

Lessons learnt from the introduction of human performance concepts and tools on oil and gas platforms.

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This paper discusses the lessons learnt when human performance concepts and tools were introduced to offshore operations in the North Sea.

Keywords: human performance; situational awareness; cognitive bias; human error; error producing conditions; trust

Background

Chevron North Sea Limited operates 4 producing fields in the North Sea, with four manned installations and one normally unmanned installation. Chevron employs incident free operations (IFO) coaches who deliver support to operations offshore with the purpose of delivering IFO. The aim of the IFO programme is to drive continual improvement in Operational Excellence performance. This was undertaken through the provision of a series of training modules and tools that were delivered by the coaches to enhance human performance (HP) understanding offshore. With this aim in mind Chevron partnered with The Keil Centre, a consultancy that specialises in human factors. The Keil Centre developed a tool called Team Error And Violations Analysis Method (TEAVAM) to help organisations manage human error proactively. This approach was utilised in the IFO approach and rebranded for the purposes of the organisation.

The IFO coaches were trained during a series of train-the-trainer sessions and delivered the first five modules offshore during 2016. Although the material was initially developed by The Keil Centre, the final version of the materials and tools were a joint effort based on an open discussion. All training materials were provided to the IFO coaches with detailed delivery notes and supported by further reading.

An initial baseline survey was completed on the offshore installations to gauge current understanding and application of HP. This included questions about personal behaviours and understanding as well as the behaviours of colleagues, supervisors and leaders. The survey covered topics such as communication, safety compliance, risk awareness and risk prevention behaviours. A follow-up survey will be completed in 2017 to understand the impact of the HP project offshore. Anecdotal feedback was collected during the training sessions and will be discussed in this paper.

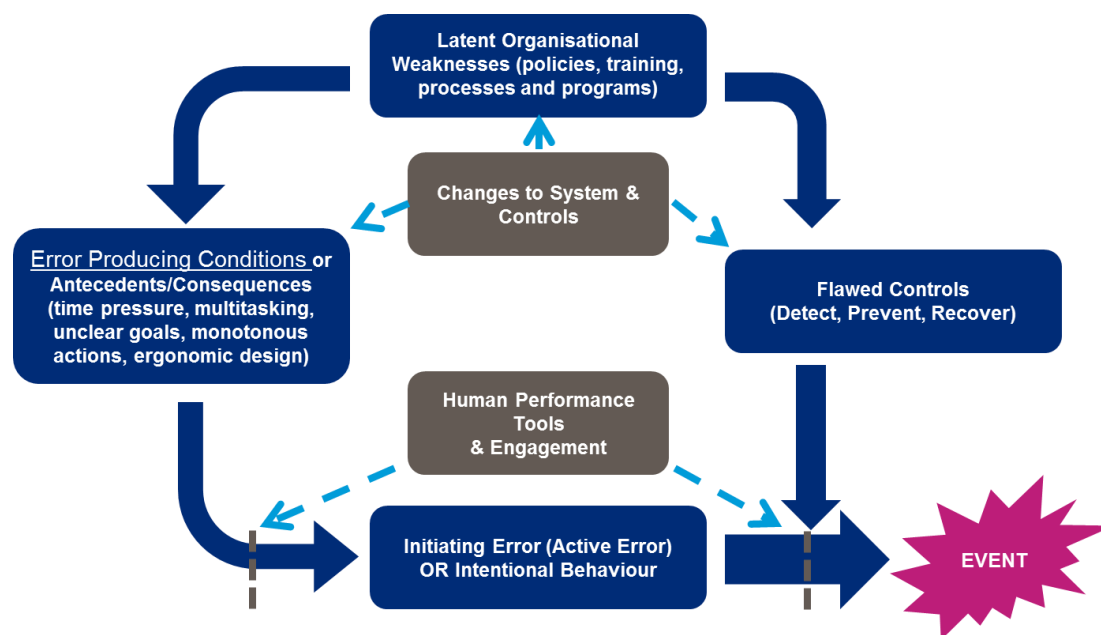
Further modules have been developed and will be delivered during 2017. These modules will focus on the application of the HP tools offshore and to develop awareness of the concepts onshore.

Key Concepts

Initially five training modules were prepared for offshore personnel that included two modules specifically for leaders (managers and supervisors) and three modules that were delivered to all employees but aimed specifically at front-line staff. The main aim of the first five modules was to introduce the key HP concepts and to engage all staff in the programme.

