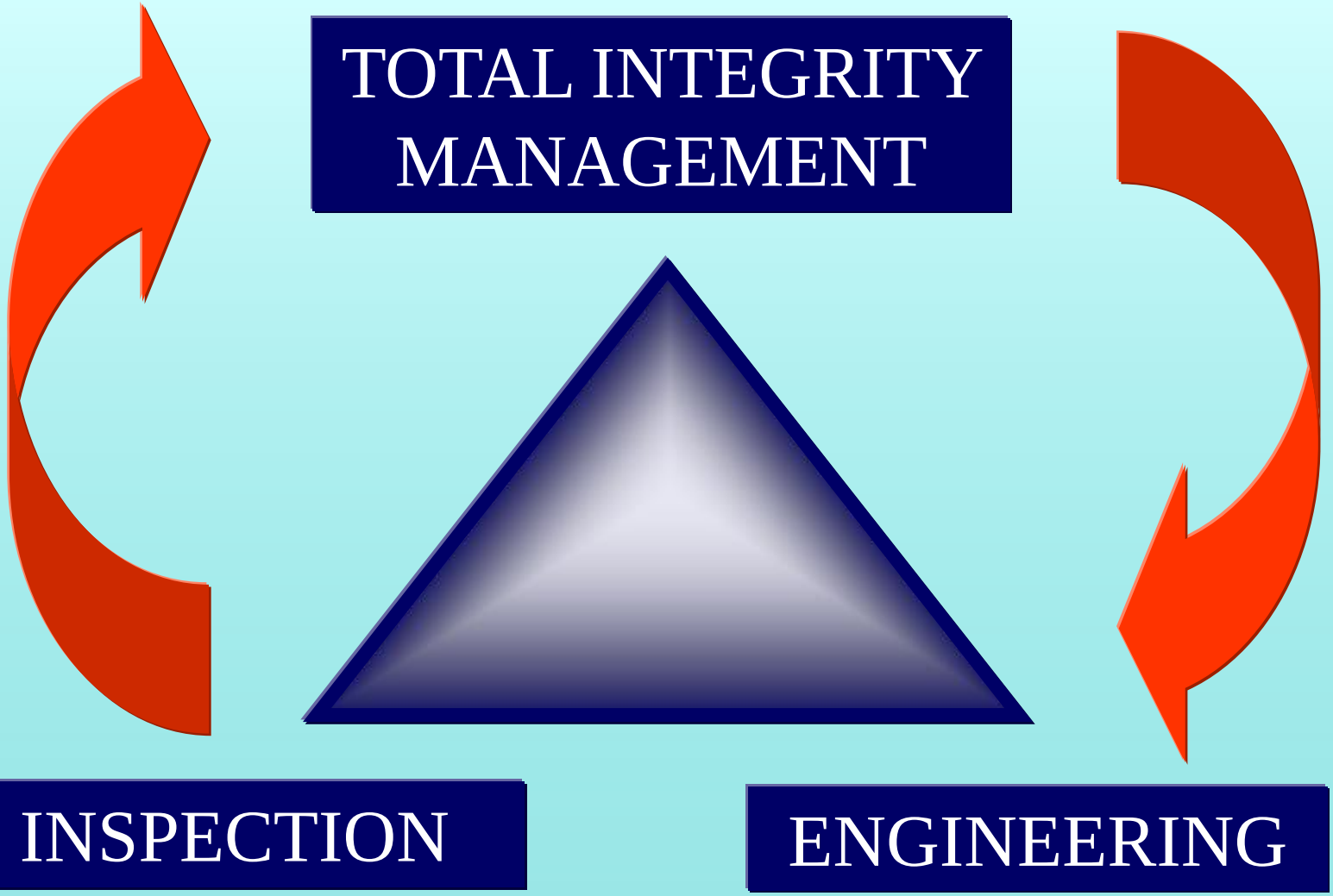
Who we are …….

- Bluewaves Global Energy Services Ltd (BGESL) is an indigenous company with offices in Port Harcourt(Head Office), Lagos and Warri.

