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Solving Human Factor Issues as Applied to the Work Force

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WORKING GROUP 4

2ND INTERNATIONAL WORKSHOP ON HUMAN FACTORS IN OFFSHORE OPERATIONS (HFW2002)

SOLVING HUMAN FACTOR ISSUES AS APPLIED TO THE WORKFORCE

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SOLVING HUMAN FACTOR ISSUES AS APPLIED TO THE WORKFORCE

1.0 INTRODUCTION

This paper aims to capture a range of current approaches to the management and delivery of safety by means of addressing workforce human factors issues. The paper is divided into a number of sections and each section is the product of the facilitated debate and discussions around the original discussion paper.

2.0 HOW DO YOU ESTABLISH THE CORRECT MANNING LEVEL?

Crew numbers were cut during the $12 barrel period with many offshore operators adopting long term plans to operate profitably in the $11 barrel range. Now that prices are higher, the companies are taking considerable profits but there remains a degree of sentiment that the low prices could yet return.

Many organisations have attempted to develop methods for determining ideal crew sizes. Some have been more successful than others. Some petrochemical companies have linked manning levels to the types and number of pieces of equipment, e.g. compressors, exchangers or reactors that are operated or maintained. The results have reportedly lead to under- rather than over-staffing. Attempts have been made to apply analyses developed for establishing crew compliments on Royal Naval vessels or manning levels on manufacturing plant. A number of defence contractors have produced methodologies for determining crewing levels for military ships and also ship naval ship repair yards. These methodologies are based on detailed task analysis and work planing theory.

The above approaches work satisfactorily when applied to a war ship as roles and responsibilities are very clearly defined. They do not appear to work when applied to repair yards and reports from offshore operators who have engaged defence contractors to analyse manning levels are that these projects have not been successful. These failures are not in the public domain but tend to come to light in discussions between HSE Inspectors and operating offshore company staff when the latter are explaining how the current staffing was determined.

Naval crew levels have been much higher than commercial ones as war ships are usually over-manned to cover for the additional requirements of battle conditions. Because tasks and roles are very tightly defined with clear hierarchies a considerable body of past analyses can be called upon to reduce the costs of undertaking a new assessment, additionally the costs can be amortised over a number of identical vessels. Similar arguments apply to the work and job

analysis methods when applied to the staffing of manufacturing plant. The work in manufacturing is made possible by clearly defined tasks to a degree that cannot be related to the typical offshore environment.

In our experience detailed task analysis of offshore crew levels always results in a recommended crew level that is higher than the current compliment. As mentioned above, this experience comes to light only in discussion with offshore operators who are often quite disappointed with the poor outcome of an expensive consultant's project and as a result such analyses tend to be ignored. There is a clear case for more open sharing of experience between operators with a forum for bench marking techniques and approaches to staffing levels.

We have found that the staffing levels for emergency response are easier to assess than those for a normal or abnormal operating regime. The latter is probably the most difficult. The UK regulatory framework requires a Duty-holder to provide a demonstration of an adequate emergency response plan. The requirement for demonstration is the key and is the area where shortages of staff will become apparent. It has not been uncommon to find plans in which the same individual is required to treat the injured in the role of first aid medic and provide regular status reports as radio operator at one and the same time!

HSE has recently taken enforcement action with regard to inadequate manning on an offshore installation. The operator did not contest this action as the number of fatigue-related problems and rise in human error had led them to the reach the same conclusion. We have a 22 item question set to assess down manning (see Appendix 1) which the author has found to be effective but which has yet to be formally evaluated. The approach taken in the question set to require a demonstration that the operation at the current manning level is not subject to problems know to be caused by insufficient personnel. There are a number of benefits to this approach:

1. It removes the dependence on synthetic data as the operators and jobs are available for direct assessment.
2. There is no legal defence against reducing staff numbers when problems due to insufficient staff are already apparent (prior knowledge).
3. If manning levels are already too low the assessment of the current these manning levels and past accidents will invariably draw the senior management's attention to the cost of down time and accidents resulting from insufficient staff.

The methodology does require the operating company to have a record of past accidents, incidents and ill health in sufficient detail to analyse for workload related problems, however as a Regulator we would argue that no organisation should contemplate reducing staff unless it had these basic monitoring mechanisms in place.

