The Link Between Safety and Shift Handover

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Abstract

Health, safety and environment have always been important to the industry but recent events have brought them to the fore. Accidents such as Buncefiled, Texas City and the Gulf of Mexico spill are examples of how poor shift handover and lack of communication of operational information in particular can be a contributing factor to major incidents.

This paper will focus on the importance of effectively communication key operational data, from the control room through to senior management. It will examine the methods currently in place today for collecting and sharing this data and introduce the concept of electronic shift logging. It will look at real examples from other industries, e.g. Power Generation, of how it can minimize the likelihood of error in the high risk activity of shift handover, through improved communication and information management which in turn impacts safety and accident prevention.

This paper will demonstrate with case study example how new technologies can achieve this by replacing the myriad of paper logs, spreadsheets and disparate databases with a single electronic system designed to integrate information from many different sources in one location. This information can be used across the business to improve safety, reliability, production and environmental performance.

As Infotechnics have an established and successful track record of delivering operational logbook software to customers worldwide from the chemical and power industries as well as oil & gas, they are well positioned to offer knowledge and experience in this paper that will illustrate how the upstream industry can learn from other sectors.

Introduction

Oil and gas facilities are complex and hazardous systems that rely on plant, equipment and people to work together to achieve commercial goals in a safe and effective way. People need information about the system in order for them to maintain an accurate picture of what is happening. They use this information to determine when they need to act and when deciding what they need to do. When

this information is not available failures occur due to inaction or the wrong actions being performed. Arguably, the potential risks associated with these failures has increased as new technology has allowed more complex and hazardous operations to be carried out and new ways of working have affected organisational structures and cultures.

Communication Failures

A number of recent major accidents provide a vivid illustration of the potential risks when people do not have the information they need to recognise hazards and make decisions.

The Gulf of Mexico oil disaster gives us a clear idea of the challenges faced by modern businesses. Deep water drilling is hazardous and platforms are operating at the cutting edge of technical and practical experience. A large group of people need to work together to achieve the end goal safely. However, the fragmentation of the industry means that they often work for different companies, contractors and sub-contractors. Whilst working relationships may be clearly defined in commercial contracts, this does not necessarily reflect how people communicate in practice. The result can be that individuals will communicate well with their immediate colleagues; they may not see the need or find it easy to communicate with personnel from other companies, who they may not actually know very well. This hinders the flow of critical information that can mean people make decisions without an understanding of what is really happening. The official report [National Commission 2011] shows that prior to the blow-out that many people were involved in analysing data and making decisions that ultimately resulted in the blowout. If individuals had been able to assess the whole picture it seems likely that the disaster could have been avoided.

The Buncefield fire is another example of where modern business creates problems for personnel and, without careful management, can lead to high risks. The site was fed by three pipelines supplying fuel from Humberside, Merseyside and Essex. However, control room staff only had control and process information readily available for one of them. Over the years the site's throughput had increased. This made control and monitoring of fuel receipt far more critical. Commercial pressures and a lack of engineering support meant that site personnel could easily be overloaded and distracted. The official report [COMAH Competent Authority 2011] highlights problems with communication, particularly during shift handover that contributed to the accident. In particular, there was confusion amongst supervisors about which tank was being filled. The handover documentation used only captured information about one of the pipelines, with information about the others only dealt with on an ad-hoc basis. Also, the documentation was designed to only record information about the situation at the end of the shift and no events occurring during the shift.

The CSB report of the BP Texas City accident [CSB 2007] makes specific reference to communication failures. Supervisors and operators poorly communicated critical information during the shift turnover (handover). The night shift operator left early. Subsequent shift handover was brief because it did not involve the person who had done all the work. Records in the shift log were brief

and ambiguous. They were mis-interpreted by the incoming shift. This was further exacerbated by the failure to record steps completed on the start-up procedure by the previous shift operators. A root cause of these failures was that BP did not have a shift turnover communication requirement for its operations staff. More generally, the investigation found that key messages were not written down, but passed verbally over phone and radio. This resulted in the board and outside operators interpreting a message regarding routing of rafinate differently. The Board operator closed a control valve. The outside operator manually opened that valve.

