Asset Integrity and Process Safety Management

- How it Works (maintaining the SECE's)
- Control and Assurance
- Audits and Reviews
- Independent Verification

Presentation to the
European Union Offshore Oil and Gas Authorities Group (EUOAG)
3rd of July 2014

Vision: “Our Assets are Safe, and we know it”

UIO/ T Producing Assets: Groningen, Land and OneGas

- 60 billion Nm3/yr gas production
- 1000 wells
- 200 production locations/platforms
- 3600 km pipelines
Vision: “Our Assets are Safe, and we know it”

Asset Integrity

Design Integrity

Technical Integrity

Integrity Leadership

Operating Integrity

HSE Case & ALARP-statement
EXAMPLES of SECE's

- Instrumented Protection System (SIL rated)
  - Trip setting of initiating element (e.g. 85% of set pressure relief valve)
  - Right sequence of events (shutdown schedule)
  - Fail safe
- Shutdown Valve (upstream design pressure)
  - Closing Time < ... seconds
  - Leak Rate < ... m³/hr
- Pressure Relief Valve (set pressure to protect design)
  - Opening Pressure > 110% Set Pressure (safety)
  - Opening Pressure < 90% Set Pressure (environment)

Hardware barriers and SCE groups (addresses Safety and Environment)

- "SCE = SECE"
  SCE's address both Safety and Environment
- Safety and Environment are managed in integral way
Technical Integrity Management

Methodology & Strategy
- Risk and Reliability Management (RBI, WIMM, PIMM, JIP, CNF, …)

1. Identify SCEs and Performance Standards (using HEMP)

2. Create / Update Maintenance, Inspection and Test plan
   - Planned maintenance, inspection and testing routines automatically called by the CMMS

3. Execute Maintenance, Inspections and Testing
   - SCE functions correctly?

4. Initiate Corrective Task
   - Risk assess and mitigate.
   - If not acceptable production is stopped.
   - Facility Status Reporting (FSR) with TA approval

SCE functions OK

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7th EUOAG - 3rd of July 2014

DEVELOP / PROJECT

PRODUCE

SCE Management through the Asset life cycle

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### Agenda

- Asset Integrity & Process Safety Management – How it Works
- Asset Integrity & Process Safety Management – Assurance
- Line of Defence – Audits and Reviews
- Independent Verification
  - 1st Party Assurance
    Technical Authority, Audits and Reviews
  - 2nd Party Inspection
    Accredited Internal Inspection Body
  - 3rd Party Verification
    by Bureau Veritas (OneGas UK)

### Independent Technical Authorities

- TA0: EVP of Shell Upstream International Operated (UIO) and EVP Upstream Development (PTU)
- Del-TA0: Engineering & Production is VP Global Production Excellence
- TA1’s appointed by del-TA0:
  
  - ENGINEERING: Mechanical Static, Rotating; Electrical; Control & Automation; Pipelines; Inspection; Materials & Corrosion; Civil; Offshore Structures; Process Eng
  - HSSE SP: Technical Safety, Environmental
  - PRODUCTION: Production Operations; Maintenance and Reliability; Production Technology (well integrity); Production Chemistry; Logistics

- TA2’s and TA3’s are appointed by the TA1’s
- Competences of all TA’s are formally assessed before being appointed
**Technical Professional Foundation**

- **Shell Graduate Program**
  - JG 5 – JG 6
  - Foundation on Awareness and Knowledge level

- **Shell Advanced Technical Program**
  - JG 5
  - Core Discipline Development on Knowledge and Skill level
  - JG 4 – 2
  - Water Production Function convergence or specialisation

- **Technicians and Operators**
  - JG 9 – JG 6
  - TOPP Technician Operator Professional Program

- **Milestone-1**
  - ICA Assessment

- **Milestone-2**
  - ICA Assessment

- **Technical Assurance**

**Independent Technical Authorities**

- **EVP Upstream International Operated (TA0)**
- **VP NAM NL and OneGas UK**
- **Discipline Lead / TA1**
- **Maint Eng TL**
- **Maint Mgr**
- **Ops Mgr**
- **Disc Eng Mgr**
- **Prod Serv Mgr**
- **Asset Mgr**
- **VP NAM NL and OneGas UK**

**Appointment and escalation**

- **Business priorities**

- Strategic Development Programmes (including assessments) are available for all engineering disciplines.

- Passing the milestone assessment is a prerequisite, but does not entail a promotion.