Human Performance Framework

A HP framework was developed to explain the conditions in which human errors are more likely to occur. Model 1 illustrates that human errors often occur when there are latent weaknesses in the organisation that lead to Error Producing Conditions (EPCs) and Flawed Controls. EPCs are defined as any condition that makes errors more likely to occur and include things such as time pressure, fatigue and poorly designed procedures. Flawed controls refers to a system which does not adequately prevent errors occurring or detect when errors have occurred or allow the situation to be recovered following an error. The role of latent organisational weaknesses has been a key message of the programme and tools have been developed to help recognise and reduce EPCs at all levels, improve controls and develop tools and safe habits that workers can apply to reduce the likelihood of human errors at the workplace.

Model 1: Model of Human Performance**The fallibility of humans**

One of the key concepts that was communicated at the start of Module 1 was the fallibility of humans – we all make mistakes and human errors often contribute to incidents. The tendency to over-trust both equipment and colleagues was emphasised and the concept of creative mistrust (Hale, 2000) was introduced. ‘Creative mistrust’ is similar in many ways to the concept of ‘mindfulness’ where emphasis is on constantly being aware, never being satisfied with safety performance and looking to anticipate potential issues. It was important that any complacency was challenged at the beginning of the programme so that employees were willing to take on board new concepts.

Error Producing Conditions

Nine categories of EPCs were introduced and explored through case studies. The categories introduced were work environment/ergonomic; procedures; Lack of training/knowledge; multi-tasking/concentration; complexity of task; individual factors; team/communication; time pressure/high workload; and violation of a rule. These EPC categories were then incorporated into tools that would be applied at a later date. Examples include a decision-making tool to help prevent the introduction of latent EPCs and a pre-task discussion sheet to explore existing EPCs before a task commences (e.g. the correct tools are not available!).

Human Error Types

“Human error is an unintended human behaviour; the person has done something that they did not set out to do, and is usually puzzled by how their unintended behaviour came about. To be considered an error the unexpected outcome occurs as a result of the behaviour of the individual rather than the influence of an external event.” Mitchell & Scaife, 2015

Four categories of human error (Sensory; Memory; Decision; Action), based on a model introduced by Wickens (1984), were introduced during the training. Wickens (1984) describes how people process information firstly through sensing what is happening around them (using sight, hearing, smell, taste, touch and balance), retrieving information from their memory, making a decision on how to respond and then acting on what they have decided. An error can occur at any one of these stages and understanding this process is an important step in learning to manage error effectively. The delegates practiced classifying errors and these classifications were incorporated into HP tools, such as a tool to analyse a human error and a pre-task discussion sheet.

System 1 versus System 2 and cognitive bias

The seminal work of Daniel Kahneman (2011) on *system 1* and *system 2* thinking was introduced and several examples were used to illustrate this work. Kahneman describes how *system 1* thinking is fast and automatic and does not require great effort. *System 2* thinking is more effortful, deliberate and logical. Kahneman describes how, to avoid the effort and energy, people develop mental shortcuts known as heuristics. These shortcuts can often save us time but can lead to cognitive biases in our thinking that result in poor decision being made. An example being that when collecting evidence to make a decision we only look for evidence that confirms our way of thinking and ignore evidence to the contrary (confirmation bias). Bias impacts many areas of safety. For instance, when investigating an incident people may be impacted by hindsight bias i.e. in

hindsight the correct actions/decisions to take may seem obvious. The types of cognitive bias and their potential impact were discussed and a tool was developed for decision making to help identify where cognitive biases have been made.

Situational awareness

Another concept that was introduced was the concept of Situational Awareness (SA). Endsley proposed three stages of SA (Perception; Comprehension; Prediction) and these were discussed with reference to the prevalence of errors in each of these stages.

Human Performance Tools

As well as managing the conditions that contribute to error, one of the key focuses for managing error is in the use of HP Tools. Wachter and Yorio (2013) had researched and identified the top 10 HP tools used in high performing organisations in several industries. For the purposes of this project these were distilled down to the 5 most practical ones. This included 3-way communication; Peer Checking; Concurrent verification; Jobsite review and Contingency planning. Each HP tool was discussed with reference to relevant examples of incidents which would have been prevented through effective use of the tool. The 5 HP tools were developed into a handbook with simple instructions for use (see model 3). The tools were introduced during the first 5 models and a programme to encourage use of the tools will be part of the next stage.