Benchmarking manning levels with similar facilities in your own or another organisation can be effective. It is better to benchmark within your own organisation as more variables will be the same. Or course it is easier to benchmark when an installation is similar to others. If the work site is new or novel then it may be necessary to turn to outside consultants who may have experience of this type of plant.

In such a situation in which the plant or installation represents a departure from traditional or historic practice, the process of HAZOPS can be used to arrive at estimates of emergency manning levels based on the HAZOP scenarios. This can be very effective as the emergency scenarios represent the situations in which the manning level is most critical. When using the HAZOP/scenario approach it is important to select a range of representative scenarios. These should include such elements as (for example) critical tasks, simultaneous operations, and combined operations with other organisations.

Ongoing monitoring can provide a validation of manning levels in the form of periodic interviews with staff or discussions when jobs or task are planned. It may be tempting to raise workload issues during annual staff appraisals or reviews but it is improbable that workers will complain to too much work when bonuses are being discussed. In any review or HAZOP process it is important that those undertaking this work are fully conversant with the details of the tasks and activities. One way to monitor manning levels is to establish a set of performance indicators which can be tracked.

Lastly remember that problems can occur outside your work site as well as in it: is also important to monitor contractors to ensure that they are not aggregating additional hours while away from your site, by working on another contract for example.

3.0 CHANGES IN WORK ORGANISATION

The reduction in staffing has lead to the introduction of multi-skilling and multi-rolling to the extent that many of the old trade and craft demarcations have gone. Supervisors have given way to team facilitators and technicians now manage delivery assets. These changes are having a number of knock-on effects. The old common taxonomy for describing jobs no longer applies so that workers find it difficult to know what job they do. This makes applying for jobs very difficult as it does matching staff to jobs.

These changes have also introduced something of a split between those amongst the UK workforce from the old “smokestack” industries and those who only recently joined the labour-force. The older generation raised on rigid hierarchies and organised labour representation find it difficult to speak up in the new flat and “open-door ” organisational settings, a factor that could be very significant for the success or failure of any work-force involvement programme.

Many organisations are adopting semi-autonomous work teams, team based working or "self-managing" teams. These changes are associated with significant cost reductions and improvements in productivity when properly introduced. If the implementation is good than significant safety improvements can also occur due to such features as greater employee ownership of safety and employees discretion to allocate the required resources quickly[1]. These changes and the greater range of the jobs that result can require a heavy off-the-job training demand that can be difficult to meet when crew levels are cut to marginal levels. We now believe that non-attendance at training (typically for multi-skilling) is a key performance indicator for an excessively low crew level. Where staff are multi-rolled regular practice will be required for each of the roles, often with a greater emphasis on the less frequently applied skills[2].

Like most in the industry we are concerned about the impact of organisational change on safety performance. An example of industry practice is attached at Appendix 2. The approach taken is to ensure the maintenance of the normal management of risk processes throughout the change period. In practice this simple object masks a number of problems. Interestingly BP have been at the forefront of developing approaches to maintaining safety during change but the two key elements to their success do not appear in the attached materials from BP. These two elements are temporary over provision of expert staff during the change process and very fast and open communication paths from the workforce to the management to enable managers to identify and resolve problems before they become serious. One successful change used dedicated telephone hot lines to provide progress reports to staff working on the plant and allow these staff to provide feedback on problems as they occurred.

The additional variety brought into the work-site by multi-skilling can make for more interesting and rewarding jobs so long as the process is well managed. Delegating some authority to a work team does not mean that no one is in charge. Decisions still have to betaken, getting the job done safely is still someone's responsibility and management remains accountable. It is particularly important to be sure who is responsible for taking charge in an emergency, the best way to be sure is to run regular and varied emergency response drills. Even straight forward emergency response tasks such as raising the alarm have been known to be forgotten in a poorly organised team in which no one took charge.

Remember that changes is work organisation and the deployment of staff are as significant and critical to the safe productive operation of a site as are changes in technology or plant. As such they need to be planned with the same rigor and checks and balances as would be usual for engineering changes.

[1] HSE contract research report : OTO (?) Safety Implications of Self Managed Teams
[2] Oil Industry Advisory Committee publication "Multi-skilling in the petroleum industry" HSE books.

