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Alarm Response Procedures – A Marriage of PCS and MES

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ABSTRACT

There are numerous standards, guidelines, and best practices surrounding alarm management in Process Control Systems (PCS). For instance, EEMUA 191 guidelines specify no more than 5% of the alarms that annunciate within a PCS should be of the highest priority. Safety related alarms should occur even less frequently. Ironically, strict compliance or poor management of alarms can lead to the same predicament – poor operator response to critical alarms.

Poor management of alarms tends to lead to nuisance alarms which in turn can lead to operator apathy. Strict compliance will (hopefully) lead to infrequent occurrences of critical alarms. In either case, the operator response to the alarm – how can I get the process back in control – can be effected.

Advancements in PCS functionality have lead to Alarm wiki tools, manageable directly by the operations and manufacturing staff. Best practices can be added directly to Alarm Help fields by senior operators, allowing distribution to all necessary HMI's.

In regulated environments however, inclusion of "tribal knowledge", especially for critical or GMP alarms, is not an acceptable solution. These critical alarms should have Stand Operating

Procedures for response. Accessing the current, effective version of one of these Alarm Response Procedures (ARP) in a timely manner can make the difference between an incident report and loss of production, plant assets, or safety. When the electronic retention and management of ARP's is contained within an MES structure, and that structure is closely coupled with the PCS layer, operator access from the HMI's is possible, enhancing overall response time and effectiveness.

Recently, I conducted an informal and highly unscientific poll of manufacturing personnel – operators, production supervisors, plant process engineers. The questions focused on "how do you (or your operators) respond to critical/GMP alarms?" While primarily focused within Life Sciences, I also asked my questions to other industry sectors, both regulated and not.

The general theme of the responses centered on notifying someone else (I guess misery loves company). These notifications took the form of phone calls and sometimes emails, with some sites actually generating emails automatically using a paging system tied to their automation platform. A typical follow up question was "OK, what does the person you get a hold of do?" Answers started to get fuzzy at this point, and I could tell some of my responder's were getting uncomfortable.

There are plenty of standards, guidelines, and best practices surrounding alarm management in Process Control Systems (PCS). For instance, EEMUA 191 guidelines specify no more than 5% of the alarms that annunciate within a PCS should be of the highest priority. Safety or SIL related alarms should occur even less frequently. But managing the sheer number of alarms and their severity is only half the issue.

If I've gone to all the trouble to evaluate, create, and manage an alarm setting, perhaps I should provide the operator with the information to deal with the abnormal situation. At the end of the day, what we really want is to not only alert the operator for a Warning level alarm, but empower him with a response procedure to keep that Warning alarm from turning into a GMP or safety event.

Advancements in PCS functionality have lead to the development of Alarm Help or Wiki tools, manageable directly by the operations and manufacturing staff. Best practices can be added directly to Alarm Help fields by senior operators, allowing distribution to all necessary HMI's. Letting the operator know how long the alarm has been active and how long before potential negative consequences occur is also important.

But in regulated environments, the inclusion of "tribal knowledge", especially for critical or GMP alarms, is not an acceptable solution. These critical alarms should have Stand Operating Procedures (SOP) for response. And by the way, you want to make sure the operator is accessing the latest and greatest version of that SOP. Back to my survey results, several operators told me that the phone list they used to contact other personnel was "somewhere" in the supervisor's office.

Accessing the current, effective version of an Alarm Response Procedure (ARP) in a timely manner can make the difference between an incident report and loss of production, plant assets, or safety. So the first key to success is to keep these ARP SOP's in an electronic document library, not a file cabinet in the control room or shift foreman's office.

There are many electronic document libraries or repositories on the market. Structure and access are the features to look for. Those packages aligned with or part of a Manufacturing Execution System (MES) or Operations Management System (OMS) inherently understand the manufacturing and PCS space through the application of the ISA S95 model. Since we're

looking to integrate our document library with our PCS, a zero footprint client (Internet Explorer) is important. Most PCS vendors are particular about what 3rd party applications get loaded along with their HMI software. But Internet Explorer (IE), being part of the OS, is usually accessible.

