Operational issues for transitioning to the pilot plant scale

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A pilot plant is a tool intended to allow investigation of a process or process problem on a manageable scale in a realistic manner in a timely fashion. – Richard Palluzi

Build the tool. Use the tool.

Know the design goals – spec, build, & staff accordingly.

Integrate safety and quality at every step.

Assess, plan, & execute
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Biomass Deconstruction
Fermentation
Recovery
Off-line Analytics

ABPDU
Lower barriers to market entry
Be a proving ground for new technologies
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Build the Tool…
- Facility Readiness
- Staff Readiness

Use the Tool…
- Technology Readiness
- Technology Transfer
- Project Management
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Facility Readiness

Facility Design

Goals & Requirements

Predecessors

Construction & Startup Teams

Equipment Specification & Selection

Engineering Controls

Documents

Data management infrastructure

Maintenance
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Facility Readiness

Facility Design

Engineering Controls

Documents

Data management infrastructure

Maintenance

Ex: Two Successes & One Failure…
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Facility Readiness

Facility Design

Engineering Controls

Documents

Data management infrastructure

Maintenance

Sprinklers & Alarms
Rupture disks & Check valves
Electrical relay bypasses
Interlocks
Continuous monitoring & control
...

Design expertise and experience
Risk assessment
Implementation and testing
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Facility Readiness

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Facility Readiness

Facility Design

- Design documents
- Turnover Documents
- As built drawings
- P&IDs, Circuitry & Logic
- Materials of build
- Equipment Manuals
- Purchase Histories
- Commissioning Reports
- Inspection and readiness reports
- Safety Plan
- Emergency Response & Contingency Plans
- Arc Flash Study
- Hazardous Materials Business Plan
Facility Readiness

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Facility Design

Engineering Controls

Documents

Data management infrastructure

Maintenance

Document control and collaboration
cloud servers, SharePoint, etc.

Relational Databases
facilities, assets, training records, & projects

Process control & data collection
central, local, or mixed
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Facility Readiness

Facility Design

Engineering Controls

Documents

Data management infrastructure

Maintenance

Contracts

Contractor Rapport

Facilities, riggers, et al. teams

LOTO and HazWOPer certifications

In-house maintenance activities

Schedules & tracking
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Staff Readiness

Never doubt that a small group of thoughtful, committed people can change the world. Indeed, it is the only thing that ever has. – Margaret Mead
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Staff Readiness

Team Size & Expertise
- Facility dependent

Operational Excellence
- Extremely important strategic process
- Subject to rapid change

Administrative Controls
- Money Ball-esque approach not available

Training

Morale
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Staff Readiness

Team Size & Expertise

Operational Excellence

Administrative Controls

Training

Morale

SMART Goals

Lean
- Pull & Flow
- Changeability
- Continuous Improvement
- Identify and eliminate waste

Process Control
- Standard Work
- Trend Analysis
- Gauge R&R
- Six Sigma
Staff Readiness

Team Size & Expertise

Operational Excellence

Administrative Controls

Training

Morale

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5.3.3 Ensure bolts securing the top plate are tightened.

5.3.4 Ensure all probes and blind plugs are tightened.

5.3.5 Ensure there are no system alarms. If there are any alarms check what they are in the “Alarms” window and determine how they can be rectified.

5.3.6 Empty the water from the vessel.

5.3.6.1 Connect a hose to the 1 1/2” tri clamp fitting at the harvest port (KV-19), route the hose to the floor drain.

5.3.6.2 Open the “force Proc/Oper” window via the “Utilities” window. Set the “State #,” “Procedure #,” and “Operation #” to 1, 5 and 1, respectively.

5.3.6.3 Press [Enter Now] button to begin the harvest procedure. After the temperature and pressure reach the control points press the [Advance] button to begin draining the reactor.

