

Guidelines for implementing Well Operations Crew Resource Management training



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1. Executive summary

Crew Resource Management (CRM) has proven to be effective in addressing the human factors and lack of non-technical skills that can lead to major accidents in the airline industry.

Effective implementation of CRM can potentially reduce the risk of such events in other industries. CRM training is acknowledged as a good practice within the Maritime industry and the Healthcare sectors. As a high risk activity, Well Operations needs to follow these examples of best practice.

This report has been written for training providers who aim to put appropriate training programmes in place that introduce and sustain Well Operations Crew Resource Management (WOCRM).

It provides details of Learning Objectives for given CRM competencies (non-technical skills) and guidance on training delivery and on assessment. It provides guidance on the qualifications and knowledge of instructors and facilitators.

This is the starting point for the oil and gas wells industry to adopt CRM as a standard practice to reduce or even avoid the occurrence of major accidents. Every encouragement should be given to ensure its success.

human factors

interaction of individuals with each other, with facilities and equipment, and with management systems

non-technical skills

cognitive, social and personal resource skills that compliment technical skills, and contribute to safe and efficient task performance (Flin *et al.* 2003) [1]

2. Previous Crew Resource Management oil industry publications

This new report builds on previous work:

- IOGP Report No. 501, *Crew Resource Management for Well Operations teams* [2]
- *Guidance on Crew Resource Management (CRM) and non-technical skills training programmes*, published by the Energy Institute (“the EI report”) [3].

IOGP Report No. 501, *Crew Resource Management for Well Operations teams*

Report No. 501 was written by Professor Rhona Flin and colleagues of Aberdeen University specifically to address the CRM needs for the wells industry.

It states that the intent of this guidance on training is to supplement IOGP Report No. 476, *Recommendations for enhancements to well control training, examination and certification* [4].

Report No. 501 states that, looking forward, the oil and gas industry must recognize the importance of non-technical skills to operational safety in the area of Well Operations, and must embed discipline-relevant skills and attitudes in training and operational practices.

It states that training alone will not bring about a step change in our industry but a period of stand-alone CRM training is imperative to build appreciation of the importance of human factors and to establish a foundation of knowledge and skills within our industry.

The suggested course syllabus in Report No. 501 is based on current scientific research into human performance with the aim of:

- improving the skills of the individual worker in a team setting
- addressing behaviour in routine operations with the aim of avoiding critical incidents
- developing skills for dealing with time-pressured critical events.

The syllabus describes a stand-alone course. A benefit of a stand-alone course is its focus on CRM fundamentals and principles.

Longer term, the Well Operations Crew Resource Management (WOCRM) principles should be integrated into the curriculum for normal well control training (alongside equipment, fundamentals, and simulator training). A stand-alone course is appropriate while integration evolves in the industry.

The EI report: *Guidance on Crew Resource Management (CRM) and non-technical skills training programmes*

The Energy Institute's *Guidance on Crew Resource Management (CRM) and non-technical skills training programmes* ("the EI report") covers generic requirements for CRM Training, its implementation in the oil and gas industry.

It details the background to CRM, the case for its use and how other industries have embraced it, together with comprehensive guidance on implementation and training.

The EI report has a much broader scope than wells. It is equally relevant.

Further guidance is being prepared to provide information, examples and other assistance reflecting scientific knowledge and industry best practice that supports implementation of this report. This will be published separately by IOGP.

3. Scope

This report provides guidance on training to initiate, develop and assess the CRM competencies required in well-site Well Operations.

It is intended to be used by training providers in organizations aiming to provide training in Well Operations Crew Resource Management (WOCRM). Its use will develop consistent WOCRM courses across the industry.

It is for use in conjunction with the EI report and Report No. 501. Together they provide a recommended practice for training and competence assurance of WOCRM.

Training is for well operations personnel from oil and gas producing companies and also critical well operations personnel including drilling contractors, well intervention and well servicing companies, covering both wellsite and office-based personnel.

This report captures relevant existing best practice in delivering CRM-type training where it exists among oil and gas operators, maritime, aviation, medicine and related industries.

This report provides guidance on how the skills acquired through CRM training should be assessed to demonstrate competence.

The UK Health and Safety Executive describes competence as the combination of training, skills, experience and knowledge that a person has and their ability to apply them to perform a task safely in the work place to a recognized standard on a regular basis.

Other factors, such as attitude, fatigue, state of mind and physical ability, can also affect someone's competence.

