Approach to Identifying and Solving Problems beginning at Plant Operation

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**Improvement Activities Carried Out in the Field**

Field Improvement Activities:

- Define Problem
- Organize and Analyze
- Effective Action

"Concerns"

- Safety
- Stability
- Guarantee
- Quality
- Global
- Efficiency
- Human
- Environment
- Development

Production Field
Sometimes You May Feel as if You Are Whacking Moles

As long as your action does not remove the root cause, the problems will occur repeatedly
Today’s Subject

Today I will present with some examples to increase the effectiveness of field improvement activities, along with the approach method.

- Start from the plant operation and provide extensive and continuing benefits in level 0~3 layers of ISA-95.

IEC62264.03/ISA-95 Functional Hierarchy Model
How Is the Operator Working?

- Auto Control
- Manual Intervention
- Operation
- Alarm
- Screen Switching
- Change (Parameters)
- Monitoring
- Judgment
- Plant
- DCS Console
- Operation
- Quality Analysis
- Field Work
- Manual Intervention Operation
- Change (Parameters)
- Judgment
- Plan
- Result
Understanding Current Status of Operation Utilizing Benchmark Report

- Overview of Operation

- Average the index rankings for each category

- The longer the vector, the better the performance

- Category Balance

- Target
- Top
- Top 25%
- Top 50%
- Top 75%

* The gray area indicates the bottom 25%.
What Is the Root Cause?

- Alarms occur frequently
- There are many manual operations

Think of the causes behind the visible events!

Identify the root cause and consider the solution

Superficial Problems

Hidden cause of problems
Approach to Identifying Problems 1

Implementation Examples for Chemical Plants
Operation Improvement Example at Chemical Company A

Customer Plant
- Low density polyethylene plant

DCS System and Process Operation Status
- Continuous polymerization plant
- Brands are switched often
- Labor saving automation is advanced
- Relatively many manual operations
- Alarm generation is extremely infrequent
Separate operation into the steady state and brand switching (auto and manual)

### When switching brands

<table>
<thead>
<tr>
<th></th>
<th>Auto</th>
<th>Manual</th>
<th>Sub-total</th>
<th>Steady State</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation time percentage (%)</td>
<td>1.2</td>
<td>3.4</td>
<td>4.7</td>
<td>95.3</td>
<td>100</td>
</tr>
<tr>
<td>Number of operations (%)</td>
<td>5.7</td>
<td>38.6</td>
<td>44.3</td>
<td>55.7</td>
<td>100</td>
</tr>
<tr>
<td>Number of alarms that occurred (%)</td>
<td>4.3</td>
<td>35.6</td>
<td>40.2</td>
<td>59.8</td>
<td>100</td>
</tr>
</tbody>
</table>

Brands are manually switched unexpectedly often

Manual intervention operations are concentrated in this area

Number of alarms that occurred

Number of operations
Major Problems | Solution Proposal
--- | ---
Problem 1. It is time consuming to switch brands manually |
Problem 2. There is a variation in the time until quality is stabilized when switching brands |
Problem 3. Stabilization and quality are dependent on the monitoring of the operator when switching brands |
Approach to Identifying Problems 2
Comments from Management

- We want to eliminate unnecessary operations and ensure safety and security at the plant.
  - Operators are busy dealing with problems so improvement activities need to be reviewed.

**Expectation**
Focus should be concentrated on achieving goals

**Gap (Frustration)**

- Near accident
- Giveaway (loss)

**Actual situation on the production floor**
- Failure
- Operation error
- Clogging

**Busy dealing with Problems**
Basics for Approach to Identifying Problems

Highlight problems by both understanding the daily field operations and the facts based on data

Starting point to approach problems (1)
Develop a hypothesis from the interview results

Starting point to approach problems (2)
Discussion based on the data

Search for the root cause
### Basics for Approach to Identifying Problems

- Highlight problems by both understanding the daily field operations and the facts based on data

#### Starting point to approach problems (1)
Develop a hypothesis from the interview results

#### Starting point to approach problems (2)
Discussion based on the data

#### Search for the root cause

- Composition of an improvement team:
  Leader, field supervisor, production staff, instrumentation/machinery, etc., Yokogawa

#### [Goal Examples]
- Eliminate unnecessary operations in the operation flow, so that the operator can concentrate on safe and secure operations
- Members can share the whole operation flow from production plan through to operation
- Improve yields and quality, so that the quality can be stabilized
Approach to Identifying Problems 3

Stabilize the Quality Using Pattern Recognition Technology
**Stabilize the Quality Using Pattern Recognition Technology**

<table>
<thead>
<tr>
<th>Target</th>
<th>Zero Complaints</th>
<th>Reduction in Quality Defects</th>
<th>Zero Quality Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>Quality Inspection</td>
<td>Defect prediction in production process</td>
<td>Root Cause Analysis</td>
</tr>
<tr>
<td>Means</td>
<td>Multivariate Quality Inspection</td>
<td>4 M Inspection Using CBM</td>
<td>4 M Real-time Monitoring</td>
</tr>
<tr>
<td>Action</td>
<td>Quality Card System</td>
<td>Equipment Abnormality Inspection System</td>
<td>Quality Real-time Monitoring System</td>
</tr>
</tbody>
</table>

**Example:**
- **Film Forming Process**
- **Batch Process**

4M Material Method Man Machine
## Application Examples

<table>
<thead>
<tr>
<th>Equipment Name</th>
<th>Steady/Unsteady</th>
<th>Application Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Reactor</td>
<td>Steady</td>
<td>Polymerization reaction monitoring</td>
</tr>
<tr>
<td>Batch Reactor</td>
<td>Steady</td>
<td>Polymerization reaction monitoring</td>
</tr>
<tr>
<td>Refining Column/Distillation Column</td>
<td>Steady</td>
<td>Control monitoring</td>
</tr>
<tr>
<td></td>
<td>Unsteady</td>
<td>Process data balance monitoring</td>
</tr>
<tr>
<td>Heat Exchanger</td>
<td>Steady</td>
<td>Efficiency monitoring</td>
</tr>
<tr>
<td>Cracking Furnace</td>
<td>Steady</td>
<td>Performance monitoring</td>
</tr>
<tr>
<td>Extruder</td>
<td>Steady</td>
<td>Extrusion quantity balance monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resin quality monitoring</td>
</tr>
<tr>
<td>Film Forming Equipment</td>
<td>Steady</td>
<td>Quality characteristics monitoring</td>
</tr>
</tbody>
</table>
Solve Problems Approach

Benchmark report for quantifying

Dig deep to reach the problem

Approach to the root of the problem

Drilling from the perspective of quality

Manual Cont.

Difference Between operators

Quality
Framework for Solving Problems  Three Introductory Steps

Step 1  Opportunity Identification Services
Identify new areas of improvement and prepare for the solution

Step 2  Solution Implementation Services
Introduce the optimum solution to solve the problem

Step 3  Lifecycle Effectiveness Services
Monitor the achieved improvement effect permanently

Plant Lifecycle
New Plant Construction
Operation
Plant Disposal
Operation
Plant Extension
and System Upgrade