But this is not a new discovery. The inquiry into the 1988 Piper Alpha disaster found that prior to the accident critical information about the status of the condensate pumps was not communicated at shift handover. This meant operators started a pump that was not in an operational state. And before that, following the discharge of highly radioactive material from the nuclear processing plant at Sellafield in 1983, it was found that failures of communication between shifts created confusion regarding the contents of a particular tank that was pumped to sea.

Other Industries

Oil and gas is not the only industry that has identified problems with communication resulting accidents. The inquiry of the loss of Bourbon Dolphin anchor handling vessel [Commission of Inquiry 2008] cites problems with crew handover resulting in activities being carried out that were beyond the safe capability of the vessel.

The medical industry is another that has identified communication failures as a significant risk, with the potential to cause harm to patients. Across the NHS a number of documents have been published addressing the issue, particularly related to handover of care. The National Patient Safety Agency states [Junior Doctors Committee 2006] that “Handover of care is one of the most perilous procedures in medicine, and when carried out improperly can be a major contributory factor to subsequent error and harm to patients. This has always been so, but its importance is escalating with the requirement for shorter hours for doctors and an increase in shift patterns of working.”

The Scale of the Problem

Whilst a number of accidents have identified communications including shift handover as a contributory cause, it may not appear to be a major problem. However, the Health and Safety Executive’s guidance document HSG48 [HSE 1999] states that reliable communication is highly critical to safety; and this seems to be the consensus amongst people working in high hazard industries. From this it is concluded communication failures are probably under-reported and is not necessary something that is examined in any detail as part of accident and incident investigations.

Failures of communication occur for a number of reasons. In general either the information being communicated is incomplete or inaccurate; or the person on the receiving end misunderstands the

meaning of the information they are given. There are many reasons why this can occur, with information being presented poorly being the underlying factor.

Whilst all communication is error prone, the more complex the situation the more likely errors are to occur. For example shift handovers are high risk during times when maintenance is on-going and when there are deviations from normal working. In these situations communications errors are more likely and their consequences can be more significant.

Improving Communication

HSG48 provides advice for improving communication. This includes carefully specifying information that needs to be communicated, using aids such as log books, using more than one communication medium (e.g. both written and verbal), allowing sufficient time and developing communication skills and behaviours.

Despite its importance and the occurrence of numerous incidents influenced by poor communication across industries, it is quite a surprise that there is not more advice available. The reasons for this are not clear, but it is easy to surmise that it is a 'soft' and intangible subject that has probably fallen into the 'too hard' category for many years.

Communication Theory

One thing is clear, people tend to underestimate how complex the communication process is and consequently over estimate their ability to communicate effectively. The reality is that error is a natural and inevitable aspect of communication because language is inherently imprecise and ambiguous.

A successful communication is one where a person receiving a message achieves exactly the same understanding of that message as the person transmitting it intended. However, the following factors can interfere with this process [Lardner 1999]:

1. It is not possible to transfer meanings from one person to another directly. Rather, the receiver creates meaning in his or her mind;
2. Anything is a potential message, whether it is intended or not;
3. The message received is the only one that counts;
4. Taking the above together, unintentional meaning is likely and potential miscommunication is the norm.

Communication requires effort by both parties to avoid miscommunication. Although not infallible, face-to-face communication is generally the most reliable, not necessarily because it is a better way of transferring understanding, but because it allows immediate discussion. In contrast, written communication is generally less reliable because of this lack of immediate feedback.

Adopting mechanisms such as SBAR being used by the UK Health Service (NHS 2010) can assist. The Acronym, which stands for Situation – Background - Assessment – Recommendation, demonstrates that communication needs to be planned and carefully executed if it is to reliable.

Behavioural aspects

One of the reasons communication is a difficult topic to address is that individuals' behaviours have such a significant impact on its effectiveness. In this context the following are relevant:

- People need to be willing to say if they do not understand what they have been told;
- They need to be willing to challenge what they have been told;
- They need to be able predict what someone else needs to know;
- They need to show that they are interested in what they are being told;
- They need to make time for the handover.

No procedure or management system can address these issues directly. Whilst guidance can be provided to help people understand what is expected of them, there will be a requirement for continuous supervision and coaching to ensure bad habits are avoided and to drive continual improvement. Given the pressures of work, it is unlikely that this will happen automatically. Shift handover practices are likely to evolve over time. Sometimes this will result in improvement, but at other times short cuts and bad practice may be the result.