- BGESL is into:
- Manpower Supply Services
- Technical & Non- Technical Training
- Procurement
- Technical Services

- BGESL provides support services to the IOCs, NLNG, NNPC, Marginal fields along with her Technical Partners

Technical Capability



Technical Capability

Inspection Services

- API 510 Pressure Vessel Inspection
- API 570 Piping Inspection
- API 653 Tank Inspection
- NACE Coating Inspection
- NACE Cathodic Protection Surveys
- Automated Corrosion Mapping
- Automated Time of Flight Diffraction (TOFD)
- Phased Array Examination (AUT)
- Guided Wave Ultrasonic Testing (LRUT)
- External Laser Scanning
- Alternating Current Field Measurement (ACFM)
- Tank Floor MFE Inspection (MFL)
- Eddy Current Tube Inspection
- Remote Field Tube Inspection (RFT)
- Internal Rotary Tube Inspection (IRIS)
- B-Scan Ultrasonic Inspection
- Infrared Component Inspection
- Ultrasonic Inspection
- Magnetic Particle Testing
- Magnetic Liftoff Testing
- Acoustic Emission Testing (AE)
- Manpower Supply
- Radiography (Iridium)
- Robotic Crawler Visual Video Inspection

Pipeline Integrity

- Close Interval Potential Surveys (CIPS)
- Direct Current Voltage Gradient Surveys (DCVG)
- Pipeline Depth of Cover Surveys
- Mechanical Pipeline Cleaning
- Chemical Pipeline Cleaning
- MFE In-Line Inspection Services (Bi-Di Pig)
- Advanced In-line Geometry Pigging
- UT Short Segment ILI Inspection

Pipeline Construction

- X-RAY Pipeline Crawlers
- Automated Girth Weld Ultrasonics
- Certified Welding Inspectors

In-Service Tank Services

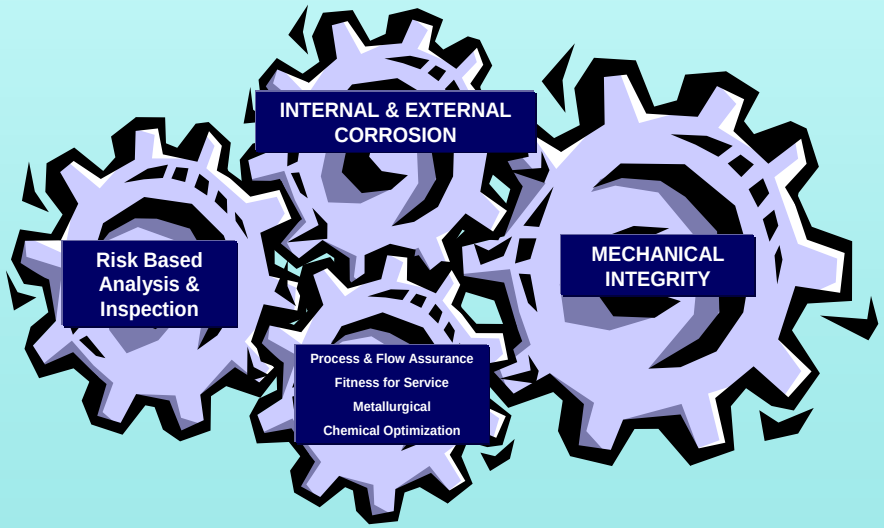
- OTIS – In Service Tank Inspection
- HD 200 – In Service Tank Cleaning
- SCAVENGER – Waste Water Pond
- OPROBE – Small Diameter Tank Inspection
- QLOOK – In-Service Video Inspection

