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Heavy Oil

Controlled Document

Quest CCS Project

Project Execution Plan

Project	Quest CCS Project
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Revision History

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1	2009-05	Updated for FPP			
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4	2010-11-15	VAR3 Issued for Approval			
5	2011-08-11	VAR4 Issued for Review			
6	2011-09-22	VAR4 Approved			
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Signatures for this revision

Date	Role	Name	Signature or electronic reference (email)
	Originator		
	Reviewer		
	Approver		

Summary

Project Execution Plan per PS10 Project Execution Strategy and Planning

Keywords

Execution, ORM, VAR4, CCS, PEP

DCAF Authorities

Date	Role	Name	Signature or electronic reference (email)
		Add name	Actual signature
		Add name	Actual signature
		Add name	Actual signature

IMPORTANT NOTICE

THE PROJECT PREMISE DOCUMENT (PPD), TOGETHER WITH THE BASIC DESIGN ENGINEERING PACKAGE (BDEP), PROJECT EXECUTION PLAN (PEP), AND THE OPERATIONS READINESS PLAN (ORP), PROVIDES A COMPREHENSIVE AND INTEGRATED SUMMARY OF THE FRONT-END ENGINEERING DESIGN PHASE (DEFINE) STUDY.

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1. INTRODUCTION

1.1. Purpose

The purpose of the Project Execution Plan (PEP) is to communicate those plans, assumptions, and decisions that have been made by the Quest Project Team regarding how the Quest Project will be implemented.

A clear, concise and consistent PEP facilitates decision-making, thereby supporting the project assurance and governance processes. By providing a common basis for project implementation, the PEP also facilitates alignment and integration among project team members. This common basis also enables major changes to the execution plan to be identified and evaluated.

1.2. Scope

The PEP encompasses all phases of project implementation: detailed engineering, procurement, construction, commissioning and startup. In addition, the PEP addresses various activities vital to a project's success, including (but not limited to): HSSE, project drivers, assurance, governance, risk management, project organization, interface management, project controls, quality, contracting, procurement, and information management.

Although the project premises, the project design basis, and the handover plan to Operations are all touched on in the PEP, these topics are properly addressed in the PPD, BDEP, and ORP respectively. The PEP makes reference to these and other project documents, which should be consulted as required to gain a deeper understanding of certain topics, or a broader understanding of the venture as a whole.

2. PROJECT BACKGROUND

2.1. Business Objectives

The Quest CCS Project will reduce GHG emissions from the Scotford Complex. By enhancing the environmental competitiveness of existing Oil Sands facilities, Quest should enable the unlocking of further development opportunities of the resource base.

A full description of the business objectives can be found in the PPD.

2.2. Location of Quest CCS Facilities

The "CO2 Capture" component of the Quest CCS Project will be located within the existing Scotford Upgrader site (both Base Plant and Expansion 1), in Fort Saskatchewan, near Edmonton Alberta. Construction will encompass both greenfield and brownfield elements. The

pipeline will extend to the north of Fort Saskatchewan approximately 84 km, where the CO2 will be stored underground in a deep geological formation (Basal Cambrian Sands).

2.3. Operator of Quest CCS Facilities

Shell Canada Energy, as operator of the existing Scotford Upgrader facilities (both Base Plant and Expansion 1), will be the operator of the new Quest CCS facilities. The Scotford Upgrader Operations organization will take over operations and maintenance of the capture facilities, pipeline, and wells on behalf of the joint venture owners (Shell, Chevron, and Marathon).

Execution of the Quest CCS Project will be managed by Shell's Projects & Technology organization in Calgary Alberta. The Execution team will lead the project until mechanical completion, when it will be turned over to the customer, the Scotford Upgrader Operations organization. The Operations team will lead commissioning and start-up activities.

3. PREMISES

3.1. Opportunity Statement

The opportunity statement for this venture, from the most recent Opportunity Framing workshop in November 2008:

"To develop a world-scale CCS demonstration for AOSP, Shell, and Alberta, exceeding 1 Mtpa by December 2015."

3.2. Value Drivers

Quest CCS will not generate revenues other than via Carbon Credits. The project has assumed a price of $40 per tonne of CO2 for its economic calculations. However, without considerable funding by federal and provincial governments, the project cannot break even. It is therefore essential for the Quest CCS Project to be developed such that CAPEX, OPEX, and GHG efficiency are optimized, resulting in the greatest possible value for AOSP.

Although cost is the primary driver for this project, quality is also important. If production and availability are not attained as planned, project economics will be significantly impacted.

The following are the project drivers in order of importance:

- Cost – This is the primary project driver, not only because cost is the default driver throughout RDS, but because the Quest facilities will not generate any revenue except via carbon credits.

- Quality – This is the secondary project driver, because part of the government funding is tied to sequestering a specified amount of CO2 (10.8 Mt) by a specified date (December 2025). If this is not achieved, part of the funding will be pro-rated accordingly.
- Schedule – The strategy for Quest is to achieve sustained operations (S.O.) by December 2015, matching the commitment to government. However, if the execution schedule starts to slip, money will not be spent to maintain this schedule, as government funding is not significantly impacted unless S.O. slips past December 2017. S.O. is deemed to have been achieved when the following three tests have been passed either together or at separate times:
    1. Test A – Capture Unit Capacity – 24 consecutive hours in which Quest capture unit processes a minimum of 2,960 tonnes of CO2 (1.08 Mtpa over 24 hours) from the HMU facilities.
    2. Test B – Capture Unit Efficiency – 20 consecutive days in which the Quest capture unit processes a minimum of 75% of the total CO2 produced by the Upgrader base and expansion HMU facilities during those 20 days, while running at an average of at least 50% and a minimum of at least 30% of design rates.
    3. Test C – Integrated Project Reliability – 30 consecutive days in which the Quest project maintains operation whereby the capture, transportation and subsurface facilities operate continuously without shutting down, while running at an average of at least 30% of design rates.

3.3. Key Technical and Execution Boundaries

- The CO2 Capture facilities involve only the existing Upgrader HMUs (HMU1/2 at Base Plant, and HMU3 at Expansion 1). There is no integration with the Scotford Refinery HMU or with Shell Chemicals.
- There are no provisions for future capacity increases.
- SGSI Amine technology (ADIP-X) will be used to capture CO2
- CO2 Compression will only use commercially proven technology
- No impact on base business performance (CO2 plant modifications must not impact Upgrader availability)

3.4. Project Givens

- Alberta Government funding requires project to be operational by December 2015 (requirement in FPP)
- 1 Mtpa CO2 reduction by CCS (also required by FPP)
- CCS required to retain ability to grow the Oil Sands business
- Sequestration will be by geological storage
- Voluntary commitment to GHG reduction by AOSP is in public domain as part of leadership in CO2 management
- Regulations are emerging that will soon call for CCS

- MMV is a given – internal and external
- The Quest CCS Project is an AOSP project – 60% Shell, 20% Chevron, 20% Marathon: JV Partners must support the project and sign-off on the FPP
- Any single JV partner has veto power to terminate the project

3.5. Critical Success Measures (after one year of operation)

- No disruption to existing plant
- Achieve Goal Zero (Safety & Environment)
- Secured pore space for life of project
- No loss in well injectivity
- Sustained rate of 3300 tonnes/day
- Minimum impact on environment
- Demonstration of CO2 containment and predictability of its subsurface location: MMV program is working
- No complaints from neighbours
- People coming to visit as a showcase
- Full support from all key stakeholders
- Best achievable combination of CAPEX, OPEX, and GHG efficiency

3.6. Key Opportunity Milestones

- Regulatory Application Submitted: November 2010
- DG3: January 2011
- DG4: November 2011
- Regulatory Approval and FID: March 2012
- Sustained Operations: December 2015

4. DEVELOPMENT CONCEPT & SCOPE

Shell Canada currently operates three Hydrogen Manufacturing Units (HMU1/2 at Base Upgrader and HMU3 at Expansion Upgrader). The production of hydrogen represents a significant source of CO2 generated in the Upgrader, which is released from the reformer furnace stack.

An amine absorption and regeneration system is used to capture and recover 80% of the total CO2 from the three HMU PSA feed gas streams. The absorption process used is the ADIP-X process, which is an accelerated MDEA-based process licensed by Shell Global Solutions International (SGSI). The CO2 Rich Amine streams from each individual HMU is combined in a common Amine Regeneration section, where the CO2 is stripped from amine into a greater than 95% CO2 purity stream.

The recovered CO2 is compressed in an 8 stage centrifugal Integral Geared (IG) compressor with an electric motor drive. In the first 5 stages, free water is knocked out through compression and cooling. The CO2 from the 6th stage of compression is routed through a TEG dehydration unit to reduce the water content to less than 4 lb per MMSCF in winter and 6 lb per MMSCF in summer. In the final two stages, the CO2 stream is compressed to a supercritical fluid state (dense phase) at 14,790 kPag. This dense phase CO2 is transported by pipeline from the Scotford Upgrader to the injection locations which are located up to 84 kilometres from the Upgrader. There will be between 3 and 8 injector wells drilled to a depth of approximately 2200 m to inject the CO2 into the Basal Cambrian Sands (BCS) formation.

5. GOVERNANCE

5.1. Governance Structure

The Quest CCS Project follows the established governance structure for the AOSP JV:

- **Executive Committee**
- **Operating Committee**

5.2. Financial Authorities

Specific financial authorities will be specified by the Executive Committee for managing EPC contracts for the duration of the project. The Quest CCS Project will be managed based on a no-change policy. However, if a change order became necessary, its monetary value and schedule consequences will require approval by the Project Manager, Vice President – Projects & Technology, and the Executive Vice President – Heavy Oil, depending on their financial authority limits. Financial authority levels for the EPCM contractor for a reimbursable type EPC contract have been defined in the contract.

5.3. Project Development and Implementation Process

As the AOSP JV is operated by Shell, the Shell Opportunity Realization Manual (ORM) is applicable to the Quest CCS project.

As prescribed in the ORM, a Decision Executive (DE) is in place supported by a Decision Review Board (DRB) that takes all key decisions to progress the Quest CCS opportunity.

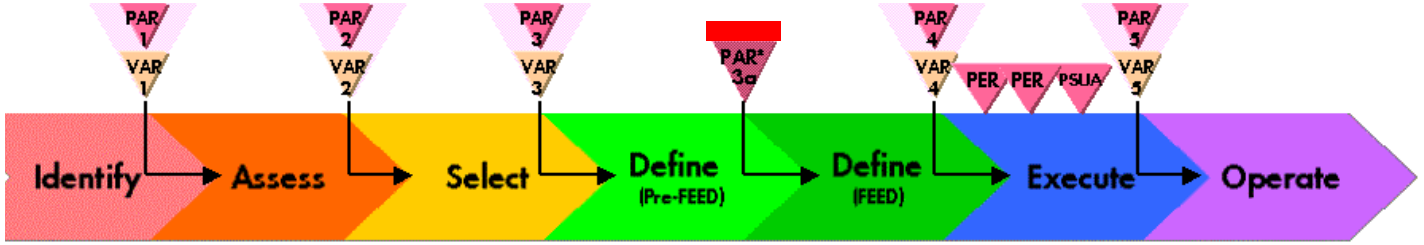
The DE and DRB meet regularly to review and assess the required decisions as identified in the Decision Based Road Map. The Decision Based Road Map is the deal sheet of the Venture team, led by the Business Opportunity Manager (BOM). The Decision Based Road Map is a key document for the venture and can only be updated with approval from the DE/DRB. It describes the key decisions that must be taken to progress this opportunity and its associated risks. The line of sight (LOS) to FID is through the DE (EVP Heavy Oil) and the Quest BOM.

The BOM is supported by his venture team, Heavy Oil Operations, and a project execution and technical team from the Projects and Technology (P&T) division in Shell. The P&T team is led by the Project Manager (Anita Spence).

The Project Manager is responsible for the technical definition and execution of the Quest CCS surface facilities, pipeline and well hook-ups. Subsurface definition is being led by the Storage Manager. After DG4, the PM's responsibilities may also include delivery of the injection and monitoring wells

6. PROJECT ASSURANCE

6.1. ORM Deliverables by Project Phase



Phase Objectives	**Business Planning** Identify options Economic evaluation SD strategy Opportunity Framing workshop Assurance Reviews	**Business Planning** Assess & select best options Economic evaluation SD strategy Project Assurance Plan (PAP) ± 30% Estimate Assurance Reviews	**Basis for Design** Optimum technology Operational requirements Site Selection HSSE assessment Economic Evaluation ± 30% Estimate Assurance Reviews	**Process Design** Fully defined process scope (PFD's) Economic Evaluation Risk Review HSSE assessment Execution & Ops Planning ± 20% Estimate Assurance Reviews	**Basic Engineering Design** Complete Project Specification Final Economic Evaluation Integrated EPC & Commissioning schedule Execution & Ops Planning ± 10% Estimate Assurance Reviews	Design Procure Construct Assurance Reviews	Flawless start-up Flawless first cycle of operation Meet business plan PIR
Phase Deliverables	Schedule Estimate Risk Register Opportunity Framing report Assurance Review Reports	PAP Project Premise Document (PPD 0) Scouting report Project Execution Strategy (PES 0) Operations Implementation Plan (OIP 0) Technical Assurance Plan Risk Register Schedule Estimate Assurance Review Reports	Updated PAP PPD Rev.1 Basis of Design (BOD) PES Rev.1 OIP Rev.1 Technical Assurance Plan Risk Register Schedule Estimate Assurance Review Reports	Updated PAP PPD Rev. 2 Basic Design Package (BDP) Project Execution Plan (PEP) OIP Rev. 2 Risk Register Schedule Estimate Assurance Review Reports	Updated PAP PPD - Final Project Specification (PS) PEP Rev. 1 OIP Rev. 3) Risk Register Schedule Estimate Assurance Review Reports	Updated PAP Safe, environmentally sound, operatable facility Assurance Review Reports	PIR Report

6.2. Discipline Controls and Assurance Framework

During the SELECT phase, the Quest CCS Project began applying DCAF to manage quality. This resulted in the development of a project-specific Project Controls and Assurance Plan (PCAP) for the period until DG3. The PCAP was subsequently defined for the DEFINE phase, for the period until DG4. The PCAP lists critical project deliverables, whom is accountable or responsible and identifies those people authorized to sign-off on these deliverables; it should be consulted for details on these topics.

Fluor developed their own quality plans for DEFINE phase deliverables and activities. The project team has checked the contractor's and Shell's compliance with the DCAF management system and will participate in the system where and when appropriate. The preparation and alignment of contractor QA plans with the PCAP will be undertaken for EXECUTE phase.

The contractor QA plan will cover technical quality, procurement quality and construction quality. Commissioning and start-up quality will be discussed in the Operations Readiness Plan. Shop inspection and equipment commissioning requirements by both the owner's team and by contractors will be specified in the project QA plan and purchase orders prior to execution of a PO.

