MARSH

Energy & Power Practice

SHIFT HANDOVER

RISK ENGINEERING POSITION PAPER – 07

SOLUTIONS...DEFINED, DESIGNED, AND DELIVERED.

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EXECUTIVE SUMMARY

While effective communication is important in all organizations, it is particularly important for continuously operating plants during shift changes. Clear and effective communication during a shift handover provides a key layer of protection in the prevention of major incidents.

The objective of this shift handover position paper is to promote accurate and reliable communication of relevant information across shift changes, thereby ensuring the continuity of a safe and effective working environment. An effective handover consists of three steps:

- Preparation by the outgoing personnel for handover.
- Performing the handover in which the outgoing and incoming personnel communicate to exchange relevant information.
- Cross-checking of information by the incoming personnel as they assume responsibility.

A lack of effective information transfer has led to serious incidents in the process industry. This has included the Piper Alpha offshore platform incident and the Texas City refinery incident, which are outlined in the Reference to Industry Losses section of this report.

In this position paper, we define the standards that would be rated by Marsh as "very good" for a shift handover system in the oil, gas, and petrochemical industry. These attributes reflect those in the Marsh energy risk ranking criteria which can be used to determine risk improvement opportunities and provide detailed advice to organizations seeking to improve their shift handover systems.

This paper includes guidance on the formal routine for the handover of communication from one shift to another, the rotational shift handover that occurs offshore, and the compilation of shift logs to aid in these handover processes.

SPECIFIC REQUIREMENTS

POLICY AND PROCEDURE

There should be a comprehensive written local policy and procedure governing shift handover. Any corporate expectations for shift handover should be available to all operating sites and incorporated into local procedures as appropriate.

The procedure should clearly define:

- The standards required for an effective shift handover.
- The contents and structure of the shift logs used in the shift handover process.

SHIFT HANDOVER

It is as important to consider the **way** in which the handover takes place as it is to consider **what** information needs to be communicated.

WHAT MAKES AN EFFECTIVE SHIFT HANDOVER?

An organization needs to ensure that shift handover communication is given a high priority and the consequences for miscommunication are clearly understood (see also Appendix A).

For a handover to be considered effective, it should be conducted:

- At the normal place of work, such as the shift office, control room, or field operator stations. For example, it should not take place in the changing room or car park.
- Face-to-face, using clear language.
- Without interruption.
- As a two-way communication with feedback. Both participants are taking joint responsibility for ensuring the accurate transfer of information. This means:
  - Developing the communication skills of existing staff with appropriate training.
  - Ensuring that communication skills are considered in the recruitment of shift-workers and are included in the training and training validation process for new employees.
- Both verbally and in written format. It should meet the information needs of incoming staff, which will mean giving consideration to:
  - The design of operator supports, usually a shift log book.
  - The input from operators on the design of these supports.

  ***NOTE:** It is not good enough to just leave the shift log for the oncoming shift to read.*
- With as much time as necessary to ensure accurate communication of information. This includes:
  - Sufficient time to prepare the shift handover log.
  - Sufficient time to complete the handover, which is typically 10-15 minutes for field/panel operators and up to 30 minutes for area team leaders and shift managers.
  - Additional time when the handover involves less experienced staff, periods of high activity, following the undertaking of complex tasks, or where shifts are 12 hours long.