The Challenges to Improving Handover

Arguably shift handover is one of the more complex and critical communication events. However, there are reasons why making improvements are difficult. In particular, we must recognise that the individuals involved may not always have incentives to put in the effort required.

The most important person in any handover is the person finishing their shift. The quality of the information they provide and their communication skills will have the greatest influence on how well informed the person starting their shift is. However, at the end of an 8 or 12 hour shift even the most conscientious person will be interested in getting home. Also, some may have the attitude that any problems they leave are going to be dealt with by someone else (i.e. the incoming shift).

It is true that the person starting their shift can influence the quality of the handover they receive. Asking questions and being interested will tend to improve the quality of the handover. However, they are not in a particularly powerful position because they do not know what questions to ask, especially if key data has not been logged.

Finally, we must recognise that the people typically responsible for improving performance are often not present (i.e. managers) or busy themselves (i.e. supervisors) when handovers are taking place. Most handovers will be carried out unsupervised.

An Alternative Perspective

Changing behaviours is always difficult, especially when the individuals may not perceive a direct benefit. Therefore, it would be useful to have an alternative approach to improving shift handover.

Having studied the communication process it is clear that a lot of information passes between individuals on a continual basis, but that much of it is never captured in a usable form. This means it is only useful to a very small number of people and over a very short time-scale.

Much wider use of it could be made if made available in an appropriate format. If other people were to start accessing that information it would increase the number of stakeholders in the process. More people would have a vested interest in improving communication and would be more likely to intervene if the information they need was not forthcoming. Ultimately it seems likely that a better consensus would be reached over what needs to be communicated.

The proposal here is that electronic logging has great potential to improve communication with clear safety benefits. The beauty of this information being that it reflects what actually happens in practice. Face to face communication will remain the most important part of the handover, but the logs will add structure and detail.

A Study of the Information Recorded for Use at Handover.

In order to determine what type of data is recorded for use at handover, a study was conducted at an offshore oil production platform [Brazier 1996]. Copies of pages from log books and handover reports from across the platform were collected covering a seven day period. This information (a stack of paper weighing 3 1/2 kg) was carefully examined to determine what information had actually been recorded about events occurring during the period of interest.

Analysis of the information showed that many of the events recorded in log books and handover reports could be particularly useful for safety and reliability studies, given that they were rarely reported in other systems and this information was a largely untapped resource. The study categorised the information as being related to human error, minor incidents, routine events, and solutions to problems.

Human Errors

There is a general consensus that human error is a significant cause of accidents and incidents. Also, that many of those errors occur frequently with minimal consequence, and only on occasions combine with other events and conditions to cause an accident. Therefore, it is particularly useful to

know about the errors that occur routinely, but these are rarely reported through formal channels. The following errors were found in log books examined in this study:

- Valve 'inadvertently' closed – delayed the return of equipment to service;
- Gas leak from a newly fitted gasket – system had to be shutdown and joint remade;
- Parts missing from replacement components (two events) – delays in critical repairs because components were supplied with parts missing;
- Part missed when assembling equipment – oil leak occurred, equipment had to be shutdown, dismantled and reassembled again;
- Incomplete modification – pipework modified but control system was not. An additional task was required to rectify;
- Error in job description – diving work was delayed because instructions referred to an incorrect valve location;
- Unable to find an up to date drawing – delays whilst a drawing showing all recent modifications was found;
- Data lost from computer disk – system temporarily unavailable whilst backup data was recovered.

None of these errors had significant consequences, which explains why they were not reported through more formal channels. However, any error indicates a problem that in other circumstances could have contributed to more serious events. Having information about the errors that occur more readily available would be useful for ensuring risk assessments are accurate and for prioritising human factors activities.