6.3. Value Improvement Plan

During the SELECT phase, the project plan for application of VIPs was developed in conjunction with the EPCM contractor. By using multi-discipline teams and external third-party participants, value improvement ideas were identified, developed and implemented; the effect was a >15% reduction in CAPEX prior to completion of the VAR3 estimate.

In addition, the EPCM contractor has an established Value Awareness program to facilitate the ongoing collection of ideas to reduce costs from the integrated team. A Value Awareness committee has been established comprising Shell and EPCM personnel to review and approve ideas as appropriate.

6.4. Top Quartile Project Delivery

Cost is the primary value driver for Quest CCS. Therefore, cost metrics have been selected for benchmarking, and Top Quartile targets have been identified for those metrics. In general, 2nd-4th quintile targets have been selected for schedule. However, there is no target for the overall Execution Schedule, because the lack of overlap between detailed engineering and site construction makes the overall schedule very long compared to most projects. The Project Team belief is that cost excellence will be achieved during construction by having no holds remaining on the Issued For Construction (IFC) drawings, and is therefore not interested in overlapping the

engineering and construction schedules. IPA Prospective benchmarking has been carried out prior to VAR4, and the findings will be incorporated in the TQ Plan for the project; this plan should be consulted for details on metrics, targets, and gap closure plans.

7. FORMS OF AGREEMENT

7.1. Background

As part of the plan for greenhouse gas management and to reach desired CO2 reduction targets, the governments of Alberta (GoA) and Canada (GoC) initiated programs to incent early carbon capture and storage projects. The Quest project applied to these programs in a competitive bidding process with the submission of a Full Project Proposal (FPP) in March 2009. After evaluations of the bids submitted and subsequent discussions and negotiations, Quest was notionally awarded funding in both programs, conditional upon having completed and signed funding agreements with federal and provincial governments. The broad terms of the agreements were outlined with the signing of Letters of Intent with the GoA and GoC in September 2009. Amongst other terms, the funding levels are Cdn$745 million from the GoA and Cdn$120 million from the GoC for a total funding level of Cdn$865 million.

Negotiations on the terms of the agreements have been completed and agreed to by all parties in the government and the AOSP JV. On 24-June-2011, the agreements were signed and announced to the public.

In parallel to the funding agreements, negotiations were conducted and concluded on a related agreement between Quest and the Provincial Government for multi credits applicable to the project. The agreement calls for an additional carbon credit to be awarded to Quest for each tonne of CO2 captured during the first ten years of the project's operating life, subject to CO2 market prices. These credits will be usable for meeting greenhouse gas reduction commitments by the AOSP JV partners within the province of Alberta firstly, and any additional amounts are tradeable. The additional credits generated by the design volume of 10.8 million tonnes over ten years represent a significant additional revenue source in achieving the project goal of NPV=0 with a total revenue of 162M CAD at current 15 CAD/tonne credit prices, or 432M CAD at premise 40 CAD/tonne credit prices.

The key terms for each of these agreements are outlined in the following sections.

7.2. GoA Agreement – Key Terms

(a) Funding amount – Cdn$745 million
(b) Administered by the Department of Energy (ADOE)
(c) Payment of funding is phased as 40% during the post-FID and construction period, 20% upon successful startup and the final 40% over the first 10 years of operating life

(d) Agreement by Shell to a broad knowledge sharing framework, whereby key CCS knowledge is granted to the government for use in sharing with future CCS developers
(e) Project startup by end of year 2015 with penalties if late and full repayment of funding if beyond end of year 2017, subject to certain force majeure clauses
(f) Total government funding is not to exceed 75% of total project costs, including operating costs over the 10 year project operating window
(g) Money from the operating phase will be withheld if the project is deemed to be profitable. The amount of money withheld will be that amount that brings the project back to a neutral profitability position
(h) The agreement contains clauses regarding eligible costs and revenue definition, Force Majeure, assignability rights, audit provisions, reporting requirements, etc that protect the interests of all parties.

7.3. GoC Agreement – Key Terms

(a) Funding amount – Cdn$120 million
(b) Administered by Natural Resources Canada (NRCan)
(c) Payment of funding is immediate upon receipt of information verifying completion of valid work
(d) Agreement by Shell to a broad knowledge sharing framework, whereby key CCS knowledge is granted to the government for use in sharing with future CCS developers
(e) Funding to be released after the project has complied with an environmental assessment as per the Canadian Environmental Assessment Act (CEAA)
(f) Project startup by end of year 2017, otherwise full repayment of funding, subject to force majeure
(g) Total GoC funding is not to exceed 50% of total project costs
(h) Money will be returned to the government if the project is deemed to be profitable. The amount of money returned will be that amount that brings the project back to a neutral profitability position
(i) The agreement contains clauses regarding eligible costs and revenue definition, Force Majeure, assignability rights, audit provisions, reporting requirements, etc that protect the interests of all parties.

7.4. Multiple Credit Agreement – Key Terms

(a) The agreement allows for the granting of additional credits to Quest under the conditions of the agreement and the amendments to the Specified Gas Emitters Regulation of the Province.
(b) Additional credits are to be used for compliance purposes by Shell facilities in Alberta.
(c) The credits expire 3 years after their creation.

(d) Additional credits not required for compliance are tradeable.
(e) The maximum amount of additional credits is 10.8 million.
(f) If the project is in a net positive revenue position, then additional credits in that year will not be granted.
(g) The quantity of additional credits will be determined by the market price of CO2. For prices at or under 40 CAD/tonne, one additional credit will be granted per tonne of CO2 captured and stored. For prices at or over 80 CAD/tonne, no additional credits will be granted. For prices between 40 CAD and 80 CAD, the amount granted will be a linear ratio between one credit at 40 CAD and zero credits at 80 CAD. For clarity, in an example of CO2 market price of 50 CAD/tonne, the amount granted would be 0.75 credits per tonne of CO2 captured and stored.

7.5. Agreement Next Steps

Operationalization of the agreements has begun with a program being laid out that clearly specifies the responsibilities and timing of the AOSP obligations. This will ensure timely and effective delivery of all agreement items.

8. FINANCING & INSURANCE

8.1. Financing

The AOSP JV Owners will fund the Quest CCS Project proportionally.

8.2. Insurance

A Capital Project Risk & Insurance Strategy has been developed for the Quest CCS Project. It sets out strategies and plans for ensuring that all stakeholders in the Project, including insurers, see their interests addressed in a mutually beneficial way. Topics addressed include, but are not limited to, the following: Role of Risk & Insurance – Modus Operandi, proposed risk management approach, risk allocation principles in contracts (i.e., CARM), insurance clause structure required from contractor to support risk allocation, capital projects risk engineering, marine warranty survey, insurance principles – recommended best practice, proposed insurance procurement strategy, competitive tender exercise, underwriting information, participation of captive companies of the stakeholders, risk retention levels, statutorily and contractually required insurances, insurance in construction phase, early works insurance, general third party liabilities, marine cargo, Construction All Risks (CAR) – Onshore, and claims management.

Prior to FID, an insurance risk review will be performed utilizing results of the independent risk assessment being carried out by DNV. This review will combine the key elements of the Design Phase Risk & Insurance Review (DPRIR) and Underwriting Survey to assist with risk reduction measures and cost effective placement of the insurance policies. The scope of Loss Control Surveys will depend on the requirements of the lead insurer.

During construction, an Owner controlled insurance program placed by Shell.

Also during construction, it is expected that each contractor and subcontractor will carry specified types and amounts of insurance to include Workers' Compensation, Employer's Liability, Commercial General Liability, and Automobile Public Liability, and other insurance that may be required to reflect risk exposures of specific scopes (Professional Indemnity, Aviation Liability, etc).

Post construction, it is anticipated that operational risks will be absorbed into each JV partners' operational insurance programs or, to the extent that is not possible, insured in the commercial market.

9. RISK MANAGEMENT

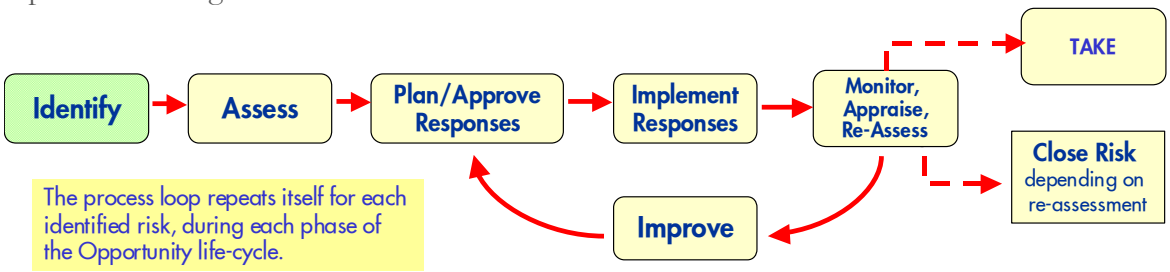
This section provides an overview of Risk Management for Quest CCS.

9.1. Risk Management Process

The goal of Risk Management is to identify and evaluate significant risks to the achievement of project objectives, set boundaries for risk acceptance, and apply fit-for-purpose responses.

Risk Management applies equally to upside risks ("opportunities") and downside risks ("threats") to maximize the likelihood of the project achieving its objectives while maintaining risk exposure at an acceptable level. Therefore, both threats and opportunities are explicitly included in the project Risk Register.

Project risks are being managed using the TECOP (technical, economic, commercial, organizational and political) approach outlined in ORM PS20 Risk Management. Risks are identified, categorized and assessed to identify owners and put mitigation plans in place; this is depicted in the figure below.



The Risk Assessment Matrix for Quest CCS is shown in the figure below:

Last Update: April 22, 2016								PROBABILITY				
		IMPACT						Score	1	2	3	4	5
								Assessment	VLO	LO	MED	HI	VHI
Score	Assessment	Cost/Benefit**	Schedule to FID	Schedule to Sustained Operations (SO)	System Capacity *	HSE	Reputation		0-5% Occurs in almost no Projects (extremely unlikely)	5-20% Occurs in Some Projects (low but not impossible)	20-50% Occurs in Projects (fairly likely)	50-80% Occurs in Most Projects (more likely than not)	80-100% Expected to Occur in Every Project (almost certain)
5	VHI	> CDN$ 50 mln	> 6 mos	> 6 mos	<0.9 mln tons/year >25% downtime)	Refer to HSE RAM	International impact		5	10	15	20	25
4	HI	CDN$ 25-50 mln	3 - 6 mos	3 - 6 mos	0.9 to 0.95 mln tons/year (~ 20% - 25% downtime)		National impact		4	8	12	16	20
3	MED	CDN$ 10-25 mln	1 - 3 mos	1 - 3 mos	0.95 to 1.02 mln tons/year (~ 15% - 20% downtime)		Considerable (regional) impact		3	6	9	12	15
2	LO	CDN$ 5-10 mln	0.5 - 1 mos	0.5 - 1 mos	1.02 to 1.08 mln tons/year (10% - 15% downtime)		Limited impact (public concern/ local media)		2	4	6	8	10
1	VLO	< CDN$ 5 mln	< 0.5 mos	< 0.5 mos	>1.08 mln tons/year (< 10% downtime)		Slight impact (some public awareness)		1	2	3	4	5

** System Capacity refers to the overall system rate of Capture, PL and Sequestration. Relates to annual % downtime in Operations. May be measured as either single possible annual impact or cumulative impact during project Funding Period (first 10 years of operation)*

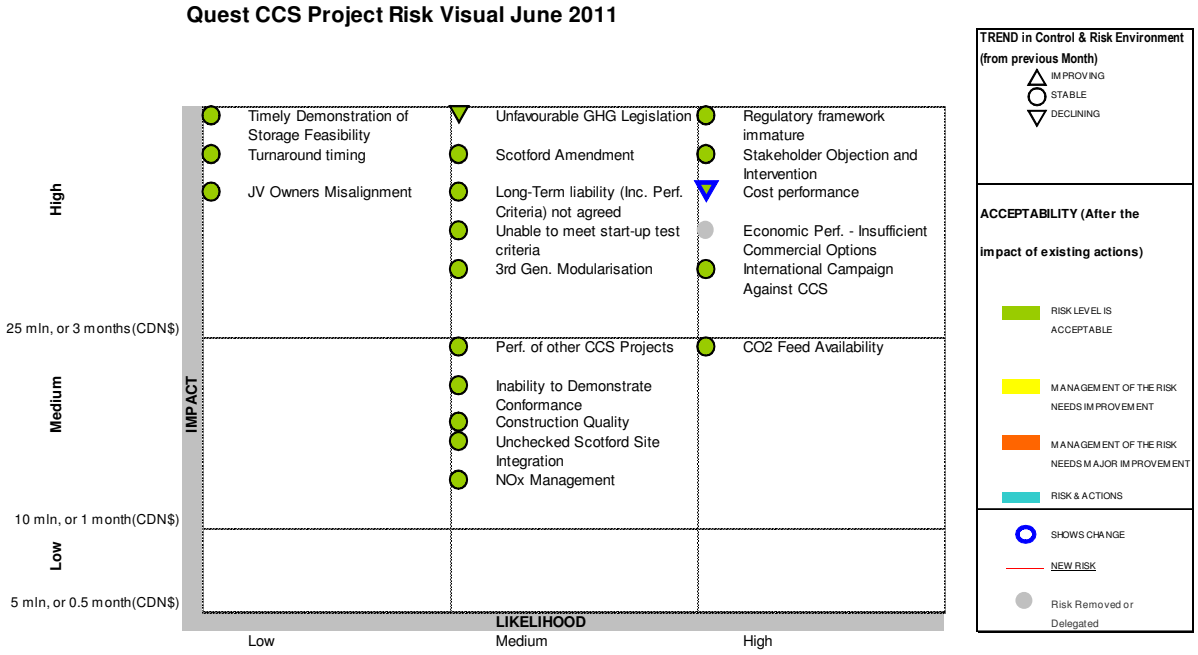
*** Cost/ Benefit in Operations is measured by either single possible annual impact or cumulative impact during project Funding Period (first 10 years of operation)*