ADDITIONAL OR SPECIAL HANDOVER RISKS TO BE CONSIDERED

An organization should consider how to manage additional or special risks associated with:

- Any non-standard or higher-risk handovers, such as during a plant run down for a turnaround, during a turnaround event, or on plant re-start after a turnaround. Other examples could include major project construction or commissioning activity.
- A lengthy absence from work, which could be due to:
  - Illness.
  - Shift patterns: If the shift cycle includes rostered leave periods, then special arrangements should be made to extend the handover to ensure that the returning shift team is properly updated. Some sites prepare a special set of handover notes for these situations based on a compilation of the logs over the absence period. In other cases, specific shift team members are required to return to work one day early to receive an update and/or attend a team safety briefing.
  - Offshore crew change: Most crews have two to three weeks off between work periods. This places significant additional emphasis on a good quality handover, as during the intervening period there will have inevitably been loss of awareness for the oncoming crew, while the outgoing crew will be fatigued and may be focused on travel requirements.
- Unmanned operational facilities: Areas or facilities that are not normally manned should be provided with a log book that is completed by any person visiting the area. This is to register their attendance, log their activities, and provide information on the status of the operation in that area. Key information from these visits should also be reported into the central log system for the operation. Typical facilities in this category are unmanned offshore platforms, substations, and remote pipeline facilities, such as metering or pumping stations or jetties that are not manned unless they are occupied by a vessel.
- Noncontinuous shifts: Not all shifts require continuous 24-hours-a-day coverage. For example, the shift pattern might not have a night shift but could have two day shifts of eight hours each. Consideration would then need to be given to how the oncoming day shift would receive a shift handover if verbal communication is not possible.

SHIFT LOGS

FORMAT OF A SHIFT LOG

The shift log should NOT be a blank book, in which the content is left to the discretion of the off-going shift personnel. It should follow a set format that reflects not only the basic information that the shift crews need to perform their roles, but also the information that site leadership require to be discussed to ensure the key systems of work (including process safety elements) are being monitored adequately.

The scope, content, and level of detail in a shift log should be predefined. This may vary depending upon the shift roles and should be tailored to the specific shift position in question. For example, a shift manager's log should contain high-level information to ensure that the oncoming shift manager is fully apprised of the overall status of the site operation, matters that require their attention, and situations that they may need to take into account when responding to emergencies or making decisions. A field operator's log may contain some of the same information, but it is likely to contain low-level information more relevant to the role he/she is performing.

Shift logs may be handwritten or electronic, and this may vary from shift role to shift role. In any instance, shift logs for each role should have a set format and content to ensure that relevant information is captured and handed over to the oncoming shift teams. The information required should be clearly understood and obtainable. The log should be logical, easy to understand, intuitive, and user friendly. It should include information not only on what has happened but why, and what actions have been taken. The shift logs could include checklists, area maps, process diagrams, and color coding of risks.

Typically, the shift manager's log is produced electronically, although this is not necessarily a requirement. Often electronic logs can be designed to import information from other databases that may be available, such as the process information system, product quality monitoring system, work order system, electronic permit to work system, and the incident and accident database. This reduces the amount of input required from the author. However, paper versions of logs can be equally valuable, and are commonly used for field operator positions.

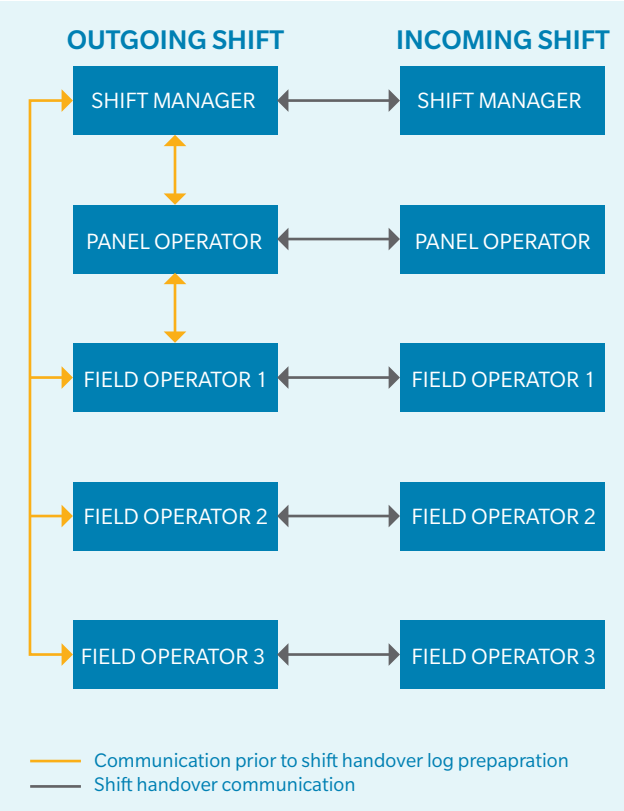
Input from the operating team is important when designing the required content for the shift logs. Ultimately, the shift log is a key vehicle for leadership to show their priorities in running the site, both in terms of what is included and the order in which it appears in the log.