5.3.7 Connect any probes that were stored out of place, e.g. pH probe.

5.4 Calibrate pH probe

Note: pH probe must be calibrated once prior to sterilization using standard buffers and checked against a media sample after sterilization using a bench top probe.

5.4.1 Ensure the vessel is empty, then remove pH probe from the vessel. Inspect the probe for damage or debris, rinse with DI water and pat dry with Kimwipes.

5.4.2 Enter calibration mode by pressing the [Cal] button on the pH transmitter.

5.4.3 Navigate using the [↑]/[↓] buttons until “Channel A pH” is displayed, then press the [Enter] key to advance to the “pH Calibration” menu.

5.4.4 Use the [↑]/[↓] buttons to select “2 point” as the type of calibration; press [Enter].
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Staff Readiness

Team Size & Expertise

Operational Excellence

Administrative Controls

Training

Morale

Safe Practices

Built into every SOP, batch record, and routine inspection.

Checklists

Callouts

Work alone restrictions

Continuous improvement

Training
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Staff Readiness

Team Size & Expertise

Operational Excellence

Administrative Controls

Training

Morale

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5 Procedure

Figure 1. The Job Instruction reference card, initially devised by the US Army in 1944 remains largely unchanged and still in use today, within many companies throughout the world.

<table>
<thead>
<tr>
<th>JOB INSTRUCTION POCKET CARD</th>
<th>HOW TO INSTRUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP 1 – PREPARE THE WORKER</td>
<td>• Put the person at ease</td>
</tr>
<tr>
<td>• State the job</td>
<td>• Find out what the person already knows</td>
</tr>
<tr>
<td>• Get the person interested in learning the job</td>
<td>• Put the person in correct position</td>
</tr>
<tr>
<td>STEP 2 – PRESENT THE OPERATION</td>
<td>• Tell, show and illustrate – one IMPORTANT STEP at a time</td>
</tr>
<tr>
<td>• Do it again – stress KEY POINTS and REASONS</td>
<td></td>
</tr>
<tr>
<td>• Instruct clearly, completely, and patiently giving no more than they can master at one time</td>
<td></td>
</tr>
<tr>
<td>STEP 3 – TRY OUT PERFORMANCE</td>
<td>• Have the person do the job – stating IMPORTANT STEPS – correct for errors</td>
</tr>
<tr>
<td>• Have the person do the job again – explaining KEY POINTS and REASONS</td>
<td></td>
</tr>
<tr>
<td>Make sure the person understands</td>
<td></td>
</tr>
<tr>
<td>Continue until they know</td>
<td></td>
</tr>
<tr>
<td>STEP 4 – FOLLOW UP</td>
<td>• Put on own</td>
</tr>
<tr>
<td>• Who to go to for help</td>
<td></td>
</tr>
<tr>
<td>• Check frequently</td>
<td></td>
</tr>
<tr>
<td>• Encourage questions</td>
<td></td>
</tr>
<tr>
<td>• Taper off coaching</td>
<td></td>
</tr>
</tbody>
</table>

5.1 Preparing for Job Instruction

5.1.1 Prepare an agenda for training, which includes:

1. Who to train
2. What skills you expect the trainees to accomplish
3. What training level you expect the trainees to be at the beginning and end of the training
4. What date do you expect to accomplish all this.

5.1.2 List important steps associated with the job as well as selecting the key points on the Training Module. Safety factors are always key points.
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Staff Readiness

- Team Size & Expertise
- Operational Excellence
- Administrative Controls
- Training
- Morale

- Strategic Vision
- Inclusion
- Ownership
- Stretch Goals
- Transparency
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Technology Readiness

Plant’s ability to execute a project.

Process history

Specs, expectations, unknowns, & risks

Process economics
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Technology Transfer

Harmonize analytical methods.
Verify process protocols, batch records, components, as well as reagent grades & high-impact consumables.
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Project Management

Charter
Deliverables
Resource Mgmt
Daily work programming
Protect the project -- Beware Scope Creep
Meet the expectations
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Thank You!