9.2. Risk Management Tools

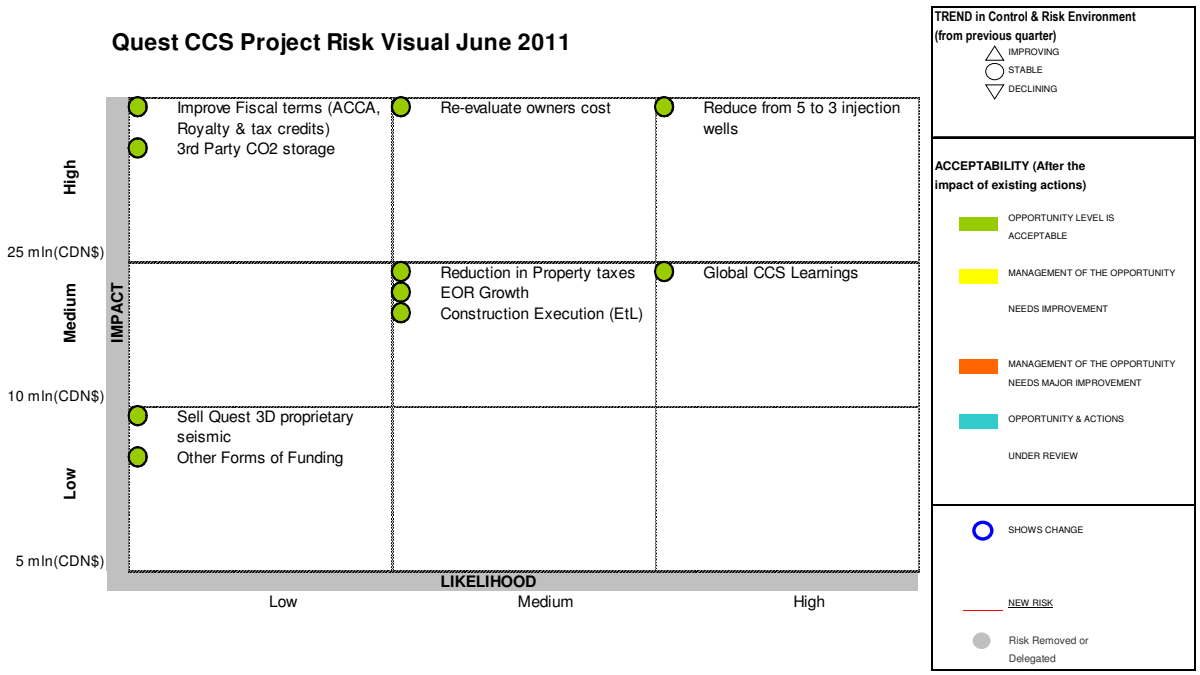
The following software tools are being used to manage Quest CCS Project risks:

1. EasyRisk v. 3.1: to maintain the Quest CCS Project risk register.
2. Pertmaster v. 8.1: for probabilistic schedule risk analysis.
3. @Risk v. 5.0: for probabilistic cost risk analysis.
4. MS Excel: all probabilistic inputs/outputs and the risk visualisation/plotting tool are kept in MS Excel.

9.3. Key Risks for the Venture



9.4. Key Opportunities for the Venture



10. PERMITS & APPROVALS

This section provides an overview of Quest regulatory approvals

10.1. Requirements

The mandate for AOSP is to secure all necessary regulatory approvals for Quest in such a way that:

- All major approvals are in place by FID, anticipated in Q1 2012
- Promotes a thorough and transparent review of the potential environmental impacts of the project, given the public monies invested; and
- Follows the prescribed process, such that it can withstand a legal challenge

Approval must be sought for each of the three major components of the project: Capture, Pipeline, and Storage. Approvals are specified by component below:

Capture

- An amendment to the existing ERCB approval for Scotford
- An amendment to the existing AENV approval for Scotford

Pipeline

- D56 approval for the pipeline
- A Conservation and Reclamation Plan approval from AENV

Storage

- D56 approvals to drill and construct the wells and D51 approvals to inject CO2 through the wells

- D65 Disposal scheme application, with injection in accordance with D51
- AENV approval

It is recognized that Quest will receive public scrutiny; decisions made by regulators in the process of issuing approvals, or the approvals themselves, will likely be subject to legal challenge from NGOs or local stakeholders.

10.2. Strategy

A strategy for securing these approvals has been devised which provides the maximum thoroughness of review without sacrificing efficiency of schedule, or the defensibility of the approvals themselves once they are secured, specifically:

- The application to the ERCB and AENV has been bundled in order to have a concurrent, efficient review of all aspects of the project
- A Quest EA has been prepared to address federal and provincial requirements, Shell's requirements for Integrated Impact Assessment, and Global Environmental Standards
- The Quest CCS Project has planned for a provincial ERCB hearing on all aspects of the project

10.3. Schedule

- November 2010 – Submission of bundled application and EA
- Q2/Q3 2011 – Response to Information Requests
- Q4 2011 – ERCB Hearing
- March 2012 – Regulatory approval received

11. HSSE & SOCIAL PERFORMANCE

11.1. Objectives

The most important objective for the Quest project is Goal Zero. Goal Zero is defined as:

- Zero Lost Time Incidents
- Zero Total Recordable Incidents
- Zero significant environmental incidents

Although the *goal* for total recordable incidents is zero, the target TRCF for Quest will be 2.1. This is a 10% reduction on Expansion 1 results, and keeps Heavy Oil progressing in the right direction. The goal is zero, but a target TRCF of 2.1 is something the project team can manage towards based on recent project performance.

The project will support Goal Zero through the 12 Life Saving Rules and a zero tolerance attitude towards infringements.

The HSSE Plan enables the project manager and venture manager to:

- identify the HSSE requirements for the project
- structure the project plans to successfully implement HSSE requirements during all project phases

In addition, the project leadership team will take responsibility for implementing these objectives and will have Quest specific objectives as part of their Goal Performance Appraisals (GPAs).

One of Shell's key HSSE requirements is to demonstrate that HSSE risks from its operations are As Low As Reasonably Practicable (ALARP). A HSSE Design Case demonstrates that the Hazard and Effects Management Process (HEMP) has been applied throughout the project development. As a result, the project will demonstrate that the process hazards associated with the design have been managed and reduced to a level as low as reasonably practicable (ALARP).

The HSSE Design Case will be the auditable record for HSSE and will be continuously developed throughout the project.

11.2. HSSE Issues Identified in DEFINE Phase

During the DEFINE phase, the following key HSSE issues were identified:

- Dispersion modelling of CO2 hazards still contains uncertainties, however recent experiments have provided some assurance that current modelling does not underestimate dispersion effects.
- Simultaneous Operations during construction of the Capture component.
- 3rd Generation Modularization will necessitate increased focus on HSSE management at the modular fabrication yards.
- Issues around the Prime Contractor designation of different construction areas at the Scotford site.

11.3. HSSE Plan for the EXECUTE Phase

The control framework, DCAF and PG1 serve as the basis for the project HSSE plan. The plan will be supplemented with group industry guidance and scope specific activities, as agreed to by the HSSE Manager and the Project Manager. This is to ensure that Detailed Engineering design documents are consistent with Shell's requirements and the required reviews have been undertaken on the proposed design. The plan will be reviewed to ensure the selected HSSE activities are consistent with the project scope and the Brownfield nature of the project, and will take consideration of existing Scotford Operations' design safety documents. As part of the plan

a project HSSE management system will be developed to describe the systems and process to be followed to execute work safely at the construction site.

The project HSSE Manager will be accountable for the HSSE Activity Plan. Due to some of the uncertainties surrounding the HSSE impacts of CO2, specialist technical advice will be sought. In addition representatives of the Scotford operating organizations and the main engineering contractor will be requested to participate in key reviews, as defined in the plan.

During DEFINE some construction activities were accelerated to address issues raised during SELECT, e.g. concurrent operations. As the project proceeds into EXECUTE, work will continue to address these issues. A construction HSSE team will be mobilized prior to any field work taking place. This team will consist of dedicated HSSE field staff, including environmental specialists and trainers.

Key HSSE activities for the EXECUTE phase include, but are not limited to:

- Final Design HSE Case & Input to Asset HSE Case
- Security Operating Plan
- Model Reviews (30/60/90%)
- Detailed Bow-Tie Analysis
- Updated QRA
- Final HAZOP
- Final Desktop Safety Reviews
- Final IPF Review
- Final LOPA
- Final SAFOP
- Hazardous Area Classification
- Pre-Startup Safety Reviews (PSSR)
- HFE Implementation Plan
- HEMP for Construction & Commissioning
- Concurrent Operations Plan
- In accordance with AI-PSM, a Statement of Fitness will be developed and maintained for the Quest assets

11.4. Environmental, Social and Health Profile

This section provides an overview of ESH..

(a) Environmental and Socio-Economic Impact Assessments

The provincial and federal governments each have established Environmental Assessment (EA) Acts and processes; the Canada-Alberta Harmonization describes the provisions to combine the

two should an EA be required from both levels of government. The Quest EA has been prepared to meet the requirements of both processes, in addition to Shell's requirements for Integrated Impact Assessment, and Global Environmental Standards.

A Socio-Economic Impact Assessment was carried out in early 2009, and reassessed in 2010 in light of the EA and Regulatory Application activities carried out as part of the revised Regulatory Strategy (see section 10).

(b) Social Performance

The Social Performance Vision for Quest (and for the larger Scotford complex) is:

- To be viewed as having positive impact on the quality of life of the community, and providing significant economic benefit
- To be viewed as operating responsibly and safely
- To be viewed as open, transparent and honest when communicating with neighbours
- To have the support of the community when faced with challenges; and
- To ensure neighbours believe we care about our impact on them

Seven key issues have been identified relating to social performance in the affected communities:

1. Process safety
2. Demonstrating personal safety
3. Demonstration of CO2 containment
4. Quality of life
5. Health
6. Cumulative effects
7. Maximizing local benefits

Actions related to managing these issues can be found in the Social Performance Plan.

12. PROJECT ORGANIZATION

12.1. Venture and Project Organizations

Management of the Quest CCS Project is the responsibility of Shell Canada Limited-Oil Sands (AOSP) on behalf of the Joint Venture partners.

The Business Opportunity Manager (BOM) has the single point accountability for managing the Quest CCS opportunity from pre-scouting through to completion of DEFINE phase. Thereafter, the BOM remains responsible for managing the opportunity until Handover.

From DG4 onwards, the Projects and Technology (P&T) division is single point responsible for delivering projects on behalf of the business (in this case Heavy Oil). The Quest CCS project will adhere to the processes and procedures that are applied in P&T for project delivery. P&T in Calgary will staff the Quest CCS Project team to reflect the transfer from the DEFINE phase to the EXECUTE phase in the latter part of 2011.

The Project Manager Quest from the Projects and Technology business group will have single point accountability for managing the Quest CCS Project (including the subsurface component) during EXECUTE, until the project is 'Ready for Start-up' (RFSU) and is handed over to Upgrader Operations.

The Operations organization has staffed up during DEFINE to support the early engineering reviews which are required to realize a 3rd Generation Modularization design.

A workshop will be convened after DG4 but before FID to align around Venture and Project responsibilities during EXECUTE phase.

Shell will be 'Prime Contractor' during the EXECUTE phase for the Quest facilities inside Scotford. Furthermore, the brownfield nature and integration with the Scotford Upgrader whilst in Operation (SIMOPS) has necessitated additional owners' team and Operations resources, as shown in the organization charts above.

12.2. Market Conditions

Market projections indicate that the Quest CCS Project will be executed in a period of high construction activity in 2013/14. Alberta is likely to experience a tight supply for both skilled trades as well as professional disciplines such as engineers, planners/schedulers, project controls, estimators, SCM, etc. The resources of the owners' team will have to be regularly assessed against the development of the market and the performance of the EPC contractors. A quarterly performance review is built into the Capture-component EPCCM contract, as well as the Pipeline-component EP contract.

12.3. Ethics & Compliance

An Ethics & Compliance Plan has been developed for the project team to ensure that all project activities are conducted in accordance with Shell General Business Principles, the Code of Conduct, and all applicable laws and regulations. A risk assessment has been carried out for members of the project team to identify areas (e.g. Antitrust, Anti-Bribery, Export Controls, Conflict of Interest, etc.) of risk exposure, and a training plan has been initiated for the team to address any gaps. The Ethics & Compliance Plan will be monitored and updated throughout EXECUTE.

13. STAKEHOLDER ENGAGEMENT

This section gives an overview of Stakeholder Engagement.

Stakeholder engagement is a key component of gaining public acceptance for CCS. Stakeholders' interest in Quest must be recognized, and the ways in which Quest may potentially impact them must be understood. AOSP has developed Consultation Principles which provide the framework for engaging stakeholders:

- **Shared Process** – Design consultation programs with public input
- **Respect** – Respect individual values
- **Timeliness** – Start consultation early
- **Relationships** – Establish and maintain relationships
- **Communication** – Consult with interested parties; gather and listen to feedback to resolve concerns
- **Responsiveness** – Adapt plans based on stakeholder input
- **Accountability** – Trust that representatives of interest groups are accountable to the organizations they represent

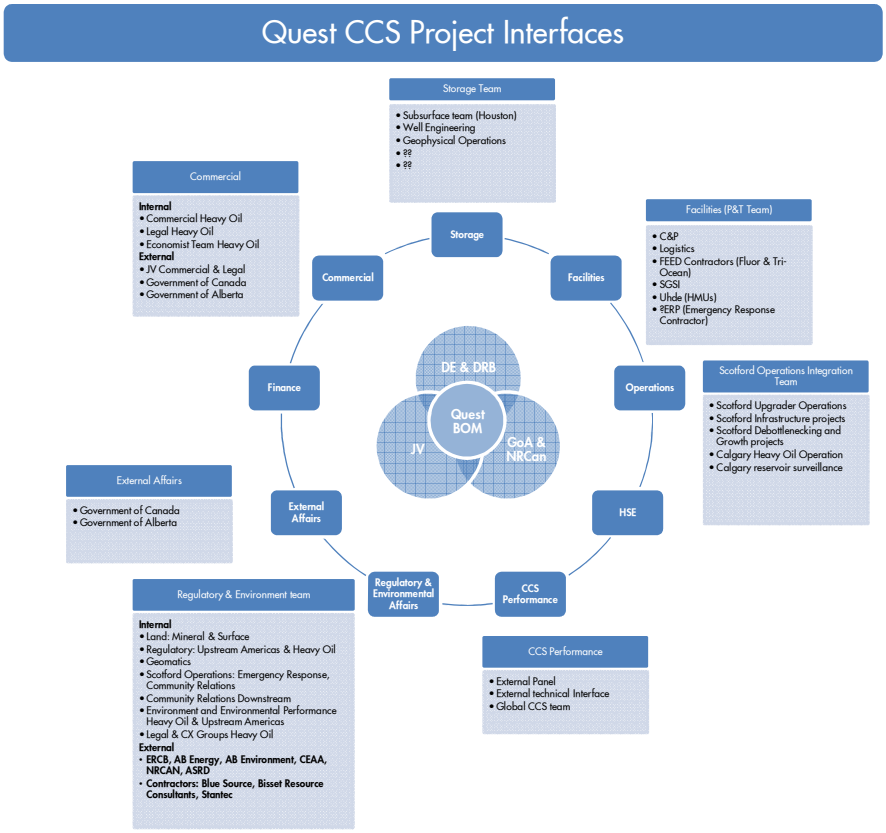
14. INTERFACE MANAGEMENT

An interface management process has been established that will facilitate the timely identification and resolution of project interfaces. Effective interface management is a key element of sound project management and is a critical success factor to ensure cost, schedule, safety and quality targets are met. The key aim is to provide a consistent cross-project method by which interfaces can be identified, developed, mutually agreed, managed, tracked, controlled and closed out.

