Blast Furnace Life Cycle

**Diagnosis**
- Inspections
- Non destructive testing
- Audit Assessments
- Process Review

**Campaign Extension**
- Operating Practises
- Supplemental Cooling
- Refractory Repairs

**Performance Enhancement**
- Productivity Improvements
- Operating Cost Reduction
- Operational Issue Resolution
- Environmental and Safety Improvements

**Reline Management**
- Scope definition
- Technology Selection
- Planning
- Modularization
- Execution

**Campaign Extension**
- Operating Practises
- Supplemental Cooling
- Refractory Repairs

**Performance Enhancement**
- Productivity Improvements
- Operating Cost Reduction
- Operational Issue Resolution
- Environmental and Safety Improvements

**Reline Management**
- Scope definition
- Technology Selection
- Planning
- Modularization
- Execution

**Copyright © Hatch 2016. All Rights Reserved.**
Scope Development and Enhancement Selection Drivers

- **Plant Driven Scope Selection**
  - Eliminate historic issues
  - Minimize future maintenance
  - Maximize new technological improvements (wish list)

- **Corporate Spending Limitations**
  - Optimize plant availability
  - Justify all spending through cost, productivity, environment, and safety improvements
  - Minimize capital expenditure
Scope Definition at Various Stages of the Project

Scope Definition should be Driven by Tangible Benefits and Assessed at Each Gate Review
Estimate Basis and Accuracy
# Hatch Project Life Cycle Classification

<table>
<thead>
<tr>
<th>Type of Project</th>
<th>Hatch Classification</th>
<th>Gate Review Level</th>
<th>End Use (Typical purpose of estimate)</th>
<th>Client Decision Basis</th>
<th>Methodology</th>
<th>Level of Engineering Definition (note)</th>
<th>Level of Contingency</th>
<th>Indicative Probability Range</th>
<th>Indicative Accuracy Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Feasibility Study</td>
<td>Level 2</td>
<td>Gate 2</td>
<td>Selection of Best Project Option; setting of Project Objectives; target cost and schedule; Go or No-Go Decision Point</td>
<td>Business Planning, Technology Assessment, Project Options</td>
<td>Equipment factored, benchmarked or parametric models</td>
<td>0% to 1%</td>
<td>30% or more</td>
<td>N/A</td>
<td>-50% to +50%</td>
</tr>
<tr>
<td>Feasibility Study</td>
<td>Level 3</td>
<td>Gate 3</td>
<td>Development of detailed project basis consistent with Project Objectives and target Business Plan, ROI and detailed project implementation planning</td>
<td>Utilized if significant departure from project basis occurs (i.e. project basis significantly decreased or increased; market or labour experience rapid escalation, etc.)</td>
<td>Detailed MTO's, unit costs with forced detailed take-offs; planning; defined W O packages</td>
<td>1% to 5%</td>
<td>20% to 30%</td>
<td>N/A</td>
<td>-30% to +30%</td>
</tr>
<tr>
<td>Implementation Phase</td>
<td>Level 4</td>
<td></td>
<td>Check Estimate</td>
<td>Same as Level 3 but uses actual productivity, etc.</td>
<td>Same as Level 3 but uses actual productivity, etc.</td>
<td>10% to 20%</td>
<td>15% to 20%</td>
<td>Not greater than 90%</td>
<td>-20% to +20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30 to 40%</td>
<td>10% to 15% base on CRA</td>
<td>Not greater than 90%</td>
<td>-10 to +10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-10% to +10%</td>
</tr>
</tbody>
</table>

### Note:

- **Level of Engineering Definition** is expressed as a % of total engineering, where total engineering = all engineering services in phases FEL1, 2, 3 and FEL4 (except FEL4 Procurement, Project and Construction Management functions). It is presented as a range to reflect that in the early FEL stages "total engineering" has not been fully quantified.
Scope Definition – Non Destructive Inspections

AUE (Acousto-Ultrasonic Echo Inspection) (Refractory Measurements) (Best Used with Thermal Modeling)

LFPU (Low Frequency Pulse Ultrasonic) Testing (Stave Thickness)

AU-E Technique

Methodology:

Ultrasonic – detection of shell thickness – unable to penetrate castable layer

LFPU – detection of fin/rib/tip
- intermediate wavelength able to penetrate castable and detect fin/rib/tip

AU-E – detection of refractory/hearth thickness
- wavelength larger than fin/rib/tip

Copyright © Hatch 2016. All Rights Reserved.
Scope Definition – Non Destructive Inspections

Inspection Using Drones

Laser Scanning
Scope Definition - Inspection by Infra Red Thermography
Project Execution Plan

• Overview of Project Scope
• Site information
• Design information
• Capital budget
• Preliminary risk evaluation
• Project execution strategy
• Contracting strategy
• Milestone schedule

• Project responsibility matrix
• Approvals and authorization matrix
• Communication requirements
• Cost reporting requirements
• Construction management plan
• Change management plan
• Safety management plan
Development of Change Control Procedures

Implementation change control procedure

change request

Change approved?

Design change needed?

Specification change needed?

Fix design

Fix implementation

Get approval / stop work

To SCM

yes

No

yes

No

yes

No

Adjust specification

Fix implementation

Fix design
Thank you.

For more information, please visit www.hatch.com