The Role of Design Assurance in Improving Process Safety for Chevron’s Major Capital Projects

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Presentation Agenda

- Chevron Major Capital Projects Overview
- Chevron Project Development and Execution Process
- Design Assurance Mission and Workflow
- Examples of How Design Assurance Improves Process Safety
- Q&A
Chevron 2013 Capital and Exploratory Investment Program

Chevron’s Capital and Exploratory Investment Program for 2013 is $36.7 Billion

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Total Upstream</td>
<td>$33.0 Billion</td>
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<tr>
<td>U.S. Upstream</td>
<td>$7.5 Billion</td>
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<tr>
<td>International Upstream</td>
<td>$25.5 Billion</td>
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<tr>
<td>Total Downstream</td>
<td>$2.7 Billion</td>
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<tr>
<td>U.S. Downstream</td>
<td>$1.4 Billion</td>
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<tr>
<td>International Downstream</td>
<td>$1.3 Billion</td>
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<tr>
<td>Other</td>
<td>$1.0 Billion</td>
</tr>
</tbody>
</table>

Source: Chevron External Press Release, December 5, 2012
Chevron 2013 Upstream Major Capital Project Investment

- Gorgon - Three-train LNG foundation project with total capital cost estimate of AU$52 Billion (US $52 Billion)

- Gulf of Mexico - Jack/St. Malo, Big Foot and Tubular Bells

- Nigeria – Further development of the Usan and Agbami deepwater fields; and construction and plant commissioning of the Escravos gas-to-liquids facility

- Angola/Republic of Congo – Startup and ramp up of Angola LNG and development of Mafumeira Sul (Angola) and Moho Nord (Republic of Congo)

- Kazakhstan/Russia – Advancement of the Tengiz Future Growth Project (Kazakhstan) and the Caspian Pipeline expansion (Kazakhstan, Russia)

- Brazil – Advancement of the Papa-Terra deepwater project

- Canada – Hebron offshore development

- United Kingdom – Advancement of the Clair Ridge project and the Rosebank deepwater field

- China – Development of the Chuandongbei natural gas project

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Presentation Overview

- Chevron Major Capital Projects Overview
- **Chevron Project Development and Execution Process**
- Design Assurance Mission and Workflow
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Chevron Project Development and Execution Process (CPDEP)

- Phase 1: Identify and Assess Opportunities
- Phase 2: Generate and Select Alternative(s)
- Phase 3: Develop Preferred Alternative
- Phase 4: Execute
- Phase 5: Operate and Evaluate
Major Capital Project Challenges

• Very Large Project Expenditures
• Long Project Schedules
• Extended Start-up/Ramp-up
• Deferred Production and Operational Issues
• Process Safety Incidents
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Design Assurance Mission

Develop and deploy Design Assurance processes and tools to improve design quality and reduce the likelihood of technical design errors resulting in improved business performance on Chevron projects and facilities.

**Assurance** - Reviews or audits performed by people from outside of the project team to evaluate the quality, intent or function of the project’s decision quality, organizational capability, project deliverables and/or work processes to meet expectations of the Chevron Project Management System while taking into consideration the project’s scope and complexity.
Components of Design Assurance

Applies to CPDEP Phases 2 through 4

- Screening
  - Identify design risk and corresponding work plan

- Through-phase engagement
  - Periodic check-ins
  - Peer Pool reviews driven by screening results
  - Previous lessons learned
  - Issue tracking of items discovered throughout the phase
  - Deep System Dives (i.e. Choose equipment items from P&IDs and complete a system check)

- End of Phase Review
  - Finalize previous findings and final project checks
Design Assurance Funding & Planning

- Design Assurance Screen
  *Not funded by project budget during Pilot

- Establish Plan & Close Gaps
  *Strategic use of funds already planned for Technical Expert Engagement plus incremental

- End of Phase Review & Report Out
  *Will need project funding

FE Disciplines
- Current Project TEE Plan
- Amended Design Assurance Focused TEE Plan
Design Assurance in Projects for Each Phase

