TODAY

Tomorrow & Beyond

LEVERAGING LEADERSHIP, DIVERSITY AND INNOVATION
Strategic Issues Workshop
Improving Brownfield Projects

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Independent Project Analysis

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BASF
Welcome

• Safety Moment
• Today’s Challenge
• Agenda Review
Safety Moment

Facility Safety Briefing
The Challenge:

• In today’s capital constrained environment, Owners are looking for ways to leverage their assets with minimal capital investment. This has led to an increase in “Brownfield” Projects. However, Brownfield Projects involve issues and challenges not encountered on Greenfield Projects. At this year’s ECC Conference, there is an added emphasis in identifying Best Practices in executing Brownfield Projects.
This workshop is an open forum providing a safe, non-commercial environment in which owners, engineering and construction contractors, and suppliers can freely exchange ideas and experiences to:

- Improve mutual understanding
- Debunk myths (perhaps) about Brownfield Projects
- Identify shared experiences (good and bad) which have led to the development of Best Practices for executing Brownfield Projects
Agenda Review

• Brownfield Project Definition/Overview & Perceptions
• Improving BFPs
  • Project Charter & FEP Phases
  • Project Management Issues
  • Detailed Design & Technology Considerations
  • Construction Phase
  • Completion/Turnover Phase
Brownfield Projects Overview

Hunter Mayo
Brownfield Projects

- Definition
- Characteristics of Brownfield Projects
- Discussion Exercise – Brownfield Project Case Study
Defining a Brownfield Project

• Expanding or revamping an existing operating facility
• Stakeholders are often distracted by the existing facility
• Design and construction is constrained by the operating unit
  • Increased interfaces
  • Permitting issues
  • Outages (turnarounds)
  • Incorporating existing conditions
Survey: What is your industry segment?

- Owner
- EPC Contractor
- Supplier
- Other

Percent of Respondents

- Owner: 10
- EPC Contractor: 90
- Supplier: 20
- Other: 10
## IPA’s Large Brownfield Projects Database

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Projects</td>
<td>3,532</td>
</tr>
<tr>
<td>Median Project Cost (2016 USGC$*)</td>
<td>$58 million</td>
</tr>
<tr>
<td>Range of Total Project Cost</td>
<td>$20 million to $992 million</td>
</tr>
<tr>
<td>Median Authorization Year</td>
<td>2005</td>
</tr>
<tr>
<td>Range of Authorization Year</td>
<td>1986 to 2017</td>
</tr>
<tr>
<td>Companies Represented</td>
<td>295</td>
</tr>
<tr>
<td>Construction in a Turnaround</td>
<td>73 percent of projects</td>
</tr>
<tr>
<td>Median Execution Duration (Authorization to Startup)</td>
<td>20 months</td>
</tr>
<tr>
<td>Range of Execution Duration</td>
<td>7 months to 58 months</td>
</tr>
<tr>
<td>Average Cost Growth</td>
<td>3 percent</td>
</tr>
<tr>
<td>Range of Cost Growth</td>
<td>-36 percent to 88 percent</td>
</tr>
</tbody>
</table>

* USGC = US Gulf Coast

**Source:** IPA
Brownfield Projects Experience More Schedule Slip Than Greenfield Projects
Schedule Slip
Greenfields are comparable to brownfields

Projects Between $20 million and $1 billion
Brownfield Projects Experience More Cost Growth Than Greenfield Projects

65% of respondents found that Brownfield Projects experience more cost growth than Greenfield Projects.
Cost Growth
Greenfields are comparable to Brownfields

Cost Growth: Estimate to Actual

Not Statistically Different

75 percent
Median
25 percent

Brownfield Projects
Greenfield Projects

Projects Between $20 million and $1 billion
Greenfield Projects Have a Lower TRIR Than Brownfield Projects

Percent of Respondents

TRUE: 48
FALSE: 52
Safety
Brownfield Projects Have Lower Total Recordable Rates

Projects With at Least 200,000 hours and in North America or Europe
Case Study – Brownfield Project

• Quick table introductions

• Read each section of the case study
  • Stop and discuss questions at the end of each section

• Facilitator
  • Keep the conversation going
  • Involve each member
  • Decide when to move to next question

• Scribe
  • Record important points, we will collect and distribute
Project Charters & FEP Phases