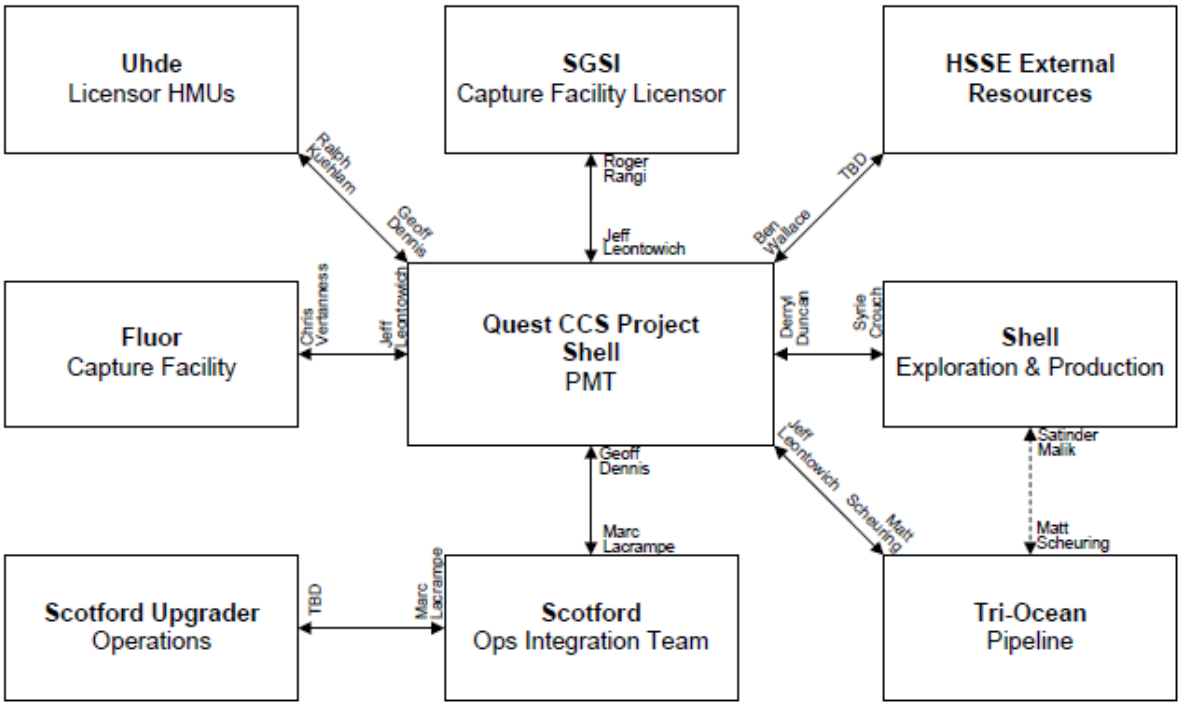
The Interface Management Plan (IMP) provides:

1. A consistent approach for achieving alignment between work areas
2. A process for initiating information requests
3. An auditable trail for interface transfers
4. A process for resolving difficulties or disputes
5. A process for managing changes arising that affect project activities

The Venture and Project Interface Maps and focal points are shown below:


Quest CCS Project Interfaces
Storage Team
• Subsurface team (Houston)
• Well Engineering
• Geophysical Operations
• ??
• ??
Commercial
Internal
• Commercial Heavy Oil
• Legal Heavy Oil
• Economist Team Heavy Oil
External
• JV Commercial & Legal
• Government of Canada
• Government of Alberta
Facilities (P&T Team)
• C&P
• Logistics
• FEED Contractors (Fluor & Tri-Ocean)
• SGSI
• Uhde (HMUs)
• ?ERP (Emergency Response Contractor)
Storage
Commercial
Facilities
Finance
Operations
DE & DRB
Quest BOM
JV
GoA & NRCan
Scotford Operations Integration Team
• Scotford Upgrader Operations
• Scotford Infrastructure projects
• Scotford Debottlenecking and Growth projects
• Calgary Heavy Oil Operation
• Calgary reservoir surveillance
External Affairs
• Government of Canada
• Government of Alberta
External Affairs
HSE
Regulatory & Environmental Affairs
CCS Performance
Regulatory & Environment team
Internal
• Land: Mineral & Surface
• Regulatory: Upstream Americas & Heavy Oil
• Geomatics
• Scotford Operations: Emergency Response, Community Relations
• Community Relations Downstream
• Environment and Environmental Performance Heavy Oil & Upstream Americas
• Legal & CX Groups Heavy Oil
External
• ERCB, AB Energy, AB Environment, CEAA, NRCAN, ASRD
• Contractors: Blue Source, Bisset Resource Consultants, Stantec
CCS Performance
• External Panel
• External technical Interface
• Global CCS team

Quest CCS Project
Feed Interface Map
and Focal Points Roster



First Level Interface
Dispute Resolution

- Geoff Dennis (HMU's)
- Jeff Leontowich (Pipeline; Fluor)
- Derryl Duncan (E&P/Wells)
- Chris Vertanness (Fluor)
- Ben Wallace (HSSE)

Second Level Interface
Dispute Resolution

- Quest Lead – Geoff Dennis

The process description of the Interface Management Plan is as follows:

1. Focal point (FP) generates an Interface Data Sheet "IDS" request.
2. IDS request goes to Document Control; Document Controls routes it to FP's and required recipient(s).
3. IDS acquires unique number cover sheet from Document Control.
4. FP's resolve directly and close out.

5. If dispute arrives elevate to interface lead.
6. The IDS revs up under the unique cover.

Monthly updates will be provided to the Shell Interface Lead (report of open and closed issues, past due items, etc.).

15. PROJECT CONTROLS

This section provides an overview of the Project Control Plan (PCP) for the EXECUTE phase.

15.1. Objective

The objective of the Project Control Plan (PCP) for the EXECUTE phase is to provide a specific plan, aligned with Shell's guides and project control procedures (PSM-I-U-001182-FA-0003), that identifies the project controls methods, tools and techniques that will allow identification of potential budget and schedule deviations at an early stage, in a consistent manner, enabling the Project Management Team (PMT) to make decisions that mitigate potential negative cost and schedule impacts.

One Project Controls team will manage project controls for all 11 areas into which the Quest Project has been divided:

A. Common
B. HMU
C. CO2 Capture Facilities (Greenfield)
D. Utilities
E. Offsites (Brownfield)
F. Reservoir
G. Wells
H. Logistics
I. MMV
J. Pipeline
K. Wellsite/Hook up

15.2. Project Controls Organization

The Quest Project Controls organization is in place for the project.

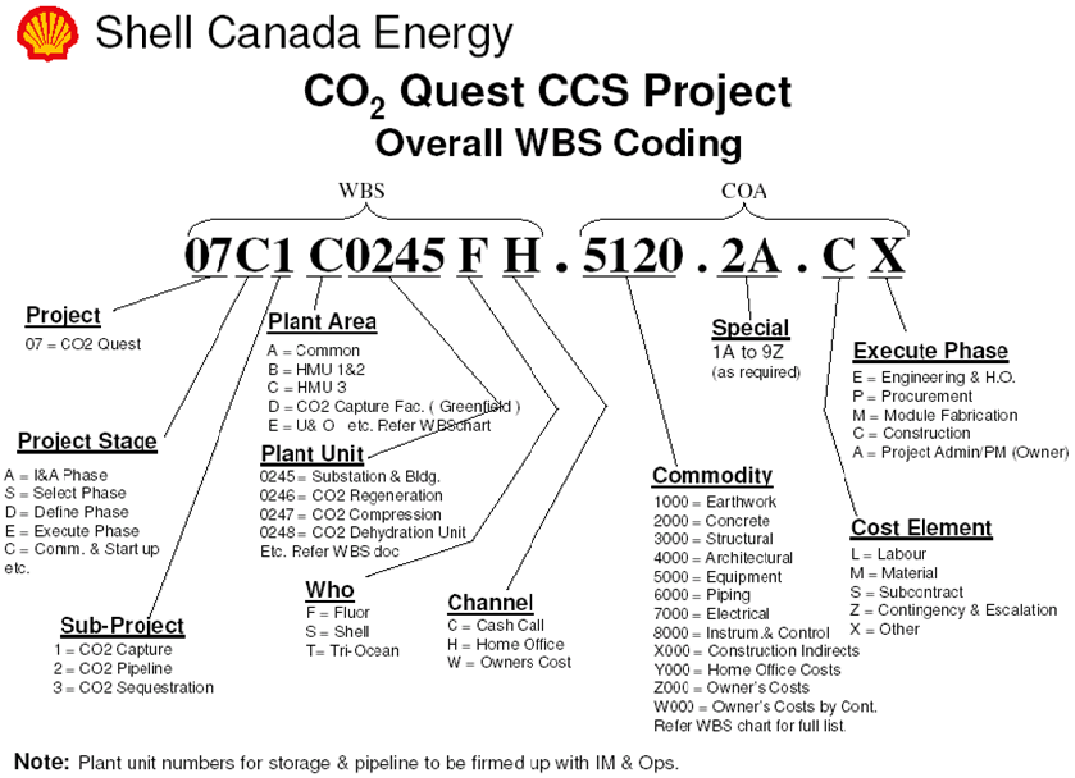
15.3. Cost Control

Cost control during any phase of a project comprises the setting up of the cost procedures and systems and the monitoring and the reporting of the actual project expenditure and commitments against the approved project budget. The early identification and registration of deviations together with the following of trends enables project management to control the project. Cost

control for Quest will be accomplished by implementing the processes and tools described in the following sub-sections.

(a) Work Breakdown Structure (WBS)

The Work Breakdown Structure (WBS) is a hierarchical subdivision of a project work scope to be controlled by the project team. The WBS allows cost, resources and schedule control to be exercised. The WBS for Quest has been prepared and is shown in the figure below. It will be maintained in accordance with the Quest-specific WBS Procedure.



Note: Plant unit numbers for storage & pipeline to be firmed up with IM & Ops.

(b) Cost, Time, and Resources (CTR) Catalogue

The CTR catalogue consists of a number of individual CTR sheets that break down the project scope into identifiable work activities. Each WBS element will comprise one or more CTR sheet. The CTR catalogue for EXECUTE has been developed.

(c) Value of Work Done (VOWD)

VOWD is defined as an estimate of "the cost of goods and services received, at a point in time expressed in monetary terms, regardless of whether they have been paid for" and shall be calculated in the local currency of the contract/work.

VOWD is a key financial measure of the project costs because it is consolidated and published in the Group financial results, which are subject to external regulation (including Sarbanes Oxley or other new applicable regulations).

VOWD will be calculated, recorded, and reported each month in accordance with the RDS VOWD procedure PSM-I-U-001182-FA-6180-0022.

(d) Commitment Management

Commitment is the value of any contract, purchase order or other agreement between the project and a supplier of goods and/or services, including agreed changes as they are approved and shall be recorded in the transactional currency of the agreement.

Commitments will be authorized, recorded, and reported each month in accordance with the RDS Commitments procedure – PSM-I-U-001182-FA-6180-23

(e) Management of Change (MOC)

Management of Change (MOC) applies to the project's scope, estimated cost, estimated schedule, and production performance. All changes proposals must be identified, recorded, evaluated, approved, and reported.

The intent of managing change during EXECUTE is to:

- Prevent preferential changes that can occur during Detailed Engineering against the backdrop of progressive design development that normally occurs during this project phase;
- Provide for systematic evaluation of potential changes and dissemination of change information to all affected parties;
- Manage staff time in respect of assessing change proposals;
- Identify when a proposed change needs to be formalized in the manner of a Change Proposal;
- Evaluate the impact of proposed change across all disciplines;
- Establish a review process and identifies roles and responsibilities in this process;
- Assure appropriate HSSE review;
- Assure Asset Integrity review; and,
- Facilitate quick and efficient documentation and communication of Change Proposals

(f) Earned Value Management (EVM)

Earned Value Management (EVM) is a project control tool for performance monitoring and analysis. Corrective or recovery actions based on EVM will contribute to project success. The EVM method will measure project performance and includes Earned Value Analysis (EVA) and Earned Schedule (ES).

The EVA process combines both cost and schedule based on analyzing the variances between actual earned and planned cost of work performed. The ES process is only applicable to schedule and is based on analyzing the variances between the actual time and the planned time taking to reach the earned value.

The results of Earned Value Management support early warning, cost earned, forecast, communication and objective assessment.

(g) Cost and Cash Forecasting

A critical part of the monthly cost control process is the forecasting of the Estimate at Completion (EAC). The EAC is the current estimate, at the reporting period cut-off, of the final cost of the project including the Base Cost Forecast and the P50 Contingency Forecast. The resulting EAC is compared to the project budget to determine if corrective actions and/or supplemental budget funds are required.

15.4. Integrated Planning and Scheduling

An Integrated Master Schedule (Level 2) and underlying EXECUTE phase schedule (Level 3) have been developed for the Quest project. The schedules have been developed using the Shell approved planning software, Primavera P6. The Detailed Schedule (Level 3) will serve as the control schedule for the EXECUTE phase of the project. Key milestones and interfaces between project sub-components are included. The schedule is logically linked such that the critical path and near-critical activities are visible and understood. Schedule risk analysis has been performed using the Shell approved schedule risk analysis software, Pertmaster, and the resulting schedule contingency has been reflected such that the schedule yields a P50 sustained operation milestone.

The table below illustrates the key milestone dates for the Quest Project:

Quest Project Milestone	Date
SELECT Phase complete	Q4 2010
DEFINE Phase complete	Q3 2011
Regulatory Approval	Q1 2012

FID	Q1 2012
Start-up	Q4 2014
Sustained Operation	Q4 2015

15.5. Cost Estimating

(a) Type III Budget Authorization Estimate

At the end of DEFINE, a Type III estimate has been prepared. The Project Control Team has been engaged with the contractors' estimation departments, in defining, guiding, and reviewing the basis of this estimate. The Project Control Team has also participated with the Heavy Oil/P&T Project Control Group in preparing estimates of other costs outside the contractors' scopes, e.g. Owners' costs. The Type III estimate is structured in accordance with the Project WBS, and is described below (and in greater detail in the Project Controls Plan).

The Type III estimate will be used to support the Final Investment Decision (FID). The estimate is a "bottoms-up", material take-off (MTO) based estimate. It is made up of all the MTO quantities available in the design at the time of the estimate deliverable cutoff, and any allowances needed to account for future design growth. Equipment and Bulk material pricing are based on firm quotes for major equipment (65% of material spend), budget quotes (28%), and historical data (7%), which have been escalated to Real Terms (today's value). Labour rates are based on the latest labour agreements. Engineering home office costs are based on the latest contractor information available.