Minor Incidents

Most companies now have near miss reporting systems that mean all incidents should be reported no matter how minor the consequences are. In practice the effort of reporting an incident is often perceived as outweighing the benefit. This study found 15 events recorded in log books and handover reports that could be considered as incidents, in addition to the human errors described above. Examples included:

- Unplanned hydrocarbon releases (three events) – small oil slicks observed on the sea following activities and a valve found to be leaking gas;
- Equipment failures (eight events) – chemical dosing pumps failing simultaneously, generator and compressor trips, compressors failed to start and an emergency shutdown valve did not close during a test;
- Equipment found to be inoperable (four events) – pressure override switch broken, pump operating at high temperature, pig receiver door damaged and pressure gauge pipework blocked.

The fact that incidents are being recorded suggests that log books and handover reports may provide an alternative mechanism for capturing these events. The advantage is that the reporter does not have to report the same information twice whilst the information is still immediately available for shift handover. However, the study showed that information about why these incidents occurred was often missing. This suggests that effort will be required if such an approach is taken to ensure the information about why events occur is recorded to allow further investigation.

Routine Tasks

It is a bit of an anomaly, but the tasks people perform most frequently are often the ones we know least about. This is because they are often not covered by procedures and, when performed successfully, there is little indication to show they occurred. Because of this it is easy to think they are not important, but this is not the case. In fact, when considering plant reliability it is particularly useful to know what routine tasks are performed, their frequency, their duration and success rate. This study showed that this information can often be extracted from log books and handover reports. Of particular interest was that operators recorded 120 different routine tasks that had been performed in the seven day period. Whereas maintenance tasks are often captured in a management or recording system, operations tasks are usually not captured anywhere else.

The study concluded that the information about routine tasks recorded in log books and handover reports is probably more accurate than other sources of information because it is a record of what actually happens (i.e. rather than a pre-defined schedule which may not always be followed). Therefore, it was potentially particularly useful for reliability studies.

Solutions to Problems

One reason we continue to employ people on facilities, despite advances in technology, is that they are good at dealing with unforeseen events and developing ad hoc solutions to problems. Understanding how people deal with events can give us a very useful insight into how they understand the systems they deal with. Where successful, solutions to problems can be shared so that others can use them in the future. However, it is important to know about any temporary or experimental solutions, as they may contribute to problems in the future.

This study found that solutions to problems were often recorded in log books and handover reports. For example:

- The need to release trapped pressure to reset an alarm;
- A production well that will only flow at low pressure;
- Another production well that would restart flowing if left for a while;
- The need to reduce gas pressure to start a turbine;
- Use of a ‘similar’ spare part where the correct one was not available;
- Manually manipulating a valve to stop it sticking;

- Using plastic sealing compound instead of a gasket to prevent a leak.

In each of these cases the operators were clearly solving the immediate problem. The successful solutions may be useful for others. In a number of cases it appears that the solution may not be fully approved, and hence it may be important in the future to know what has been done. A number of additional instances were recorded where people logged their suspicions about the cause of a problem being experienced, but where they had not been able to test them out. In these cases these assumptions may assist personnel tasked with solving the problem in the future.

Improving Communication by Making Data Available

The study described above shows that the information used at handover can have a much wider application. However, extracting that information is not usually easy because much of it is in handwritten log books. Even though computers are now being used to record events and prepare handover reports, many use word processor or spreadsheet packages, or simple databases. Whilst these make the information more legible and hence may help people carrying out handovers, they do little to improve the availability of data and so do not fundamentally increase the number of stakeholders in the process with a direct incentive to drive improvement.

A More Sophisticated Database

It is one thing to capture information. It is another to make it readily available for people to use. A database can assist in this process, but to be effective the following needs to be understood:

- To get the full picture, it is usually necessary to have input from more than one area of the business;
- It is useful to be able to consider logged information alongside the relevant 'hard' process data;
- Information may be required in different formats for different purposes.

To address these issues it becomes apparent that the current approach of having lots of individual log books and handover reports will never allow the potential of the data stored to be realised. Instead a system is required that acts as a source of information that can be used during shift handover, but has a much wider use across the business. At the same time any system used to make data available and improve communication must be easy to use; otherwise the efforts may be counter-productive.

Practical Requirements

History is littered with lots of examples where technology based products have failed to achieve their potential because they were not used as intended. In this case it is no use developing a database system that people do not record information in or extract the useful data. Therefore the following are the minimum requirements:

- Logging of information must be simple;
- To be really valuable the information must not only say what has happened, but explain why;
- Information must be highly visible so that people know what is happening;
- Analysis of historical information must be possible.