4.0 COMPETENCE

The change from job based to role, task or team-based working has introduced a number of problems for traditional approaches to competency based on the assumption of defined jobs with linear career development. Many HSE regulations require a “competent person” however the working definition of such an individual tends to contain insufficient information to establish a clear definition of the level of knowledge or skill required. Major duty-holders usually have well defined competence assurance programmes in place however it is not uncommon to find little or no mention of sub-contractors in these despite the significant proportion of such staff working on the same company’s installations.

The UK National Vocational Qualification (NVQ) system attempts to break all of the required competencies down into discrete observable elements with a recording and assessment system. However required level of detail renders the NVQ process cumbersome and open to abuse and its adoption therefore patchy.

As a regulator we have experienced particular difficulty inspecting for competence and as a consequence we are about to embark on a programme of work to attempt to identify the key enforcement issues. The poor coverage of task and job analyses in the UK offshore sector that is a contributor to the problems of determining manning levels is also a barrier to establishing detailed skill and competency matrices.

One area that is worth developing is the linking of the hazard assessments and safety barriers detailed in the operational Safety Case to a set of core competencies for staff whose work is critical to the integrity maintenance of these barriers and defences.

A common error is to assume that "training" = "competent" whereas of course training is important part of becoming competent but experience and learning are also vital. Programmes for mentoring which work by assigning experienced staff to guide the less experienced can be very effective. This applies to both new-hires and staff new to a specific task or job. The mentoring approach is very compatible with, and appropriate to, a well managed change process. Remember to provide ongoing management support for the staff doing the mentoring to ensure they have the additional time to take on this extra responsibility. Provide clear corporate support for the 'right way of doing things' so that the mentors do not get diverted into bad habits by less experienced staff. Mentoring programmes can fall victim to cost cutting; if such a programme is working well be sure to collect performance data to support the programme.

The US approach of working with local colleges to establish skills based foundation programmes is a good one as it sets an agreed and validated base line for workers coming on to a high hazard plant to work. If such a programme is running in your area then participate in it, if it is not then use your industry networks to set up a local programme models on successful approaches elsewhere.

5.0 SHIFT WORK AND FATIGUE

Workers on offshore oil installations appear to be the only major UK employee group who routinely adjust their circadian rhythms (by up to 12 hours) to adjust to their working schedule. This has many consequences, some beneficial, some not so. The primary benefits are significantly increased night shift performance. However this comes at the cost of a period of poor performance during adaptation to nights at the start of the tour and back to days after a roll-over (on a 7N/7D schedule) or at home at the tour end (on a 14N schedule).

A number of issues have come together to provoke considerable heated debate around the removal of the mid-tour rollover so that workers do a tour of 14 days with the next tour being one of 14 nights. We believe this to be safer and healthier for a number of reasons, however it van be very unpopular with some members the workforce. Objections centre on two factors, firstly workers prefer to adjust back to days while offshore rather than have this eat into their leave time, secondly they cite increased travel risk due to fatigue when coming off 14 nights. We are receptive to these arguments but note that as safety regulator we cannot condone tiredness at work in preference to tiredness at home, even when the consequences are domestic disharmony (the biggest single complaint)!

We have an extensive programme of research on shiftwork and we are currently investigating the issues around adjustment offshore versus adjustment onshore. The recent data does not support the workers proposition that adjustment back to days is faster in the regimented regime offshore. Quite the reverse appears to be true, however more data points are required before we can make any definitive statements. The road accident research would also predict that fatigue related driving accidents would be more likely to occur when driving from home to an early morning check-in at the heliport than when driving home at night at the tour end while still night adjusted. We have not been able to collect detailed information to support this proposition but a small pilot study found only one fatigue related offshore commuting accident and that was an early trip to the check-in.

We are concerned about fatigue as a result of excessive hours in cases where overtime is worked beyond the 12 hours. We now believe that overtime is another one of the key indicators for insufficient manning. A recent paper on this topic is appended[3].

[3] *Shift-working offshore: roll-over vs. permanent nights*: Robert Miles; Offshore Safety Division, HSE. ERA conference proceedings, London 2001.

There is a wide variation between countries with respect to the extent to which working hours are regulated by national legislation and this is an important factor in determining the way that shift work is organised. For examples some countries apply a maximum day or night shift length, typically 12 hours, although some may alone one or more hours overtime under specified circumstances. A total number of days offshore may be specified, as may be a total maximum number of workdays per year. Some countries apply a waiting to permissible hours worked that takes into account the nature of the work or the harshness of the work environment. This seems a sensible approach and one that could be applied as a matter of good practice, regardless of the extent to which is was required by specific regulation.