Pete Luan
## Brownfield vs. Greenfield Challenges

<table>
<thead>
<tr>
<th>Greenfield Project</th>
<th>Brownfield Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Project is ‘ring fenced’ and independent of other facilities</td>
<td>• Manage linkage between existing facilities / Operations organization and new plant</td>
</tr>
<tr>
<td>• New plant with design and condition fully know</td>
<td>• Current plant condition unknown until shutdown and inspection</td>
</tr>
<tr>
<td>• The project team manages scope rigorously</td>
<td>• Project scope will change based on Due Diligence and Post Shutdown discovery</td>
</tr>
<tr>
<td>• Minimal impact from non-project team controlled projects</td>
<td>• Must integrate project with Maintenance and Operations driven shutdown projects</td>
</tr>
<tr>
<td>• Projects tend to be schedule centric</td>
<td>• Projects are event centric due to plant discovery scope changes</td>
</tr>
<tr>
<td>• Hydrocarbons introduced post mechanical completion</td>
<td>• Safety issues with SIMOPS (simultaneous operations)</td>
</tr>
<tr>
<td>• Operations is an important stakeholder, but one of many</td>
<td>• Must effectively manage Operations interface</td>
</tr>
</tbody>
</table>
Brownfield Project Challenges

- Unknown facility condition
- Integration with other projects
- Demolition
- Changing work scope
- SIMOPS safety issues
- Operations work priorities
- Facility environment issues
### Brownfield Project Activity Stages

<table>
<thead>
<tr>
<th>Appraise</th>
<th>Select</th>
<th>Define</th>
<th>Execute</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Due Diligence</strong></td>
<td><strong>Integrate into Development Concept</strong></td>
<td><strong>Planning</strong></td>
<td><strong>Post Shutdown</strong></td>
</tr>
<tr>
<td>• Data collection</td>
<td>• Integrate new scope with existing facility</td>
<td>• HAZOP</td>
<td>• Equipment purging, cleaning, &amp; isolation</td>
</tr>
<tr>
<td>• As built drawings</td>
<td>• Ensure existing facility systems can support new scope</td>
<td>• Decommissioning plan</td>
<td>• Formal handover to Projects from Operations</td>
</tr>
<tr>
<td>• Historical operating data</td>
<td>• Final design basis</td>
<td>• Demolition plan</td>
<td>• Equipment inspection to confirm assumptions</td>
</tr>
<tr>
<td>• Inspection reports</td>
<td>• Demolition scope</td>
<td>• Remediation plan</td>
<td>• Project execution</td>
</tr>
<tr>
<td>• Incidents &amp; accidents</td>
<td>• Finalize concept</td>
<td>• Waste management plan</td>
<td>• Formal handover to Operations</td>
</tr>
<tr>
<td>• Historical maintenance</td>
<td></td>
<td>• Air emissions</td>
<td></td>
</tr>
<tr>
<td>• Pipeline locations</td>
<td></td>
<td>• Facility effluent plan</td>
<td></td>
</tr>
<tr>
<td>• Underground issues</td>
<td></td>
<td>• SIMOPS plan</td>
<td></td>
</tr>
<tr>
<td>• HSE permits and issues</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Due Diligence Helps to Prevent Scope Surprises

Due Diligence

- Desk Studies
  - Operational
    - As Is Condition
  - Cursory
    - Detailed

- Site Investigation

- Site Construction
Discussion Topic

- Why do organizations have such a difficult time planning and delivering Brownfield Projects?
- What can we do during FEL 1 – FEL 3 to support meeting project objectives?
- What steps can we take to better integrate with turnaround activities and Operations activities?
- Why are we often surprised with emergent scope that occurs after the shutdown?
Survey: Rank the following FEP considerations/activities unique to Brownfield Projects in order of impact on project outcome (1=greatest impact to 4=least impact)

<table>
<thead>
<tr>
<th>Activity</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of Pre-Turnaround vs. Turnaround activities</td>
<td>46%</td>
<td>24%</td>
<td>13%</td>
<td>17%</td>
<td>205</td>
<td>2.99</td>
</tr>
<tr>
<td>Work Permitting Planning (in operating units)</td>
<td>16%</td>
<td>35%</td>
<td>31%</td>
<td>18%</td>
<td>207</td>
<td>2.48</td>
</tr>
<tr>
<td>Underground Obstruction/Hazardous Material removal</td>
<td>17%</td>
<td>29%</td>
<td>34%</td>
<td>20%</td>
<td>208</td>
<td>2.43</td>
</tr>
<tr>
<td>Facility Siting</td>
<td>21%</td>
<td>14%</td>
<td>22%</td>
<td>43%</td>
<td>207</td>
<td>2.13</td>
</tr>
</tbody>
</table>
Survey: What is the most important key project tenet, unique to Brownfield Projects, which should be incorporated into the Project Charter/Project Objectives?

