Process Industry Practices

A Case Study of the Benefits and Secrets of E&C Industry Peer Collaboration

RICE FORUM
NOVEMBER 18, 2011
PAUL JAHN, MIDDOUGH
WAYNE DOLBEC, SHAW GROUP, PIP CHAIRMAN 2012
OBJECTIVES AND AGENDA

- Collaboration Framework
- PIP Value Proposition
  - Mission, history, & membership
  - Structure & work process
  - Knowledge products
- Sources Of Value
  - Cost and time savings
  - Enabling know how
  - Employee development
  - Knowledge management
- Takeaways
  - Application of PIP work processes to other knowledge management areas
  - Secrets of peer collaboration success
A consortium of companies sharing the goal of reducing plant costs through development and implementation of common industry practices for detailed design, construction, procurement, operation, and maintenance of manufacturing facilities.
Seventeen members established PIP in 1993
Self-funded under CII
Now includes 60 process industry companies
  - 35 owners
  - 25 EPC contractors
Practices utilized in 26 different countries
<table>
<thead>
<tr>
<th>Member Companies</th>
<th>Owners</th>
<th>Owners</th>
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<tbody>
<tr>
<td>3M</td>
<td>Eastman Chemical</td>
<td>Occidental Oil &amp; Gas</td>
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<tr>
<td>Aramco Services</td>
<td>Evonik Degussa</td>
<td>Pasadena Refining</td>
</tr>
<tr>
<td>Archer Daniels Midland</td>
<td>Flint Hills Resources</td>
<td>PPG</td>
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<td>FMC</td>
<td>REC Silicon</td>
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<td>Ascend Performance Materials</td>
<td>Hess Corporation</td>
<td>Rentech Inc.</td>
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<td>BP</td>
<td>Holly/Frontier</td>
<td>SABIC</td>
</tr>
<tr>
<td>Celanese</td>
<td>Honeywell*</td>
<td>Sekisui</td>
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<td>DuPont</td>
<td>Monsanto</td>
<td>UOP</td>
</tr>
<tr>
<td></td>
<td>Mosaic Fertilizer</td>
<td>Western Refining</td>
</tr>
</tbody>
</table>

* Denotes Member Of Rice Global E&C Forum
Ambitech Engineering  
BE&K (a KBR Company)  
Bechtel*  
Brinderson LP  
Burns & McDonnell*  
CB&I*  
CDI Engineering Solutions*  
CH2M HILL*  
Chemtex International  
ENGlocal Engineering Inc.*  
Fluor*  
GE Energy  
Jacobs Engineering*  
KBR*  
Kvaerner*  
Merrick & Company  
Middough Inc.  
S&B E&C, Ltd.  
Samsung Engrg. America Inc.  
Shaw Energy & Chemicals Group*  
SK Engineering & Construction  
SNC-Lavalin E&C, Inc.*  
Technip USA*  
URS Corporation*  
WorleyParsons Ltd.

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PIP MEMBERSHIP REQUIREMENTS

- Annual dues payment — 1st year = $25,000
- Active steering team participant
- At least one active participant on function team
- Provide internal non-proprietary standards for harmonization of industry practices
- Voluntarily adopt and implement practices
- Follow PIP business guidelines
- Commitment to improvement of the process
Adopting Process Industry
• Engineering
• Procurement
• Construction
Agrium
Bahrain Petroleum Co. (BAPCO)
Chemetall Foote Corp.
Chevron Phillips Chemical LP
Coffeyville Resource Refining & Marketing LLC
Emerson Process Mgt.
HOVENSA L.L.C.
Invista
KPS Technology & Engineering
Kraton Polymers
L-Con Engineers & Constructors
Lyondell Chemical Co.
Marafiq
North West Upgrading

NuStar Logistics, L.P.
ONEOK
Petroleum Co. of Trinidad & Tobago
Plasco Energy Group
PlusPetrol S.A.
Saudi International Petro-chemical Co. (SIPCHEM)
Seadrift Coke
Sinclair Oil Corporation
Stepan Company
The Williams Companies
UT Austin, Dept. of Utilities & Energy
Valero Corporate Services
Wink Engineering, an InServ Company
Wynnewood Refining
PRACTICES BY DISCIPLINE

As Of September 28, 2011

Number of Practices

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Published</th>
<th>Planned</th>
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<td>29</td>
</tr>
<tr>
<td>ELEC</td>
<td>72</td>
<td>86</td>
</tr>
<tr>
<td>MACH</td>
<td>2325</td>
<td>6063</td>
</tr>
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<tr>
<td>PIPE</td>
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<td>29</td>
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<tr>
<td>VESS</td>
<td>8</td>
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<td>WPT/DM</td>
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Critical Mass of Practices for Process & Related Industries
STREAMLINING THE COMPANY LIBRARY