- PO: Production Operations
- MFA: Maintenance, Reliability & Turnaround
- IT: Information Technology
- PC: Production Chemistry
- ISO: Logistics
Independent Technical Authorities – Control and Assurance

- Engineers, Operators, Maintainers, …  
  - Own the Delivery and Responsible for the Quality of the Work

- Technical Authorities 2 and 3 (TA2, TA3)  
  - Own the Quality Control and Sign off on Deliverables (Design Docs, Deviations; etc.)

- Technical Authority 1 (TA1)  
  - Set / maintain the Standard for their Discipline  
  - Assess and appoints TA2s/TA3s  
  - Approve Deviations from the Discipline Standard

Asset Integrity

- Design Integrity
- Technical Integrity
- Operating Integrity
- Integrity Leadership

Management Review

- Integrity Meeting at Asset level (every month)
- Integrity Meeting NAM & OneGas UK (every 6 months)

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    by Bureau Veritas (OneGas UK)
The Line of Defence (LOD) Model

LOD 3
- Independent (internal and external) audit provides assurance to the RDS Board and senior management on how effectively the organisation assesses and manages its risks.

LOD 2
- Higher level controls and business assurance to assess the effectiveness of business processes, operational controls and management controls in ensuring compliance with processes, controls and external laws and regulations.

LOD 1
- Management controls give effect to Management ownership, accountability and responsibility for delivering business objectives and assessing, controlling and mitigating associated risks, together with maintaining effective internal controls.
- Operational processes and controls are the means by which business objectives are achieved and many risks are managed on a day-to-day basis, usually governed by documented Group, Business and lower level standards and policies.

Audit and Review
- Shell Internal Audits (Asset Mgt, ...)
- HSSE SP Audits
- Hardware Barrier Assessment
- Process Safety Review
- Integrity Assurance Sustain Review
- Maintenance Execution Sustain Review
- Operation Integrity Reviews
- ...
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Verification: “a multi dimensional playing field”

- SCE groups (Structures; Pressure Containment; Ignition Control; Emergency Response; ...
- Project Phase (Design, Construct, Commission) ...
  - Produce Phase (Maintain, Operate, Management of Change, Life Extension)
- Management System level (processes, methodology, organisation, competences) ...
  - Output level (Check Plans /Programmes; Condition of equipment, Witness Activities)
- Sampling (100% ... Random check ... Risk Based Methodology)
- Level of Independence: 1st Party ...... 2nd Party ... 3rd Party
- Reporting of findings to Duty Holder ... Competent Authority
- Certificates of compliance .... Approved .... Accepted .... No further Questions

What is the right level of verification?
1st Party Assurance – Technical Authorities, Review and Audits

Hardware Barrier Assessment- HBA
- Technical Authority team visits site and verifies effectiveness of hardware barriers
- Each year several sites per Asset according to multi year plan
- Close feedback loop: Which HBA-groups are effective and where are improvements required (strategies; PM-routines; competence; ...).
- Outcome HBA is input for PSR evidence at Asset level.

Process Safety Review - PSR
- Technical Safety lead review to verify Asset at HSE case level.
- Builds on findings of HBA’s, with focus on:
  - Management of Changes: Ops Conditions; Hardware; legislation; LFI’s; Procedures; Technology and Organization
  - Safety studies (e.g. HAZOP)
  - ALARP statement

Operation Excellence Reviews
- Integrity Assurance Sustain Review
- Maintenance Execution Sustain Review
- Operation Integrity Reviews

Audits and Reviews (LoD2 and LoD3)
- Shell Internal Audits (e.g. Asset Management)
- HSSE SP Audits

1st Party Assurance - Strengths and Points of Attention

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<tr>
<th>Strengths</th>
<th>Points of Attention</th>
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<tr>
<td>Close to the business and linked with production and maintenance processes</td>
<td>Requires up-to-date standards and accepted methodologies and processes</td>
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<td>Integration of design, construction &amp; produce phase allows direct feedback and optimization</td>
<td>Requires sufficient in-house capability and competences which are formally assessed</td>
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<td>Allows pro-active approach to anticipate future changes (operating conditions, modifications)</td>
<td>Needs special attention to keep up to date with legal requirements, standards and technology developments</td>
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<td>Gives higher efficiency and stimulates “pro-active” behaviour</td>
<td>Appropriate level of independence must be ensured</td>
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<td>Stimulates ownership and cross learning between different assets and operations</td>
<td>Needs right leadership and behaviours of both asset line and Technical Authorities</td>
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<td>Formal escalation to Shell EVP level (above VP NAM NL and OneGas UK)</td>
<td>Might be perceived as less independent by the community at large</td>
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For Pressure Equipment an accredited 2nd or 3rd party inspection body is required to meet NL legislation of pressure equipment
- Pressure Vessels
- Heat Exchangers
- Storage Tanks
- Piping Systems
- Relief Systems

