Safety Contact video
Contents

- Brief Introduction of KGD6
- Concept, Design & Engineering
- Construction & Commissioning
- Operational Excellence
- HSE, Quality & Compliance
- Asset Integrity
- Improvement Suggested
- Innovation
Development Facilities - Offshore

CRP

Manifold

Pipelines

Jumper

Wells & XMT

Umbilical
Development Facilities – Onshore

Onshore Terminal

GTG & Heaters

MEG Column

Slug Catchers

GDU
Operational Areas & Support

Deep Water-Offshore

Onshore Terminal

ROV

ROV – Doing Inspection

Multi support Vessel
First Oil – 17th Sep-2008

First Gas – 1st Apr-2009

Central Control Centre at Onshore Terminal
Concept, Design & Engineering
Design and selection of equipment and facilities guided by:

- Proven Technology as far as possible
- Use of Standard Equipment / Product
- Simplicity in Design and Operation
- Flexibility for integration of other known and future discoveries
- Maximize reliability and availability
- Safety in Operations
Engineering, Surveys and Studies

- Conceptual Engineering and FEED (Aker Kvaerner) – Front end Engineering & Design
- Third party validations as part of FEED
- Review of Subsea Pipeline Engineering (Dr. Andrew Palmer)
- Review of Flow Assurance work (Scandpower)
- Certification and verification works and HAZOP (DNV)
- HAZID of Subsea System (DNV)
- Review and validation of FEED (Bechtel)
- Geotechnical investigations for all subsea structures locations
- Geo-hazards Study incl. site specific earthquake study (NGI)
- Geo-mechanics Study (Schlumberger) & Validation (Terralog) - Soil Stability
- Hydrate Remediation Studies (Paragon) – Flow Assurance
- Chemical selection and compatibility studies - IFE
- Integrated Reliability, Availability & Maintainability (RAM) Analysis performed by DNV (including subsea, pipelines, CRP & OT)
- 100 years of metrological data considered for the design
Construction & Commissioning
24X7 Excellent Management support & Integrated Team

Utility system commissioning at early stage proved to be very useful

Timely support from Other Sites, Engineering, Vendors & Consultants

Audit recommendations implemented before first gas

N2/ He Test & Bolt Tensioning – helped in better integrity of pipelines

Excellent documentation on startup

Design and construction with proper safeguards
Audits during construction & commissioning:

- DNV audits
- Shell Global Solutions
- Ward Associates
- Aker Solutions Australia (ASA)
- Internal Audits

<table>
<thead>
<tr>
<th>Audit Status- Construction &amp; Commissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Audits</strong></td>
</tr>
<tr>
<td>Audit</td>
</tr>
<tr>
<td>Shell 2008</td>
</tr>
<tr>
<td>Shell 2009</td>
</tr>
<tr>
<td>Ward 2008</td>
</tr>
<tr>
<td>Ward 2009</td>
</tr>
<tr>
<td>ASA</td>
</tr>
</tbody>
</table>

*Internal Audits done by GMS, Becrel, Process Integrity Team*
Operational Excellence
Operational Excellence

- 99.9% uptime in operations
- 100% Safe Operation
- 100% Quality gas exported
- 100% Statutory Compliance
- Zero Security Incidents

Benchmarking operations in Deep water field.
KGD6 Operations – Processes /systems

Processes /Systems in place

- HSE MS / HEMP in place
- SAP in place since start up of the plant
- PM module in place & effective monitoring in progress
- All documents uploaded in REIMS (1,00,000 approx)
- All IT enabled systems in place
- Laboratory: LIMS implemented
- Business process- Technical Capitalization jobs completed
- LMS is implemented

Abbreviations:

HSE – Health Safety & Environment .  
SAP- System Application & Products .  
PM-Plant Maintenance .  
LIMS- Laboratory Information Management System .  
LMS- learning Management System  
REIMS- Reliance Enterprise Information Management System  

Effective use of processes and systems
Integrated Operation – Intelligent Field

- From Deep Water Operations to Customers in Integrated manner along with RGTIL & Gas Marketing
- Coordinated interaction by O&M team on 24X7 basis with Subsurface, CS-1, RGTIL & Gas Marketing

