USING OIL & GAS EMERGENCY RESPONSE TRAINING TO HELP ENSURE THE UNDERSTANDING OF THE MAJOR HAZARDS OF HYDROCARBON INDUSTRIES

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The starting point for developing any truly effective and realistic emergency response training in the oil & gas/hydrocarbon industry should be the review, analysis and consolidation of the major hazards for the specific installation, site or location, as identified by the Safety Case, Safety Report or other major hazards study. Ideally, the hazards should be summarised into simple pie diagram and the hazards rated from highest to lowest; the frequency of the required emergency training can then be put into a table or spreadsheet so that the frequency of the emergency response training events are done at a similar frequency to their occurrence in the relevant safety study. Once the required frequency has been established over say a 5-year period, then individual scenarios should be developed using site specific emergency response plans; cause and effect charts; piping and instrument diagrams; relevant fire and gas detector locations and, as needed, input from site staff ('trusted agents').

The next key step is to identify the level and scope of the Emergency Response skills needed by the on-site Command Team to support the Person-in-Charge(PIC) – this will vary widely and will depend largely on how much help can come from elsewhere, particularly the emergency services. The training required for an offshore team will be significantly different to that required for onshore teams who may expect the Emergency Services on site within minutes. The requirements for, and composition of, tailored training packages will be discussed in the paper, as will legal or industry guidelines. A further consideration is the nature and scope of training required for any alternates or deputies to the PIC. Thus a comprehensive training programme aligned to the major hazards for the specific location should be completed foray PIC, Deputy PIC or team member prior to their appointment to any emergency response duty rota.

The authors will provide examples from their extensive experience of conducting Emergency Response training onshore and offshore in variety of industries around the world to support the concept of a targeted training programme that results not in "more training" but in "more effective training" and where "less can be more" highlighting the inclusion and understanding of site or location major hazards.

Examples of some of the tools used in the above training will be presented and discussed during the paper.

The flyer for this symposium asked the question: "How do I know that I am not going to have a major accident tomorrow?" – In the absence of a 100% foolproof answer, another approach is to ask: "if I do have a major accident, how am I going to minimise and mitigate its effect?" – and we believe a very important part of the answer is through appropriate and effective Emergency Response Training.

I emphasise the words *appropriate* and *effective* as too many organisations have the mistaken belief that the mere presence of a training regime is sufficient without considering its content and execution – practice doesn't make perfect, but it can make permanent so if you regularly practice the wrong thing, you will always do the wrong thing – as many golfers will recognise! Prevention of incidents, major accidents and disasters begins in the mind – learning through experience (hopefully the experiences of others rather than own!) or through correctly devised and delivered training – and reinforced through the conduct of credible and realistic exercise scenarios.

This paper will discuss the inclusion of major hazards in emergency exercises and training in two parts. The first will cover the need for, and design of, an Emergency Response Programme and the fundamentals of scenario selection and scenario development. The second will outline the implementation of the Emergency Response Training and the development of the Emergency Manager (EM) and their Deputies as the Person in Charge (PIC) for both onshore and offshore teams. In our experience of working worldwide in more than 12 countries, we have found that whilst the generic universal methodologies are widely applicable, they can also be adapted and aligned to meet the needs of specific industries, legal regimes and training standards organisations – "one size does not necessarily fit all".

Any Emergency Response Training Programme should adopt the 'building block' approach and be success-based, in other words there is no point in attempting a major exercise with multiple players unless and until each unit has gained a base level of competence before bringing them together to tackle a realistic integrated scenario. Once this has been achieved it will be possible to put in place an Emergency Response Training Plan but what scenarios should be considered, the "worst case" or the "most likely"? Should we analyse previous incidents and create similar scenarios so that we can become proficient at handling them?

Unfortunately history is full of examples of fighting the "last war", of cavalry charges against machine guns. Brian Appleton said during the Piper Alpha Inquiry: "We know from experience that the circumstances of any major accident never repeat themselves". This often results from equipment re-design, training and an overall increase in awareness; however, that does not stop something very similar occurring and also does not take into account the complacency that creeps in a few years afterwards – again there are many examples of this, just think of the comparison between the capsizes of the Herald of Free Enterprise and the Estonia and the similarities between the rail incidents at Southall and Ladbroke Grove. For this reason we should keep an open mind (though some would say a 'devious mind') when considering what incident scenarios to incorporate in our training.

