Automating Manual Procedures in Continuous Process Applications Using the Concepts of ISA-106

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ISA106 Standards Committee

Procedure Automation for Continuous Process Operations

Membership

- 168 members from 106 companies
- 25 voting members
- ~45% of members are from owner / operators

Co-Chairmen

- Yahya Nazer, Dow Chemical
- Bill Wray, Bayer Material Sciences
Membership (partial)

- ABB
- Aramco Services Co
- AREVA
- Bayer MaterialScience
- BP Lubricants
- Braskem
- CDM Smith
- CH2M HILL
- Chevron
- Conocophillips
- DuPont
- Emerson Process Management
- ExxonMobil
- Herman Storey Consulting
- Honeywell
- Invensys
- Mustang Automation and Control
- NovaTech Process Solutions
- PAS
- Prosys
- Rockwell Automation
- RSI Simcon
- Saudi Aramco
- Savannah River Nuclear Solutions
- Shell
- The Dow Chemical Company
- Valero Energy Corp
- Yokogawa
ISA106 Work Items

- Published 1st Technical Report in 2013
  - Models and Terminology
  - Available in the ISA store at www.isa.org

- Working on the 2nd Technical Report
  - Work Processes

- Work on the Standard is expected to start in 2014
  - Use industry feedback on the technical reports to create the standard
Technical Report 1: Models and Terminology

States committee’s current thinking on how to organize and approach procedure automation

**Models**
- Concepts to give the industry a common mental model

**Terminology**
- Definitions to give the industry a common language

3.1.45 state-based control
A plant automation control design based upon the principle that all process facilities operate in recognized, definable process states that represent a variety of normal and abnormal conditions of the process.

3.1.46 status notification
A notification generated by the BPCS that helps provide the operator situational awareness, is part of normal operation and does not require operator action.
Summary sheet

ISA-106 Procedure Automation for Continuous Process Operations Technical Report 1 Summary 1 of 2

Technical Report Summary

Committee Purpose: Develop Standard for automating procedures in continuous process operations.

Scope of Technical report is to provide a common basis of understanding of the benefits, best practices, application, and language including terms and definitions, that will allow for the application of procedure automation across the continuous process industries.

In agreement with the scope of the ISA88 Committee, this Technical Report focuses on substation Procedures that primarily reside on systems within the supervisory control, monitoring, and automated Process Control (CP) section of the production process. It is not the intent of the committee to have this Technical Report focus on Procedure execution at the operations management functional level.

Additionally, the focus of this Technical Report will be on continuous processes. However, the contents of the technical report may be used in other types of Process Control such as batch or discrete.

The Technical Report is intended to be applicable to Process Control activities within the Basic Process Control Systems (BPCS) and Safety Instrumented Systems (SIS).

Key Definitions

Basic process control system (BPCS): System which responds to input signals from the process, its associated equipment, other programmable systems and/or an operator and generates output signals causing the process and its associated equipment to operate in the desired manner which does not perform any safety instrumented functions with a claimed SIL or SIL 1.

Implementation methods: A tool used to create a Task Example: Programming languages, BPCS configuration tools and a word processor.

Operator confirmation operation: The command is performed by the control system, however the operator needs to verify.

Procedural automation: Implementation of a procedure on a programmable mechanical, electrical, or electronic system.

Process point of view: The point of view of a particular unit as a whole, not as a collection of individual loops. A control program written from the process point of view allows the operator to interact with the process as opposed to with control loops.

Process state: Distinct mode of operation that a unit moves through as it progresses from startups to shutdowns and back to startups. Each Process State represents a unique operating regime that supports the unit’s objectives of processing an input into a desired output.

State-based control: A control program methodology that utilizes a framework that defines the “process states” through which a unit passes during startups, shutdowns, and startups.

State-based alarm (mode-based alarm): An alarm that is automatically modified or suppressed based on process state.