- Intelligent Field Operations:
  - IP21 implemented for the 1st Time in Upstream Operations
  - Parameters are monitored 24X7- Every second
  - More than 60000 Tags Monitored
  - Parameters from Well Bottom Subsea, till delivery to Customers monitored
  - Well Opening/ Closing, Changing other parameters being Controlled from OT Central Control Room
  - Various Processes & Systems used to integrate the data
  - Intelligent Field Creates Benchmarking in uninterrupted Operations

Seamless Integrated Operations result in Uninterrupted Operations
FPSO

- FPSO Availability more than 99% from 2009-10

- Proactive maintenance with planned shutdown

- High Availability of Subsea Systems & Wells

- Total 97 parcels offloaded successfully incident free in high seas

- All Parcels sold with Nil Bottom Sediment & Water and RVP < 10 psi

- Uninterrupted Operation of FPSO during cyclone “Thane” and “Neelam”

- Produced water discharge into sea with Avg. Oil < 24 PPM against 40 PPM

Dhirubhai 1 is the leading FPSO in availability in the world
HSE and Quality
Health, Safety & Environment

- 100% Safe Operation. LTI Free operation of 2053 days at OT & CRP, 2029 days at FPSO
- No Loss to Personnel & Property
- HSE Management System adopted – Shell Global Solution
- Environment: Over 2,00,000 saplings planted
- IMS ISO 9001, 14001, OHSAS 18001 from April 2010 by M/s DNV,
- Pre & Post project environmental monitoring- Onshore by NEERI & Offshore by NIO
- More than 20000 Mandays of HSE Training after First gas
- HSE audit by Internal, External & regulatory authorities from time to time (GMS, M/s Marsh, M/s Ace, M/s DNV, M/s SGS, M/s BP, OISD, Factory Inspector & APPCB)
- One Reliance Best Practices are under implementation

Robust HSE Management System
Quality System

- Samples are analysed in inhouse Laboratory
- Laboratory with all facilities inside the plant area is an added advantage
- LIMS is used for sharing analysis report instantaneously
- Corrective measures taken based on reports
Asset Integrity
Integrity management is a complete life cycle process and needs to be considered throughout all phases from concept to decommissioning.
Capability Building

- O&M team much prior to commissioning (almost 2 years)
- Participation in FAT & SAT, Handholding with Experts, AKER, AGR etc.
- **OTS** - Operator Training System to Panel Engineers before first gas
- **PSS** - Production simulator System - on & off-line, open loop simulator
- **LMS** – Learning Management System in place for competency improvement
- +500 SOP’s & SMP’s prepared prior to commissioning
- +60% Employees received Behavioral training
- Competency development for Contractor Employees
- Number of Programmes
  - Before First Gas – 178 Nos
  - After First gas - 1826 Nos

Enhanced, Capable, Futuristic, Inspired & Motivated Personnel
Resources – Sub sea team

RIL Integrity Management Organization starts at top level management and includes all levels of management and support engineering as well as additional call off support as required.

- CEO RIL E&P
- Head KGD6 Operations
- Offshore Head
- Subsea Maintenance Head
- Lead Integrity Engineer
- Integrity Engineer D1D3 Field
- Integrity Support Engineer D1D3 Field
- Integrity Engineer MA Field
- Integrity Support Engineer MA field
- Lead Structural Engineer
- Specialist available to Lead Integrity Engineer as required:
  - Subsea Controls
  - Document Control
  - Naval Architecture and Vessel Motions
  - Riser Specialists
  - FEA Analyst
  - Corrosion Specialist
  - Offshore Inspection Support

One of the best teams in sub sea deep water industry
RIL has a full time MSV with ROV in the field to implement IM plan and perform any remedial activities.

- ROV: Water Depth 3000 M
  - Work Class 150HP ROV
- MSV Crane: 91T @2500M
  - With AHC
At KGD6, innovative approach takes AIM beyond routine inspection, maintenance and repair.

100% uptime of subsea assets is maintained.

AIM program has helped KGD6 team to continue meeting one of the most challenging life cycle management goals.