The Type III estimate has been escalated in line with the project schedule and the escalation rates to be applied as per the RDS Project Services guidelines (the Market Guidance Letter).

All estimates have been subjected to a detailed estimate risk analysis. The results of the risk analysis will be used to set the contingencies and determine the range of accuracy for the estimate.

(b) Type IV Control Estimate

Looking forward to EXECUTE, the Project Control Team will integrate and prepare a Quest Control estimate during Q2/Q3 – 2013. Fluor and Tri Ocean will prepare the fall out estimate during Q1/Q2 – 2013 when engineering is 95% complete. The Shell Project Control Team will be intimately involved with the contractors' Project Control Teams, in defining and reviewing the estimate basis, and supporting estimate preparation. The Type IV Control Estimate will be the control base for the construction phase of the project.

15.6. Probabilistic Risk Analyses

Formal, quantitative cost and schedule probabilistic risk analyses will be performed prior to FID as well as during EXECUTE, to analyse the variables and uncertainties present in the base cost/schedule. These analyses will assist with the following:

- Forecasting the most likely outcome of project cost/duration by recommending appropriate levels of contingency;
- Identifying the elements of uncertainty that have the greatest impact on overall project cost/schedule; and,
- Quantifying the chance of achieving cost/schedule targets.

15.7. Project Control Tools

The following tools are used for Project Control functions and reporting:

- Cost Estimating – CapCo$t an in-house estimating software
- Planning & Scheduling – Primavera P5/P6
- Cost Risk Analysis - @Risk
- Schedule Risk Analysis – Pertmaster Risk Expert 8.1
- Cost Management/Control - PRISM
    - The Shell Canada SAP Blueprint implementation team is developing a PRISM to SAP Blueprint interface so data can flow from the Contractor to PRISM to SAP Blueprint.
- Financial Management - OASYS and JDE (in future, SAP Blueprint will be used)
- Time Writing - SERP

16. QUALITY MANAGEMENT

16.1. Quality Overview

The Quest quality strategy is to implement three key quality programs:

1. Discipline Control and Assurance Framework (DCAF),
2. Technical Integrity Verification (TIV), and
3. Flawless Project Delivery (FPD)

The quality efforts will be implemented by a Quality Focal Point who will coordinate quality efforts project-wide.

Most of the Quality procedures and systems extend throughout the complete cycle of Project Realization, including design, engineering, procurement, fabrication, construction, testing, start-up and commissioning.

The Quality Management System also contains processes that are not a part of the main three systems. These are: Equipment Criticality Assessments, input to Contract language regarding quality requirements (i.e. Inspection and Test Plans, ITPs), and Reviews and Audits of the Quality Management System.

16.2. Discipline Control and Assurance Framework

The Discipline Controls and Assurance Framework (DCAF) sets the corporate standard for Quality Control (QC) and Quality Assurance (QA) of discipline deliverables and events. As a part of DCAF, a Project Controls and Assurance Plan (PCAP) was developed and used for SELECT phase; another PCAP was then developed and used for DEFINE phase. The PCAP for EXECUTE phase has also been drafted and has been used to form the structure of the EXECUTE phase workplan with the Capture EPCM Contractor. The DCAF incorporates the Technical Authorities from both P&T and UA.

The PCAP includes the list of Global Controls (standard throughout Shell) and the list of Project Specific Controls/Events. The Project Quality Focal Point is responsible for auditing and facilitating the DCAF process for Quest.

16.3. Flawless Project Delivery

Flawless Project Delivery will be implemented on Quest in a fit-for-purpose manner and will include mitigation of Flaws and development of assurance plans for selected Q-areas. A Flawless Project Delivery Implementation Plan has been developed in DEFINE and will be updated in EXECUTE. The FPD implementation effort consists of the following actions:

- Learnings (Flaws) applicable to Quest have been extracted from the FLAWS database, PWRs, and Lessons Learned database.
- Applicable learnings have been assigned to appropriate project team members for mitigation. A Flaws mitigation focal point has been assigned and is responsible for tracking close out of all items.
- Q-areas have been assigned a Q Focal Point to lead the efforts and ensure implementation.
- Q Focal Points will review FPD checklists for their Q-area to assure coverage of all aspects of their responsibility. Applicable items shall be included in equipment/system Inspection & Test Plans.
- The Q Focal Points will establish KPIs for the selected Q-areas.

16.4. Technical Integrity Verification

Technical Integrity Verification has been implemented for Safety Critical Elements which have been identified through Bow-Tie workshops. Technical Integrity Verification consists of the following actions:

- Development of Performance Standards (PSs) and quality management of activities and deliverables that are critical for verification that the performance standards have been met.

- An audit and review schedule of the Performance Standards, with follow up action to verify audit closure.

16.5. Quality Procedures supporting Phases of Project Realization and Execution

Equipment Criticality Assessment: The Project Team shall establish the criticality of systems or items of equipment in the engineering phase (Define and Execute) in order to ascertain the extent and level of involvement in design reviews, maintenance program requirements, and the extent of quality surveillance to be undertaken during the manufacture and testing of equipment. The equipment criticality assessment drives mitigating actions within the Inspection & Testing Plan (ITP) and Contract Terms and Conditions to lower quality risks identified during the assessment. The Project Team will assign a criticality rating to each system or item in accordance with the Equipment Criticality Assessment Procedure.

16.6. Construction and Installation Quality

The Quality language in the Invitation To Tender (ITT) will be refined by Quality in conjunction with each discipline lead. Project Team shall monitor the construction and installation activities in a planned and methodical manner to assure that the construction work meets the requirements of the Contract, design and specifications. The Contractors shall perform the work in accordance with approved procedures, work instructions, method statements and Inspection and Test Plans (ITP) and with suitably qualified and experienced personnel. The extent of monitoring by the Project Team is dependent upon the technical criticality of the work, and shall be indicated in the Inspection & Test Plans.

Regarding the wells, suppliers will be selected that are on the Shell Approved Vendors List and have previously supplied wells tubular to Shell specifications. Single source suppliers will be worked through Shell Canada SCM.

16.7. Reviews and Audits

- The Project Quality Focal Point with the help of the PMT will develop a program of reviews and audits necessary to provide quality assurance throughout design, procurement, fabrication, integration, installation and commissioning/startup. Audit Plans for the EXECUTE phase have been prepared.
- The program of reviews and audits are included in the Project Quality Plan (PQP). The PQP outlines the roles and responsibilities for execution of assurance. The Lead Discipline Engineers are responsible that proper design control is used in the production of project deliverables. Documentation and Data will be prepared and managed as per Shells Project Information Handover Guide 07-0-JA-6180-000. Documentation Requirements and as per agreed project Job Bulletins signed by Shell. Design control will be facilitated by using Fluor Discipline Activity Plans which specify the appropriate procedures, work instructions, and requirements for checking, review, and approval.

- Design reviews will be performed at appropriate stages in the design. All design review comments will be resolved prior to final approval. The PQP specifies what reviews are needed during EXECUTE phase.
- The following areas will be audited by the Quality team:
    - DCAF setup and compliance,
    - Technical Integrity Performance Standards and Verification of Assurance Activities, and Flawless Project Delivery Key Performance Indicators.
    - Contractor discipline audits (in the case of Fluor, this applies to both Calgary and New Delhi). EXECUTE audit plans can be found in the Fluor and Tri-Ocean PEPs respectively.
- Wells will adhere to Shell mandated GWDP (Global Well Delivery Process)

17. TECHNOLOGY

The major systems of each capture concept analyzed in the Assess phase were probed for components requiring technology maturation. The results are documented in the Quest Technology Selection Report – Capture (Document Number 07-0-PX-0580-0001). ADIP-X is the selected CO2 removal process.

TEG and a solid bed desiccant mol sieve were considered to remove water to prevent hydrate and corrosion issues. Mol sieve is attractive for very low water specifications. However, for the Quest Project the water specification is at the normal TEG dehydration range, so TEG Capital Cost and Operating Cost are lower than for mol sieve. Thus, TEG is selected as the CO2 dehydration process.

The compressor selected has been reviewed by the TA1 Rotating Discipline Lead. The Dakota Gasification project currently operates three MAN Turbo 8-stage integrally geared centrifugal compressors; model RG80-8, in CO2 compression service. Other than the fact that they have air-cooled intercoolers whereas the current QUEST design basis is water-cooled intercoolers, those compressors are very similar in size and performance parameters to the compressor required for the Quest project, hence the technology is sufficiently mature for Quest.

During the novelty workshop sessions initially conducted in September 2010, and updated in May 2011, the project team and external participants were consulted to document any novel aspects of the project scope including Capture Pipeline & Subsurface scope. No R&D or technology development releases are required for the capture, pipeline, or wells scopes of the Quest CCS project.

18. ENGINEERING

18.1. Engineering Execution and Deliverables

The following entities / contractors are currently involved in the venture:

- Capture Facilities Process Licensor - Shell Global Solutions

- Capture Facilities – Fluor Canada Ltd.
- Pipeline and Wellsite Facilities – Tri-Ocean
- Preparation of HMU PDP - Uhde
- Wells – Shell Exploration and Production
- Operations – Scotford Ops Integration Team
- PSA vendors (Air Products for HMU 1&2, UOP for HMU 3 PSA unit modifications)

The Capture EXECUTE phase engineering will be completed by Fluor based out of their Calgary office with significant support from their New Delhi office. Tri-Ocean will complete the detailed design work for the pipeline and well surface facilities from their Calgary Alberta office.

The focus of EXECUTE phase engineering is the realization of the 3rd Generation Modularization strategy, completion of engineering deliverables for major construction contracts (pipeline and module construction), completion of HSE-in-design deliverables, and handover of key documents to Operations to facilitate start-up and safe initial operation. This work will culminate with the issuance of Issued For Construction deliverables in construction work packages.

To accomplish the EXECUTE scope of work, Fluor will utilize the following strategies and resources:

- An Engineering strategy for straight through engineering with work completed sequentially and building on foundations of reviewed information will be used. This approach reduces recycle and is consistent with project objectives of cost efficiency. Process engineering will finalize P&IDs by resolving action items from PHAIII. Mechanical, electrical and instrumentation disciplines will prepare key procurement packages early in EXECUTE to support acquisition of selected vendor data required for layout.

- The "3rd Generation Modularization[SM]" design approach has matured significantly in DEFINE with buy-in from Operations, and peer reviews completed to validate the approach and layouts developed in FEED phase. The modularization guideline and all specifications were updated in FEED phase and establish the foundation for EXECUTE phase design. During Detailed Engineering the focus on maintaining shippable module weights and centers of gravity, and complying with HFE requirements as vendor data continues to be received will be a significant effort.

- EXECUTE phase deliverables are drafted in the PCAP. This has been included in the EXECUTE Phase Work Authorization with Fluor and appropriate supporting documents have been listed in the Fluor Scope of Services portion of the work authorization (for example detailed calculations, RFQ packages, module drawings etc.).

The Pipeline EXECUTE phase engineering will be completed by Tri Ocean, directed by a dedicated Shell Quest Pipeline Project Engineer. Given that the pipeline is not in the critical path of the overall schedule, the execution plan for the detailed engineering for the pipeline is to complete all engineering activities and have all drawings issued for construction before construction activities begin. A detailed survey of the right of way will be performed in Q4-2011 and detailed drawings will only be produced in April-2012 to minimize pre-FID expenditure. Detailed design of the crossing of the North Saskatchewan River (NSR) by Horizontal Directional Drilling (HDD) was performed during DEFINE to better understand the risks involved.

Subsurface engineering will continue to be supported from within the Shell E&P organization. The challenge for subsurface will be to incorporate all well delivery objectives in a commercial injector design; a standardized well design will be used for all injectors. Two injectors will be drilled in 2012 after which a decision will be made if any further wells are required; this may enable the pipeline to be shortened prior to submitting the final order for pipeline material.

18.2. Design Class considerations

A design class (also referred to as Class of Facilities) session was held with Fluor and the project leadership at the commencement of the SELECT phase. To help the project achieve its overall goal of being NPV neutral, the Capture unit will be designed with no provisions for expandability, no ability to exceed nameplate capacity and limited provisions for online maintenance (Design Class 1). The high level decisions were reviewed and confirmed by the project DRB.

During DEFINE, a peer review confirmed general adherence to the selected Design Class by the Quest project team.

18.3. Modularization Considerations

3rd Generation Modularization is to be implemented on this project. In order to support this modularization strategy, almost all equipment will be supplied to the module yard shop versus traditionally at site in order to set these into the modules. The compressor package, large horsepower pumps, and vessels that are required to be dressed, will be shipped directly to site.

The plant is designed with a maximum module size of 24'x24'x120'. These are to be assembled in the Alberta area and transported by road to the Scotford site via the Alberta Heavy Haul corridor.

3rd Generation Modular execution is a modular design and construction execution method which is different than the traditional truckable modular construction execution methods which have limitations to the amount of components that can be installed onto the modules. The modules are transported and interconnected into a complete processing facility at a remote location including all mechanical, piping, electrical and control system equipment. The use of specialized design practices and installation details are required to produce this type of design.

This 3rd Generation execution approach provides the following advantages over traditional Oil Sands modular approaches:

- maximum shift of labour hours from the immediate work area off-site to fabrication shop resulting in
    - a reduction of site congestion
    - allowing activities to occur in parallel that otherwise would not
    - ease pressure on site staffing
    - a reduction of overall construction labour cost due to differential in rates between field and fabrication shop.
- reduced quantities of concrete, pipe and cabling resulting in overall reduced cost and schedule
- relocating underground process drainage piping to aboveground shop installation
- reduced construction schedule resulting in a reduced total cost for the project
- minimization of safety risks associated with elevated work and a reduction in scaffolding duration and costs
- maximize shop work to reduce weather impacts on productivity
- improvement in quality of workmanship due to more controlled production environment.

The 3rd Generation Modular Execution[SM] Design Guide (Fluor document # A6GT-200-1065) was issued in SELECT and was customized to Quest requirements during DEFINE. Modularization will also be employed at the wellsite facilities and pipeline linebreak stations largely through the use of skid mounted piping & instrument enclosures.

Where possible, equipment is standardized with existing Scotford equipment. For Quest this is relevant to electrical switchgear, instrumentation, pumps and (possibly) air coolers.

18.4. Plant Availability and Reliability Considerations

Shell Global Solutions has performed an update to the SELECT phase reliability study for the CO2 capture, compression, and storage facility for the Quest CCS Project. The study was used to determine the availability of the facility, identify key equipment that contributes to the downtime of the system, then use sensitivity analysis to quantify the impact of alternative design

configurations. Reliability data was taken from previous studies performed for Shell Canada and other refineries.

For the Base Case, the average Quest production efficiency was predicted to be 97.6%. When the availability of the Scotford Baseplant and Expansion Upgraders were considered this resulted in an overall CO2 injection availability of 90%, meeting the premises set out in the GOA funding requirements.