We believe the best starting point for developing a truly effective and realistic Emergency Response Training Plan in the oil & gas/hydrocarbon industry is the review, analysis and consolidation of the site-specific major hazards as identified by the Safety Case, Safety Report or any other major hazards study done for the specific installation, site or location. It is recommended that when presenting major hazard information to a 'general' emergency response audience it is important to try to avoid using too many 'e-numbers', for example 10^{-2} or 10^{-4}, and instead use terms that can be more easily equated to daily life. The hazards should be identified and grouped and then ideally, be summarised into a simple graphical form such as a pie diagram (See Figures 1 and 2). Experience shows that a pie diagram is much more meaningful both to site operation staff, who are a key audience for both major hazards appreciation and emergency response training, and to senior management. The impact of the hazards should be ranked from highest to lowest and the frequency of the required emergency training can then be put into a simple graphical form such as a table or spreadsheet (See Figures 3 and 4). The emergency response training events should then be performed at a similar frequency to the expected/predicted occurrence of the major hazards in the relevant safety study. For example, if the risk of a fire or explosion is assessed as 50% then then 50% of the exercise scenarios should involve a fire or explosion.

Once the required exercise type (fire, flooding etc.) and frequency has been established and fitted into a cycle of exercises over say a 5-year period, then individual scenarios should be developed using site specific emergency response plans; cause and effect charts; piping and instrument diagrams; relevant fire and gas detector locations and, as needed, input from site staff ('trusted agents'). (Figures 5 and 6 show a sample 5-year major exercise plan for sample offshore and onshore facilities). The key is these major exercise plans should be site specific and related to the major hazards of the individual location to ensure relevance and credibility. A recommended ratio of scenarios is about one third as routine major hazard scenarios with no controls overridden, one third with some controls removed with subsequent severe consequences and the remaining third as scenarios that are theoretically possible and credible according to the safety case/safety report but have not yet happened.

The above seems simple and straightforward to implement but unfortunately this is not always the case; we need to consider what could go wrong? – Well, quite a few things can disrupt this plan, mainly caused by humans and human failings – Typically:

1. Most larger organisations have a single person in the 'Emergency Response Co-ordinator' role - either as a part-time or full time person, depending the size of the organisation. We see the Emergency Response Co-ordinator as a safety critical role – the person fulfilling this role should have a real understanding of all of the following:
   a. major hazards of the installations, including prevention, mitigation and control measures which keep the major accident hazard scenarios to an 'acceptable level;
   b. Be competent to write or approve emergency response exercise scenarios which include major hazard scenarios and preferably including the removal of a prevention or control measure which has serious or severe consequence;
   c. Have a good knowledge of the facility operations and personnel;
   d. Be technically competent to evaluate the technical competence of any emergency response contractor used to run or help run any emergency response activity eg training, drill or exercise.

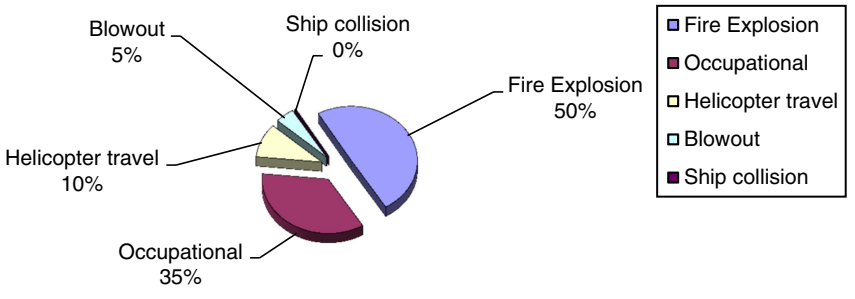


Figure 1. Sample offshore concrete platform IRPA.

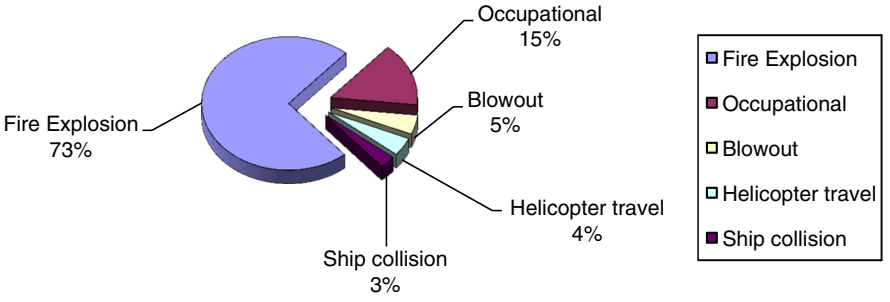


Figure 2. Sample offshore steel jacket IRPA.

See Example 1 'Emergency Response Co-ordinator Sample Competence model'.