Shift logs should be retained for a designated period of time, as any information recorded may be useful in the future, such as during incident investigation.

PREPARATION OF A SHIFT LOG

During the shift handover process, a shift log is the usual means of recording the information that has been exchanged between the incoming and outgoing shifts. Each member of the outgoing shift will need to prepare a shift log and use this to conduct a shift handover with the incoming shift.

Relevant information will need to be communicated in advance of shift log preparation to other roles within the shift team to ensure that the correct information is entered. The shift manager should be aware of all key information. This may require individual discussions with personnel prior to shift log completion. The diagram below illustrates how the communication network may look in a simplified shift team structure.



Depending upon the size and complexity of the operation, it may be appropriate for the organization to have a shift team meeting after the shift handover process has been completed. This is typically led by the shift manager, based around the content of his/her shift log, and attended by the relevant team members to ensure that all key information has been clearly and effectively communicated and any plans for the forthcoming shift are coordinated.

WHAT SHOULD BE INCLUDED IN A SHIFT LOG?

Key information for routine shift logs will vary by role. Information that should be considered includes:

- Shift role being handed over.
- Identity of outgoing and incoming shifts:
  - Shift name.
  - Shift rotation; morning, afternoon, night (time and date).
- Personal and process safety:
  - Incidents, accidents, and reported hazards, plus any steps taken in response.
  - Status of work permits, with particular emphasis on extensions, incomplete work, and isolations.
  - Any special permits to prepare, such as confined space entry.
  - Status of emergency control systems, with particular emphasis on bypasses or defeats (including gas detection, fire detection, relief valves, emergency shutdown, fire water systems, etc.).
  - Alarm status.
  - Temporary operating arrangements, such as air hoses on hot-spots, use of bypasses, or manual valve settings.
  - Temporary plant modifications.
- Operations status:
  - Unit operating status, operating rates, plant out of service, deviations from target, deviations from operating envelope, and any operating limitations.
  - Events such as changes in operation, tanks switches, upsets, and recoveries (include times of events).
  - Summary of operating problems and actions taken to resolve.
  - Key equipment status and changes: It is good practice to maintain a "white board" register to show the status of trips/bypasses, safety system impairments, cooling water configuration, steam and power configuration and operating mode, flare header configuration, backup equipment, and any temporary operating arrangements.
  - Equipment out of service.
  - Product quality results, including any actions taken to remedy out of specification material.
- Maintenance:
  - Status of work orders that are in progress, planned, or raised.
  - Preparation required for future maintenance activity and permit preparation.
- Any environmental excursions taking place.
- Staffing issues such as illness, any on-shift training, and any cover requirements.
- Daily instructions, including procedure changes, management communication, and special instructions.
- Routine duties: Records of any routine tests and checks performed by shift personnel on a periodic basis for the area, such as status of rotating equipment, checks on fire protection (monitors, hydrants, foam, active systems settings, and auto-start status of firewater pumping systems), and the testing of alarms, detectors, and monitors.
- Comments: A comment area can be provided to detail any other points not covered, but should be a small part of the overall handover log.
- Signatures: The log should be signed and dated by the incoming and outgoing shift roles.

For periods of special hazard, such as before, during, or after a plant turnaround, a differently structured shift log may be required to reflect the ongoing risks and status of relevant activity.