Over 300 API, ASNT and CSWIP Inspectors & Technicians

Each Specialised In A Number of Disciplines

Technical Capability

ENGINEERING



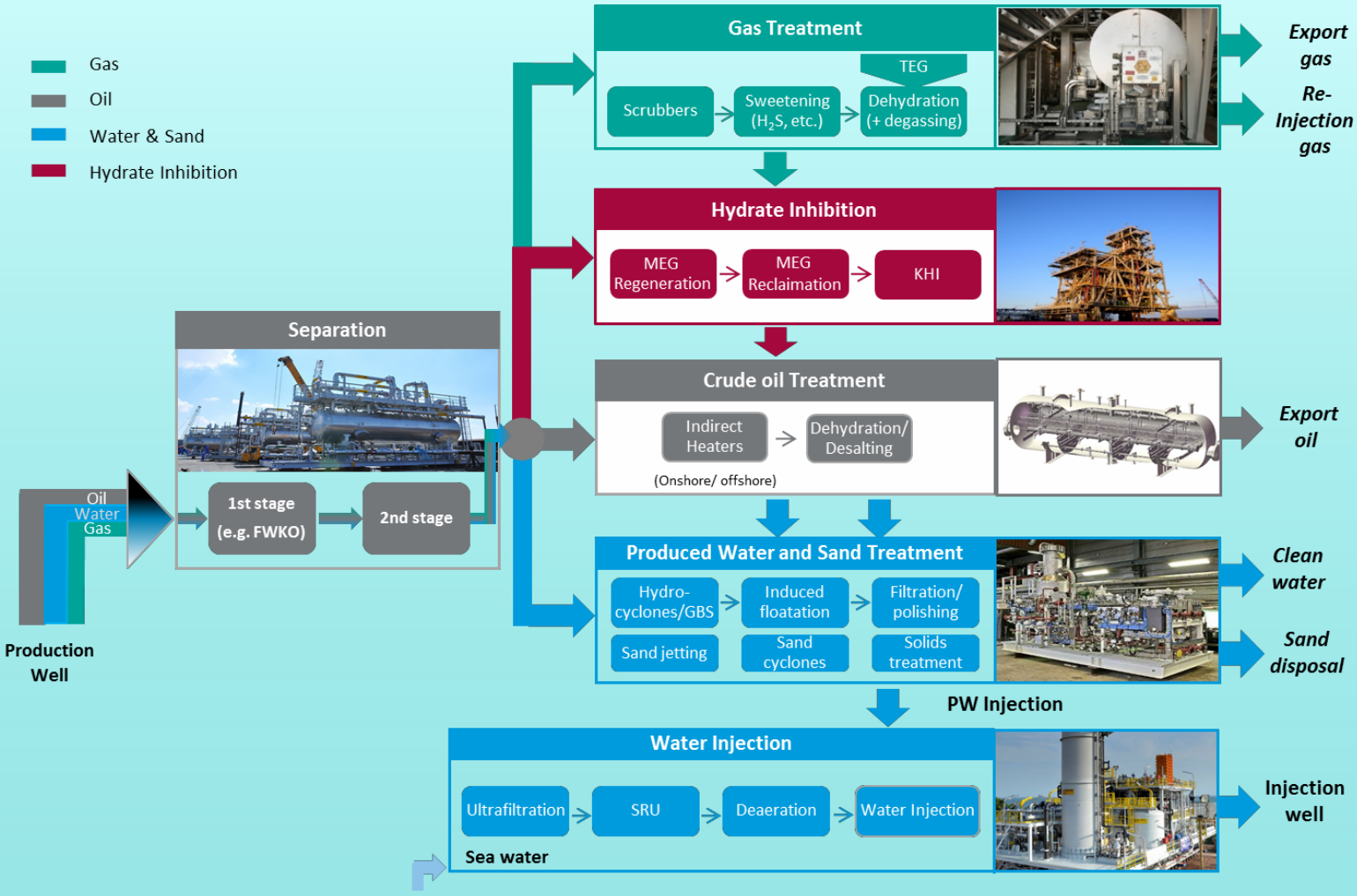
- Direct Assessment – ECDA, ICDA, SSCDA, CDA
- Risk Based Inspection / Risk Based Analysis
- Mechanical Integrity Systems Implementation
- Fitness For Service (Vessels, Piping, Tanks)
- Structural Integrity (Civil Infrastructure)
- Failure Analysis & Root Cause Analysis
- Internal / External Corrosion Control
- Cathodic Protection Design and Installation
- Chemical Treatment Audits & Optimization
- Corrosion Monitoring – Selection & Analysis
- Coating Selection and Evaluation
- Material Evaluation, Testing & Selection
- Welding Procedures and Qualifying
- Pipeline Cleaning Program Development
- External Corrosion Direct Assessment
- Internal Corrosion Direct Assessment
- Flow Assurance & Process Flow Modeling
- Construction Project Management
- Engineering Cost Estimating & Analysis
- Procurement Price Optimization
- Third Party Inspection Auditors

De-Sanding Solutions

What does it really do?

- Solutions to separate sand for upstream production of oil and gas
- Delivered as equipment, modules or services

De-Sanding Systems



Wellhead De-Sanding

DESCRIPTION

The Wellhead Desander incorporates an innovative cyclone liner technology, and is designed to separate solids from multi-phase well fluids with a gas volume fraction ranging from 0 – 100%.