Before PIP

- SOCIETY STANDARDS
- INTERNAL STANDARDS
- SITE SPECIFIC

With PIP

- SOCIETY STANDARDS
- PIP
- INTRNL STDS
- SITE SPECIFIC
PIP BENEFITS CITED BY MEMBERS

- Estimated reduction of up to 5% in TIC for project and maintenance work
- Piping specification group work hours reduced by 25% on a typical project
- Annual maintenance of internal specifications savings of $250,000
- Valve inventory reduced by 10% using PIP Practices
- Local permitting authorities recognize PIP thus improving and shortening regulatory approvals
- Fewer specification conflicts and code inconsistencies
• Full EPCM services
• 800+ professionals
• 11 office locations
• Thousands of job sites nationwide
• Focused on complex processes
Middough typically used client legacy standards

We had developed partial sets of unique specs, standards, and details

However, they were not complete

Significant cost to develop and maintain

While they were good, they were not recognized in the industry
Middough recent project activity spans $50 to $200 million in total installed cost

- Scale demands a significant number of standards
- 3D design also drives need for specification libraries

Several projects still executed to client standards

- But for newer clients standards were either missing, conflicting, incomplete, or out of date
PIP PRACTICES WERE THE SOLUTION

- More efficient than creating standards on our own
  - Less expensive to develop and implement
  - Lower maintenance costs to stay current
  - Excellent feedback on what is going on in the industry
  - Easy to use

- Accepted and used by large segment of industry including several existing Middough clients

- Impressive member base supporting PIP

- Pip interest in expanding to other industries fits well with Middough’s broad client base
ENABLING KNOW HOW FOR MIDDOUGH

Decreasing Reliance On Legacy Standards

Tailor Specifications To Individual Client Needs

PIP Practices

Unifying Platform For Multi-Industry Projects

Pharma    Biotech    Process    Power    Metals
Selecting the Educators: Functional Team Members and Discipline Contacts

- **Functional Team Selection**
  - Recognized in Shaw as Subject Matter Experts
  - Must have relative control of own time (projects recognize value)
  - Regularly participate in Shaw internal knowledge sharing sessions
  - Must be low cost trip expense

- **Discipline Contact Team Selection**
  - More on this on next slide

Functional Team Member – Required
Discipline Contact - Optional
EDUCATING THE TECHNICAL WORKFORCE

Discipline Contacts

Discipline Contact Team Selection
- Achievers — adoption is not easy
- Highly Motivated — overcome resistance
- Experienced yet relatively early in their careers
- Good working relationship with their Chief Engineers
  - Need to be able to bring the Chiefs into negotiations with Subject Matter Experts

Discipline Contact Education and Value
- Technical Mentoring
  - Working with Global and Local Chief Engineers
- Recognition
  - ShawWeekly, Shaw Technical Blogs
- Leadership
  - Presentations to Shaw Discipline Groups, Shaw PM Forum
  - Explaining practices on the project floor
EDUCATING THE TECHNICAL WORK FORCE

- **Types of Learning**
  - PIP Practices are rich in content
  - Collaboration: Understanding our Clients
    - TIC vs. Cost of Ownership
  - Surveys of Members
    - Adoption Surveys
    - Software Surveys

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**PIP 2011 Software Survey Results**

<table>
<thead>
<tr>
<th>Internet Browser (All Internet Explorers)</th>
<th>Microsoft Office Version (Word, Excel, etc.) (not operating system)</th>
<th>Adobe Reader Version (to open PDFs, including PIP Practices)</th>
<th>Email Attachment Size Limit (MB)</th>
<th>Company Document Management System(s) for Documents Within the Company</th>
<th>Document Control System(s) for Documents Flowing into and Out of the Company</th>
<th>Company Material Management System</th>
<th>What Engineering/Intelligent Database Software does your Company use by discipline?</th>
<th>Other Pertinent Information</th>
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<td>Documentum, SharePoint, Inhouse</td>
<td>Accelion</td>
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<td>SmartPlant/PM, Instrumental &amp; Electrical &amp; SD, PSS ID</td>
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<td>SharePoint, Document Direct, ProjectWise</td>
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<td>Manual Policies &amp; Procedures, FileNet</td>
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EDUCATING THE TECHNICAL WORKFORCE

Rich Content in the PIP Practices

Perform ‘read-throughs’ on the project floor.

5.4.5 A construction detail for a compacted granular fill foundation with a steel band is shown in Figure 2.

*Figure 2. Granular Fill Foundation with Steel Plate Band*

The foundation may be determined using the equation:

\[ b = \frac{P_t + W_p (L)}{q_a + (h - e)\gamma_s - h\gamma_c} \]

*Figure 5. Calculating Foundation Bearing*
Reducing Cost – Owners / Contractors Working from the Same Set of Rules

- Less commercial risk when our client’s are using PIP
  - Due to reduced uncertainty in the project’s design and engineering rules at the bid phase.
  - Forecasting schedules and budgets is easier because of relevant past history.

- Less cost when our client’s are using PIP
  - Lower deviation count to negotiate and manage.
  - Learning curves are shorter which helps productivity in personnel.
  - More team help to individuals
# REDUCING COST – LESS SHAW MAINTENANCE ON PRACTICES

## Adoption Decisions:
- What PIP Practices have our competitors adopted?
- What PIP Practices have our customers adopted?