<table>
<thead>
<tr>
<th>Si. No</th>
<th>Activity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General inspections of subsea structures</td>
<td>80</td>
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<tr>
<td>2</td>
<td>SCM interventions</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Subsea valve operations</td>
<td>70</td>
</tr>
<tr>
<td>4</td>
<td>Subsea pipelines inspection</td>
<td>70</td>
</tr>
<tr>
<td>5</td>
<td>Subsea installation, pre commissioning and commissioning</td>
<td>40</td>
</tr>
</tbody>
</table>
Monitoring Programme

Key Performance Indicators
- Sand/Erosion events
- Corrosion events (RPCM)
- Chemical Injection reconciliation
- Fluid sampling (Laboratory testing) and trending
- BOD compliance (P&T, fluid composition, chemical injection quality)

Testing
- XMTs (system critical parameters, Valves, Guages etc.,)
- SSSV test

Top Side Facilities (CRP)
- Regular Inspection / Audits
- Maintenance of Riser
- SSIV partial stroke tests

CI residual measurements

Fe Count trend analysis

December 50-56 ppm
**Surveillance**

**Digital Field from Well to Market**

- IM team reviewing day to day intervention and operational actions that may have an impact on system integrity
- Real time process surveillance using DCS, IP21 to give 24X7 access to instrumentation and valve movements
- Daily review all parameters, flow, pressure, pressure, sand, erosion
A key component of an effective IM program is inspection data management.

Visual Works is a modular suite of applications to record, archive, review and report digital video inspection data.

Visual Works integrates with inspection packages to allow real time event logging.

Data can be accessed from desktop PC’s.

ROV data management softwares found to be more very useful.
To Manage Permanent / Temporary change in:
- Plant
- Equipment
- Process or
- Chemicals
- Plant performance Improvement
- Minor Modifications

Process control
- Alarms Review
- Trip settings

Changes updated in
- P & ID’s
- Isometrics
- Alarms and Trips Set point Register
- Master Line List
- Control Narrative
- Cause & Effect Matrix

Management Commitment to comply Critical Processes
Scheduling, Monitoring & Review

- KPIs are set at individual and department wise and periodical review of the same
  - Department KPIs are reviewed half-yearly by Site Head
- Monthly Inter-Departmental & Department Review Meeting
- Fortnight production schedule finalization – by VC with all stakeholders
- Daily Operations & Maintenance review meetings and PTW meeting
- Monthly Safety Committee meeting & Monthly Process Safety Meeting
- Capturing the incidents/Near miss data through SHIEMS, conduct PSSR before restart
- ReSOP system for improvement during maintenance/other non-routine field