- Minimize Impact on Ongoing Operations (27%)
- Maximize Consistency with Existing Plan Standards, Equipment, etc. (20%)
- Maximize Engagement with Existing Plant Personnel (10%)
- Maximize the integration of the Brownfield Project with the upcoming Plant Turnaround (10%)
Survey: From an Owner’s Perspective – what is the most important factor that you look for in an Engineering and/or Construction Contractor when executing a Brownfield Project?

- Experience with decommissioning/recommissioning
- Safety Total Recordable Incident Rate (TRIR)
- Construction Execution Planning Capabilities
- Project Team

Percent of Respondents

- Experience with decommissioning/recommissioning: 28%
Survey: Safe Project Execution is an overarching Objective in all Project Charters. Brownfield Projects typically have greater safety hazards than Greenfield projects. What are the most successful techniques for improving safety on Brownfield Projects?

- Minimize Brownfield Project access to surrounding Operations during Construction
- Reduce Hot Taps for piping tie-ins
- Integrated Safety Orientation covering Project and Facility Issues
- Decrease the Craft to Safety personnel ratio

![Bar chart showing the percentage of respondents for each technique.]

- Minimize Brownfield Project access to surrounding Operations during Construction: 30%
- Reduce Hot Taps for piping tie-ins: 10%
- Integrated Safety Orientation covering Project and Facility Issues: 70%
- Decrease the Craft to Safety personnel ratio: 10%
Why Do Our Contractors Often Get Hurt During Capital Project Work on a TAR

Post Operational Activities
- Mechanical isolation of plant
- Plant hydrocarbon removal
- Plant cleaning
- Waste disposal
- Permit to enter

Preparation for Modifications
- Equipment, vessel & plant inspection
- Confirm current plant state
- Emerging scope items
- Final cleanout
- Handover to Projects Process

Demolition and Remediation
- Permit to work
- Execute detailed demolition work plan
- Perform on site remediation work plan
- Offsite waste management

Execute Work Scope
- Permit to work
- Integrate new works with demolition
- Mechanical completion
Project Management

Warren Kennedy
Project Management

CHALLENGES
I Expected Times Like This - But I Never Thought
They'd Be So Bad, So Long, and So Frequent.

www.despair.com
Professional and conscientious project management is critical to a successful outcome!
Project Management

Keys to Successful Project Management

or

...Duh?!?

Things you already know but let’s review anyway
Steps to Successful Project Management

Plan

Lead

Communicate

Manage
• Identify all stakeholders up front!
• Develop the project plan before starting the project
• Establish communications protocols
Define your requirements (SOW) in detail

Establish a speedy conflict resolution process

Make contingency plans

Use Interactive Planning meetings to establish a reasonable project schedule
• Assign an experienced project manager
• Ensure strong, committed management support
• Connect the business goals to the project
• Be Proactive – problems only get worse with time
Project Management - Communicate

- Communicate objectives frequently
- Recognize different perspectives
- Check assumptions frequently
Project Management - Communicate

- Manage expectations
- Share success and broadcast achievements
- Invite feedback
• Ensure the project design reflects the Project Charter and FEP Objectives

• Fight Urban Renewal while maintaining relationships with Operations
Survey: What is the most important attribute in selecting team members for a Brownfield Project?

- Experience with Brownfield Projects: 42%
- Personality: 4%
- Skills/Technical Knowledge: 22%
- Site Knowledge: 19%
Survey: Communicating Brownfield Project Issues and Decisions can be challenging as a key stakeholder is busy operating the facility. What is the most successful technique you have found useful in keeping all stakeholders aware and engaged in key project decisions?

- Assigning Facility Staff full-time to the Brownfield Project
- 3-D Model Reviews with Facility Staff
- Engineering Contractor Staff in-residence at the Facility during Design
- Monthly/Weekly Project Status Meetings/Teleconferences

Percent of Respondents: 43
Discussion Topics

Tables 1 & 2

Who are the key stakeholders within the Owner’s organization for Brownfield Projects? What differences, if any, from the stakeholders in a Greenfield Project?

Tables 3 & 4

Does the fact that a project is a Brownfield project impact the selection criteria of team members for E/P/C, Turnover, or Start-up? If so, how?