18.5. Codes and Standards

The order of precedence for Codes and Standards applicable to the Quest CCS Project will be:

- Canadian Federal, Provincial and municipal laws and regulatory requirements
- Existing site approvals. These documents refer to a variety of standards and guidelines. Reference to voluntary documents in the site approvals gives them force of law.
- Shell Canada Energy Minimum Health, Safety, Environment and Sustainable Development Expectations
- Shell HSSE Control Framework Standards and Guideline Manuals
- Shell ESTG (Engineering Standards Technical Guidelines) and DEP (Design & Engineering Practices)
- International Codes and Standards (e.g. ISO, ASME, API)

A Quest Specific list of specifications has been set as the basis of DEFINE and EXECUTE phases for the Capture facilities. The list provided in the BDP has been updated to:

- Identify mandatory specification requirements of DEM1 Rev 6, 2010.
- Identify which specifications are not applicable to Shell Quest Scope and remove them from the project list.
- Include updated specifications issued in February 2011 required for Enterprise Framework Agreements (primarily instrumentation and rotating equipment disciplines).

During DEFINE the specifications have been reviewed in detail to:

- Generate project specific deviations to align project specifications with the Quest Design Class Report requirements.
- Generate project specific deviations to align project specifications with specifications included in Enterprise Framework Agreements used on the project.
- Generate DEM1 derogations where required to address specific needs of the Quest project.

Wells will adhere to the GWDP (Global Well Delivery Process).

19. CONTRACTING & PROCUREMENT

19.1. Process and Principles

(a) Procedures, Manual of Authority & Governance Model

The Quest CCS Project will ensure strict adherence and compliance to the Shell Contracting and Procurement Procedure Manual (CPPM) and Category Management and Contracting Process (CMCP) for any sourcing activities. Authorizations will be obtained in accordance with Shell Manual of Authorities (MOA) and in compliance with Shell Contracts Board and Joint Venture requirements with Chevron and Marathon.

(b) Tendering & Market Approach Principles

The tendering process will be in compliance with Shell C&P requirements. Typical sourcing options will be based on either:

- Competitive tender where several contractors with similar capabilities compete against each other on pricing and project execution, or
- Sole sourcing whenever there is a monopoly situation (i.e. specific expertise) or HSSE concerns or schedule constraint precludes any bidding process.

(c) Project Contractor & Vendor List Development Plan

The list of bidders/vendors has been developed and it is currently under review with the Category Management Team in Calgary. The list is confidential and for sensitivity reasons will be shared on a need-to-know basis.

(d) Global Category Management (GCM) Leverage Opportunities

New EFAs continue to be executed and the Quest Project has established a working relationship with the Category Management Team in Calgary to be aligned with all new developments in GCM and Outline Agreements (OA).

Below is a List of Global Sourcing and OAs as of August 1, 2011 that will be utilized on the Quest Project:

Mechanical Equipment	CO2 Compressor (EFA) Vertical Line Pumps (EFA) Centrifugal Pumps (EFA)
Piping Bulks/Specialities	CS Pipe & Fittings (OA)

	Gate, Globe & Check Valves (OA)
Electrical Equipment	34.5 kV Switchgear (OA) Power Transformers (EFA) LV and MV Switchgear (OA) LV and MV MCCs (OA) Neutral Grounding Resistors (OA) Power and Control Cables Electrical Bulks Cable Trays Heat Tracing Materials
Control Systems & Instrumentation	Control Valves, On/Off Valves (EFA) DCS and SIS Components (EFA) DCS (EFA) Relief Valves-PSV (OA)
Pipeline	Linepipe (EFA) Pipeline Coating (OA)

(e) Market Intelligence

Investment in utilities and oil sands projects quickly regains previous peak levels of activity. Employment is projected to remain near record levels until 2015 when a second wave of capital, sustaining capital and maintenance projects drives employment to new peak levels. By 2017, employment on oil sands projects is estimated to be 25 percent higher than the 2007 peak levels of activity.

Rising labour requirements for new construction across the scenario from 2011 to 2019 increases the labour force by 30,000 workers. Expected exits from the labour force due to retirements and mortality total 35,000 workers. Half of the total requirements will be met with 26,000 new entrants, leaving a net in-mobility requirement of almost 30,000 workers that industry will need to bring in from outside Alberta's construction market.

These will impacts modular yards, suppliers and on-site labour for the Project. A heated market situation leading to above average escalation may create higher prices and competition for shop space.

(f) Business Principles

All sourcing/contract awards will be undertaken in full compliance with Shell Group Business principles.

19.2. Contracting Strategy

The project CP and Category strategy was endorsed by the Contracts Board in Q4 2010, with its implementation started afterwards. It was articulated around the project drivers, identifies sourcing risk and opportunities, leveraging on the global enterprise categories and maximizing local content. The key to the strategy is the use of an EPCCM contractor to execute the works for the capture facilities. Further to this, detailed procurement, construction and pipeline execution strategies have also been developed and approved.

Shell awarded an Engineering, Procurement, Construction and Construction Management contract to Fluor Canada in March 2010. Within this agreement, Fluor is responsible for project management, quality assurance and control plans, engineering, procurement, contracting, project controls, construction, construction management services and information management services, as applicable, to its scope of EPCCM Services, and is required to achieve, within budget, safely, efficiently and timely, Mechanical Completion of the Project in accordance with the Contract Documents and readiness of the Project for Commissioning, Flawless Start-Up and Performance Tests and Turnover to Operations.

The Heavy Oil Contracts Board approved on February 24th 2011 to award Scotford on-site construction services (Module Installation, Structural Steel, Piping & Mechanical and Electrical and Instrumentation) to Fluor Canada Ltd, the contracting party in the EPCCM agreement and consent to the subcontracting of the Construction scope to Fluor's affiliate Fluor Constructors through a specific work authorization release after FID (2012).

The following details the supporting elements for the pipeline contracting strategy:

<u>Define phase, Detailed Engineering and Procurement:</u>

Single source to Tri Ocean Engineering Limited for the following supporting reasons;

- Ensure continuity with Tri Ocean and build on relationships already established with other CCS projects
- Enhance bridging work from Select phase to Define and Execution
- Experience with Shell designing pre-fabricated and assembled skids
- Leverage Shell's experience with pipeline design and construction

<u>Construction:</u>

- Mechanical/Civil and E&I: The recommended strategy is to bid the work between onshore gas mechanical contractors and invite additional contractors that have specific expertise and experience for large size pipeline projects. The rationale is to obtain the most cost effective alternative option. In addition the Project will conduct a labour market assessment review in 2012 to review the market conditions and identify whether this scope of work might attract labour attention. Our current strategy is to go "open shop" however the result of the labour posture assessment will influence the choice of potentially using a unionized workforce.

- SCADA: The project recommends calling off Shell existing agreement to ensure compliance with existing standards.
- HDD: Bid this scope to maximize cost savings opportunities.

The project team will conduct a landscaping exercise late 2012 to review potential contractors having both the capacity and the expertise to undertake the construction of the CO_2 pipeline. Project team will seek Heavy Oil Contracts Board support for strategy prior to engaging with any Shell North America onshore gas contractor or tendering construction work.

Construction Management & Project Management:

To be done in-house (Shell). In order to drive accountability and to streamline decision making Shell is better served retaining control of the key managing functions, such as Project Management and Construction Management.

(a) Stakeholder Analysis

The interests of different stakeholders have been considered to arrive at a contracting strategy with the widest possible support. The stakeholders include Shell and its various functions, the ASOP Venture, Canadian Government, Alberta Government, NGOs, local, regional & international contractors as wells as the local communities.

As part of direct involvement, the EPCCM and EPC contractors will have direct impact with the work and the labour market while impacting the local communities and business via various means through procurement and services provision.

The high level key stake holder expectations are:

- Top-class safety and transparent environmental performance
- Optimum use of Alberta and Canadian industry capabilities, supply chain and employment
- An equitable risk profile for contractors that will allow them to obtain support from their shareholders, funding and maintain a healthy cash flow
- Good relationships with local communities

Continuous engagement with stakeholders will be a key element of successfully managing the project as it progresses through the EXECUTE phase.

(b) Key Risks/Opportunities

Key risks related to C&P are:

1. With the local market heating up and the major players jostling for resources, lack of capacity and skilled labour in Alberta to meet the rising demand would make it difficult to competitively source fabrication and procurement expertise. This could impinge on the cost and schedule of the project.
2. Aligning strategic agreements (e.g. EFA, LCCS) specifications and terms with the requirements of the project, local regulations and funding agreement could prove to be a challenge.
3. Landscaping of potential contractors later in 2012 (post FID) for various works could result in identification of "available" against "preferred" vendors and contractors and ability to book slots.

Key opportunities related to C&P are:

1. Maximize the use and leveraging of Shell strategic supply agreements and supplier relationships.
2. Maximising low cost country sourcing (sustainable sourcing)
3. Support the engineering team to ensure effectiveness and productivity during implementation by effectively monitoring and managing contractual issues proactively
4. Price certainty for a cost-driven project: Lock in existing negotiated rates in the EPCCM contract for Direct Field Labour performed by Fluor
5. Leverage Shell existing and past project experience while seeking resources for key positions
6. Maximise on Fluor's motivation to perform very well on the project for future work with Shell, while ensure contractor's commitment to negotiate competitive deals on behalf of Shell where applicable.

Mitigation strategies and actions for all of the above are detailed in the project risk register.

(c) Contracting Plan

The Quest project contracting plan is to leverage the Shell Global Enterprise Categories to maximize the outcome of the sourcing process, which will be beneficial in terms of volume discount and meeting Shell approved safety and quality standards.

The Quest Project has worked closely with the Local Category Manager team (Canada) to coordinate work with Global Categories and ensure that other sourcing alternatives are available in the event that local sourcing is required or that no services can be provided through the Global Enterprise Categories.

Key stakeholders from the local Category Management team will be included in the individual Contracting Strategy Workshop to help coordinating the sourcing schedule.

Available expertise of the EPCCM contractor will also be harnessed in the implementation of agreed strategies to ensure complete integration of the technical requirements hence avoiding negative impact on quality, cost and schedule.

19.3. Procurement

The Quest Project includes three (3) main components: the Capture Facility, the Pipeline and the Subsurface activity. Quest Project Procurement manages the procurement activities for the Capture Facility and the Pipeline with two (2) EPC Houses being awarded the procurement scope of work. Fluor will procure for the Capture Facility and Tri Ocean will procure for the Pipeline. The UA Wells CP team manages the Subsurface CP activity.

(a) Critical Scope

In order to meet the 3rd Generation module schedule, critical early vendor engineering data and critical long lead materials will be required necessitating the award of some Purchase Order pre-FID. Some equipment is required to be purchased pre-FID to meet the Scotford 2013 shut-down schedule. With an FID target date in Q2 2012 and the attendant gestation period for these equipments a justification will be raised to the Shell CB and JV partners for pre-FID investment.

These pre-FID POs will release engineering data and materials (equipment) only and these items will be priced for invoicing purposes. Post FID, the strategy is to award all the remaining POs as soon as possible.

(b) Long Lead Items Procurement

Various long lead items have been identified from the early engineering. To meet the schedule to install the underground facilities and piping at the Upgrader in August 2012, a small portion of line pipe material is needed to be ordered pre-FID. The rest of the line pipe material will be ordered post-FID.

(c) Standardisation and Variety Control

As part of the standardisation programme, the engineering team is liaising to the existing Scotford plant team to ensure equipment procured is aligned for maintainability and uniformity. The use of Global EFAs where applicable for the purchase of equipment is mandatory and has helped in the standardization programme.

(d) Site Services

The Procurement for the Capture Facility will be managed by Fluor with the following areas of responsibilities:

a) Storage inventory and preservation activities
b) Field procurement
c) Backcharges as required
d) Co-ordinate field Supplier representatives as required
e) Minimize and dispose of surplus material
f) On-site warehousing

There will be no Marshalling Yards. Scope related to the Pipeline will be managed by Tri Ocean and Flint Energy Services Ltd. (Flint) with the areas of responsibilities similar to the above items listed.

(e) Early Supplier Involvement Philosophy

Further to Section 19.3.1, early Supplier involvement is a critical step in ensuring early vendor engineering data and materials and equipment requirements for the Project. It also played a major part in ascertaining budget information for the 2012 FID submission with an intention to secure fixed pricing.

19.4. Administration

Contracting and Procurement activities for the project will be administered by a dedicated Project C&P team headed by a C&P Lead. He will be part of the project leadership team and will manage and administer the project portfolio of contracts and procurement. The team will structure and manage contracts and agreements in a proactive manner with the objective of minimising claims and disputes. The team will also advise and support the Project Management Team on the fundamental principles, processes and procedures to be adopted in developing and implementing contracting strategies and contract management.

The team will utilize and co-ordinate resources and input from other support functions e.g. legal, risk and insurance, finance and global category managers to ensure value for money and compliance with best contracting and procurement practices.

The C&P team will also be responsible for developing contracting strategies and tactics for application in differing contracting markets. Particularly those with severe constraints on availability, capability and competitiveness of engineering contractors and construction subcontractors, while maintaining a close working relationship with other functions central, regional and local to achieve the mandated project objectives.

The C&P team will leverage on the C&P resources of the EPCCM and EPC contractors for the execution of most C&P activities with the exception of EFA call-off orders which will be raised and administered by the Shell C&P team.

(a) Organisation

Contract Manager

- Overall focal point for the entire project
- Accountable for the delivery of Quest Capture, Pipeline and Venture CP activities including gate deliverables
- Strategy and tactics development
- Contract Board/JV approvals
- Governance compliance
- Contract Management of Fluor EPPCM contract

Contract Administrator

- Under direction from the CP lead, responsible for Venture contract development and execution
- Contract Management of Venture contracts
- Develop Engineering and Procurement contract with Tri-Ocean with support from CP Lead
- Responsible for Livelink CP folder administration and compliance with Shell archiving rules

Procurement Manager

- Equipment and Materials support
- Strategy and tactics development
- Contract Board/JV approvals
- Governance compliance

As the project progresses into the execution stage, there might be a need to place off-site personnel to oversee the administration of various contracts; should this be required, these positions when identified will be resourced accordingly.

(b) Contract Models and Conditions of Purchase

The project has made an effort to bring all the contract and procurement models and templates in compliance with the group standard. With the help and support of the Legal and UA Contracting team, all models used for Quest as of April 1st 2011 are in compliance with the RDS Model Contracts library. Contracts which have been placed prior to this date are being proactively monitored and managed to ensure minimal exposure to the business on areas where they are lacking. In all cases Group Standards will be applied with deviations being signed off via appropriate authority.