*KPI’s enhance the planning & monitoring process*
<table>
<thead>
<tr>
<th>No</th>
<th>Scope</th>
<th>U o M</th>
<th>Limit</th>
<th>% Wt.</th>
<th>Actual Value % (Full year)</th>
<th>KPI Achievement (Actual x % Wt. / 100)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Statutory Compliance - Safety Critical Element Inspection</td>
<td>As reported</td>
<td>100%</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
<td></td>
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<tr>
<td>2</td>
<td>Close out of Audit observations</td>
<td>%</td>
<td>100%</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
<td>closed out in a timely manner</td>
</tr>
<tr>
<td>3</td>
<td>HSE Awareness - Competency</td>
<td>%</td>
<td>100%</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
<td>Awareness of Safety Critical SOP's, Emergency Response Plans, Permit to Work. Sign off sheet for SS Panel and Discipline Engineers.</td>
</tr>
<tr>
<td>4</td>
<td>Employee PME compliance</td>
<td>100% of All Subsea Personnel</td>
<td>20</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
<td>no. of personnel to complete PME on time divided by total personnel x 100</td>
</tr>
<tr>
<td>5</td>
<td>Risk Assessments for managing risk</td>
<td>%</td>
<td>10 / year</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
<td>Risk Assessments are done for managing risk. No set numbers. But approximately</td>
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<tr>
<td>6</td>
<td>SHEIMS Reporting and Closure including Near misses</td>
<td>%</td>
<td>&lt;60 to close out</td>
<td>3</td>
<td>100%</td>
<td>3.00</td>
<td>All SHEIMS reports to be closed out in a timely manner.</td>
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<tr>
<td>7</td>
<td>HSE Observation for Subsea team</td>
<td>No.</td>
<td>24</td>
<td>2</td>
<td>24 Nos</td>
<td>2.00</td>
<td>SS team only to put in Stop Cards. Each SS = 4.77%</td>
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<tr>
<td>8</td>
<td>Monthly Safety Meetings</td>
<td>No.</td>
<td>12</td>
<td>2</td>
<td>12 Nos</td>
<td>2.00</td>
<td>1 Safety meeting per month - 3 per quarter = 25%. Each meeting = 8.33%</td>
</tr>
<tr>
<td>9</td>
<td>LTI</td>
<td>Hrs</td>
<td>0</td>
<td>2</td>
<td>0 Hrs</td>
<td>2.00</td>
<td>= 25% per quarter</td>
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<tr>
<td>10</td>
<td>Production Loss / Asset Damage incident</td>
<td>No.</td>
<td>&lt;4</td>
<td>2</td>
<td>0</td>
<td>2.00</td>
<td>&lt;4 = 25% per quarter</td>
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<tr>
<td>11</td>
<td>ERP Mock Drill - Level 1</td>
<td>No.</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>1.67</td>
<td>1 Drill = 16.67%</td>
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<tr>
<td>12</td>
<td>Internal Audits / Safety Walk at Operations Base</td>
<td>No.</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>2.00</td>
<td>1 Safety walk = 16.67%</td>
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<tr>
<td>13</td>
<td>Roxar WGFM re-calibration</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
<td>Call-off Issued 25% Mobile and resolving issues 75% Report Issue 100%</td>
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<tr>
<td>14</td>
<td>Quarterly review of Alarm and trip settings</td>
<td>No.</td>
<td>4</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
<td>1 Generation of four alarm and trip settings Review documents - 4/25%</td>
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<tr>
<td>15</td>
<td>SCSSSV Testing as per schedule</td>
<td>%</td>
<td>12</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
<td>Monthly Operations progress report. Each report = 8.33%</td>
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<tr>
<td>16</td>
<td>Annual review of Operation’s SOP’s</td>
<td>No’s</td>
<td>28</td>
<td>1</td>
<td>1</td>
<td>0.93</td>
<td>26 SOPs reviewed. Review of each SOP each 2.5% * 40.</td>
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<tr>
<td>17</td>
<td>MEG Optimization/MEG Utilization</td>
<td>%</td>
<td>10%</td>
<td>2</td>
<td>10%</td>
<td>2.00</td>
<td>Annual Review of MEG Optimization (% Reduction compared to previous year / m3 of water production)</td>
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<tr>
<td>18</td>
<td>Reports on Flow Analysis by performing Transient Simulations.</td>
<td>No.</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>2.00</td>
<td>Quarter review of: 1) Multiphase Flow Analysis 2) Single phase Flow Analysis 3) Production Planning</td>
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<tr>
<td>19</td>
<td>Well performance analysis reporting</td>
<td>No.</td>
<td>16</td>
<td>2</td>
<td>16</td>
<td>2.00</td>
<td>Monthly reports on: 1) Well performance of flowing wells. Quarterly review/reports on: 1) Proposals for well re-starts, risk &amp; rewards 2) Water studies.</td>
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<tr>
<td>20</td>
<td>Solid Transportation Study</td>
<td>%</td>
<td>100%</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
<td>Call-off of weekly component for review.</td>
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<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Subsea Base Operations</td>
<td>Controlled Copies-Print and get the signatures done; upload in REIMS</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------------------------------------------------------</td>
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<td>----</td>
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<td></td>
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<tr>
<td></td>
<td>BOM Items for SAP Codification-Enter all the missing SAP tags of BOM Items in MMCS for codification</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
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<td></td>
<td>Spares Management</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
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<td>SCM-RCA Regularization through SAP</td>
<td>No.s</td>
<td>25</td>
<td>1</td>
<td>90%</td>
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<td>Transfer of Subsea Project documentation not in REIMS into Sharepoint</td>
<td>No. /24 Well reports</td>
<td>24</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
<td></td>
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<tr>
<td></td>
<td>Long term preservation of Spare Umbilicals</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
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<td></td>
<td>Tooling Anomaly Report closeouts</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>99%</td>
<td>0.99</td>
<td></td>
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<tr>
<td></td>
<td>100% redundancy of all operational tooling</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
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<tr>
<td></td>
<td>To keep to ROV Tools PM schedule</td>
<td>%</td>
<td>98</td>
<td>1</td>
<td>95%</td>
<td>0.95</td>
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<td></td>
<td>Annual Review of SMP's &amp; SOP's</td>
<td>No.s/90</td>
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<td>100%</td>
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<td></td>
<td>FCM CP rectification</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
<td></td>
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<tr>
<td></td>
<td>PRS Strategy + Engineering Study</td>
<td>%</td>
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<td>2</td>
<td>85%</td>
<td>1.70</td>
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<td></td>
<td>Development of BT Process for Subsea</td>
<td>%</td>
<td>75</td>
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<td>99%</td>
<td>1.98</td>
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<td></td>
<td>TDF Completion</td>
<td>%</td>
<td>100</td>
<td>2</td>
<td>98%</td>
<td>1.96</td>
<td></td>
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<td></td>
<td>Develop KGD6 Subsea MDR</td>
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<td>100</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
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<tr>
<td></td>
<td>Vibration Monitor installation</td>
<td>%</td>
<td>100</td>
<td>2</td>
<td>40%</td>
<td>0.80</td>
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<td>Making of Hydraulic Hoses on site</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>25%</td>
<td>0.25</td>
<td></td>
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<tr>
<td></td>
<td>Completion of one yr storage pilot project</td>
<td>%</td>
<td>100</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
<td></td>
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<tr>
<td></td>
<td>KHI feasibility study for D1D3 field (Lab Test)</td>
<td>%</td>
<td>100</td>
<td>2</td>
<td>100%</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCM Repair facility at Aker base</td>
<td>%</td>
<td>100</td>
<td>1</td>
<td>75%</td>
<td>0.75</td>
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<tr>
<td></td>
<td>Complete Training Schedule</td>
<td>No. / 10</td>
<td>session</td>
<td>1</td>
<td>100%</td>
<td>1.00</td>
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</tr>
</tbody>
</table>