Model 3: Three-way communication

Three-way Communication

This tool should be used to ensure critical steps are being followed precisely & information is being correctly understood. It should also be used during safety-critical communications (e.g. shift handover, changes to equipment).



- 1) The performer states the message
- 2) The receiver acknowledges the sender and repeats the message in their own words
- 3) The sender acknowledges the receivers reply and corrects any misunderstandings

Understanding Intentional Behaviours

The offshore leaders were introduced to ABC, a practical model of understanding non-compliance in the workplace. ABC stands for *Antecedents – Behaviour – Consequence* and is a simple model, grounded in Psychology that helps people think through the degree to which the Antecedents (the precursors to a behaviour such as training; procedures; the example of others) and Consequences (the perceived positive or negative consequences of following that behaviour) are in place to support a behaviour and what needs to be improved. Following feedback from this module the model was simplified even further to focus on three things. Are people: able to do it; prompted to do it; motivated to do it. The aim of this tool is to think through the behaviour systematically from the point of view of the person doing the task and put things in place that maximise the chance of people engaging in the required behaviour.

Group Think

As well as understanding the behaviours of others the leaders also discussed how they interact as a group and make decisions. Group think occurs when a group strives for cohesion and unanimity rather than objectively appraising all the options. This can result in poor decisions being made and examples were discussed that have resulted in major incidents. Two tools were introduced that help the group avoid group-think situations. One of these tools involved a member of the group being assigned the role of 'devil's advocate' and purposely asking difficult questions. The other tools involved members of the team writing down 3 questions that the decision maker should consider between meetings, thus avoiding any initial defensive reaction.

Trust

Other topics in the leaders modules concerned how they interacted with their teams, including how they build trust. There has been a great deal of research on the importance of the trust of managers and it has been shown to be a strong predictor of how safety compliant and pro-active people are (Mitchell, 2007). A model of trust (Mayer et al, 1995) was introduced to the group and a discussion was held on practical ways that trust could be developed.

Managing social threats in safety discussions

David Rock (2008) describes five social threats (e.g. questioning Status) that have a similar impact on the brain as a physical threat (e.g. the body gets prepared to fight or flight). These 'social threats' have the impact of derailing conversations and the group discussed ways to manage these social threats in a productive way.

Future topics

More modules are to be rolled out next year and new topics will be introduced. These modules will include topics such as safety leadership; procedural and organisational drift; latent failures and cognitive bias following an incident.

Training style

One of the key requirements of the training modules was that they were interactive. In order to achieve this the modules included many case studies, games, quizzes and discussion to enable the delegates to consider how the new information impacted them. Games were developed to illustrate the importance of using HP tools. As an example, a game was developed in Microsoft Excel where pairs of delegates had to recall the colour sequence of wires to successfully defuse a device. This game was used to illustrate the limits of short-term memory and how delegates can use the HP Tool 'Concurrent Verification' to improve the chances of success.

An 'escape' game was developed to reinforce the learning from the modules. This involves a series of linked puzzles that delegates have to solve in order to escape from a room. Each puzzle requires the use of a HP tool and after each puzzle the use of the tool is discussed.

The IFO programme is leadership led and owned with the IFO coaches supporting the delivery of the main modules. To further reinforce the role of leadership in the programme a number of 'bite-size' modules have been developed to allow platform leaders, including the Offshore Installation Managers, to take the lead on delivery of IFO materials. In this way, the leaders can show their commitment and demonstrate their knowledge and understanding to the workforce involve. These are short modules aimed at reinforcing tools and concepts through worked examples.

Tools for developing Human Performance

Introducing the HP concepts was one aspect of the project, however there was also a need for a set of practical tools that could be applied on a day-to-day basis.

HP Tools booklets for Performers and Leaders

These booklets are designed so that performers and leaders can refer to materials to remind themselves of the HP tools and concepts which have been delivered in the modules. The idea is that these will act as a prompt for using the tools before or during these tasks for performers. They can be used by leaders to support pre-job discussions and when undertaking worksite discussions.

Pre-job discussion form

A pre-job discussion form was developed that help the team think through any errors that are likely to occur on the task as well as EPCs that need to be addressed. Just before starting work is an important moment to remind the team of potential errors and how they can be managed. It is also an ideal opportunity to remind employees to use and HP Tools or Safe Habits they have discussed.