It is essential that end users are actively involved in developing the system to both embed their experience into the system and to ensure they understand the objectives of the new approach. In this case operator involvement is key to ensuring information logging will be practical and efficient. However, there will be other end users who have different needs, particularly in extracting and analysing data. A consensus is required about what constitutes the optimum solution for all end users.

It is important to recognise that this is not just an exercise of transferring a current log system to computer, as the benefits of this are quite limited. Therefore, as some of the concepts will be new to the end users, it is equally important to involve people who can input information about what can be achieved with such as system.

Finally, whilst technology can assist the handover process, it can have negative consequences if not managed correctly. Robust systems must be in place that addresses the requirements for good communication at shift handover and between different job functions (most significantly between and day workers).

The Proposed Solution

There is no intention to replace current arrangements with something completely new. Therefore, the proposed solution builds on the existing use of shift logs and handover reports. It assists by automating the process as far as possible and provides numerous functions and procedures that ensure handovers are as comprehensive and consistent as possible. Also, it makes information far more visible and this means there are more stakeholders with an interest in maximising the quality of shift handovers and who are more likely to intervene where these requirements are not achieved.

The old adage of ‘rubbish in, rubbish out’ certainly holds true in this case, especially since much of the information we are talking about is ‘soft’ in nature, being based on the observations of people rather than ‘hard’ plant data from instruments and control systems. The aim is to ensure all critical information relating to past, present, and future events are captured, will be visible and is supported by additional information including process data.

This will only be successful if the information that forms the basis of the handover is of high quality. This solution therefore encompasses the creation of operational logs and the subsequent use of that

information for the benefit of managing the operation (of which handovers is a major use). In order to successfully underpin the handover process the solution must fulfil a number of key requirements:

- FACILITATE LOGGING OF INFORMATION: whatever method of capturing operational information is used, it will be, to some degree, an imposition on the operator. The proposed solution encourages quality logs by allowing most information associated with an entry to be made with a few mouse clicks. The operator is then required to type only value added information, which generally explains why an event occurred. The operator is guided through the logging process in a structured way, ensuring all essential information is captured. This has added benefits for less computer literate operators as it minimises the input required.
- PROVIDE A STRUCTURED LOGGING ENVIRONMENT: it is essential that any solution provides the flexibility to capture all the varied operational activities required in logs across the operation. At the same time, it is important to impose a level of structure on the logs to encourage consistency of input. Simply providing for free-format text entry provides flexibility but does not allow for a structured approach. The solution allows 'Event Hierarchies' to be pre-defined. Each log can have its own hierarchy tuned to the specific logging requirements. Each hierarchy point (an event that can be logged) can have its own template. This template defines the structure of the log entry and can accommodate any additional information to be captured, any rules on how the entry is shared or copied with other logs and any external documents to be attached or referenced. The level of structure imposed by the template is defined by the users. A template could in its simplest form be a simple free format text field. This template approach helps ensure that the same event logged over time will be logged in the same way and is of great benefit when reviewing and reporting on logs.
- ALLOW FOR EASY SHARING OF INFORMATION: the solution allows log entries to be very easily shared across multiple logs throughout the operation. This can be automated if required to ensure important information is highly visible to the appropriate people or issues are effectively escalated.
- ALLOW QUICK SEARCHING AND REPORTING OF LOGS: the solution allows easy access to logs, whether it is the current shift reviewing the previous shift logs, engineers carrying out analysis of historic logs or management reporting across multiple logs. Providing the structured templates allows reports to be very easily built. This helps turn the logs from an operational record to be filed away into a live repository of valuable information. The logs become valuable assets of the business.

Operational Logbook Software

Infotechnics developed an operational logbook software tool that provides the functionality to capture operational intelligence and makes data accessible across the organisation to a wide variety of users. It replaces the myriad of paper logs, spreadsheets and disparate databases to integrate information from many different sources in one location.

The software provides a mechanism for improved consistency of logs in terms of format, structure and content. It enhances the ability of logbooks to act as a source of information by recording key site status information on safety, environment, commercial, plant and other issues with the ability to search, view and report on historic plant data for event tracking and in support of trend analysis. With the software events become more visible and are quickly communicated allowing for faster and more informed actions to be taken. It provides excellent support for shift handover and production meetings.