In the European Community and Norway the trend has been for greater formal regulation of working hours on the grounds of improved safety, long term health and quality of life. However in practice such regulation often has ambiguities, or opt out clauses that can be exploited by less scrupulous employers and as with all regulation it is only of value if enforced. In practice it can be difficult to obtain accurate figures for hours worked as employees and managers may work together to conceal the true length of hours worked. A useful approach is to consider the worker as the critical component in a socio-technical system. As with all components the operator also needs maintenance and repair and has to be 'fit for the task'. It is sometimes hard to understand why a major company will pay the full rate for staff in critical posts who are close to sleep due to long hours when they could have someone alert if hours were cut slightly.

6.0 WORKFORCE INVOLVEMENT

There is now considerable evidence from a number of major accident investigations that greater workforce involvement is associated with improved safety. The key knowledge and experience required to recognise and identify a dangerous situation is usually to be found in those who have the most experience, often the front line process operators and maintenance staff. There are safety and performance benefits to gaining their involvement is the design / procurement process as a means of preventing the implementation of difficult to use or dangerous equipment and procedures. Evidence of the benefits of this approach are to be found in the work on Human Factors Engineering with some excellent cost benefit material collected by advocates of this approach which has been more widely adopted in the US than the UK[4].

There are a number of barriers to greater workforce involvement; the recent lay-offs have produced a climate of distrust in some companies and workers need to be equipped with sufficient knowledge to participate constructively. In addition managers need to be secure and competent so that the process is not taken by them to be a threat to their authority.

[4] GE Miller: Human factors engineering, what it is and how it can be used to reduce human factors errors in the offshore industry. OTC 10876.

One theoretical approach to work-force involvement it to look at the process from the perspective of distributed knowledge. The managers, engineers and technician/operators all hold some of the knowledge required to fully assess the risks of an activity and how best to mitigate them. Not until their knowledge is pooled can a real picture be assembled[5].

Some three years ago the UK offshore industry introduced their STEP Change in Safety Initiative. This has been a great success with demonstrable and considerable improvements in safety performance in a number of areas. The STEP initiative merits a paper in its own right and is too large to covering detail here but full information is available on an excellent web site at www.stepchangeinsafety.net.

One part of STEP is the setting up of a number of safety networks, one of which is the Workforce Involvement Network or WIN. WIN has recently undertaken a survey of offshore workers and produced a report on the findings[6] in which issues raised by the workforce are responded to by Offshore Installation Managers (OIM's) and other senior mangers within the industry.

7.0 DESIGN

HSE is concerned about the number of incidents in which poor design is identified as a causal or underlying factor. Historically poor design has been grossly underreported with many incidents involving unusable or dangerous equipment being attributed to “human error.”

Recent HSE funded research has concentrated on the development of performance indicators for the design process so that a major operator could be equipped to audit the management of the design of a new installation. The outcomes from this research are two new methodologies, the Design Safety Performance Indicator (DSPI) and the Design Capability Maturity Model (DCMM). Both of these methodologies are described in detail in HSE contract research reports[7]. The DSPI provides a means of associating and tracking the relationship of each component of a design process to the overall safety performance and identify areas of the design process that are weak. The DCMM provides a means of assessing an organisation's high level capability to produce a design that is likely to be safe.

The fractured nature of the supply chain with many suppliers and sub-contractors means that bringing together designers and users is problematic. Offshore workers tend not to consider poor design as one of the underlying causes of accidents and so poor design is greatly underreported in past accident investigations and reports. When human factors experts and users participate in accident investigations more examples of poor design are found.

[5] Busby et al: Distributed cognition and human factors failures in operating and design processes. 2002 in press.
[6] Step change in safety. Workforce involvement network; Year end report and feedback survey, Southern North Sea, 2000 - 2001
[7] Copies will be provided for the workshop

One of the major benefits of isolating design causes is that remedial work can then be identified in the form of equipment improvements so reducing the probability of a repeat accident. Anyone responsible for safety will recognise and share the disappointment and frustration that comes with seeing workers killed and injured in repeats of known and preventable accidents.