4. Well Operations Crew Resource Management training objectives

Well Operations Crew Resource Management (WOCRM) training provides the knowledge, skills and motivation to members of wellsite Well Operations crew involved in safety critical operations in order to:

- perform effectively in a team context
- recognize any deterioration in cognitive and interpersonal skills in themselves and others
- have the willingness, cognitive and interpersonal skills to both take action and to accept interventions from others in a timely and effective manner.

WOCRM training achieves these objectives by:

- allowing crew members under high levels of pressure and stress to develop and practice cognitive and interpersonal skills that are used under routine, normal operational conditions (in order to minimize errors and unsafe acts that can contribute to a major accident scenario)
- sensitizing crew members to the signs and indicators that reflect deterioration in their own cognitive and interpersonal skills and in others
- enabling crew members to recognize when their own behaviour or actions might be interfering with effective teamworking.

Achieving high quality Crew Resource Management (CRM) skills will contribute to mitigating the risk of human error in safety critical operations, enhancing operational performance and reducing the potential for poor decision making in stressful situations.

There should be an emphasis on the need to routinely practice these skills in the workplace.

5. WOCRM Competencies and Learning Objectives

WOCRM Competencies are:

- situation awareness (SA)
- decision making
- communication
- teamwork
- leadership
- factors that impact human behaviour.

They need not be presented in this order in training.

Situation awareness (SA)

Developing and maintaining a dynamic awareness of the situation and the risks present during a Wells Operation, based on gathering information from multiple sources from the task environment, understanding what the information means and using it to think ahead about what may happen next.

Learning Objectives

- a) Describe or explain common causes and symptoms of SA problems, e.g. inattention, distraction, cognitive bias and tunnel vision¹
- b) Develop SA skills relevant to Well Operations environments:
 - actively seeking relevant information
 - correctly interpreting and understanding information
 - being able to foresee what is likely to happen next or the effect of current events on future states.
 - recognizing mismatches between your own SA and that held by others.

¹ The terms *situation awareness* and *cognitive bias* are explained in the guidance notes in IOGP Report No. 460 [5].

Decision making

The ability to reach a judgement or choose an appropriate option to meet the needs of an assessed or anticipated situation.

Learning Objectives

- a) Recognize different approaches to decision making, including strengths and weaknesses e.g. following procedures, use of expert judgement, intuition.
- b) Explain how problems to be solved need to be correctly defined and that difficulties can be caused in Wells Operations with decision errors, e.g. confirmation bias and task fixation, often due to inadequate comprehension of the problem.²
- c) Understand workplace, personal and inter-personal factors affecting decision making:
 - develop decision making skills relevant to Well Operations environments
 - recognize the situations where a decision is needed
 - recognize where different approaches to decision making are appropriate
 - identify personal role and contribution in making decisions
 - recognize where bias, such as group think, and other factors may result in poor decisions.

² The term **confirmation bias** is explained in the guidance notes in IOGP Report No. 460 [5].

Communication

The exchange (transmission and reception) of information, ideas and beliefs, by verbal and non-verbal methods.

Learning Objectives

- a) Describe the characteristics of effective communication.
- b) Recognize the personal, inter-personal and workplace factors that can impair effective communication.
- c) Explain the difference between an instruction/order and a dialogue and recognize where each is appropriate.
- d) Practice the importance of timely and effective feedback appropriate to the operational situation, e.g. in ensuring an instruction has been understood.
- e) Recognize situations where different types of communication are appropriate, e.g. radio communication, briefing and de-briefing and shift handovers.
- f) Develop communication skills relevant to Well Operations environments:
 - creating a clear message (how, what, where, why, when, who)
 - delivering a clear message
 - effective listening skills and seeking clarification
 - tuning in to non-verbal responses
 - being appropriately assertive for the situation (delivering and receiving communication)
 - seeking and providing feedback and confirmation of understanding
 - avoiding jumping to conclusions in critical time-pressured situations.

Teamwork

The ability to work effectively and interdependently in groups of two or more to achieve a shared goal.

Learning Objectives

- a) Explain the critical importance of being an effective team member to the safety of Well Operations.
- b) Describe the characteristics of effective teamwork.
- c) Provide examples of how different roles and responsibilities contribute to effective team performance.
- d) Recognize how factors such as personal, inter-personal, workplace, cultural, contractual and dispersed location can impair effective teamwork.
- e) Recognize how individual behaviour influences team dynamics and team performance.
- f) Develop team working skills relevant to Well Operations environments:
 - effective team coordination
 - cooperation and collaboration
 - recognize when team members do not have a common understanding of a shared situation or goal
 - avoid creating situations of unnecessary conflict within a team
 - detect and resolve disagreements and differences within a team
 - show courage and ability to challenge when necessary.