Value Proposition Summary

1. Improved safety performance - Automating procedures and utilizing state awareness for alarm management the workload on the operational staff is reduced during abnormal conditions. This enables more effective responses to abnormal conditions and reduces the probability of human error.
2. Improved reliability - Automated procedures can aid in maintaining maximum production rates, minimizing recovery time, and avoiding shutdowns.
3. Reduced losses from operator errors - Automating procedures automate operations staffs to standardize their operating procedures. A standard approach both reduces the likelihood for human error contributing to abnormal conditions and also reduces the time required to recover from abnormal conditions.
4. Increased Production by improving startups and shutdowns - Operations may benefit by achieving faster, safer and more constant startup and shutdown operations of processes by automating the procedural steps.
5. Increased Production and Quality via efficient transitions - Most operational requirements staffs require process transitions from one condition to another during normal operating conditions. Automating procedures enables operators to accomplish transitions with reduced variability and in less time.
6. Reduced losses through improved responses to disturbances - Automated procedures can be prepared for potential disturbances, reducing the time to return operations to desired steady state conditions.
7. Improved Operator Effectiveness - Reduces the time an operator spends carrying out repetitive tasks and analyzes them to focus on process optimization and avoidance of abnormal conditions.
8. Higher Reliability and Improved Dissemination of Knowledge - Automated procedures can be used to maintain the knowledge of the operator. This process is especially important for procedures that are not executed frequently.
9. Improved Training - As knowledge and best practices are captured into automated procedures, the resulting documentation and code can be used as material for training new operators on the process.
10. Improved Insight into the process - By recording system and operator actions with procedural automation, users have the opportunity to review and analyze data from unit startup, shutdown, process transition, and abnormal condition recovery.
11. More efficient change control - A structured, modular approach to procedural automation minimizes production and change control costs.
12. Reduced costs of enterprise adaptation - Once the overall and standard framework for sequence control has been defined and implemented, it can be modularized into libraries of code/procedures/documentation to allow easy deployment/application from one area to sites to another.
13. Common definitions and terminology - Operational staff have a common set of terms with uniform definitions to describe the requirements for improvements and changes in procedural automation. This improves communications with EOC’s, system integrators, automation suppliers, and internal company departments.
Examples of Physical Model Level Names

<table>
<thead>
<tr>
<th>Physical Model Level</th>
<th>Level Name/Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td>An Equipment grouping to carry out one or more processing activities such as reaction, crystallization, or distillation. It contains all necessary physical processing and control process equipment required to perform those activities as an independent process equipment grouping.</td>
<td>Resin - Dry/Dew Oil Tanks, Filters, Distillation Column, Reactor, Compressor, Glycol Pump, Wall Head, Sequence, Reactor, Pelletizer, Flat Bed, Reaction Cell</td>
</tr>
<tr>
<td>Device</td>
<td>A collection of physical devices and process hardware that performs a finite number of specific processing activities.</td>
<td>Pump Set, Compressor, Feed System, Analyzer and Sampling System</td>
</tr>
<tr>
<td></td>
<td>The lowest level of physical hardware in the Physical Model in a Process. Examples include control valves, instrument, and motors.</td>
<td>Analyzer, Pump, Control Valves, Temperature Transmitter</td>
</tr>
</tbody>
</table>

An Automation Style is a consistent approach to designing and implementing implementation modules. Automation Styles provide operators with confidence in the use of automated procedures and can lower engineering costs by providing a framework that fosters re-use of procedural logic.

There are any number of Automation Styles that cover a spectrum of existing styles from a no automation resulting in full manual operation to complete automation with fully automated operations.

An important aspect of an Automation Style is how much process knowledge is to reside in the Automated Procedures. More complex Automation Styles contain more process knowledge and can therefore perform more normal and abnormal process conditions automatically thereby providing more consistent and efficient operation of the Process.

Simpler Automation Styles contain less process knowledge so the Operator must more Procedures and more closely monitor the Process. Three examples of Automation Styles are:

- Manual Automation Style - The Operator is responsible for the Command, Perform, and Verify work items. The Operator may use the BPCS controls to local indicators and actuators in the field, but there is no computerized Procedure Automation involved.
- Computer Assisted Automation Style - Implementation Modules are created computer-assisted when the Operator and computer share responsibility for the Command, Perform, and Verify work items. The computer is responsible for the bulk of the Command, Perform, and Verify work items.
- Fully Automated Automation Style - Implementation Modules are consistently fully automated when the computer is responsible for the bulk of the Command, Perform, and Verify work items.

Process States - States-Use of Process States is one method that gives a framework for organizing automated Procedures so more complex Automation Styles are used.