Operators report that preferring to use design teams with direct offshore work experience produces safer and more usable designs of installations and plant. Where the availability of such staff is limited there will still be benefits in sending the design team to similar installations on observation tours. Some operators also use 'surveillance engineers' to observe plant in operation and capture the workforce experiences and suggestions so closing an important feedback loop.

The use of 'design, build and operate' contracts in which the design team are closely involved in the commissioning also leads to better design as does the US practice of keeping design teams together between contracts when possible.

8.0 FITNESS FOR WORK

The average age of the workforce offshore is increasing rapidly. The average in the UK sector is now in the region of 45 years of age. Offshore work is not seen as attractive as it was by those in the younger age ranges that need to come into the industry to take it forward. There will need to be a greater emphasis on understanding the exact physical requirements of offshore tasks so that staff can be selected or assessed. Wherever possible tasks will need to be redesigned and or automated so those older employees can carry them out. The nature of the offshore work environment with many heavy components, limited space and a general lack of crane cover below deck means that there is a lot of manual handling with the resulting musculo-skeletal injuries. Some companies estimate that up to two thirds of their employees leave offshore employment prematurely because of work related health problems.

In the UK these and related problems have come to be labelled under the catch-all title of occupational stress. This has now become a hot topic in the UK with a great deal of media attention and subsequent pressure to “do something.” Our own research does not indicate any particular cause for concern in the offshore sector for stress, however the reduction in manning levels and increasing work-load does give cause for concern in the future and the rate of musculo-skeletal injury remains high.

There are considerable benefits to be gained from simple and straight forward improvements in manual handling and job design to reduce the physical job demands. Successes that have reduced lost time injuries and improved productivity include[8]:

- Setting a maximum weight limit for individual luggage items (typically 20kg)
- Using a luggage trolley on the helideck
- Ordering lube oil and paint in 2.5 or 5 litre (1/2 or 1 gall) tins as a bulk palletised load (this cuts lifting injuries and reduces waste and fire hazard from part used open containers.
- Ordering frozen food in 5 or 10 kg packs not 50 kg as is sometimes the practice. We have seen a number of LTI's on FPSOs occurring when the vessel rolls while someone is carrying a 50kg potato sack.
- Storing heavy items near where they are needed.
- Providing wheeled trolleys and guide rails between lay down area and stores on FPSO's

Current HSE research in the offshore sector has focussed on the development of a simple to use stress risk assessment workbook for completion by workers. The trials so far have been a great success and have made the process of stress risk assessment manageable[9]. The approach taken is to avoid assessments of harm or mental ill health as these are emotive and can be seen as threatening by managers. The process centres on identifying problem areas and eliciting suggested improvements[10]. Tests so far indicate that operators like this approach and can embody it into their existing continuous improvement programmes.

One interesting outcome has been the ability of the method to identify a number of issues that have been missed by normal management means such as poor maintenance and poor reliability of equipment as major causes of stress and increased workload. It may be that the work book approach creates space for these ongoing problems to be raised, the importance of stress as a topic may also raise expectations about the problem being solved and so increase participation. As the assessment does not assess harm the element of “guilty knowledge” is removed and the continuous improvement focus allows the risk assessment to be used before there is any evidence of a major problem. In practice the process of using the workbook to elicit solutions to workplace problems is a good one regardless of whether it takes place under a 'stress' banner or not.

[8] "Well Handled" Book of manual handling case studies available from HSE Books (www.hsebooks.co.uk)
[9] Briner: British Psychological Soc Annual Conference 2002.
[10] Copy of draft work book to follow.

9.0 CULTURAL ISSUES

A topic which has so far received very little attention but may turn out to be very important is that of culture. By culture we mean whatever personal cultural elements impact on the workplace. Examples include:

- Professional culture i.e. 'mariner' or 'oil worker'
- Socialisation i.e. unionised or non-unionised
- Domestic i.e. single, married, parent
- Residential i.e. city dweller or rural dweller
- National

Prof Bob Helmreich at the University of Texas has developed a three level model of employee culture that is proving very useful in the prevention of aviation errors in multi-cultural aircraft crews. There are very stable and repeatable cross-cultural differences between nationalities on such key safety issues as rule violations and attitudes to authority. The skill shortages in the offshore oil sector, the multi-national nature of the industry, and the demands to recruit local labour mean that we will mean that the offshore workplace will increasingly become a multi-cultural workplace. While many offshore installations are already experiencing this trend there is little evidence of any industry wide agreement on what this means and how best to manage it.