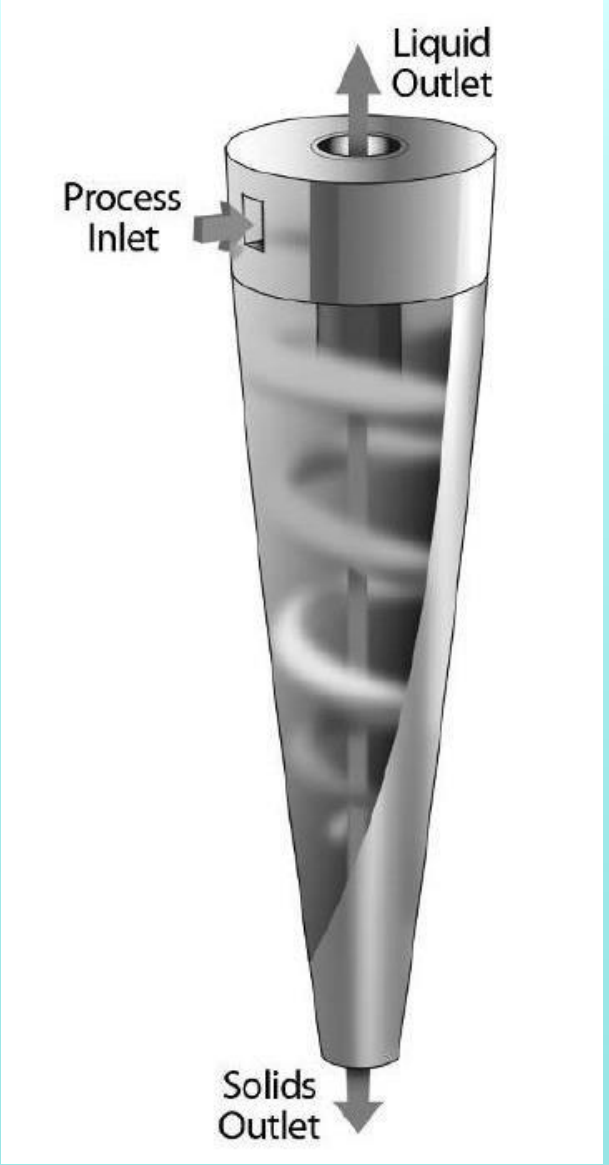
APPLICATION

Areas of application include frac flowback, initial production and permanent facility operation.

Wellhead De-Sanding

Features & Benefits

- Removes 95% of 50 micron solids. Larger solid sizes are removed at higher efficiencies. This efficiency is significantly greater than standard Sand Traps and Vessel Style Cylonic Sand Separators that do not offer correct cylcone sizing across all flow ranges
- Multiple Sand Traps used in series or parrellel service are no longer required in an attempt to protect donwstream equipment
- Carry over of sand into dowstream equipment is minimized
- Allows wells to be flowed back and produced at higher flow rates
- Allows operation of wells with less than complete well cleanup