(c) Legal/Regulatory requirements, Tax/Customs, Materials Traceability

Aside from the Shell Group legal requirements which need to be met, the project needs to also focus on and be in compliance with the following:

(a) Statutory requirements of the Government of Canada, the most notable which affects Contracting and Procurement activities being compliance with the National Blanket Orders (NBO) as issued by the Government from time to time, as well as the various environmental laws. Also legislations under the Province of Alberta as they affect the project on various issues.
(b) The governance and procedural requirements of the Joint Venture agreement between Shell, Chevron and Marathon.
(c) The requirement of the Funding Agreement between the JV and the various Canadian governments.

The requirements have to be incorporated in advance into the various contracts and procurement orders to be issued by the project.

(d) Local Supplier Development in Contracts

A Project Quest Local Content Policy Statement has been drafted in accordance with Shell Business Principle 6 (good neighbour policy).

19.5. Project Insurances

Purchase Orders and Contract Insurances will be CARM compliant. Should the project choose to call out equipment RFP's issued prior to April 2011 by Fluor to obtain fixed pricing for the Type 3 Cost Estimate for major equipment, the terms will be reviewed before final order.

20. CONSTRUCTION

This section provides an overview of the Quest Construction scope and activities

20.1. Objectives

Presented below, in order of priority, are the construction objectives for the project:

- Achieve "Goal Zero" with respect to all HSSE aspects of the construction activities.
- To ensure the constructed facilities are built at or below the construction budget.
- To ensure that quality of construction facilitates a Flawless Startup and a reliable operating plant.
- To ensure the constructed facilities are built within the schedule parameters.

20.2. Scope and Construction Management

The major scopes of work to be managed and delivered by the Construction Management Team(s) are as follows:

- Offsite module fabrication
- Onsite construction of the Capture facility at Scotford
- Field construction of the Pipeline and Wellsites
- Development of temporary infrastructure required to support onsite construction
- Transportation of materials, equipment, modules and resources to the Scotford site and to the field construction locations

Overall responsibility for Construction Management resides with the Shell Quest Construction Manager, who will have a team of Shell Construction direct reports (as shown in the organizational chart in Section 12), spanning all components of the project: Capture (module fabrication yard), Capture (Scotford site), Pipeline, and Wells.

Shell has employed Fluor to provide EPCCM services for the Capture component of the project. Fluor has the capability to manage this scope, with direction from Shell to ensure compliance to corporate and project processes, standards, and procedures as required. Construction management for the Pipeline and Wellsites will be carried out directly by Shell construction resources.

20.3. Work Optimization and Productivity

(a) Minimize Onsite Construction Work

Quest CCS is seeking to maximize the level of modularization at the Capture facility, thereby moving construction labour hours from onsite to offsite. By working in a more controlle environment, safety and quality are improved, and cost and schedule are more predictable. During DEFINE, the module configuration envelopes table was completed, and the critical modules identified; this enabled the team to determine the optimal path of construction and Received At Site (RAS) dates. The modularization plan will be refined in EXECUTE to provide the best combination of ALARP HSSE risks, capital costs and lowered execution risks.

To achieve minimum onsite construction for the Capture component of the project, a "3rd Generation" modularization strategy has been selected (see section 18 for a description of a 3rd Generation module and how it differs from a typical Alberta module). The key benefit of 3rd Generation modularization for construction is that the increased level of shop work dramatically reduces back-end (onsite) completion scope and complexity.

Wellsite facilities, pigging facilities, pipeline line break stations, and monitoring and control stations will be fabricated as completed skids and then shipped to their respective locations.

(b) Integrated Turnaround Schedule

The Scotford Upgrader Complex recently undertook a fundamental revision of its T/A strategy. Instead of large, plant-wide shutdowns every 4-5 years, the intent is to have smaller, unit-level shutdowns at a nominal 18 month frequency. Smaller T/As would be less onerous to manage and execute. An added benefit of having smaller T/As is that the schedule is more flexible. Flexibility enables this optimized T/A strategy to be extended to incorporate the needs of Oil Sands Growth Projects (like Quest CCS).

The new T/A schedule has now been finalized and incorporated in the Quest Level 1 schedule. T/As will take place in 2013 (HMU2), 2014 (HMU3), and 2015 (HMU1). Many tie-ins (especially utilities) will be executed by the Scotford Projects Group on Quest's behalf outside of these T/A windows.

(c) Manage Construction Interfaces

Quest CCS incorporates a significant amount of brownfield work in the existing Upgraders, Base Plant and Expansion 1. Managing this interface to ensure safe and efficient execution of tie-ins and interconnects is a key project driver. Operations input has been, and will continue to be, solicited and incorporated in construction activities during EXECUTE, in order to establish the optimal construction execution sequence and timing. Several personnel are dedicated to managing this interface, including one Shell P&T project engineer, one Fluor project engineer, one Scotford Projects Group project engineer, and the Operations Readiness and Assurance team. See also section 14 for details on the Interface Management Plan.

Regarding the interface of the Capture facility and the Pipeline, it has been agreed that Fluor will hire a construction contractor and manage the construction of the pipeline ISBL Scotford Upgrader together with the rest of the undergrounds required for the Capture Facility. The interface point between Fluor and Shell construction management for the pipeline is the bored crossing of the power lines east of the southeast trailer park, where the pipeline contractor will take over the crossing and installation of the rest of the pipeline.

(d) Manage Indirects

This is a major focus area for both the Shell P&T organization and for the Shell Heavy Oil business. 3rd party organizations such as the Construction Owners Association of Alberta (COAA) and Independent Project Analysis (IPA) have identified that many recent projects in Alberta have experienced high indirect costs. The most important factor in managing indirects is comprehensive planning during the Engineering and Procurement phases, i.e. *before* mobilizing construction resources in the field. The baseline schedule and budget must clearly and comprehensively specify all elements classified as indirects, and these elements must be carefully monitored. Change of any kind in the field will inevitably cause indirect costs to increase.

By moving a significant amount of construction labour hours offsite, Quest's aggressive 3rd Generation modularization strategy should reduce indirect costs, as compared with the same project executed with a typical modularization strategy.

For the Capture component, Fluor has carried out detailed estimates for Indirect Field Costs (IFC), which will be further refined in EXECUTE, and closely monitored once construction actually begins. To this end, the Fluor construction team will be supported by a dedicated Indirect Cost Specialist.

For the Pipeline and Wellsites components, IFC estimates are currently being established. A detailed control plan for Pipeline/Wellsite indirects will be developed by Shell Construction Management in conjunction with Shell Projects Controls during EXECUTE.

(e) Business Improvement Initiatives

Both Fluor and Shell will have dedicated resources to drive Continuous Improvement Activities (LEAN Construction) throughout EXECUTE. Shell LEAN training is planned for these dedicated resources.

One initiative that has already been adopted by Quest CCS for the Capture component is Workface Planning, which is:

- A process for organizing and delivering all necessary elements (e.g. drawings materials, tools, equipment, checklists, etc) *before* the work is started, to enable craft persons to perform quality work in a safe and efficient manner, and to maximize tool time.
- A process where Construction Work Packages (CWPs) are broken down into smaller, more manageable elements called Field Installation Work Packages (FIWPs). This is done by *dedicated planners*, not by field supervision.
- Considered a Best Practice by COAA.

Regarding the Pipeline and Wellsites components, improvement initiatives (with respect to LEAN construction, Workface Planning, Rework, etc.) will be further defined during EXECUTE.

(f) Maximize Constructability

Constructability has been a key focus of the project team since SELECT, and will continue to be so during EXECUTE. During DEFINE many ideas were identified and evaluated in an attempt to improve the constructability – and thereby the HSSE risk exposure and the overall project cost – of Quest facilities.

(g) Construction Readiness Reviews

A major focus area during EXECUTE will be to develop a Construction Readiness Review process for all construction areas. The intent is to clearly establish the criteria that must be satisfied in order for construction mobilization to occur. The Shell Quest Construction Manager will be accountable to ensure that construction mobilization does not occur unless construction readiness has been absolutely assured.

20.4. Industrial Relations and Labour Management

The labour posture for the Capture Facility is to utilize unionized Alberta Building Trades (ABT) affiliates. The strategy for the Module Fabrication is to utilize either unionized ABT or Christian Labour Association of Canada (CLAC) employers in the Edmonton region, along the High Load Corridor, and to ensure both are included in the invitation to tender. A meeting was held with the President of the ABT and the UA Local 488 Business Manager. An agreement was reached to waive any conditions in the Collective Agreements, with regards to installing modules that may be fabricated by non-union or alternative union employers. For more information related to Industrial Relations and Labour Management for the Capture Facility, please see section 9 in the Fluor Construction Execution Plan. Fluor plans on having a dedicated Labour Relations Representative assigned to project and located at site.

The intent for the Pipeline and Wellsites is to execute via open-shop contracts. However, CLAC and Alberta Building Trade affiliated employers will be given an opportunity to bid the pipeline scope if they are deemed capable and pre-qualified.

The demand for construction craft labour is predicted to be very high during the Quest CCS Project construction schedule. Attraction and retention plans, incentives, LOA, and recognition awards are currently being evaluated for the Capture Facility. However, in consultation with Fluor and labour leaders from the ABT and UA Local 488, it is believed that the workforce numbers required to construct the Capture Facility and module fabrication are not onerous, hence, the supply of craft workers in the Edmonton region, looking for a local project (versus camp work) is very favourable. Also, the work week hours of 4 ten hour days and 1 eight day is also very attractive to local workers searching for a work life balance.

An Attraction & Retention allowanced has been included in the Type III estimate. However, if worker supply does run short in Edmonton, Alberta, or Canada, Temporary Foreign Workers (TFW) will be required. Shell is a member of the Construction Industry Stakeholder's Association of Alberta (CISAA). The Shell Quest Project Manager is on the board of directors of this new association. CISAA was developed to streamline the acquisition of TFW and to allow transferring TFW between owner member organizations.

20.5. Logistics & Infrastructure

This section summarizes the project requirements for logistics and infrastructure, and the plans developed to satisfy these requirements.

(a) Movement of Personnel

The construction workforce at Scotford is projected to number approximately 400 at peak, working four 10-hour days and one 8-hour day weekly. The workforce is expected to be primarily local hire. The efficiency of bussing craft to the site for a project of this size is currently being evaluated. If bussing is ultimately determined to be inefficient for a project of this size, there should be adequate parking space to accommodate craft in the main craft parking lot east of the Scotford Administration Building.

Only a small number of people are expected to require air transportation from Calgary to the site, and this on an *ad hoc* basis. Air transport will be supplied by the corporate fleet (SAI), which serves the Josephsberg airport near Scotford from which shuttle service will be provided to the site.

For the Pipeline, the construction workforce will peak at about 200 people, working a 6/1 schedule. Those who travel to/from the worksite will do so by their own means, though the project may encourage the construction contractor to use crew vans and crew cabs to minimize traffic.

(b) Movement of Equipment and Material

The strategy for the Capture component scope of the project is to maximize the amount of modularization. These modules will be built in the Edmonton area such that they are transportable by truck and within provincial regulations regarding width, size and weight via the Alberta High Load Corridor (HLC). The shipping envelope for the HLC is defined as 24'x24'x120' and a weight of 156 tonnes.

Besides modules there are also a number of large equipments that will require transportation, particularly: two Amine Absorber Vessels, one Large Amine Absorber Vessel, and one Amine Stripper Vessel. It is expected that the two smaller Absorber Vessels will be sourced from overseas, and that they will arrive in Canada at the port of Vancouver BC, and shipped from there to Scotford by rail. The Large Absorber and the Amine Stripper will be sourced from the Edmonton area and shipped to the site by truck.

For the Pipeline/Wellsites, material will be transported by truck from Edmonton to the workface as it is required. All Pipeline/Wellsite loads fall within road shipping envelopes, and the proposed pipeline route is fully accessible by road.

(c) Infrastructure

The Capture component of the project has the largest warehouse/laydown requirements. The plan is to have adequate warehouse/laydown area facilities within the Scotford Complex. A new warehouse facility will be located at the Capture construction site. Infrastructure within the Capture site will consist of warehouse space, administrative facilities, and a level compacted and drained open area for material and equipment laydown, and parking. The project has requested and been granted land at the site that will fulfill the requirements for space, so there is no need for any additional land (e.g. in Edmonton). The project has yet to define preservation requirements in detail; this will be carried out early in EXECUTE.

The layout of the Capture infrastructure facilities has been developed to minimize travel time to and from the work locations. By locating the new warehouse within the main Capture area, access to material will be faciliated. Tool cribs, lunch cars, and wash cars will all be strategically placed to maximize accessibility by craft.

Regarding the pipeline and wellsites, they are located in a predominantly agricultural area approximately 60 kilometers northeast of Edmonton AB. As such, local access is good, with a network of primary highways, and high grade secondary access roads along range and township lines. It is expected that Shell's construction team would be based in temporary facilities provided by the General Works Contractor. For the purpose of any large meetings it is the intention to make use of local community center facilities as a way of increasing local expenditure.

21. INFORMATION MANAGEMENT & TECHNOLOGY

21.1. Information Management

This section provides an overview of Information Management for the Quest project.

The objective of the Information Management Plan (documents, data, and knowledge) is to enable effective information distribution to all project & facility stakeholders in a timely manner. This plan addresses deploying IM Global Standards and ensuring that project information requirements are accurately handled through the life of the project.

Below is a summary of the areas the IM Plan addresses:

- Align Information Management activities to project and business processes by:
  - Regular scheduled meetings with all stakeholders to ensure expectations are met
  - Approving IM activities with project team leads
  - Clarify all strategies and plans with team leads
  - Maintain IM risks in project Easy Risk
- Maintain a IM organization to assist the project needs, IM Lead and a Doc Control Office to handle all project document and data requirements for the life of the project.
- Support the flow of information throughout the project phases by

  - Gather key stakeholders flow of information to better assist in Information Delivery
  - Assist in the review process for DCAF/PCAP deliverables
  - Assist in the Regulatory hearings
  - Assist in the knowledge sharing commitments as agreed with government
- Manage all deliverable documents for the project including Shell and external contractors by:
  - Use of the Quest Document Numbering Procedure
  - Use of the Quest Information Handover Guide
  - Define Handover plans for project documentation from Project phases
    - Critical documents
    - Non Critical Documents
    - Knowledge Sharing Documents
- Manage the control of data created during the project by:
  - Data loading the Asset Hierarchy in the data warehouse from contractors in timed intervals that meet the project needs
  - Communicating Shell standards to ensure the quality and consistency of this information
- Manage the handover of information to Operations that will address the information created by operations for the following:
  - Physical Plant
  - Information – documents, data and drawings
    - Critical documents gathered from operations
    - Non Critical documents
  - Information in database format
    - SAP, SPI, etc. that will populate operation applications (i.e., Systems and Products (SAP), Operational Integrity Assurance (OIA), Reliability Centred Maintenance (RCM), etc.)

The Information Management (IM) plan shall be maintained and refined throughout EXECUTE.

21.2. Information Technology

In order to achieve Top Quartile performance, Information Technology (IT) has been involved since the early stages of project planning to ensure technology is designed to comply with Shell standards and policies for reliability, accessibility, and security.