Specialized logs will also be required for marine terminals and reception/dispatch facilities (road, rail, and pipeline) where the information is related to the vessels and consignments rather the process operation. Information logged in these areas is generally required for the official transfer documentation associated with the vessels and consignments in question. Nevertheless, a log of the essential information equivalent to that described in the list above should also be maintained for handover, as well as a formal record of events.

AUDITING

Each site should audit its shift handover process on a periodic basis, with audits completed for selected shift roles. The audit should be performed by a local manager knowledgeable in the standards required, with the output reported to site management to follow-up on any actions.

An audit process would typically include:

- Observations of a shift handover taking place. This will establish if the handover standards are being followed and if there are any problems in the transfer of information.
- An evaluation of the quality of a random selection of completed historical shift handover logs, in order to establish if the logs are being provided, the extent to which information is being completed, and the relevance of the information detailed.

In addition to establishing whether the shift handover process is fit for purpose, an audit further reinforces an organization's continuing commitment to demonstrating that shift handover is a safety critical system of work.

"The audit should be performed by a local manager, knowledgeable in the standards required."

REFERENCE TO INDUSTRY LOSSES

INCIDENT SUMMARY #1
PIPER ALPHA – 1988

Piper Alpha was a North Sea gas production platform. During a routine restart following maintenance, a hydrocarbon cloud formed and subsequently ignited, killing 167 workers. Unknown to the personnel starting the pump, a relief valve in the pump discharge had been removed for service and a blank had been loosely installed in its place on the piping flange (which was not readily visible from the pump vicinity). When the pump was restarted, this flange leaked, producing a flammable hydrocarbon cloud, which subsequently found an ignition source.

The Cullen report concluded that one of the contributing factors to the Piper Alpha disaster was the failure to communicate information at shift handover. During shift handover, the status of the pump work was addressed, but the relief valve work was not mentioned or recorded in the shift logs. There was no written procedure for shift handover in place, and there was no structure as to what items to include in the handover.

INCIDENT SUMMARY #2
TEXAS CITY REFINERY FIRE AND EXPLOSION – 2005

In this incident, a splitting tower was overfilled after start-up from a maintenance outage, resulting in a flammable vapor cloud and a subsequent explosion, killing 15 people and injuring 180. Financial losses were reported to have exceeded US$1.5 billion, with houses damaged as far as 1.2 kilometers from the refinery.

The US Chemical Safety Board investigation noted that supervisors and operators poorly communicated critical information relating to the start-up during the shift handover, and no shift handover communication requirements for operations staff were in place. This was deemed to have been a contributing factor leading to this incident.

APPENDIX A – SELF ASSESMENT CHECKLIST

The following checklist is a quick tool that a site can use to test its existing processes for good practice.

	Y	N	PARTIAL
PROCEDURE			
Does the site have a formal written shift handover procedure?	☐	☐	☐
SUPPORTING INFRASTRUCTURE			
Have the requirements to complete an effective handover been put in place? (For example, defined locations, face-to-face two-way communication, free from interruptions, verbal and written communication.)	☐	☐	☐
Have staff been appropriately trained in how to conduct a shift handover?	☐	☐	☐
Does the process recognise the need for shift logs (written or electronic) to be in place for the handover?	☐	☐	☐
Is sufficient time given to prepare and deliver the handover?	☐	☐	☐
Are higher risk non-standard handovers considered, such as at turnaround or during project activity?	☐	☐	☐
Is account taken of additional handover requirements that may be required after a lengthy absence?	☐	☐	☐
Is a log book provision made for unmanned operational factilities?	☐	☐	☐
Has consideration been given to units where noncontinuous shifts may be in place?	☐	☐	☐
Does each role on shift complete a shift handover with a handover log book?	☐	☐	☐
Are the contents of the log book clearly defined for each role?	☐	☐	☐
Is a post-shift handover team meeting needed?	☐	☐	☐
STEWARDSHIP			
Are shift handover log books retained?	☐	☐	☐
Is there an audit process to ensure shift handover is being appropriately conducted?	☐	☐	☐