### PIP Adoption Summary
(Note: To view other reports select additional tabs in this workbook.)

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of responses</th>
<th>41</th>
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### Table: PIP Adoption Summary

<table>
<thead>
<tr>
<th>Practice Number</th>
<th>Practice Title</th>
<th>Y1 = Adopted</th>
<th>Y2 = Plan to adopt</th>
<th>Y2 for Shaw Competitors</th>
<th>Y2 for Our Competitors</th>
<th>N1 = No plans to adopt due to task of application</th>
<th>N1 = No plans to adopt due to general attitude</th>
<th>N2 = No plans to adopt due to general attitude that would be required</th>
<th>N3 = No plans to adopt as explained above</th>
<th>N4 = Unknown</th>
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<td>C1F CE1000</td>
<td>External Coating Selection Criteria</td>
<td>68%</td>
<td>10%</td>
<td>83%</td>
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<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>15%</td>
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<tr>
<td>C1F CE1001</td>
<td>Guidelines for Use of Coatings Practices</td>
<td>61%</td>
<td>12%</td>
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<td>C1F CE1002</td>
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<td>5%</td>
<td>17%</td>
<td>15%</td>
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<tr>
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<td>7%</td>
<td>15%</td>
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<tr>
<td>C1F CE1009</td>
<td>Hot Insulation Installation Details</td>
<td>40%</td>
<td>5%</td>
<td>100%</td>
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<td>0%</td>
<td>0%</td>
<td>3%</td>
<td>3%</td>
<td>15%</td>
</tr>
</tbody>
</table>

For an Owner Member Company, a Practice is considered to have been adopted once the company has incorporated the Practice into its specification system or otherwise made it available for use by its business units. For a Contractor Member Company, a Practice is considered to have been adopted once the company has incorporated the Practice into its specification system and offered it to its customers for use on projects.
Reducing Cost: How PIP Helps Shaw’s Practice Development

- **PIP Development of Practices — the PIP Work Process**
  - PIP’s Operations Manual
  - ADGs: Administrative Guides
    - Specification for Developing Practices
    - Specification for Editing Practices
    - Specification for Developing CAD Graphics for Practices
    - Specification for Developing Data Forms for Practices
    - Specification for Revising Practices
    - Guidelines for Increasing Global Application of Practices
Shaw Development of Practices

- The Shaw Work Process
  - Shaw has over 1500 practices
  - 1/3 are Adopted PIP Non-Proprietary Practices
  - 2/3 are Shaw Proprietary Practices
    - Work Process Proprietary
    - Refinery / Chemical Process Proprietary
    - Material Management Proprietary
    - Project Engineering Management Proprietary

The Shaw Functional Responsibilities for Practice Development
REDUCING COST:
HOW PIP INFLUENCED SHAW’S ORGANIZATION

PIP STEERING TEAM

EXECUTIVE COMMITTEE

FTS1  FTS2  ————  ————  ————  ————  ————  FTSn

FUNCTION TEAM LEADERS
(FUNCTION TEAM LEADERS & SPONSORS)

FTL1  CSA
FTL2  ELECTRICAL
FTL3  CIR
FTL4  MACHINERY
FTL5  PIPING
FTL6  P & I D
FTL7  VESSEL
FTL8  PROC CTL

STEERING TEAM COMMITTEES

LEGAL
MARKETING
WORK PROCESSES
REDUCING COST:
HOW PIP INFLUENCED SHAW’S ORGANIZATION

Senior V.P. of Engineering

Engineering Excellence

Global and Local Chief Engineers

Senior V.P. of Engineering

Engineering Excellence

Chief Eng 1
Chief Eng 2
Chief Eng n

Global and Local Chief Engineers

Discipline Contact
ELECTRICAL

Discipline Contact
MECHANICAL

Discipline Contact
CSA

Discipline Contact
PIPING

Discipline Contact
FEE

Discipline Contact
I & C

STRATEGIC INITIATIVE TEAMS
COST EFFECTIVENESS
SOFTWARE TOOLS
WORK PROCESSES
Why PIP Enables Technical Networking

- Clear definition of Non-proprietary means a clear definition of boundaries.
- Similar demographics — engineers, technical experts, energy and chemical business lines.
- Published lines of communication — phone numbers, email addresses, regularly scheduled off campus meetings.
- Long term relations

Collaborative Attitude
PIP Social Technical Network
SECRET SAUCE:

- **No Technical Hierarchy**
  - All Subject Matter Experts

- **No Contractual Hierarchy**
  - No Owner / Contractor relationship

- **No Competition**

- **PIP Management fosters an environment of collaboration**
Process Industry Practices

A Case Study of the Benefits and Secrets of E&C Industry Peer Collaboration

Q&A?

Paul Jahn, Middough
Wayne Dolbec, Shaw Group, PIP Chairman 2012