Increasing the percentage of females has improved safety performance and productivity in a number of industrial sectors not dissimilar to offshore, for example mining[11], air and rail transport[12]. The employment of females offshore varies very widely from one country to another being relatively common in the Norwegian sector and very uncommon in the neighbouring UK sector.

10.0 TO CONCLUDE

It is difficult to be sure how work in the area of workforce involvement will develop but my own assessment is that the most benefit will come from greater workforce involvement in design and procurement including working with suppliers. This will require specific training in the process of participation in addition to the technical knowledge required to underpin involvement. I believe the outcomes of this greater workforce involvement will be better decision making due to the greater diversity of experience included in the decision process and ultimately better engineering.

[11] Recent report from Prof Mark Scrimpton, Memorial University, Newfoundland
[12] recent UK rail operator reported rail driver near miss and attendance reports

The growing cultural diversity of the workforce will provide a new set of challenges and opportunities that could bring about major change in the way that work is organised and managed. Many features of the offshore working environment that have persisted unchanged may in future be reassessed and improved, for example the prevalence of manual handling, the use of written procedures (rather than pictographic) or the predominance of male employees.

APPENDIX 1

OFFSHORE DOWN-MANNING QUESTION SET

(Prepared by Robert Miles: HSE Team Leader Human & Organisational Engineering)

Introduction

The following set of questions are designed to provide the information on which to base a judgement regarding the safety of any organisational down manning programme. The questions draw on recent experience of Inspectors and Topic specialists, no claim is made for its completeness as knowledge in the area continues to evolve. It is probable that these questions are of greatest value when applied by a Duty Holder as a guide for assessing their own plans for reduced manning.

Existing Manning Level

Which analyses have been undertaken to demonstrate that the existing manning levels are sufficient?

a) In normal operation

b) At times of shut-down, unplanned maintenance or unusual operating conditions

c) In an emergency

What checks were made to demonstrate that these analyses covered all of the necessary activities in sufficient detail?

How can the confidence level of the results be demonstrated?

Existing Work Load

What monitoring is currently in place for high workload? For example are the following recorded:

a) Overtime

b) Live permits to work

c) Un-actioned maintenance

d) Work related stress or fatigue

What are the current limits for excessive work?

How were these limits for excessive work established?

Is there any evidence of work-related stress or ill health at current manning levels?

Role and Task Reallocation

How have the individuals to be down-manned, or posts to be combined, been selected?

What analyses were undertaken to determine which roles or skills can be combined?

Are the predicted workloads for these new roles or jobs reasonable and at or below 12 hours per day?

What improvements in automation or reliability are being introduced to enable the reduced manning?

Monitoring of the New Situation

What workforce health monitoring is planned?

What workload monitoring is planned?

What mechanisms are there to capture role conflicts or skill shortfalls?

Risk Assessment

What type of risk assessment has been undertaken for the proposed changes?

Have past incidents, accidents and near-misses been analysed for work-load, role conflict or competence related failures?

Corporate Knowledge

How are the key elements of knowledge or experience identified?

How will key knowledge or experience be “captured,” retained or transferred?

Do the proposed changes increase corporate dependency on third party expertise? If so how will the availability and continuity of this access be assured?

SMS and Procedures

Is the process of change being managed to the principles set out in HS(G) 65 Successful Health and Safety Management?

Are all procedures being reviewed and rewritten to be applicable to the new roles and manning levels?

Is the Safety Management System integrity maintained both during and after the changes?

See Also

Oil Industry Advisory Committee publication “Multi-skilling in the petroleum industry” HSE books.

The “Team Toolkit” produced by OPITO (links via the OPITO web site: www.opito.co.uk)

RWM.

APPENDIX 2

SAFETY MANAGEMENT SYSTEMS AND DEMONSTRATION
A PRACTICAL ILLUSTRATION
COLIN PINDER – BP CHEMICALS

The Control of Major Accident Hazards Regulations (COMAH) place a general duty on operators to take all measures necessary to prevent major accidents and limit their consequences to persons and the environment. The regulations also require a demonstration that a Major Accident Prevention Policy (MAPP) is in place and that there is a Safety Management System (SMS) to implement the policy.

This article describes the Health, Safety and Environment Management System Framework used within BP and how the requirements of COMAH have been integrated into the framework.