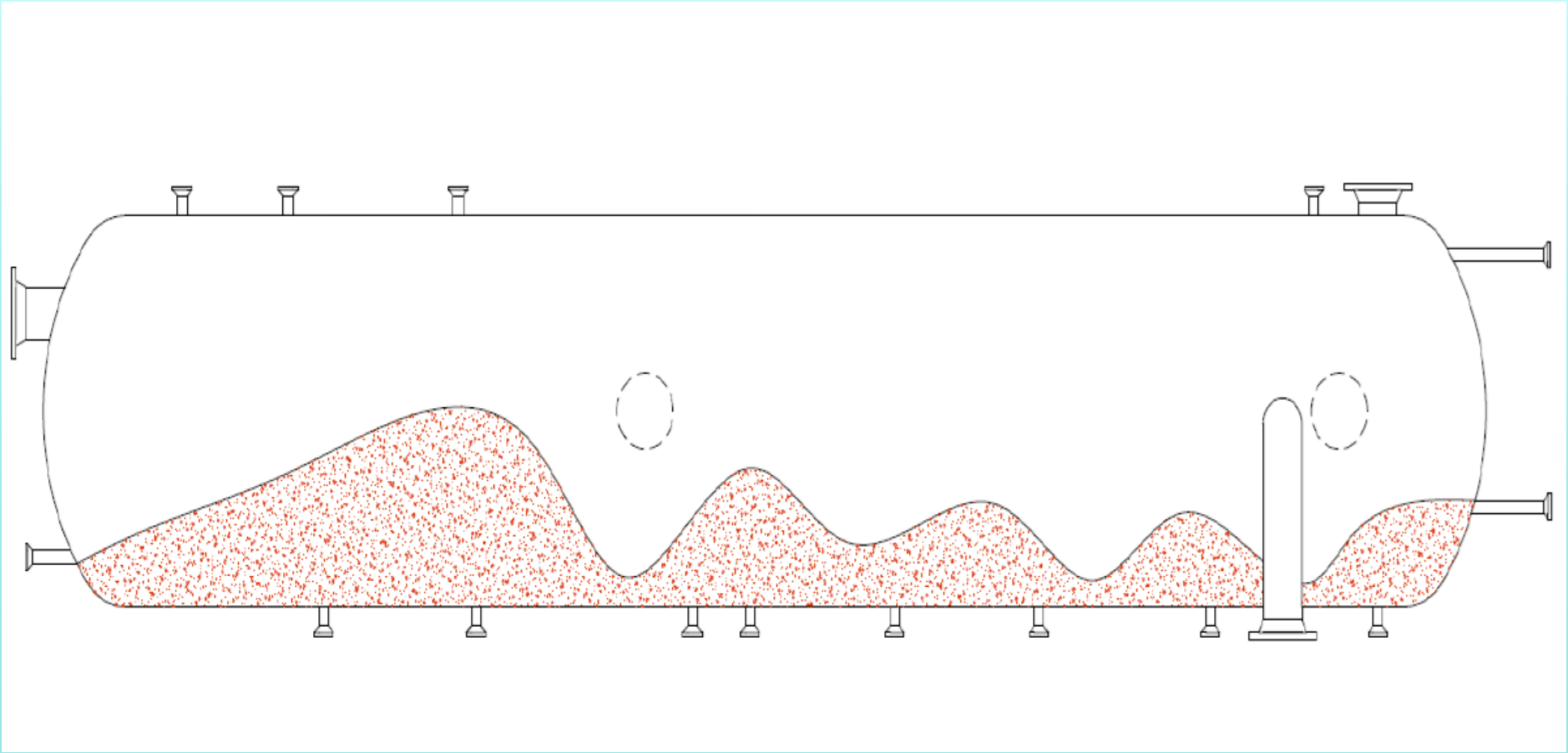
Wellhead De-Sanding

SPECIFICATIONS

Gas flow rate	1 – 13 MMSCFD
Liquid flow rate	1500 – 15000 BPD
Inlet solids concentration	Up to 5% (volume)
Temperature range	-20 F – 350 F (-28 C – 175 C)
Rated working pressure	10000 psi (69 MPa)
Desander liner	3”, 4” and 6”
Accumulation volume	1.25 barrels

Sand & Solids Monitoring

Vessel Sand/Sediment deposits – Thermographic Technology & Cleaning



Identify & Map Sand levels in a Process Separator

PRODUCED WATER TREATMENT SYSTEMS

(BGESL IN PARTNERSHIP WITH VERITAS – MSI(USA), OEM)

Produced Formation Water – The background

Production operation involves the active recovery of hydrocarbons from producing formations.

During this phase, Oil, Gas and Produced formation water are produced from the wells, and are separated accordingly.

Produced water, derived in extracting oil from fluids emanating from a well, contains several hundreds to perhaps one thousand or more parts per million (ppm) of oil and grease. It may be high in total dissolved solids (TDS), oxygen demanding organic materials, heavy metals, and other toxics (notably phenolics).

Produced Formation Water – The background

The characteristics of produced water vary from one formation to another, and are affected by the following factors:

i. The type of crude produced

ii. The total hydrocarbon concentration

iii. The amount of suspended and settle-able solids

iv. The size of suspended hydrocarbons and solid particles

v. The salinity, temperature and oxygen content

vi. The amount of such additives as demulsifiers, biocides, corrosion inhibitors, foam inhibitors, scale and precipitation inhibitors, used in the treatment of the oil.

Disposal of Produced Formation Water by DPR

(a) Inland/Nearshore Area - shall not be discharged into inland and nearshore areas.

(b) Offshore/Deepwaters - shall not exceed 10mg/l otherwise the produced formation water shall be re-injected.

There is a need therefore for the Treatment of the Produced Water before disposal…… and to achieve that DPR approved for Bluewaves Global Energy Services Ltd the use & deployment of PWT Flotation/Filtration Technology to handle the challenges & management of Produced Water in Nigerian Oil & Gas Industry.

Benefits of PWT

1 Where the existing oil pipeline is insufficient for transportation due to increase in water volume. By installing this system at wellhead or at manifold of multiple wells, the free water can be knocked out and discharged locally, increasing the oil transportation ability.

2 Where only oil is to be metered/ transported, free water can be removed from product for sales (where only Oil is metered instead of liquid) thus increasing revenue & reduce costs.