IQS (Inspection Quality System) is part of CMS (Corporate Management System)
Competency of inspectors are based on external certification
Shell Risk Based Inspection methodology is externally accepted
Inspection Department is formally accredited (Raad van Accreditatie) and appointed by the Dutch Authorities (Ministry of Social Affairs)

2nd Party Inspection - Strengths and Points of Attention -

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<tr>
<td>Accredited 2nd party Inspection Body is accepted alternative over 3rd party Inspection Body satisfy legal requirements for pressure equipment in NL</td>
<td>Needs to maintain an externally accredited “quality management system” and organisation</td>
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<tr>
<td>Builds on strengths, knowledge and experience of 1st party assurance</td>
<td>Needs to maintain certified SKK competence levels of inspectors in NL</td>
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<tr>
<td>Seen as more independent than 1st party assurance by community at large</td>
<td>Inspection techniques and sample size depend on full understanding of degradation modes/rates and defect morphology. Shell Risk Based Inspection methodology is formally, externally accepted in NL.</td>
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</tbody>
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In UK the Verification and Examination Scheme of the Duty Holder is required by the Offshore Installations Regulations (“Safety Case” and “Prevention of Fire and Explosion and Emergency Response”).

- The Verification and Examination Scheme is compiled by the Duty Holder in consultation with the Verifier (Independent Competent Person, ICP).
- The sampling is risk based aimed at all SCE groups. SCEs are ranked in terms of criticality and drives number of verifications and offshore visits. The criticality is based on risk (consequence and likelihood of failure).
- Verification and Examination comprises witnessing and checking.
- All findings are recorded in database (BV-net).
- Findings are reported as Low, Medium or High priority.
  - For OneGas West approx. 100 findings/year (80% Low; 20% medium; no high findings in past 5 years).
- Escalation (none received for OneGas UK in past 5 years):
  - “Note of Concern”, when too many findings or insufficient follow-up
  - “Note of Reservation”, when “Note of Concern” not satisfactorily resolved.
- ~3.5 man years to execute the operational (~2.5) and modifications (~1) verifications for OneGas UK.
3rd party verification - Strengths and Points of Attention

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<td>3rd party perceived as more independent than 1st party and/or 2nd party</td>
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<td>More distant from primary business processes (e.g. projects, production and maintenance) and as such reactive</td>
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<td>Verification Scheme/ sampling is risk based and agreed with Independent Competent Person</td>
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<td>Independent Competent Person needs to be competent to verify variety of SCE groups in project and/or operate phase</td>
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<td>Commercial interest of 3rd party verifier could hamper cross learning between verifiers</td>
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<td>When 1st party assurance functions properly this could result in duplication of effort</td>
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3rd Party versus 2nd Party: Examples / Considerations

- 2nd Party Inspection of Pressure Equipment
  - Corrosion and degradation rate depends on material selection, medium (CO₂, H₂S, acidity, salt, sand,...), temperatures, flow regime, ...
  - Heavily integrated with the primary production processes
  - Business impact (shutdown duration and frequency)

- 3rd Party Inspection of Electric Systems
  - Less integrated with the primary process of exploring and producing hydro carbons
  - Mature and widely accepted industry practices
Independent Verification to prevent Major Accident

- First party independent verification supplemented with reviews and audits does provide the assurance required by the RDS board of its respective duty holders.

- In case additional verification is deemed necessary (e.g. in the eye of public) it would be most effective to focus on the primary barriers that prevent high energy release top events potentially leading to major accident scenario's. Like:
  - Pressure Containment
    - Pressure vessels, Pipelines, ...
    - Shutdown systems, Emergency Shutdown valves, Pressure Relief valves, ...
  - Structural Integrity
    - Primary structure

- At present member states impose different requirements
  - "Inspection" NL: In depth on selected equipment - Pressure vessels; Life extension Primary Structure; Cranes; Electric Installation; ....
  - "Verification" UK: Risk based covering all SECE's

Concluding Remarks

- The FOUNDATION is a solid Asset Integrity and Process Safety management process, with:
  - proactive Leadership
  - Competent Staff
  - independent Technical Authorities

- Reviews and Audits (internal and external) assess the effectiveness of business processes, operational controls and management controls in ensuring compliance with processes, controls and external laws and regulations.

- Goal setting, Risk Based and Tiered approach for inspection and verification.