BP's HSE Management System Framework

BP's HSE Expectations are detailed within the thirteen elements of the HSE Management System Framework, which are summarised below.

1. Leadership and Accountability
2. Risk Assessment and Management
3. People, Training and Behaviours
4. Working with Contractors and Others
5. Facilities Design and Construction
6. Operations and Maintenance
7. Management of Change
8. Information and Documentation
9. Customers and Products
10. Community and Stakeholder Awareness
11. Crisis and Emergency Management
12. Incidents Analysis and Prevention
13. Assessment, Assurance and Improvement

Addressing the full set of HSE Expectations is mandatory for every activity across the entire BP organisation. The relevance, application and degree of implementation within a particular operation or Business Unit will be a function of:

- The operational risk profile
- Local and national regulatory requirements
- Any voluntary HSE management programmes

Managers are accountable for putting in place appropriate documented systems and processes for each Expectation, for ensuring continuous progress towards BP's HSE goals and targets, and for confirming that these are effective via the HSE Assurance process.

The content, format and terminology of HSE management and audit systems at the Business Unit or functional unit level is a matter of local choice, provided that these:

- Are Compatible With The Assurance Management System Assessments
- Are Appropriate To Operational Risks
- Are Relevant To Regulatory And Voluntary Codes Subscribed To By BP
- Can Be Referenced back to all relevant Expectations set out in this HSE Management System Framework

To illustrate how the expectations further define the requirements of each element, Figure 1 below includes the expectations for Element 7 - Management of Change.

Element 7: Management of Change

temporary and permanent changes to organisation, personnel, systems, procedures, equipment, products, materials or substances will be evaluated and managed to ensure that health, safety and environmental risks arising from these changes remain at an acceptable level. We will comply with changes to laws and regulations and take account of new scientific evidence relating to HSE effects.

Expectations:

7.1 The health, safety, security, environmental, technical and other impacts of temporary and permanent changes are formally assessed, managed, documented and approved.

7.2 Changes in legal and regulatory requirements, technical codes, and knowledge of health and environmental effects, are tracked and appropriate changes implemented.

7.3 Effects of change on the workforce/organisation, including training requirements, are assessed and managed.

7.4 The impact on product quality of changes in manufacturing processes is assessed, associated hazards are evaluated and risks are controlled.

7.5 The original scope and duration of temporary changes are not exceeded without review and approval.

Figure 1. Element 7 Management of Change

Relating detailed procedures within a safety management framework to a MAPP can be achieved by cross-referring sections of the MAPP to expectations within the framework. An extract from the MAPP is included below, demonstrating the links between the MAPP and expectations:

"BP will adopt and implement procedures and instructions for:

- Planning modifications to, or the design of new installations, processes or storage facilities (Element 7.1)"

For example, demonstration that this bullet point within the MAPP relating to modifications is being met requires following the audit trail to expectation 7.1 described in Figure 1 above. There would need to be a procedure for controlling changes in place and this procedure would have to be working effectively. There is flexibility within the expectations to write a procedure which is relevant and applicable to particular locations around the world. Using the United Kingdom as an illustration, a structure for writing such a procedure using the principles in the Health and Safety Executive publications HSG 65 and HSG 190 is given in Figure 2 below.