IT provides both applications and infrastructure to support business processes, as well as effectively integrate systems and enable communication to ensure "Business at the Centre" is realized. Early interaction with the Operations team and the execution contractors will result in architecture that holistically plans for Field Communications, Office Domain and the Process Control Domain.

The co-ordination of IM working with IT ensures supporting infrastructure is addressed for effective information and data management.

The Information Technology (IT) plan shall be maintained and refined throughout EXECUTE.

22. OPERATIONS READINESS

22.1. Commissioning & Start-Up

The purpose of commissioning is to prepare the plant for operation. The purpose of performance testing is to prove that the plant meets the guaranteed performance values by the various licensors and to demonstrate completion for the agreements now signed with the provincial and federal governments. The Operations Readiness Plan (ORP) addresses the same subjects, but in more detail.

(a) Commissioning and Start-Up Philosophy

The philosophy of dividing commissioning into system blocks will be applied to the Quest project. The unit blocks will contain operational systems and may be separated by battery limit valves and spades.

The commissioning and handover of the different system blocks (offsites, utilities, compressor and the amine system) will be phased, which will be dictated by the overall product-in-tank dates and the respective durations of the start-up of individual system blocks.

In addition to the unit blocks, a number of large operational systems will be common to more than one of the system blocks, such as cooling water and fuel gas. A systems completion approach for the large operational systems will be used for the commissioning and start-up activities. The commissioning and start-up team has identified the extent of these systems. Preliminary system definition and system block priority is completed. Further "priority by system" will be assigned after development of P&I diagrams.

The EPCM contractor will be responsible for the mechanical completion activities, with assistance from the Shell project team and the commissioning and start-up team. The commissioning coordinator, who will be part of the commissioning and start-up team, will lead the coarse cleaning activities that are required before mechanical completion. Further cleaning including chemical cleaning will be carried out by the Operations team led by the CSU manager after system handover.

Following handover, the Shell commissioning and start-up team will be responsible for commissioning the new facilities (starting with a nitrogen purge) with the EPCM contractor providing maintenance assistance.

The philosophy is based on:

- the Quest facilities, which will be too large for a single handover
- construction activities, which will be dominantly geographically organized
- hand-over of the Quest facilities, which will be varied between geographical and operational systems
- a degree of flexibility, which will be enabled by the geographical block approach in that completion of blocks will be largely independent
- Operation Readiness team will also define system priority for handover to minimize start up time

(b) Vendor and Specialist Assistance

The EPCM contractor will organize vendor and specialist assistance during construction and before mechanical completion. The Shell commissioning and start-up team will organize vendor and specialist assistance during commissioning, start-up and performance testing where required.

(c) Schedule Philosophy

The CSU team has established the start-up sequence as a schedule input. Individual engineering, procurement and construction (EPC), and commissioning and start-up schedules have been integrated into an overall master schedule. The start up schedule also includes the Pipeline and Wellsites. The overall master schedule includes all essential elements, both at Scotford, the CO2 pipeline and the wells.

The Shell project teams, along with the commissioning and start-up team, will define the target completion dates for utilities and process facilities, which will support a logical start-up sequence and will result in a phased handover. The owner teams will work with the EPCM contractor to develop schedule milestones to monitor construction work progress for the agreed-on target completion dates.

(d) Phases

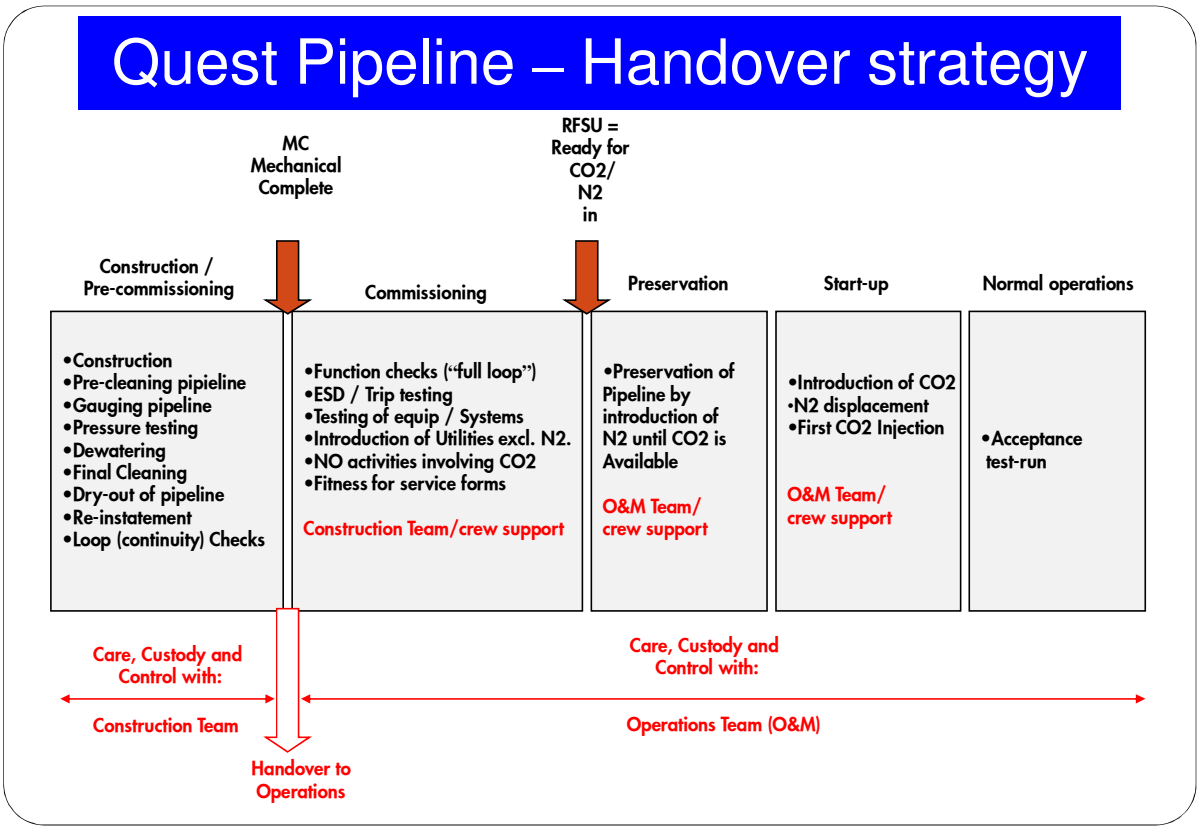
Phases of the commissioning and start-up activities for which the division of work scope responsibilities and work procedures between the Shell project teams, the EPCM and EP contractors and the operating departments are:

- mechanical completion
- commissioning
- start-up
- performance testing
- sustained operations

22.1.d.1. Mechanical Completion

For mechanical completion, a clean, tight, operable, safe and complete system will be delivered. It will include flushing, system testing, equipment run-ins and pre-punching, and will conclude with handover of the systems, with appropriate documentation, to the commissioning and start-up team.

Regarding the pipeline specifically, it is imperative to remove any solid or small particles from the construction activities that could lead to plugging of the formation. Therefore as part of the dewatering of the pipeline after hydrotest, the pipeline will be swept with specific pigs to clean small particles left in the pipeline. The following split of responsibilities has been agreed for the pipeline:



22.1.d.2. Pre-Commissioning & Commissioning

For commissioning, individual systems will be oxygen freed with nitrogen. Utility systems will be put into service. Commissioning will include final punching by the Shell project and operations teams, and will conclude with ready-for-start-up for the specific block.

Considering the highly corrosive nature of CO2 when mixed with free water, it is required to dry out the pipeline up to a specification of -45 degC. It is planned to engage a specialized contractor to perform the dry out with dry air. Once the pipeline is dried out, the pipeline will be filled up with nitrogen to preserve it until CO2 is available from the Capture facility. It is expected that this preservation period will last for at least 2 months.

22.1.d.3. Start-Up

For start-up, systems will be filled with nitrogen. The units will be brought on-line and will start to produce CO2 products. During start-up, systems will be O2 freed and charged with process fluids.

22.1.d.4. Performance Testing

After a successful start-up, a performance test-run will be conducted to confirm performance, both for warranty purposes for the various process units, and also to satisfy proof-of-performance criteria as specified in the Government Agreements.

22.1.d.5. Documentation at Handover

The project Information Handover Guide (iHOG) outlines required documentation at the handover of systems. These documents are considered vital for safe and successful commissioning and start-up, and will be handed over by the contractor with each unit block or operational system.

22.1.d.6. Documentation at Successful Test Run

Where applicable, the following documentation will be available following the performance test run:

- Certificate of Acceptance, issued by Shell to the contractors
- Certificate of Completion of Work, issued by the contractors to Shell
- Documentation to demonstrate that "Sustained Operations", as defined in the Government Agreements, has been achieved

On completion of the performance test, licensors and/or contractors will be informed in writing if there are warranty issues that necessitate subsequent actions.

22.1.d.7. Post-Implementation Review

A Post-Implementation Review (PIR) compares the actual implementation and performance of the project against the plan, according to Shell Canada Capital Budget Proposal 502F.

Accountability for ensuring that the PIR is conducted in a timely and appropriate fashion lies with the Oil Sands General Manager of mining and upgrading development.

22.2. Operations Readiness Plan

As part of the ORM deliverables, an Operations Readiness Plan (ORP) has been developed. The ORP:

- Defines an operations philosophy that provides a basis from which, together with other input, the operation and management of the facility can be developed or updated
- Defines a vision about the technical and organizational implementation of the project into the operational organization.
- Specifies operational objectives, documentation/data requirements, training, operational risks and key success areas
- Identifies key performance areas (tightness, cleanliness etc)
- Defines critical project success objectives and performance targets for the selected key performance areas
- Defines an organizational structure that supports commissioning & start up requirements with respects to the key performance areas and the objectives set.

23. ACRONYMS

AENV – Alberta Environment

AFE – Authorization for Final Expenditure

AI-PSM – Asset Integrity, Process Safety Management

ALARP – As Low As Reasonably Practicable

AOSP – Athabasca Oil Sands Project

AVL – Approved Vendor List

BCS – Basal Cambrian Sands

BDP – Basic Design Package

BOM – Business Opportunity Manager

CAPEX – Capital Expenditure

CAR – Construction All Risks

CARM – Contractual Allocation of Risk Manual

CCS – Carbon Capture and Storage

CEAA – Canadian Environmental Assessment Act

CII – Construction Industry Institute

CMCP – Category Management and Contracting Process

COAA – Construction Owners Association of Alberta

CP *or* C&P – Contracting & Procurement

CPPM – Contracting & Procurement Procedure Manual

CSU – Commissioning & Start Up

CTR – Cost, Time, Resources

CWP – Construction Work Package

DCAF – Discipline Control & Assurance Framework

DE – Decision Executive

DEP – Design & Engineering Practice

DG – Decision Gate

DPRIR – Design Phase Risk & Insurance Review

DRB – Decision Review Board

EA – Environmental Assessment

EAC – Estimate At Completion

ECS – Enterprise Categories & Suppliers

EFA – Enterprise Frame Agreement

EIA – Environmental Impact Assessment

EOR – Enhanced Oil Recovery

E&P – Exploration & Production

EPC – Engineering, Procurement, Construction

EPCM – Engineering, Procurement, Construction Management

EPCCM – Engineering, Procurement, Construction, Construction Management

ERCB – Energy Resources Conservation Board

ERP – Emergency Response Plan

ES – Earned Schedule

ESAR – Estimate & Schedule Assurance Review

ESH – Environmental, Social, Health

ESTG – Engineering Standard & Technical Guideline

EVA – Earned Value Analysis

EVM – Earned Value Management

EVP – Executive Vice President

FDP – Field Development Plan

FEED – Front End Engineering Design

FID – Final Investment Decision

FIWP – Field Installation Work Package

FP – Focal Point

FPD – Flawless Project Delivery

FPP – Full Project Proposal

FTE – Full Time Equivalent

GHG – Green House Gas

GM – General Manager

GoA – Government of Alberta

GoC – Government of Canada

GPA – Goals & Performance Appraisal

GWDP – Global Well Delivery Process

HAZOP – Hazards & Operability

HLC – Heavy Load Corridor

HMU – Hydrogen Manufacturing Unit

HO – Heavy Oil

HSSE – Health, Safety, Security, Environment

IDS – Interface Data Sheet

IFC – Indirect Field Costs

IG – Integral Geared

iHOG – Information Hand Over Guide

IM – Information Management

IMP – Interface Management Plan

IPA – Independent Project Analysis

IT – Information Technology

ITP – Inspection & Test Plan

JV – Joint Venture

KPI – Key Performance Indicator

LCCS – Low Cost Country Source

LES – Logistics Execution Strategy

LIRA – Logistics & Infrastructure Resource Assessment

LOS – Line of Sight

MDEA – Methyl Diethanolamine

MMSCF – Million Standard Cubic Feet

MMV – Measuring, Monitoring, Verification

MOA – Manual of Authorities

MOC – Management of Change

MTO – Material Take Off

NGO – Non-Governmental Organization

NPV – Net Present Value

NRCan – Natural Resources Canada

OA – Outline Agreement

OPEX – Operating Expenditure

ORM – Opportunity Realization Manual

ORP – Operations Readiness Plan

PCAP – Project Control & Assurance Plan

PCP – Project Controls Plan

PEP – Project Execution Plan

PER – Project Execution Review

PG – Project Guide

PHA – Process Hazards Analysis

P&ID – Piping & Instrumentation Diagram

PIR – Post Implementation Review *or* Project Interface Register

PM – Project Manager

PMT – Project Management Team

PO – Purchase Order

PPD – Project Premise Document

PQP – Project Quality Plan

PS – Project Standard

PSA – Pressure Swing Adsorber

P&T – Projects & Technology

QA – Quality Assurance

QC – Quality Control

QRA – Quantitative Risk Assessment

RAM – Risk Assessment Matrix *or* Reliability & Availability Model

RAS – Required At Site

RCM – Reliability Centred Maintenance

RDS – Royal Dutch Shell

RFQ – Request for Quotation

RFSU – Ready For Start Up

SAI – Shell Aircraft International

SCAN – Shell Canada

SCM – Supply Chain Management

SDP – Storage Development Plan

SEIA – Socio-Economic Impact Assessment

SGSI – Shell Global Solutions International

SIMOP – Simultaneous Operation

SO – Sustained Operations

T/A – Turn Around

TCO – Total Cost of Ownership

TECOP – Technical, Economic, Commercial, Organizational, Political

TEG – Triethylene Glycol

TIV – Technical Integrity Verification

TQ – Top Quartile

TRCF – Total Recordable Case Frequency

VAR – Value Assurance Review

VIP – Value Improvement Process

VOWD – Value of Work Done

VP – Vice President

WBS – Work Breakdown Structure