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Course: QAS 515 Human Factors Engineering in Quality

Term Paper Title: Alarm Management on an Oil & Gas Offshore Platform

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Term Project: Developing HFE countermeasures to improve the response to alarms at the control panel (HMI) at an offshore oil & gas installation such that deliberate and appropriate action is taken by the operators.

Background: Alarm Management

The purpose of an alarm is to identify areas / components of the processing plant which exceed a pre-determined design parameter or process set point and poses a threat to the safe operating condition of the plant.

The alarms are intended to guide or prompt the control room operator to respond to the exceeded parameter in such a manner that the process is returned to normal operation either by executive action or through a problem-solving process.

A review of process safety accidents reveal an increasing trend in the months leading up to the event in the number of alarm conditions registered at the control room panel. This often highlights a lack of an appropriate response to these alarms and in so doing inviting disaster.

It is not likely that the operators at plants which had significant process safety events did not care about their personal safety, the safety of their colleagues, and the integrity of the plant. Rather, there is likely to be a lesson in human factors engineering that can im-

prove the quality of response to the alarms and thereby reduce the trends to disaster.

Problem: Alarms registered in the control room are not managed in a consistent manner. This is considered to be a leading indicator to a significant process safety event.

Objective: To apply HFE counter measures in order to improve the responses of the control room operators to the alarms registered.

Considerations:

Type of alarm currently in use is an audible alarm and text descriptor at the top of screen. Screen in which the alarms appear are the top row of screens which is 40in from the operator's eye level at an angle of 40°. This positioning of the alarm messages is not optimal for rapid recognition.

Layout of the control room monitors:

Screen height: two rows of screens exist in the control room. The bottom row of screens are appropriately positioned such that the operator can view the screen from eye level to 15° below eye level without movement of the head and neck. The top row of screens however, are placed at a height such that the angle for viewing alarm text is 40° as described above

CRO seating: The control room has been outfitted with ergonomic chairs in order to meet the design standards of the facility. In general, the workforce has limited awareness and knowledge of the requirements for proper adjustment of the seating. As a result, the chairs are used as is and tends to result in poor posture for extended periods by the various holders of that position.

Work table. Based on the size of the table and the other equipment, it would not seem readily possible to change the work table height from one user to the next. Any impacts of the fixed table height on the operators should be mitigated using other countermeasures.

Visual cues on displays. The displays currently have process diagrams and diagrams of process components. Despite the availability of these graphics, the alarm messaging comes in the form of a line of text.

Set points for the process. Alarms have been designed into the HMI for events in which the process parameters make a predetermined shift from the optimum value.

Categories for the alarms:

Immediate response required

Respond within 24 hrs

Respond within 3 to 7 days

Alarm response logic

Counter Measures

Confirm / verify that the alarms are set at the appropriate levels. This is aimed at reducing the number of spurious alarms in-built to the system. The process alarms must be set correctly as well as the Hi-Hi and Lo-Lo alarm conditions which apply to plant safe operation. This scope was completed by the Surface Engineering Team as part of a recently concluded work pack. At the time of submission of this term paper this counter measure has been completed. As such, all alarms for the various parameters and set points are as per design.

Establish alarm categories. All alarms are not created equal. Some of the alarms which are registered at the control room HMI indicate process parameters which are no longer ideal. For example, it may indicate that the temperature has risen from 415°F to 425°F, but this may be a tolerable change until such time that the temperature reaches 450°F where it becomes a safety issue. The second stage of this project implementation is to categorize the alarms into 3 categories of urgency. This will allow the operator to determine the severity of an alarm and the consequent executive action required to resolve the condition. The proposed categories of ex-

ecutive action are as follows and are currently being implemented under the management of change document OFS-437:

(1) Resolve Immediately
(2) Resolve in 24hrs
(3) Resolve in 3 - 7 days

Create new visual cues for alarms. Visual cues will help to reduce the response time to the alarm once it has been registered on the HMI. The current alarm notification is a simple text message bar which requires the operator to move his head and eyes to the top screen to review the alarm condition to decide what he needs to do. Two strategies will be employed to accelerate the response time.

Colour coded alarms: Alarm conditions shall be colour coded to indicate what type of alarm category it belongs to and the urgency of the response required.

Superimposed alarm condition on process component display. Currently, the alarm messages are not visually connected to the process diagram. The counter measure identified is the placement of the new alarm signal over the component which is in alarm condition and being of the colour code described above.

Both of these measures are also in the process of being implemented as per management of change document OFS-437

Evaluate current operator / control panel interface and optimize as required. An Ergonomist was contracted to conduct this evaluation of the various workstations in use on the platform. Along with evaluation of the workstations, the raising of awareness of staff was incorporated as part of the scope.

Change the Alarm Response Logic. Once the other counter measures have been employed and the response time to the alarm condition has improved, the next area of focus is the deliberate slowing down of the response logic such that real thought can go into the resolution of the issue. This is also included in the scope of OFS-437.