When using Process States, Procedural Automation is centered on a major piece of equipment, usually a Unit. States are defined based upon the physical conditions, the process equipment passes through to insure safe and efficient operation of the Process. The process state concept can be expanded to implement State Based Controls.

Implementation Modules - Consist of a set of ordered tasks. Tasks may overlap other tasks. Each task provides plant operations with step-by-step instructions for accomplishing the actions that are to be performed and their verification. From an operational perspective, a procedure is one or more implementation modules. A figure below shows the components and input/output of an implementation module.

Mapping Implementation Modules to BPCS Components - Implementation Modules are run by a BPCS controller or a BPCS application server. Figure below provides a conceptual diagram of a BPCS and shows Implementation Modules in the controller and application server.

Three work items are required for the Implementation Module to execute:

- Command - The trigger to initiate the Implementation Module. When received this causes the Implementation Modules to Perform its Tasks. A Command may be issued by an Operator or another Implementation Module.
- Perform - The execution of a Implementation Module’s Tasks. A Task may use any type of Implementation Method, but ultimately the Task is performed by an Operator or a computer.
- Verify - Verification that the Implementation Module’s Tasks were performed successfully or failed. The verification may use any type of Implementation Method, but ultimately the verification is performed by an Operator or a computer.
Typical Targets for Automated Procedures

- **Refining**
  - Transition Management for Crude Switchover
  - Regeneration

- **Petrochemical**
  - Startup / Shutdown
  - Transition Management for Grade Changes
  - Line Switchover
  - Cleaning

- **Polymers**
  - Grade change
  - Switchover

- **Furnaces**
  - Decoking
Benefits of Using Procedure Automation

- Consistent operation
- Improved safety performance
- Increased production by improving startups and shutdowns
- Increased production and quality via efficient transitions
- Improved operator effectiveness
- Improved insight into the process

- Reduced losses through improved responses to disturbances.
- Reduces risk and losses due to fewer operational errors
- Ensures & documents compliance with procedures
Aim to Capture Best Operating Practices

Operator A’s Procedure

Operator B’s Procedure

Operator C’s Procedure

Best-Practices Procedure

- Capture the Best Procedure from all operator inputs
- Combine into a Best Practice Procedure
Which Procedures Should Be Automated?

Automating a procedure requires
- Review and sometimes updating the current procedure
- Engineering design, implementation and testing
- Operator acceptance

Base the decision upon what your business justification is
- Where is your value

Possible criteria
- Risk reduction / Safety improvement
- Consistent operation
- Critical, low frequency procedures like startups and shutdowns
- Complex procedures
- Opportunities for improved profitability, as with transitions
- Highly repetitive and low value tasks performed by the operator to free up their time for higher value work

What is your experience level with automated procedures?
Organizes physical equipment into a hierarchy

- Foundation of the ISA-106 work
  - Each item in the model can have procedures

- Provides a common set of terms and equipment levels for companies & industries to map their terms to
  - Common terms enable products and people to work more efficiently with different owner/operators.
### Physical Model - Today

#### Results of committee owner/operator terminology

<table>
<thead>
<tr>
<th>ISA-106</th>
<th>Chemical Company</th>
<th>Oil Refinery</th>
<th>Offshore Oil Platform Example 1</th>
<th>Offshore Oil Platform Example 2</th>
<th>Paper Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enterprise</strong></td>
<td>Enterprise</td>
<td></td>
<td>Field</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Site</strong></td>
<td>Site</td>
<td>Site</td>
<td>Platform</td>
<td>Platform</td>
<td></td>
</tr>
<tr>
<td><strong>Plant</strong></td>
<td>Plant</td>
<td>Complex</td>
<td>Package</td>
<td>Mill</td>
<td></td>
</tr>
<tr>
<td><strong>Plant Area</strong></td>
<td>Area</td>
<td>Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unit</strong></td>
<td>Unit</td>
<td>Unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Device</strong></td>
<td>Device</td>
<td>Device</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Physical Model - Examples