The location on the network for the document library is a consideration. By deploying a document library that's tied to or included within the MES/OMS, network gymnastics are minimized due to the close coupling the PCS and MES/OMS. Even with this arrangement, the PCS system can exist one or more firewalls away from the electronic library, providing another good reason to use IE to access our ARP's. Only a few ports need to be opened up with the firewall to allow access.

Another feature for effective ARP integration is for the electronic document library to support a kiosk mode. Document kiosks have become popular fixtures in mid-ranged hotels where having a full time concierge doesn't make sense. You walk up to a terminal, click a few buttons, and you find a great Italian restaurant 5 blocks away. You click print, and not only do you get driving directions, you also get a two-for-one appetizer coupon. You didn't have to login, you got the current, effective documentation (updated for road construction) and the documents remained secure somewhere out of site.

Providing the ARP in a timely manner (think emergency situation) is critical. Even a default username and password combination (like ARP/ARP) can slow an operator down, not to mention the popup login windows can require additional ports on the firewalls to be opened. With a kiosk mode, a document can be accessed directly, without logging in or navigating through a web page folder structure.

The direct access of kiosk mode affords us the ability to access a particular document from a single IE URL. The URL will contain both general information about accessing the electronic library, and specific information associated with the required ARP. To minimize the impact of adding ARP functionality to a PCS, deploying the information for a URL buildup can be accomplished by the use of linked composites or subroutines contained within class based control and equipment modules. How much flexibility is desired will determine how much information must reside within the specific module and how much can be hardcoded.

The final component is the HMI element. Depending on specific system functionality and overall needs, access to an ARP "button" might take the form of a visibility-controlled object on a pop-up faceplate or an always visible object located on an overview or process graphic. The key is to make the selection of the button easy and intuitive. Figure 1 is an example of an ARP button on an analog input faceplate.

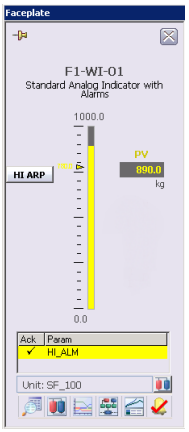

Figure 1 – ARP Faceplate Example

Visibility is set on the HI ARP button such that it only appears when the HI alarm is active. It's within the HMI environment that the final magic turns the buildup stings from the class module into an IE window launching the proper URL. An example VBA script for Emerson's DeltaV Operate is shown in Figure 2.

bmpReset2 | Click

```
Private Sub bmpReset2_Click()
On Error GoTo ErrorHandler
Dim Explore2
Dim objPath2 As String

objPath2 = "C:\Program Files\Internet Explorer\IExplore.exe" + " http://spock/dca/viewer.aspx?URLPath=http://spock/PDF/" + _
           frsreadvalue ("DVSYS.@mod@/HI_ARP_PRT1.A_CV") + "&VersionUID=" + frsreadvalue("DVSYS.@mod@/HI_ARP_PRT2.A_CV") + _
           "&ViewMode=1&DocBase=Production&KioskAccount=1"
Explore2 = Shell(objPath2, 3)
Exit Sub
ErrorHandler:
     frsHandleError
End Sub
```

Figure 2 – VBA Script Example

There are several things you can do to secure an IE window within an HMI environment. We need to make sure the IE widow can give access to the ARP, not Yahoo or Google. For instance, in a kiosk view from Syncade, the IE window is shown in Figure 3:

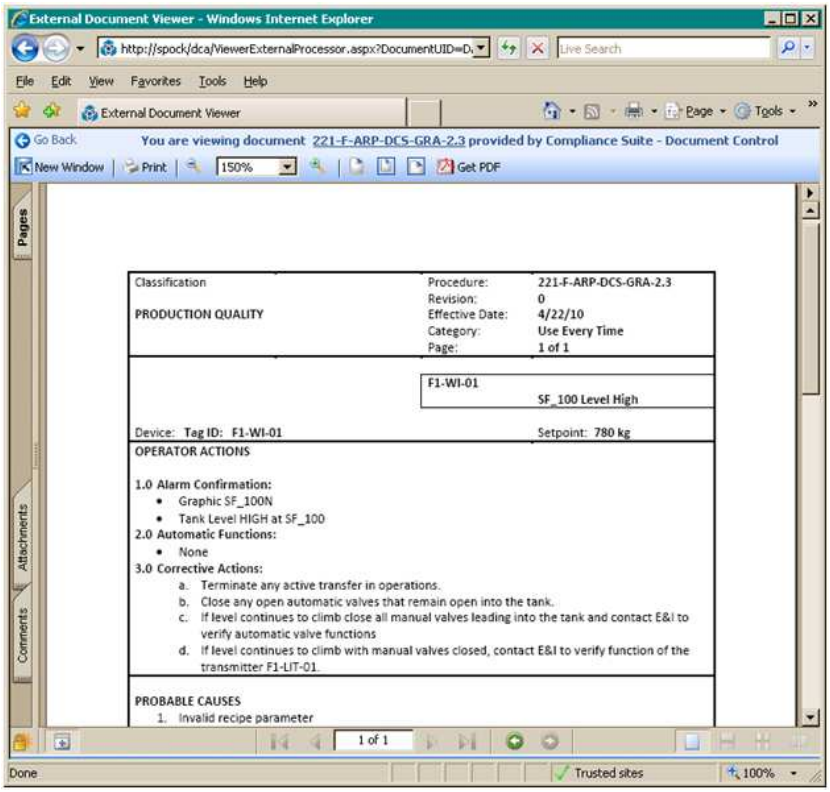

Figure 3 – Full IE Access

One of the risks is if someone were to click on the File menu, then click on Save As… - they could start dropping html files all over the system. Just as critical is having the toolbar buttons or the address bar along the top. By modifying group policies, you can remove the address bar along with the menus. The result is shown in Figure 4:

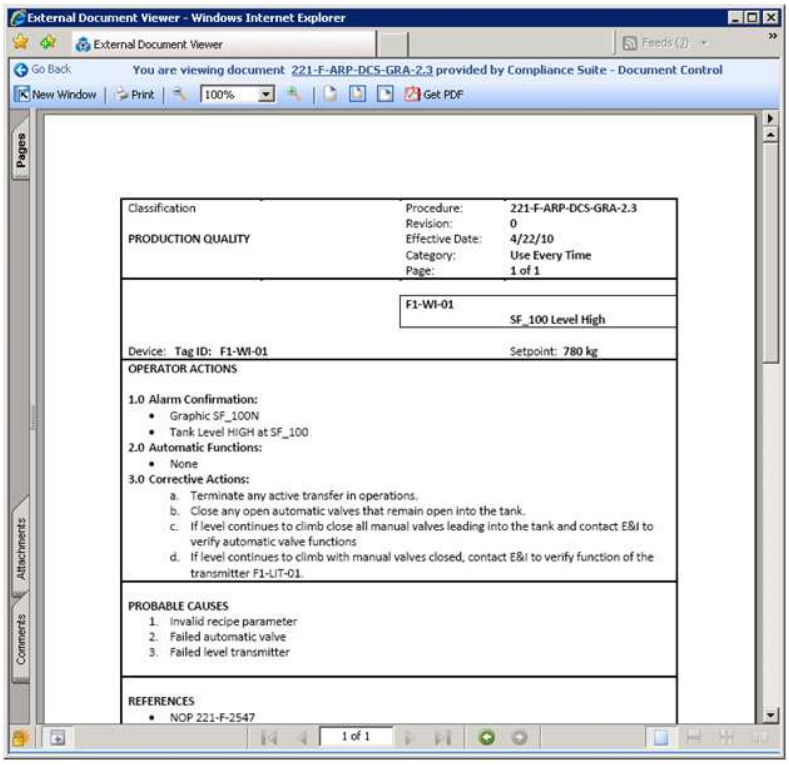

Figure 4 – Limited IE Access

Deploying at least some of these alarm response procedure concepts is probably within the capabilities of most existing process automation systems. Identify and collate the appropriate ARP documents and get them into a central location. A document repository can be as simple as a folder on a shared, network drive or a full blown, document management system. Leverage your HMI's programming capabilities for ARP access. Be mindful of network security issues so you don't leave yourself exposed.

Additional benefits will be achieved when coupling a PCS with a MES/OMS aware document management application, providing data flow through the S95 structure. When the electronic retention and management of ARP's is contained within this structure, and that structure is closely coupled with the PCS layer, operator access from the HMI's enhances overall alarm response time and effectiveness.