Leadership

The ability to successfully influence others to achieve a shared goal by providing guidance, direction, coordination and support.

Learning Objectives

- a) Recognize the critical importance of effective leadership to the management of safety.
- b) Recognize the characteristics of effective leadership and be aware of how a leader's personal behaviour affects others.
- c) Describe how to motivate a team and what techniques and behaviours can work effectively.
- d) Explain the importance of setting and maintaining high standards.
- e) Develop leadership skills relevant to Well Operations environments:
 - provide feedback, motivate and support the team and individual team members
 - set and communicate expectations appropriate to the situation
 - convey the importance of leadership decisions and the reasons for them
 - adopt leadership styles and practices suitable to the situation.

Factors that impact human performance

Many factors affect the ability of people to perform reliably. These include stress, fatigue, health, distractions, and environmental stressors. They can arise from sources personal to the individual or can be imposed by external factors such as organizational and task design, team structure and work schedule, and the design and layout of plant and equipment as well as cultural and environmental factors.

Learning Objectives

- a) Recognize that an individual's ability to remain alert and perform to a high standard is influenced by a wide range of factors: organizational, personal, psychological, physiological and environmental.
- b) Explain the importance of non-technical skills (situation awareness, decision making, communication, teamwork and leadership) to operational safety.
- c) Show awareness of major accidents within the industry where limitations in human performance have been significant contributory factors.
- d) Provide examples of how the loss of alertness, distraction can increase risk to operations.
- e) Describe the key types of human failure, e.g. slips, lapses, mistakes, violations and how these represent risks to safe operations.
- f) Recognize the type of operational situations where the risk of human error can be significantly increased.
- g) Recognize strategies and actions that can be taken to minimize the potential for human failure on critical activities.
- h) Explain the importance of sleep, work schedules and shift patterns to effective performance and the effect of time of day on alertness.
- i) Recognize cultural differences, potential impacts and mitigations.
- j) Identify factors in the design and layout of plant and equipment that can impact on human performance and how these can be mitigated.

Where possible, real industry incidents should be used to illustrate the potential for how a wide range of factors can impact on human performance. Where these are not available, invented case scenarios can be used for practical exercises.

Specific examples of where CRM skills could be practiced are performing handovers, tool box talks and task risk assessments.

6. Training delivery

6.1 Duration of training

The initial course material should be delivered across three days:

- initial education in non-technical concepts and ideas
- application and reinforcement of these concepts through practical exercises whereby each participant learns to incorporate the non-technical skills into their operational role.

The EI report quotes a range of one to five days depending on requirements.

6.2 Instructors and facilitators

Delivery of WOCRM training and assessment of achievement of learning objectives should be carried out by instructors and facilitators with demonstrated and relevant competence.

WOCRM instructors and facilitators should have the necessary knowledge, skills and experience required to deliver effective CRM training.

The EI report provides guidance on requirements for CRM instructors/facilitators in terms of technical, non-technical skills and CRM knowledge, behavioural observation, train the trainer and qualifications. It states that CRM instructors should have basic knowledge of non-technical skills and human factors in addition to the technical skills. It states that, in other industries, technical specialists receive specific training in teaching CRM.

Further guidance can be obtained in the EI report, 3.3.7 (CRM instructors/facilitators).

The Civil Aviation Authority has published a framework for CRM instruction and examination in *The Crew Resource Management instructor (CRM I) and Crew Resource Management Instructor Examiner (CRM I E) Accreditation Framework* [6].

Training materials for human factors and non-technical skills are available on the Energy Institute website [7].

Human factors professionals such as industrial psychologists are considered to be ideal resources for CRM training development especially in the early stages of course design and provision.

In some cases, the WOCRM instructor and facilitator might be a Well Operations Instructor. In these cases, it might be possible for a WOCRM course to be taught by a single individual.

In most cases, the expected class size will be such that the delivery of WOCRM training will require two facilitators and instructors jointly teaching the dedicated CRM course. One instructor might come from a wells operational background and

the second trainer could have a behavioural science or psychology background. This combination will ensure the maximum learning experience in the operational application of the WOCRM material.