#### Results of committee owner/operator terminology

<table>
<thead>
<tr>
<th>Enterprise</th>
<th>Corporate</th>
<th>Division</th>
<th>Business Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Complex</td>
<td>Train</td>
<td>Facility</td>
</tr>
<tr>
<td>Plant</td>
<td>Platform</td>
<td>Train</td>
<td>Verbund</td>
</tr>
<tr>
<td>Plant Area</td>
<td>Separation Injection</td>
<td>Train Utilities</td>
<td>Gas Compression Dehydration</td>
</tr>
<tr>
<td>Unit</td>
<td>Separator</td>
<td>Dry/Wet Oil Tanks</td>
<td>Pipeline Pumps</td>
</tr>
<tr>
<td>Equipment</td>
<td>Pump Set</td>
<td>Feed System</td>
<td>Reboiler</td>
</tr>
<tr>
<td>Device</td>
<td>Control Valve</td>
<td>Transmitter</td>
<td>Pump</td>
</tr>
</tbody>
</table>
Ethylene Furnace Example

Plant Area

Unit

Furnace 1
Furnace 2
Furnace 3
Furnace 4
Furnace 5
Ethylene Furnace Example

Plant Area

Unit

Equipment

Device

Air & Fuel Input

Discharge

Heater

QUENCH TOWER

DECOKE DRUM
Procedures are associated with objects in the physical model
- Most common for units, equipment and devices

Definition of the procedure
- Actions that must be done to accomplish an objective
- Functional requirement for the automated procedure
Procedure Implementation Model

- The actual automated procedure
  - Program, function block, sequential function chart, flowchart,…

- The design of implementation modules is an engineering process
Procedure Execution

- Each Procedure, Implementation Module & Task has 3 execution work items
  - **Command** – Trigger
  - **Perform** – Actions
  - **Verify** – Success/Failure

- Computer/Human Mix
  - C-P-V work items can be done by a computer or human

Command >>>>>> Perform >>>>>> Verify
<table>
<thead>
<tr>
<th>Operator Notification Types</th>
<th>Operator is expected to take an action</th>
<th>Operator might need to be aware but is not required to take action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arises from an abnormal process or equipment situation (ISA-18.2)</td>
<td>Alarm</td>
<td>Alert</td>
</tr>
<tr>
<td>Arises from a normal situation (ISA-106)</td>
<td>Prompt</td>
<td>Status Notification</td>
</tr>
</tbody>
</table>

ISA106 has worked with ISA18.2 which has published an alarm management standard
### Automation Styles

#### Examples of Automation Styles

- Organization of the structure of the implementation module such as using procedure sections or process states
- Use of computer or operator action for command, perform, verify
- Amount of precision used for verification
- Human machine interface philosophy
- Degree of automation from minimal automation to complex automation

<table>
<thead>
<tr>
<th>Example Automation Style</th>
<th>Example Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>The Operator is responsible for the command, perform and verify work items, minimal automation is used</td>
</tr>
<tr>
<td>Computer Assisted</td>
<td>Operator and computer share responsibility for the command, perform and verify work items. The amount of automation used may vary.</td>
</tr>
<tr>
<td>Fully Automated</td>
<td>Computer is responsible for the bulk of the command, perform and verify work items.</td>
</tr>
</tbody>
</table>
State-based Control

A plant automation control design technique that assigns process states and defined transition procedures

– Most effective at the unit level
– Provides a high degree of automation
  • Startup, Shutdown, Transitions, Abnormal Situation Responses
State-based Control Example

- Prepare Procedure
- Startup Procedure
- Production Rate of Change Procedure
- Abnormal Condition Handling Procedure
- Controlled Shutdown Procedure
Location is based upon safety, risk, cost and benefit.

Criteria include:
- Risk
- Response time requirements
- Operating philosophy for operator interaction with procedures
- Availability of instrumentation to perform automated tasks
- Implementation cost
- Procedure lifecycle cost
- Desire for incremental implementation of automated procedures
ISA-106 Technical Report 2

Procedure Automation for Continuous Process Operations - Work Processes
States committee’s current thinking on how to organize and approach procedure automation

Models
- Concepts to give the industry a common mental model for automated procedures

Terminology
- Definitions to give the industry a common language for automated procedures
Automated Procedure Lifecycle Reference Model

Procedure Automation Strategy
- Procedure Automation Philosophy
- Selection of Standards and Guidelines
- Toolkits and Examples

Lifecycle Instance

Snapshot

Planning and Definition
- Pre-FEED & FEED
- Instance Specific Philosophy
- Work Plan
- Toolkit