Post-job discussion form

A post-job discussion form was developed that help the team debrief the task and capture any lessons that can help for undertaking the task in the future. Just after finishing work it is an important moment to reflect on the activities undertaken to identify what went well, any potential errors and how they were managed. It is also an ideal opportunity to reinforce the use of HP Tools with the team.

Lessons Learnt

Development of single page lessons learnt documents for sharing at team meetings, team briefs and safety meeting has resulted in the improved understanding of how HP tools can be used as part of everyday work activities. These documents can be generated on positive or negative findings and by anyone in the organisation to ensure that learnings are shared at all levels.

Lessons Learned

Building internal expertise

At the start of the project the IFO coaches were relatively new to the topic of HP. They received training in coaching skills and in-depth training on the material. They were given all the references for the material and extra reading to embed the learning. Even at this early stage the IFO coaches were confident to shape the materials and they worked jointly with The Keil Centre to improve and add to the material. What was particularly helpful at this stage was to print out all the slides one to a page, lay them out on a big table and move them around until everyone was happy with the order. As the IFO coaches started delivering the modules their confidence grew, they started to read more widely on HP topics and they started to see new opportunities for the programme. The development of the IFO coaches has been a key component of the project as they are the ones responsible for coaching employees on the platform and giving support to leaders. The coaches had to be adept at delivering training and coaching colleague offshore. In addition, they must have an interest in human factors and a willingness to learn.

Making tools simple and easy to use

Following delivery of the initial modules the feedback indicated that some of the tools were proving too complex and time-consuming for people to use. In particular, the ABC tool for analysing intentional behaviour that was initially introduced was re-designed so that it was more streamlined and easy to use. Most of the tools have been adapted and continually improved as the project has progressed.

In addition, the feedback from the IFO coaches has been valuable for identifying tools that will work in practice. The initial analysis tool that had been developed for analysing errors that could occur in tasks was correctly identified as being too unwieldy. This was originally a 3-step process and was cut down to a straight-forward A1 sheet that is easy to complete.

Recognising what it is not

One of the key aims of the project was for the company to manage errors more proactively. This involves employees being able to think through their tasks and identify where errors might occur. The tools that were designed are not intended to replace more detailed approaches to identifying potential errors, such as Safety Critical Task Analysis. The approach has been targeted at prompting workers on the job to be more aware while they are doing the task of situations that might make errors more likely and to adopt tools and safe habits to manage these situations proactively. In this regard, opportunities to remind and embed the tools during pre-task discussions and safety conversations are a key component.

Involving all levels of the organisation

In order to embed these HP techniques it is important to get the involvement of all employees. It was recognised that the programme will not progress unless senior leaders are involved. This means engaging onshore staff as well. The next stage of the project will involve targeting the onshore population and highlighting the role they have in creating the right conditions to manage HP. In addition, the leadership offshore will be involved in promoting the programme. It is currently too early to give further feedback on the impact of this engagement.

Reducing complex language

Although all the materials for the modules are based on current research and good practice it was important to ensure the materials were not too academic. This was largely achieved although some feedback suggested that some of the slides were still too academic. Having IFO coaches and the consultancy work jointly on the materials helped to reduce the academic language in the materials and this will continue to be a priority. The high degree of practical exercises helped delegates engage with the material.

Conclusions

The programme has received excellent feedback from employees and anecdotally there is a great deal of engagement in the programme. The next stage of the programme will involve the practical application of the HP tools and the aim is to embed the concepts and projects into everyday working life.

Human Factors knowledge and awareness is often only developed in a few identified 'expert' practitioners within a company. This programme is novel in that it attempts to upskill the whole workforce in terms of Human Factors awareness and this should have a positive impact on safety.

Areas for Future Consideration

Human Error Analysis Tool

A tool that the supervisor and the team can use to analyse Human Errors that occur on site. The tool drills down into the type of error that has occurred and the EPCs. It has pre-populated recommendations for issues that have been identified to guide the team through the process.

Intentional Analysis Tool

A tool that the supervisor and team can use to analyse and Intentional non-compliance behaviour that has occurs or to ensure a new rule is followed. The tool drills down into the different items under the headings Able to do it; Prompted to do it' Motivated to do it. The tools look at the current situation and what needs to change.

Decision making tool – Latent EPCs and Avoiding Bias

A booklet that helps groups making decisions consider whether the decision they are making is introducing any EPCs into the workplace. The group work through a series of questions that challenge whether they have addressed potential issues relating to the 9 EPC topics. In addition, the group can consider how they made their decision and whether cognitive bias may have played a part.

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