6.3 Trainees

Effective WOCRM training requires a sufficient number and blend of trainees to be able to re-create team dynamics. WOCRM training, assessment and feedback should be given to a representative range of roles for different Well Operations crews. These include personnel involved in drilling, completions, work-over and well intervention and well abandonment activities.

The recommended number of trainees is 12 when simulators will be used and where there are two experienced instructors and good facilities.

When simulators will not be used, the maximum of trainees is 16. In many cases, the number of trainees for effective training will be lower.

The EI report suggests that trainees should have demonstrated competence in their designated roles for at least several months prior to attending CRM training.

The well operations roles that should undertake CRM training (those roles that can impact the safety of the well) are in Table 1.

6.4 Delivery methods

Training providers should use appropriate techniques, technologies and resources to achieve the Learning Objectives.

Providers should take the cultural context, the educational background and levels of operational experience of the trainees into account.

WOCRM competencies are generic but training scenarios specific to individuals' particular work operations can demonstrate relevance and help promote understanding of the key concepts. Training scenarios should reflect the operational experience of the trainees.

Longer term, as WOCRM principles are integrated into the well control training curriculum, the scenarios will be completely relevant to operations.

The EI report also recommends the use of simulators in CRM training if available.

Both the EI report and IOGP Report No. 501 provide an overview of some approaches used to deliver CRM training in other industries.

Machine Operator	Supervisors	Support
Driller	Tool Pusher	Roughneck
Assistant Driller	Company Man/Drilling Supervisor	Derrickman
Coiled Tubing Equipment operator & Assistants	Offshore Installation Manager (OIM) (marine and drilling)	Mud Logger
Snubbing Equipment Operator & Assistants	Barge Engineer	
Slickline Equipment Operator & Assistants	Drilling Supervisor	Drilling Fluids Engineer
E-Line equipment Operator & Assistants	Drilling Engineer (rig based)	Geologist (rig based)
Well test Work Crew	Well Intervention Engineer (rig based)	Well Intervention work Crew
	Well Service Supervisor	Cementer
	Well Test Supervisor	Crane Operator
	Coil Tubing Supervisor	Subsea Engineer
	Slick line Supervisor	BOP/LMRP Engineer
	Completions Supervisor	
	E-Line Supervisor	
	Drilling Superintendent	Well Integrity Engineer
	Rig manager	Production Supervisor
	Senior Drilling Engineer	Drilling Manager
	Drilling Engineer	Petroleum Engineer
	Senior Completions Engineer	Operations Geologist
	Completions Engineer	Reservoir Engineer
	Senior Well Intervention Engineer	Sub Surface Lead/ Manager
Well Intervention Engineer		

Bold indicates those roles that are rig-based and should be top priority for CRM training.

Table 1: Well operations roles that should undertake CRM training

6.5 Ongoing reinforcement

Organizations that embark on WOCRM training should also implement programmes to provide on-going support and reinforcement to develop and maintain WOCRM skills in the workplace.

CRM will only be successful if work routines such as tool box talks and task risk assessments embrace CRM as standard practice.

6.6 Refresher training

Both the EI report and the IOGP report No. 501 report recommend refresher training every three years. Employers may consider attendance of refreshers at more frequent intervals such as every two years to alternate with the two-yearly cycle for certified well control training.

Refresher training is recommended to be undertaken with existing team-based activities, e.g. for new rig start-ups.

Emphasis should also be placed on ongoing workplace reinforcement. In addition to work practices, refresher training could involve ongoing communications and awareness as well as a WOCRM instructors and facilitators or trained observers visiting the worksite to deliver WOCRM exercises and perform behavioural marker assessments (section 5, Assessment).

Where additional visits are impractical, companies should reinforce CRM in the workplace during more regular activities such as leadership visits and inspections.

As WOCRM principles are integrated into the well control training curriculum, specific WOCRM refresher training will not be necessary because the two-year frequency of well control training will reinforce the principles.

6.7 Keeping content up to date

Good practice from other industries indicates that the course content should be subject to periodic review, based on experience of industry or company-specific incidents over time.

Periodic review will keep the training adequately focused on current issues and lessons learned within the industry.

7. Assessment

The EI report provides guidance on assessing individual CRM skills with behavioural markers and informal and formative feedback.

Behavioural markers refers to a prescribed set of behaviours that align to the non-technical skills used in CRM which are used to determine an individual's performance. They allow industry to train and measure non-technical skills in a meaningful way.