3 Allows a direct discharge of the water at sea for offshore operations

4 Reduce OPEX, by eliminating the costs of evacuating the Produced water via barging or trucking, etc.

Benefits of PWT

5 Handles Total Suspended Solids where it's > 30 mg/l

6 Handles Total Dissolved Solids where it's > 2000 mg/l

7 Handles Oil & Grease where it's > 10 mg/l

8 Removes Salts – Calcium, Sulphate, etc

9 Removes other impurities – Bacteria, Sugar, etc.

10 Handles the De-bottlenecking of gas & oil separation

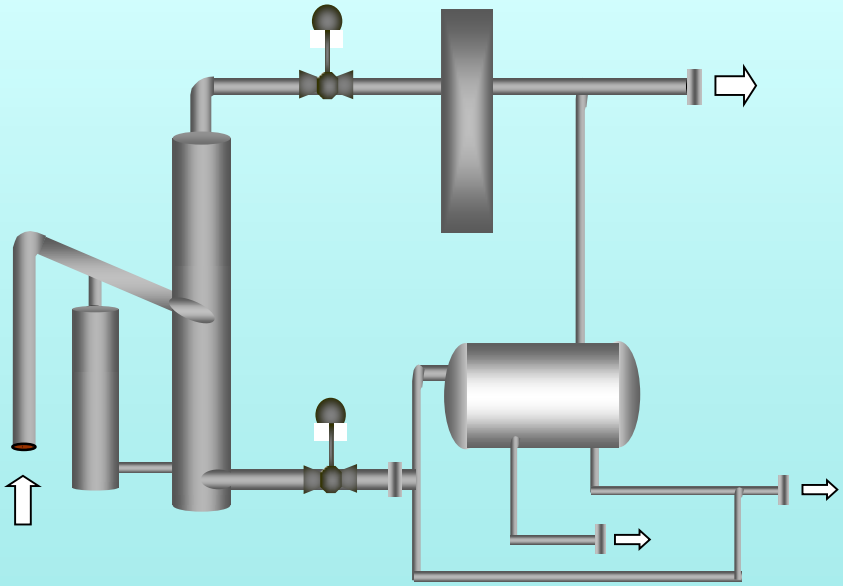
11 Helps weak wells & revive dead wells

12 Where fields are maturing, and water cut increasing

Micro-bubble Rotation Flotation

Operating Principles:

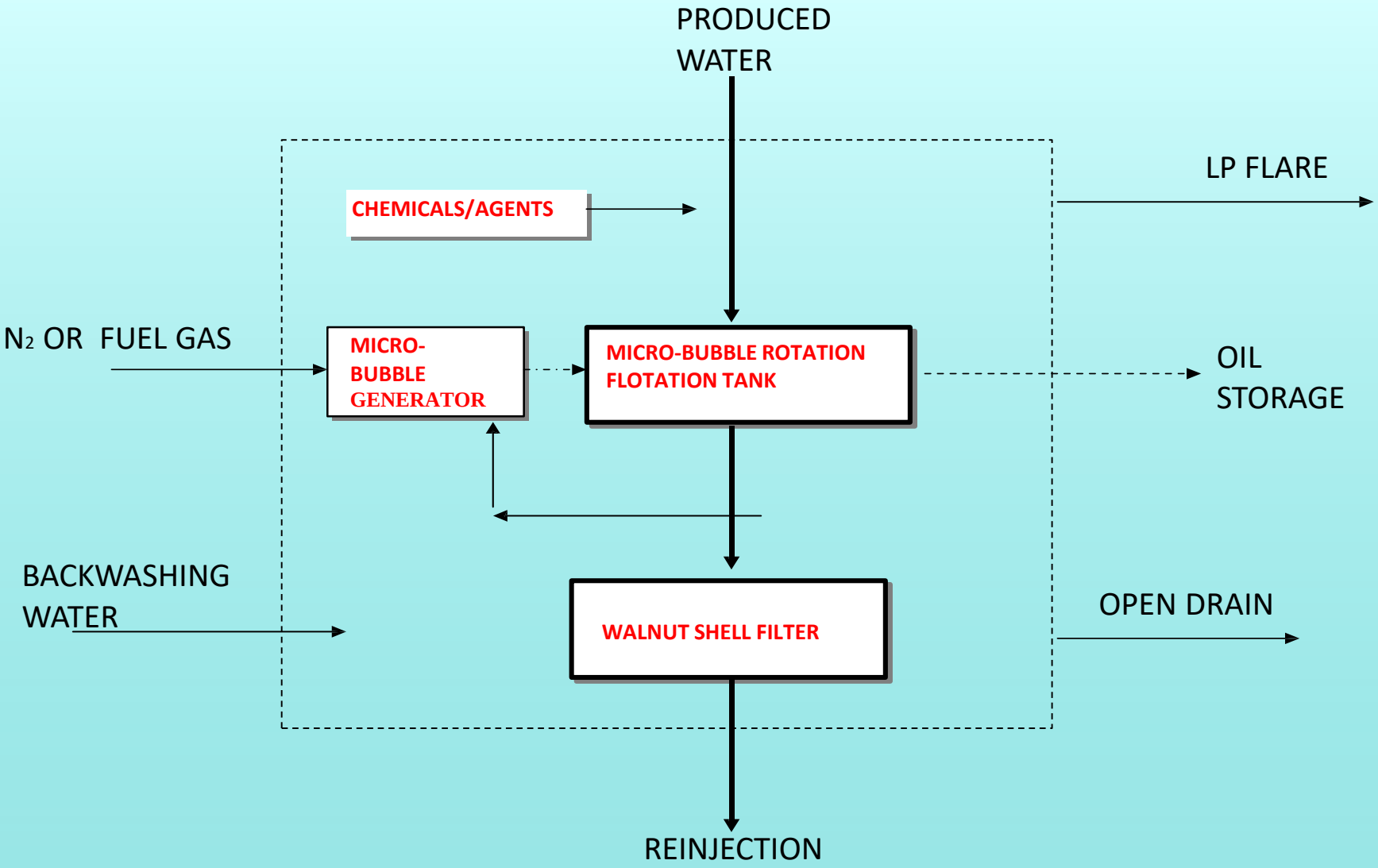
- Generates Micro-bubbles
- Micro-bubble catches dispersed oil
- Oily water flows to the top of the mixing barrel
- Oil droplets are separated from the water with the micro-bubble
- Thus separation of oil & water is achieved