FURTHER READING

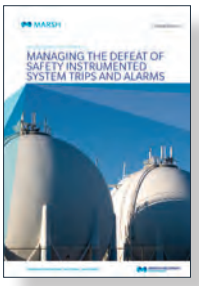
Health and Safety Executive (HSE) website: http://www.hse.gov.uk/humanfactors/topics/shift-handover.htm
HSE website: Extract from inspectors human factors toolkit – Safety critical communications http://www.hse.gov.uk/humanfactors/topics/common3.pdf
HSE (1996) Effective Shift Handover. OTO 96 003 http://www.hse.gov.uk/research/otopdf/1996/oto96003.pdf
HSE (1999) Reducing Error and Influencing Behavior HSG48, HSE Books, London, UK (free to download) http://www.hse.gov.uk/pubns/priced/hsg48.pdf
Andrew Brazier and Brian Paccitti, Improving Shift Handover and Maximizing its value to the business Symposium series no 154, IChemE 2008
HSE Improving Communication at Shift Handover, Prepared by The Keil Centre for HSE, http://www.hse.gov.uk/humanfactors/topics/shifthandover.pdf
Energy Institute Human Factors briefing note No 10 http://publishing.energyinst.org/__data/assets/file/0003/71373/BN-10-Communications-web.pdf
Shift handover after Buncefield, John Wilkinson, Ronny Lardner, Chemical Engineering Transactions Volume 31, 2013. http://www.keilcentre.co.uk/media/1059/After-Buncefield-Handover-Paper-April-2013.pdf
Department of Energy (1990) The Public Enquiry into the Piper Alpha Disaster Vols 1 & 2 Cm 1310 London: HMSO
US Chemical and Hazard Investigation Board, Investigation Report, Refinery Explosion and Fire (15 killed, 180 Injured), Report No 2005-04-I-TX March 2007

PREVIOUSLY PUBLISHED ENGINEERING POSITION PAPERS

Marsh's engineering position papers leverage our knowledge on best practices to establish standards that don't currently exist. These papers define the key attributes that we would define as being "very good."

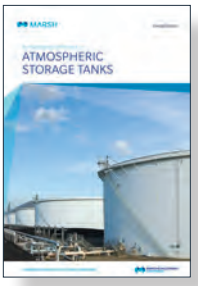
PRE-START-UP SAFETY REVIEW

These recommendations can be used to support and define risk improvements and also provide detailed advice to clients seeking to improve their management systems.



MANAGING THE DEFEAT OF SAFETY INSTRUMENTED SYSTEM TRIPS AND ALARMS

Whenever a safety instrumented system is defeated, the risk exposure is increased to an extent that depends on the nature of the hazard involved.



ATMOSPHERIC STORAGE TANKS

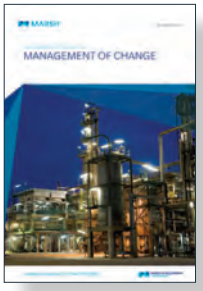
Following numerous incidents involving atmospheric storage tanks, data has been compiled indicating that overfilling of atmospheric storage tanks occurs once in every 3,300 filling operations.

PROCESS SAFETY PERFORMANCE INDICATORS

The process industry has a long history of major incidents that are well-publicized. The underlying causes of major incidents are often related to failures in process-safety management.

FIRE PRE-PLANS

There have been numerous large, damaging fires over the years, including tank fires. These often involve massive product losses, major plant damage, and process interruption.



MANAGEMENT OF CHANGE

During the lifetime of an operating process plant, many changes will occur, including to the physical hardware of the plant, control systems, business processes, and/or to the organization running the plant.

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