Tables 5 & 6

Brownfield Projects require significant balancing of preferences and tradeoffs between constituencies. What are some successful techniques to aid project management in decision making?

Tables 7 & 8

What are some of the key benchmarks, metrics, and/or KPIs for Brownfield Projects? Are there any unique to Brownfield Projects, if so what are they?
Detailed Design & Technology

David Holland
Survey: What is the most important attribute in selecting team members for a Brownfield Project?

- Experience with Brownfield Projects: 70%
- Personality: 10%
- Skills/Technical Knowledge: 20%
- Site Knowledge: 10%

Percent of Respondents
The content and scope of detailed design drawings and their impact on construction sequence is critical in the project areas that interface with the existing plant.

• What techniques are best to document existing conditions? Who is best to provide this information?

• Describe the best practice for preparing the following construction documents:
  - Equipment arrangement (demo and new construction)
  - Power and controls (demo, tie-in, and new construction)
  - Piping (demo, tie in and new construction)
  - Structural (steel and concrete)
Construction

Scott Brandenburg
Brownfield Project Construction
Survey: Daily Work Permitting can have significant impact on construction schedules within operating facilities. Brownfield Projects must balance safety considerations, operations resource availability, and construction needs when it comes to work permitting. Which of the following statements do you consider to be most true?

- Operations should assign dedicated permit writers to all projects, regardless of cost
- Contractors could do a much better job or preparing thorough permits and submitting them in a more timely fashion, which would result in issuing permits faster
- Daily Work Permits are a key element in maintaining a safe workplace, and we must take the time to ensure that work can be done safely
Work Permitting Techniques and Q&A’s

- Who owns the Safe Work Permit program?

- Do electronic construction permits work?
  - Pros/cons/what could be better

- Does operations get overwhelmed during construction with permits?
  - When and why?

- What are the traps and pitfalls of permitting in a live facility or when in Turnaround mode?
  - Conflicts with on-going ops/maintenance activities
  - Conflicts with small site projects
  - Does the permit require both contractor and owner resources?
Work Permitting and Schedules

• What does an integrated schedule and associated permit plan mean to you?
  • For construction work during normal operations
  • For construction work during a Turnaround

• How do you handle test packages and turnover packages?
  • Construction
  • Punch List work
  • Pre-commissioning
  • Commissioning
Turnaround Planning

• Is an integrated schedule/plan that includes operations, maintenance, site projects, and the large Brownfield project important?
  • How early should this work start?
  • Who is responsible for leading this?
  • Do you believe this allows overall work to be optimized?
  • Any electronic tools that really work?
  • Does a Turnaround specific work permitting system really work?
Discussion Topic

Piping tie-ins are necessary, dangerous, and are significant construction activities in Brownfield Projects. What are some good techniques for coordinating all impacted constituencies for a safe and effective piping tie-in program?
1. True or False, the P&ID’s that the constructor received from the owner and engineer at the beginning of work are still accurate?

2. What is the confidence level of existing labelling of lines in the plant by “someone”?

3. Sometimes lines are used for startup or purging or bypassing, when the plant is in a certain stage of shutdown/startup/product change over? How can you make this clear for the work?

4. What do you do different for Hot Taps? Does the plant have a more stringent or less stringent program than you?
Safe and Effective Piping Tie-ins
(pipe service index)

1. Even though it may be the same Complex, Did you consider that each section may have a different Pipe Service Index based on who and when it was built?

2. How clear are the notes/comments section of the Pipe Service Index?

3. Is the Pipe Service Index that you received at the start of the job the same as what the control room has now?

4. What is the best way to coordinate and maintain the running plant P&ID’s and PSI with the Projects version?
Project Completion/Turnover

Warren Kennedy
Project Completion/Turnover

• Unique Brownfield Completion Challenges

  • Project is frequently completed in a Turnaround

  • Turnover Systems may contain existing equipment/scope intermingled with new construction

  • Owner must balance completion/start-up with ongoing operations at the site

  • Others???
Project Completion/Turnover

• Detailed Turnover Plan & Responsibility Matrix
  • Organizational Chart & Team Assignments
  • Systems Approach
  • Procedures
  • ‘Tasks’ (Mechanical, Electrical, I/C)
  • Pre-Commissioning & Commissioning
Discussion Topic

Significant Owner resources are required to interface with the Construction Contractor at this phase of a Brownfield Project. How can the multiple constituencies (including specialty contractors and maintenance) best integrate, and avoid ‘surprises’?
Workshop Review/Wrap Up

Warren Kennedy