**OVERALL KPI Achievement (%)**

- **Subsea Base Operations**: 100.0
- **Aker base operations**: 90.99
- **New initiatives / Innovations**: 85.45
- **Training**: 100.0

**Overall**: 90.99
Well barriers testing

XMT - Integrity Testing:

- SCSSV Testing as per API 14B.
- Allowable leak rate as per API 14H for the SCSSV Test is monitored through pressure build-up.
- 4 Tests: AMV/AWV/XOV loop, PMV/PWV/XOV loop, PMV inflow, SCSSV LOT are performed

Subsea Isolation Valves (SSIIV)

- 24-inch Subsea Isolation Valves at CRP (6 off)
- Partial Stroke Test every 12 months

Barrier testing is critical for safety of the assets
Corrosion Control – Design

- Internal Corrosion - Design Strategy
  - Pipeline Design includes 4-5mm corrosion allowance
  - Continuous Corrosion Inhibitor injection at all XMT
  - Criteria - limit corrosion metal loss to 0.1mm/year over life
  - Manifold Piping – Corrosion Resistant Alloys

- External Corrosion - Design Strategy
  - Coatings and Cathodic Protection
  - External Corrosion allowance (risers)

Risk assessments list pipeline corrosion as major threat
Corrosion Control – Monitoring

Monitoring – Internal Corrosion

- Corrosion inhibitor dosing – reconciliation
- CI residual monitoring.
- RPCM – Provide continuous metal loss recording
- Iron Counts - provides average metal loss trending
- Corrosion Probes on CRP
- Subsea UT testing