Features:

- **High Separation efficiency/reliability**
- **No moving parts**
- **No chemical addition & saving space**
- **Simple & Low Cost of Maintenance**

Micro-bubble Rotation Flotation - PFD



Flotation-MOV01533
.MPG

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Micro-bubble rotational floatation

Flotation-MOV01533.MPG

Saudi Aramco Facility

Veritas-MSI IWS-Sampling.wmv

Micro-bubble based Unit-FPSO

Onshore Installation

Offshore Installation

Produced Water Treatment System

Comments from Saudi Aramco

EXPEC ARC - WEEKLY HIGHLIGHTS
January 7, 2009

Abdulla. A. Al Naim, Vice President
Petroleum Engineering & Development (A)

INLINE WATER SEPARATION PROTOTYPE COMMISSIONED, RESULTS PROMISING: The inline water separation (IWS) field trial prototype has been installed and commissioned in Abqaiq GOSP-3, and evaluation tests have begun. Initial runs with Well ABQQ-110 showed promising results, with the separated water having lower oil-in-water concentrations than even the WOSEP (water-oil separation plant) processed water – indicating excellent separation capacity. This separation system is developed based on an integration of multiple compact separation technologies, in a manner much more effective and compact than other existing huge separation systems. The objective is to use the device to separate a significant portion of the produced water from a production stream and send the remaining lower water content fluids to existing processing facilities. Once proven, the technology can be applied to de-bottleneck GOSP's, help weak wells, revive dead wells, and potentially avoid the construction of additional flow lines when the fields are maturing and water cut is increasing. The trial tests at Abqaiq GOSP-3 will last six months to fully assess the technology.

Experiences (Examples)

Customer: CNOOC Shenzhen (2015)

Project: EP23-1 DPP

Water: 105,000 BWPD

Inlet oil concentration: < 120 ppm

Out oil concentration: < 30 ppm

Experiences (Examples)

Customer: CNOOC Shanghai

Year: Mar 2015

Project: EP23-1 DPP

Water: 68,000 BWPD

Inlet oil concentration: < 120 ppm

Out oil concentration: 10-18 ppm

Experiences (Examples)

Customer: ConocoPhillips & CNOOC Tianjin

Year: 2014

Project: Pengbo FPSO

Water: 150,000 BWPD

Inlet oil concentration: < 100 ppm

Out oil concentration: < 30 ppm

Experience List

See attached document

VERITAS-MSI (CHINA) CO., LTD.