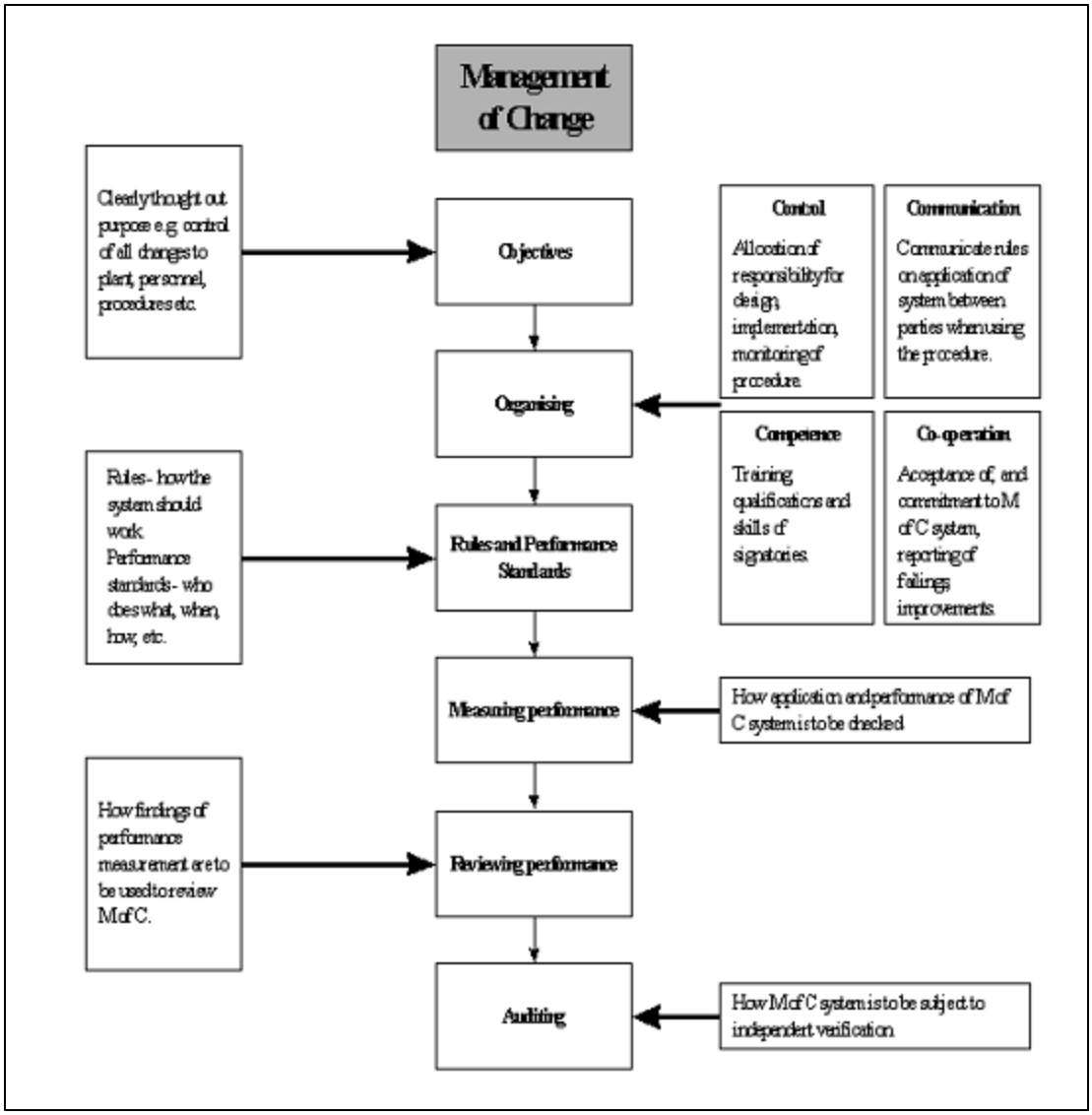

Figure 2. Document Structure

This article has tried to show how the requirements of COMAH can be integrated into the overall safety management system framework of an organisation. Important features about the SMS are:

- It Must Be Documented
- It Must Be Clearly Linked To Mapp
- It Must Have Clear Structure E.G. Hsg 65
- It Must Be Communicated To Personnel
- It Must Be Live

Significant resources are needed both to achieve demonstration of compliance with COMAH within the safety report and more importantly, to demonstrate that the safety management systems are actually being implemented in practice. The regulations provide the vehicle for both regulator and operator to work together, sharing best practice to prevent major accidents and limit their consequences to persons and the environment.

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APPENDIX 3

POSSIBLE PERFORMANCE INDICATORS FOR MANNING LEVEL

1. Overtime
2. Non-attendance at training
3. Outstanding number of preventive maintenance tasks
4. Fatigue -- as determined by asking people during incident investigations
5. Operator surveys -- ask will you be too tired to do this job?
6. Number and type of accidents
7. Presence of 5th shift system to compensate for training or maintenance
8. Risk assessments can be used to determine staffing levels
9. Use of buddy system during high risk tasks early in the morning (e.g. pig launching, prepping for maintenance tasks, rig repair during opportunities)
10. Number of unplanned call outs
11. Night manning of day person jobs as additional workload
12. Flexible / autonomous work scheduling
13. Absenteeism
14. Number of no-shows
15. Number of contractors and types of jobs that they do
16. How many people the original equipment was designed to be performed by