Monitoring - External Corrosion

- General Visual Inspection
- Cathodic Potential Measurement

Modified RIL NORSOK model

Modified NORSOK M 506 model and developed user-friendly tool in excel environment

Effective monitoring and control of corrosion enhances the integrity of assets.
Erosion Monitoring and Control

**Erosion Control - Design**
- Well completion design – Sand screens
- Material selection
- Process simulation (PSS) – maintain gas velocity control
- Sand and erosion monitors

**Erosion Control - Monitoring**

**Solids production monitoring**
- Monthly reporting by instrument vendor
- Monthly analysis by Integrity Team
- Solids trending across system

**Erosion monitoring**
- Monthly analysis by integrity team

Erosion control essential for good well integrity
Typical Findings and Issues

- **Rigid Flow lines and Pipelines**
  - CP readings good
  - Minimal Pipeline Free Spanning
  - Generally self buried without any apparent deviation since installation.

- **Umbilicals**
  - Generally buried greater than 0.5D
  - Some instances of upheaval observed & found stable during subsequent inspections

- **XMTs**
  - XMT CP readings good
  - Coating condition good
  - Some evidence of external hydrates forming

Good results enhance our confidence in operations
Typical Findings and Issues - cont

- **Manifolds**
  - Coating condition good, CP readings Good
  - Debris Items – generally insignificant
  - No leaks

- **SDAs**
  - Coating condition good, CP readings Good
  - Structure in good condition

Good results enhance the life of field
- Jacket, Riser, J-tube GVI performed from (-)14m to seabed
- Riser above water UTM program is in place.
- Topside piping erosion probe status is monitored.
- Topside Piping GVI performed
  - Performed coating Repairs
  - Flange protection mitigation is in place.
- Splash zone inspection.

Very important for structural safety of platform
Shallow water and Onshore pipelines inspection

- Shallow water pipelines GVI and CPFG survey carried out.
- Onshore Pipeline CP Survey performed every three months and shows adequate protection along onshore ROW.
- UT survey performed on onshore pipelines above ground piping once in two years.

Shallow water and onshore pipelines pose high risk of third party damage.
Audit Management - Operations

Audits during Steady State Operations:

- 2H offshore audit on Integrity management
- Integrated Management System (IMS) by DNV
- Offshore asset audit by OISD
- Insurance survey audit by ACE & Marsh

<table>
<thead>
<tr>
<th>Audit Status - Operations</th>
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</thead>
<tbody>
<tr>
<td><strong>External Audits</strong></td>
</tr>
<tr>
<td>Audit</td>
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<tr>
<td>2H Offshore Integrity</td>
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<tr>
<td>IMS audit</td>
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<tr>
<td>OISD</td>
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<tr>
<td>Insurance Audit</td>
</tr>
<tr>
<td>3rd party Safety audit</td>
</tr>
<tr>
<td>BP Operations Audit (3rd party)</td>
</tr>
<tr>
<td><strong>Internal Audits done by GMS</strong></td>
</tr>
</tbody>
</table>
Improvement Suggested
Additional Consideration?

- **Reliability**
  - Equipment Performance Data, Failure Frequency
  - System Configurations

- **Maintainability**
  - Maintenance Resource
  - Manpower constraint
  - Mobilization Delay
  - Spares Constraints

- **Operability**
  - Equipment Interchangeability
  - Response Time
  - Intervention Constraints

- **Availability**
  - Equipment Up-time
  - System Up-time

- **Enhanced Production Up-time**
Improvement Suggested

- **Proven Technology to be employed**
- **Standardization**
  - Identical Design for interfaces on IB/OB side, Standard Hot-stab design.
  - Allow interchangeability.
- **True Redundancy**
  - Back-up for all critical equipment which effects production
  - No interdependency between redundant system and ability to use them remotely.
- **Isolations and Barriers**
  - Double barrier where required,
    - e.g. Double barrier for all break-out in production and hydraulic path to facilitate safe intervention.
- **Vent Network & Hydrate**
  - Vent Network to facilitate individual well de-pressurization from both side of hydrate plug.
  - Facility of chemical injection – HXT Connector / HXT Crown
Innovations