Examples of a generic non-technical skill set and some behavioural markers are given in the EI report, Table 3 (Examples of categories and behaviours in a non-technical skills framework).

8. Implementing CRM training

The EI report provides comprehensive guidance on the implementation of CRM training – training materials, training duration, refresher training, training methods and class size and composition.

Course content developed from the recommended syllabus should be adapted to operational conditions and task demands, and to the needs and existing knowledge of the trainees. Content will then be specific to particular well audiences.

References

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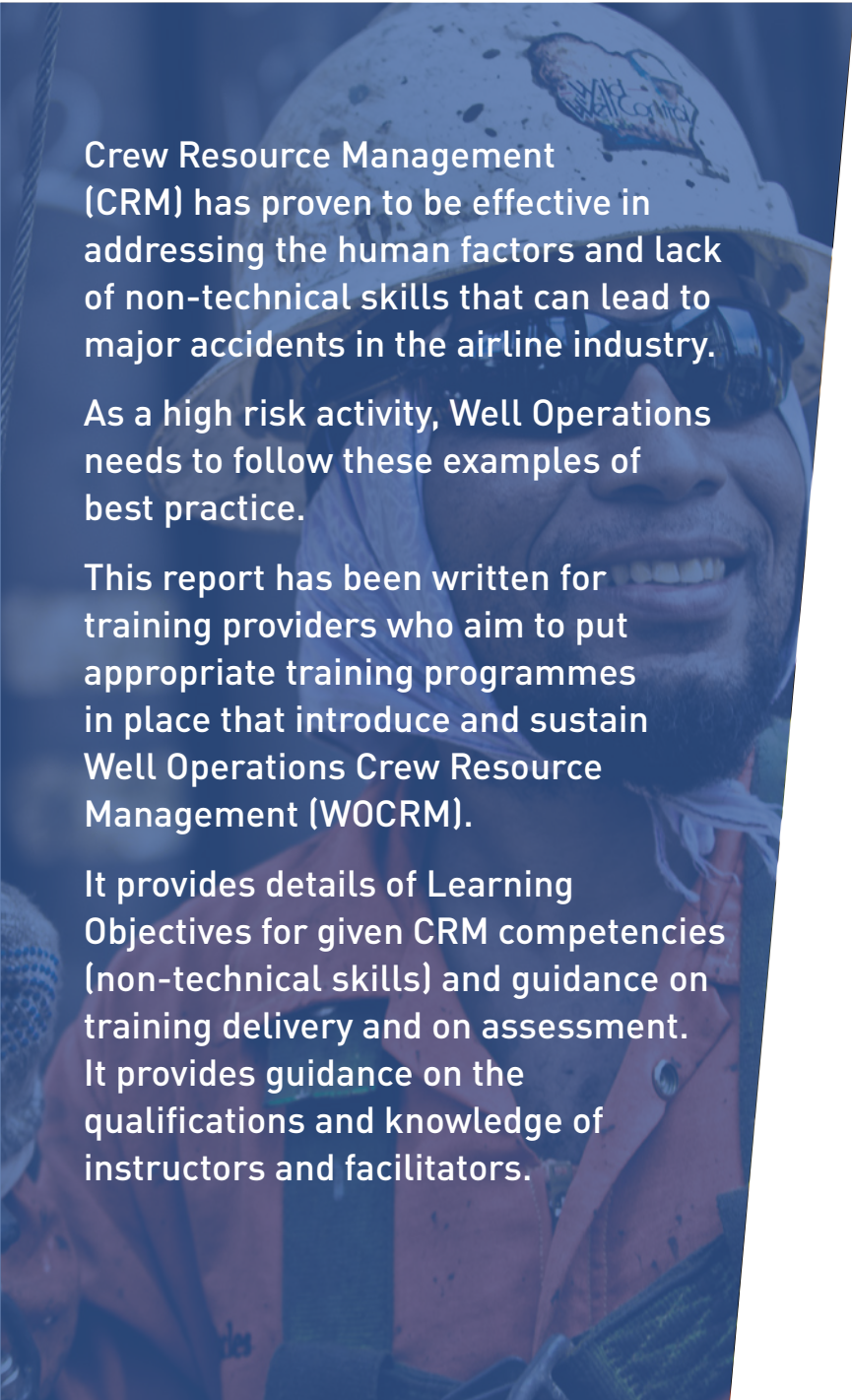
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