**PROJECT**

- **Design Development**
- **Final Deliverable**
- **End of Phase**
  - Close out Assessment
  - Next Phase Screen

**Document Management System**

**DESIGN ASSURANCE**

- **Screen for High Technical Risks**
- **Plan to Close Gaps**
  - Consult project to validate screening
  - Focus on identified risk areas
  - Develop design assurance resource plan
- **Review throughout Phase via Peer Pool**
  - Technical Reviews on Critical/Selected
  - Random Checks
  - Monthly status sent to Project
  - System Deep Dive Technical Reviews
- **End of Phase**
  - Close-Out Assessment
  - Technical Integrity Report
  - Next Phase Screen

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Element 2: “Facility Design and Construction

FD&C provides for:

- Risk-based considerations for fundamental project decisions, such as facility location and the use of inherently safer designs
- Robust process and mechanical designs
- Reliable process control
- Safeguards to help reduce the potential for human error

FD&C element verifies that designs incorporate systems to:

- Detect emergency situations
- Limit consequences of emergency situations

Click each link to learn more.
How Design Assurance Improves Element 2
“Facility Design and Construction”

- Verifies that project Engineering Standards are properly selected and followed to enhance safety of design
- Assures that facility designs are reviewed by subject matter experts in various phases of the project
- Ensures that the project team fully analyzes the safety requirements of the design
- Supplements lessons learned. Also ensures Lessons Learned are incorporated in the facility design due to peer pool participation
- Contributes significantly to robust process and mechanical designs drawing upon expertise of large peer pool discipline members.
- Contributes to reliable process controls and safety shutdown systems
- Identifies major design issues that may not have been considered by the project team
Element 3: Safe Operations

Safe Operations requires us to operate and maintain facilities with the objective of preventing very serious incidents.

Process safety within the Safe Operations Element and Expectations occurs through five processes and standards:

- Corporate HES Risk Management Process
- Corporate Standard for Process Safety Information
- Corporate Standard for Operating Procedures
- Managing safe work practices and procedures
- Workforce competency programs
How Design Assurance Improves Element 3
“Safe Operations”

• Helps to identify applicable operating scenarios, ensuring the facility design can operate safely
• Provides additional cold eyes review with respect to safe operations
• Helps to set the proper design parameters (such as design pressure and temperature) to cover the whole operating envelope
• Verifies that operating procedures, safe work practices and procedures, and other procedures meet corporate standards
• Reviews start-up procedures to enhance safety during start-up
Element 4: Management of Change

Successful Management of Change (MOC):

- Evaluates operational and HES impacts
- Considers changes to facilities, operations, products and organization
- Addresses both temporary and permanent changes
How Design Assurance Improves Element 4 “Management of Change”

- Ensures that the project ‘s MOC procedures comply with corporate standards and project needs
- Shares MOC Lessons Learned and Best Practices with the project team
Asset Integrity within Element 5 Reliability Expectations:

- Implements through the Corporate Standard Asset Integrity and OPCO-specific processes, standards and programs
- Verifies that assets perform their planned functions effectively and efficiently and that they are suitable for their intended application throughout their service life
- Includes testing, surveillance, monitoring, preventative maintenance and repair of critical equipment
How Design Assurance Improves Element 5
“Reliability and Efficiency”

• Ensures that the sparing philosophy for equipment is compatible with project requirements
• Verifies that the project team implements appropriate Reliability and Asset Integrity process
• Brings additional expertise and Lessons Learned on reliability and efficiency to the project team
Element 6: Third Party Services

Contractor management should:

- establish accountability for activities
- verify scope of work
- reinforce OE expectations
- monitor compliance at job sites

Contractor HES Management provides for the selection, orientation, and pre-job planning with contractors in order to execute work without incidents.

Often contractors perform essential functions related to operations or maintenance. When these tasks are performed well, facilities reduce their potential for serious incidents.
How Design Assurance Improves Element 6
“Third Party Services”

• Reviews third party engineering work quality to enhance safety and to ensure it meets project requirements
• Reviews software used by third party providers to ensure it complies with corporate requirements