- **Subsea**
  - Emergency SDA MEG Bypass System developed – To mitigate the risk
  - SCM Change out in Manifold – Without affecting production
  - Tool Deployment Frame - Subsea Structure Designed & Mfg. in-house
  - Two More Patent Application from Subsea Intervention Team

- **OT**
  - Internal Packing Modification in MEG Reclamation Column- Improved Efficiency
  - Use of Solid Separation system for MEG sludge processing- Dr Muller Filter
  - Hopper Arrangement for Air Compressor Molecular sieve filling- Reduced dust Carryover
  - Optimization of chemical injection in MEG Pretreatment
  - Addition of Flocculants in MEG Pretreatment – Enhancing Solid Settling
  - Introduction of Sodium Salt – Divalent salt Precipitation

7 patents and one design application filed from KGD6
## RIL- KGD6 D1-D3 Operations Performance

<table>
<thead>
<tr>
<th></th>
<th>Uptime %</th>
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<tbody>
<tr>
<td>April 09- Mar 10</td>
<td>99.92</td>
</tr>
<tr>
<td>Apr 10- Mar-11</td>
<td>100</td>
</tr>
<tr>
<td>Apr-11 -Mar 12</td>
<td>100</td>
</tr>
<tr>
<td>Apr-12 -Mar 13</td>
<td>99.93</td>
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<tr>
<td>Apr 13 to Mar 14</td>
<td>99.8</td>
</tr>
<tr>
<td>Apr 14 to Till date</td>
<td>99.97</td>
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*Setting a New Benchmark*
Recognition & Awards

Project Phase:
- Best Project Management Award from PMI India -2010
- Marico Innovation Award (KGD6 Project) – 2010
- Petrotech Award by MOPNG– Best Project Management (Joint Winner ) - 2010

Operations Phase:
- BSC 5 Star Award- Occupational Health & Safety System & Sword of Honour-2011
- BSC 4 Star Award for Environment Management System -2012
- BSC International Safety Award-2012
- OISD award :
  - Best Platform award for CRP (2010-11)
  - Best Rig for DWF (Deep Water Frontier ) (2010-11)
  - Best Onshore Processing Plant (2011-12)
  - Best FPSO DB-1 (2012-13)
- Economic Times –Indian manufacturing Excellence “Super Platinum” Award-2011
- Corporate Social Responsibility Company of the year- Asia Oil & Gas Awards 2013 by Oliver Kinross
- Ramakrishna Bajaj National Quality Award( RBNQA)- Certification of Merit - 2010
- Gold Medal from Red cross society presented by Hon’ble Governor of AP- 5th Consecutive Year in 2013
- 4 star rating EHS award in southern region by CII in 2014

Excellence in excellence
Any questions?
Thank you
Flow-assurance actions to reduce pressure drop in pipeline

- Surfactant injection in well B15 under progress in D1/D3 @ 400 Liters/day
- Surfactant injection in well B11 under progress in D1/D3 @ 100 Liters/day.
- For D26 wells, Well Fluid Samples are sent for analysis to NALCO INDIA to identify right foaming agent. Draft report rcvd Sept2014 & comments sent. Await response from NALCO.
- 12m3 of surfactant at site. Another 46 m3 ETA by Nov end.

Increase in B11 Gas rate
Increase in B15 Gas rate
Keep wells flowing

- Monitoring & optimizing wells 24 x 7 basis & actions to control water.

- Monitoring DWPLEM pressure and optimizing production by choke adjustment/Surfactant optimization/reducing CS 01 pressure. DWPLEM Pressure 51.54 Bara.

- MA gas injection into GTL-1 at DWPLEM. MA gas Injection rate 0.88 MMscmd.
Flow in Deep-water Pipeline
DWPLEM and CRP – Gravity vs Friction

- DWPLEM to CRP loading Curve ($\Delta P$ Vs $Q_g$). ($Q_g$ 8.06 MMScmd $\Delta P$ 10.0 bar)

Current Point

$Q_g$ 7.3 MMScmd $\Delta P$ 10.67 Bar on 12th Oct 2014 during FPSO shut down (cyclone HUDHUD)