Requirements and Design
- Procedure Requirements
- Design Implementation Modules
- Test Plan

Implementation
- Create Implementation Modules
- Test Environment Implementation
- Documentation & Training
- FAT
- Installation and Commissioning

Operation
- Operator Feedback
- Monitoring
- Operational Audit
- Retirement

New Project or Major Changes

DRAFT
Snapshot for each Lifecycle Instance

Procedure Automation Strategy

- Procedure Automation Philosophy
- Selection of Standards and Guidelines
- Toolkits and Examples

Snapshots

Specific Project Lifecycle Instance 1
Specific Project Lifecycle Instance 2
Specific Project Lifecycle Instance n
Examples
Opportunity to automate a feed switch

Benefits:

- Operator workload reduced by 60%
- A 42% reduction in product yield loss
- Increased feed throughput during transition by 18%
- Reduced feed switch transition time by 36%

Console Operator Moves per Hour Comparison from paper “Improving Refinery Unit Transitions Using Process Automation Technology in a base Oil Hydroprocessing Facility. AIChE Spring 2011 Robert M. Tsai, Chevron, Richmond, CA
Acrylic Acid Production

Start-up time to steady state was reduced by 30%
Less variability in start-up time
Reactors able to come on stream 70% faster
Process safety margins, of explosive conditions during startup, were significantly increased

Automate Ramp Up of Production Wells

Define the opportunity

- Consistent Well Ramp Up procedure will minimize the amount of time required to get to full production
- Remove the variance between crews and experience level of operators

Measure how Currently Executed

- Historical data indicated that Ramp Up time was not the same for different operating crews.
- Ramp Up time took longer than estimated and times varied significantly.

Analyze information and determine opportunities for improvement

- One Operator manages multiple wells.
- Written procedure not up to date with current practices.
- Well Choke movements based on fixed clock time.
- Varying levels of experience with more than one method used for Ramp Up.
Automate Ramp Up of Production Wells

--- Improve the Procedure

- Develop one updated operating procedure with Operator input.
- Develop Exapilot procedure as a tool to aid Operator
  - Allow the Operator to easily manage multiple wells
  - Determine when to make well choke changes based on pressure stability criteria rather than a fixed time.
  - Dynamic simulator used to validate procedure steps.
  - Exapilot integrated into 3rd party process control system.
- Exapilot procedure will leverage the knowledge of the experienced Operator so that new Operators are able to achieve improved results.

--- Control the Process to Ensure Repeatability

- Implement Exapilot Modular Automated Procedure in operating environment
- Training of Operators on new procedure. Operators should understand how the automated procedure makes decisions and executes steps.
- Monitor results and develop metric to monitor performance.
Well Ramp Up Operator Screen for Drill Center

Modular Procedure Automation in Gulf of Mexico Deepwater Operations, Wayne Hawkins, Chevron at the 2012 Yokogawa Users Group Conference
Well Ramp Up Operator Screen for Drill Center

PRODUCTION WELL 2 - Exaplot Ramp Up Procedure

- Time: 10:33:49
- Message: W-2 Flowing Tubing Pressure Stable

- Time: 10:22:43
- Message: W-2 Ready to start ramping open.

- Confirmation Messages
  - Time of occurrence: 10:47:29
  - Time of acknowledgment: 

W-2 Downhole Pressure Stable

- Downhole Stable at 18051.0 PSIG, 210.0 Deg F Topside at 780.95 PSIG
- Current step: 23 Min, 0 Sec Press Drop 2180.0 PSIG
- Total 23 Min, 0 Sec Total Press Drop 2180.0 PSIG

Select one:

- Next Stability Check
- End Well Ramp.