The software has a quick and intuitive method to input data which ensures that time spent writing logs and capturing operational information is minimised. Also, it has the ability to make data already held in Asset Management and Plant Information systems such as OSIsoft PI, MRO Maximo and SAP readily available. This means that plant events can also be captured automatically via standard interfaces.

The software is already used by leading power, oil and gas and chemical companies worldwide.

Supporting Shift Handover

The handover process can encompasses a wide range of information including the logs of past events, the current plant status, and issues for future shifts. This is true for shift handovers that occur on a daily basis and for 'trip handovers' that may occur weekly, monthly or at longer intervals.

The solution has a number of functions specifically designed to facilitate the handover process, including; the ability to view logs across any timeframe, ability to flag important information, ability to add log entries to ToDo lists in order to action issues across shifts and the ability to create, assign and track logbook tasks across shift teams.

One of the most important aspects of the solution is the ability for each area to configure its own log structures. This is a user centred solution that achieves buy-in from the user base and subsequently leads to higher quality logs. This is much more desirable than imposing a rigid system on operators that does not meet their own individual or departmental requirements.

It must be emphasised that any computerised solution to managing shift handovers can only support (and not replace) a well thought out and well followed handover procedure. The wider considerations are those of company and operational culture and discipline. A culture of open communications, continuous learning and continuous monitoring of process quality can be underpinned by a well developed computerised system but cannot ultimately be controlled by such a system; the whole process starts and end with the organisations biggest asset - its people.

In implementing such a solution it is important to recognise that, as with any intervention in any system, there are always potential negative consequences. In this case there is the potential that

making information more readily available over a computer network may mean that people talk to each other less often. Whilst it is felt the way the solution works means more people will become interested in what is going on and hence are actually more likely to ask questions and discuss events, this is something that needs to be monitored as part of its implementation. Also, it is recognised that this solution may not currently be appropriate in places where a significant proportion of the workforce either do not have access to a computer or lack the appropriate skills.

This solution has been in use with great success within several large operations with user bases in the 100s. One large site in the UK has used it for over three years. It replaced many paper based and individual computer based logs with a single, integrated solution that allows operational knowledge to be shared 24 hours a day whilst interfacing with other existing operational systems. In another case a large power generation and distribution company used the solution to develop an integrated logging system across its diverse range of sites and corporate level functions. Following a pilot project, the solution was implemented across the company in four months. As well as practical benefits such as more consistent logs and improved availability of information, cultural improvements have been experienced including operators having a better understanding of the value of high quality logs, shift handovers are much more efficient because the high visibility of information enables the oncoming team quickly get 'up to speed' and allows them to ask insightful questions to ensure they fully understand the issues.

Case Study

During 2006/07, a series of events in the industry coupled with the publication of various asset integrity guidance, prompted energy company Scottish Power (a subsidiary of Spanish utility Iberdrola) to consider the impact of major incidents on its business. As a result it made process safety management a priority.

It looked to the chemical and major hazard industries for good practice. It has taken this learning and good practice to develop process safety audit and management tools, and identified certification to PAS 55 (Asset Management Specification) as a goal. This has made dramatic improvements in its management of risk, delivering significant cost savings to the business.

The Institute of Chemical Engineers recognised this achievement by awarding Scottish Power first prize in the 2010 IChemE category of innovation in process safety.

Early on in the Programme a partnership was formed with the Amor Group to develop an integrated data management system that pulls performance data for Key Performance Indicators (KPI) from core operational business applications used to manage the business and asset integrity.

The smart use of IT means data management systems are integrated into process plant and other 'day-to-day' operational systems. This enables the company to drill down through each headline KPI

to reveal the underlying transactions, assess near-time performance of each generating station and to see trending information and progress towards the agreed targets. The information is available to everyone in the company at anytime enabling them to identify and act upon problems within their system before it affects their business/safety.

This information is not stand alone and is part of a complete programme covering plant, people and process. It sits within an overarching leadership framework where senior management has a good understanding of process safety and the direct links to business performance.

One potential weaknesses identified across the business was shift handover. Traditional methods were considered to be not rigorous enough for the management of complex, asset intensive environments.