Experience List FOR Produced Water Treatment

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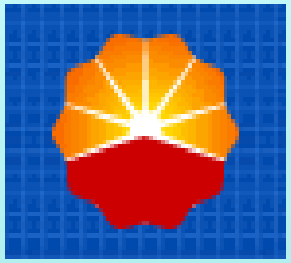
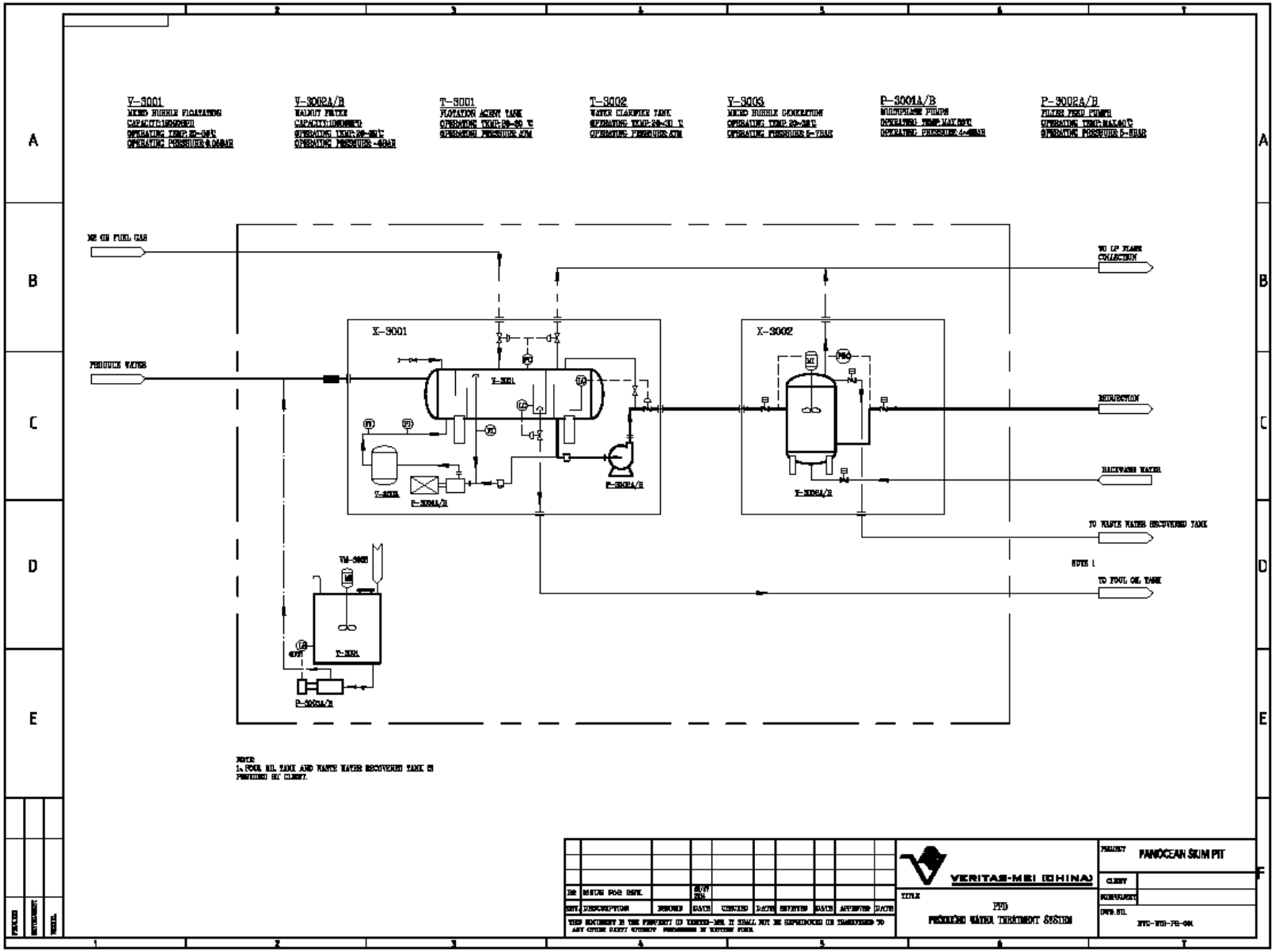
Clients



TYPICAL PWT PFD



DPR Endorsement

- **DPR has endorsed the Micro- Bubble Rotation Flotation/Filtration technologies(no chemical addition).**

- **BGESL has the DPR's approval to deploy the technology into the Nigerian Oil & Gas Industry.**

Thank You !

For further information, please contact:

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