Well Duty
- Production
- In Service

Well Interlocks
- In Service
“One Unit Procedure” for Multiple Wells

Well # 8105

Well # 8106

<table>
<thead>
<tr>
<th>GENERIC NAME</th>
<th>TAG NUMBER</th>
<th>ACTUAL UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>QAY8105</td>
<td>PMV</td>
<td>PMV8105</td>
</tr>
<tr>
<td></td>
<td>PMV8105</td>
<td>PMV8106</td>
</tr>
<tr>
<td></td>
<td>PWV</td>
<td>PWV8105</td>
</tr>
<tr>
<td></td>
<td>PWV8105</td>
<td>PWV8106</td>
</tr>
<tr>
<td></td>
<td>XOV</td>
<td>XOV8105</td>
</tr>
<tr>
<td></td>
<td>XOV8105</td>
<td>XOV8106</td>
</tr>
<tr>
<td></td>
<td>PCV</td>
<td>PCV8105</td>
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<tr>
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<tr>
<td></td>
<td>CID1</td>
<td>CID18105</td>
</tr>
<tr>
<td></td>
<td>CID18105</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>CIT2</td>
<td>CIT28106</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Instrumentation per tree can be configured differently using “*” in the table if not required.
The Dow Chemical Company, at the 2011 ARC Forum, explained how state-based control provides them a financial benefit.

Automating cleaning procedures can decrease the length of the shutdown as well. A recent example of this resulted in a 16% increase in profit for a plant.

Yahya Nazer, Ph.D. and Eric Cosman, The Dow Chemical Company, ARC Forum 2011
Procedural Assistance

- Procedures can guide and prompt operator
  - Command - operator decides when to take action
  - Perform - board operator performs control actions
  - Verify - computer or operator can verify actions successfully done

- Can help new operators become more confident and have constant backup

- Analysis of procedure execution can identify areas of variability
  - Good candidates for full automation
Capturing Operator Knowledge

Original SOP (Standard Operating Procedure)

1. Check base tank level LI100.PV >= 50%
2. Start pump P-101
3. Check answer back flag
4. Confirm field operator to open hand valve HV100

Capture Operator Knowledge!
**Alarm Response Procedures**

- Provide if-then-else scenarios to respond to alarms based on the process conditions or changes made by the operator
Rider Interactive Station (RIS) recognize and check the competence status of the specific person and presents a task list for the planned job.
Rider Personal on Board system

Every person receives a RFID card to log in on the Rider Interactive Station (RIS)
Rider navigation

Tuition - Drilling Operations - Change filter settings for rig LR-02

Choose textbook
search a textbook

Choose waybook
search a waybook

Subprocedures
search a subprocedure

- 1. Prepare casing offloading, inspection and running
- 2. Offload casing
- 3. Inspect casing
- 4. Prepare for running casing
- 5. Rig up casing running equipment
- 6. Run casing and accessories
- 7. Land casing
- 8. Break circulation

Task
Next page
Rider tasks

- Tasks and sub tasks
- Role (Executor, contributor, none)
- Extra description
- Hazards
- Attachments (pictures, movies, sheets etc.)
### Integrated hazards

#### Hazards for "Prepare sufficient lay down area"

1. **Personal injury**
<table>
<thead>
<tr>
<th>EFFECTS</th>
<th>CONTROL</th>
<th>SAFETY ALERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tripping over tools and objects left lying on rig floor</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

2. **Personal injury**
<table>
<thead>
<tr>
<th>EFFECTS</th>
<th>CONTROL</th>
<th>SAFETY ALERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body parts caught between nubbin and other objects</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

3. **Personal injury**
<table>
<thead>
<tr>
<th>EFFECTS</th>
<th>CONTROL</th>
<th>SAFETY ALERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wicker from wire rope piercing hand</td>
<td>Impact gloves must be worn for this task.</td>
<td></td>
</tr>
</tbody>
</table>

4. **Personal injury**
<table>
<thead>
<tr>
<th>EFFECTS</th>
<th>CONTROL</th>
<th>SAFETY ALERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nubbin dropping while it is being hoisted to the rig floor</td>
<td>Worker on the ground must stand clear of the area while the nubbin is being lifted up to the rig floor.</td>
<td></td>
</tr>
</tbody>
</table>
Modular Procedural Automation (MPA)

Yokogawa consulting service

- Work with you to
  - Assess the current state of standard operating procedures
  - Identify opportunities for automation
  - Capture best practices from most experienced operators
  - Automation team member
Summary

- Participate on the ISA106 committee
  - Have input to the standard
  - Receive copies of the draft standard
  - Contact Dave Emerson or Bill Wray, or any committee member

- How can the ISA-106 procedure automation concepts be used in your plant?
  - Yokogawa Advanced Solutions group is available to talk about this
Thank-You