Indeed, as a critical factor in safety management and assurance, operational logging and reporting must form part of a wider Process Safety Management System (PSMS). In many organisations, plant safety and asset integrity is often held back by manual shift handover and logging – leaving critical information detailed within distinctly disparate and inaccessible systems. Such an approach does not provide a basis for an in-depth shift handover procedure, compromising not only the effectiveness of this process, but wider asset integrity and performance.

A primary example of electronic shift logging in the wider context of driving safety and asset integrity has been evidenced at ScottishPower, as part of their push to become a high reliability organisation. As a result of their aim to achieve PAS 55 certification they established an approach to asset management that optimises performance and delivers tangible benefits to the business.

From the outset, the project contained both Business Subject Matter Experts and IT representatives to align IT with the evolving Process Safety Management System. The smart use of IT – including the use of handheld data loggers; implementation of an automated KPI dashboard logging leading and lagging indicators; in addition to embedding operational logging reporting software as a key process – has meant that critical data management systems are integrated into process plant and other ‘day-to-day’ operational systems.

By identifying the core IT systems that provide the data necessary for the management of each risk control system, integrating this information into a comprehensive framework and making it available across all generation sites, IT systems play a key role in the promotion of a culture of safety within ScottishPower.

ScottishPower has realised significant improvements across the business, both in terms of asset management, production efficiency and bottom line contribution, including:

- 29% reduction in Operations and Maintenance costs;
- 22% increase in Plant Availability;
- 50% reduction in Equivalent Forced Outage Rates (EFOR);
- 10% reduction in Annual Insurance Premium.

IT is not the solution in itself, and must be supported by a more comprehensive programme of embedding safety within the organisational culture, but can provide a solid platform from which an effective asset management and PSMS can grow.

ScottishPower is a leading example to all asset intensive industries as to how a process safety framework, supported by robust operational systems such as operational logbook software systems, can deliver tangible business benefits.

Conclusions

There is no doubt that communication is a critical activity and poor communication has contributed to major accidents. Shift handover is one communication event that has been shown to have the potential to create significant risk. However, it has received relatively little attention and the guidance available is rather limited.

The goal of shift handover has been defined as “the accurate, reliable communication of task-relevant information across shift changes, thereby ensuring continuity of safe and effective working.” To do this oncoming personnel have to gain an accurate understanding of plant status so that they are able to make correct decisions and initial appropriate actions as required.

Improving shift handover requires systems to be in place that include procedures, training and assessment, monitoring and audit. Also, it is necessary to address the behavioural aspects, which may be something that organisations have tended to shy away from. Structured log books and handover reports can assist the face-to-face aspect of a shift handover. In addition, it is important to recognise that certain circumstances such as ongoing maintenance and deviations from normal operation create higher risk and need careful consideration during handover.

This paper proposes an approach to improving communication that is complementary to developing and improving the communication aspects. It aims to make information recorded at handover a more valuable resource. Studies show information about all aspects of operation are often recorded in shift logs and handover reports, including information about human errors, minor incidents, routine tasks and solutions to problems. This can be used across the business to improve safety, reliability, production, and environmental performance.

To make the information more available it is suggested that a computer based database solution is required. This goes beyond simply converting log books into computer form, and instead results in a

comprehensive source of management information that has many uses, as well as supporting shift handover. The advantages of this approach include:

- Important information becomes more visible;
- Better information is available when making operational and strategic decisions;
- Time is saved in logging events, meaning more value-added information can be recorded;
- Information flows much better across the organization;
- A full audit trail is provided.

A computer based approach has many potential benefits, but it must be remembered that the behaviour of users will have the greatest influence on shift handover effectiveness. Any improvement must reflect the human factors involved. However, shift handover is a critical activity and should be a high priority for any organisation working in a hazardous industry. Key issues include [IP 2006]:

- Provision of clear procedures/written guidance describing the key information to be exchanged and how this should be done (e.g. word of mouth, in writing or both);
- Providing training and having systems to ensure employees are competent to use handover procedures;
- Carrying out regular and thorough monitoring and auditing;
- Involving employees in the examination and improvement of the practices;
- Updating systems in light of information from incidents and accidents due to shift handover problems and bringing this to the attention of employees.

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