2. Personnel change-out/retirement can be a major threat to the ongoing and consistent understanding of the Major Hazards. The major hazards can be very well understood when a safety case/safety report is first written/submitted - after a number of years personnel move on with a loss of the site specific major hazards knowledge – there can be a tendency to slip into the routine of generic routine exercises with standard or known outcomes/responses. However, simply by removing a different control measure, the apparently same scenario can have dramatically different outcomes eg whether a gas cloud finds a source of ignition or not or the fixed fire fighting system is overridden or not and this can dramatically affect the effectiveness and in some cases the relevance of the exercise.
3. Takeovers can result in the imposition of a 'new regime' with scant regard to the knowledge or thinking that went into the 'making of the case for safety' for the installation or plant – simply adopting the major hazard and emergency response regime from another location, which may or may not be relevant to the existing location/facility, may not be the best solution. A lot of hard-learned lessons can easily and simply be discarded when "we (the new regime) don't do it that way".
4. Emergency Response Consultants with little or limited real knowledge of the major hazards of the site will tend to 'dumb-down' the scenarios and use generic scenarios which are easier to understand and run and will avoid the removal of prevention, mitigation or control measures of major hazards.

Having considered the Emergency Response Programme, the next key step is to identify the level and scope of the Emergency Response skills needed by the on-site Command Team to support the Person-in-Charge (PIC). These will vary widely dependent upon the size and nature of the operation and plant, the location and how much help can come from elsewhere, particularly the emergency services. Onshore emergency teams may expect good support from onshore emergency services as quickly as 15 minutes in some circumstances. Offshore, the Emergency Management Team are unlikely immediately to have other than phone support and will therefore need greater decision making abilities and training. The training requirements for an offshore team are well documented in earlier work (Reference 1), OPITO Guidelines (Reference 2) and UK Oil & Gas Guidelines (Reference 3). The key thing to remember is that these requirements for, and composition of, tailored training packages are not legally binding – they are industry and training standards organisation *guidelines* and great variation in standards has been observed. A further consideration is the nature and scope of training required for any alternates or deputies to the PIC (See Appendices 1 and 2).

A comprehensive training programme aligned to the major hazards for the specific location should be completed for any PIC, Deputy PIC or team member prior to their appointment to an emergency response duty rota. A very good starting point is a course such as an OPITO-approved Major Emergency Management-Initial Response Training (MEM-IRT) course (Reference 4) – however it should be noted that these courses are, deliberately, generic in nature in order to train the principles and process of Emergency Management and so are based on generic incident scenarios only. As a result they are unlikely to include site specific major Hazards or, more importantly, the removal of site-specific controls to the site-specific major hazards.

The OPITO Approved Standard for the MEM-IRT divides major incidents into three categories:

- Type A – a major emergency that is readily controllable if managed appropriately
- Type B – a major emergency which could escalate if not controlled
- Type C – a major emergency that the EM is unable to control leading to a full evacuation of the facility

Within each of these categories, a variety of events are simulated to build a scenario that the delegates must successfully resolve. These events are:

- Injured personnel
- Multiple casualties
- Missing personnel
- Loss of containment

Topic	Suggested Frequency As Major Exercise Scenario	Concrete Offshore Platform Sample Items covered
Ignited Hydrocarbons	Once every year	Pool Fires Jet Fires Explosions F&G overridden Deluge isolated Poor isolations Structural Damage Injuries Medevac Medreascue Downmanning Abandonment
Unignited Hydrocarbons	Once every 2 years	Gas Cloud F&G overridden Deluge isolated Poor isolations Drains HVAC Structural Damage Injuries Medevac Medrescue Downmanning Abandonment
Occupational	Once every 1 year	Scaffold collapse Dropped objects Crane failure Electrocution Chemical Spill Radioactive material Diving injuries Injuries Medevac Medrescue
Helicopter Crash	Once every 3.5 years	Helicopter crash on helideck Helicopter crash on platform Helicopter crash into sea
		Aviation fuel Spill Search and Rescue Injuries Medevac Medrescue
Blowout	Once every 5 year	Pool Fires Jet Fires Explosions Structural Damage Injuries Medevac Medrescue Downmanning Abandonment

Assumptions;
1. 2 and 3 offshore shift rota
2. 1 major offshore exercise linked to onshore team/shift/year

Figure 3. Sample offshore concrete platform.

- Loss of communication
- Loss of evacuation, muster points or temporary refuge
- Stressed personnel
- Extreme weather conditions
- Loss of essential facilities
- Loss of key personnel
- Rapidly developing situation leading to information overload
- Evacuation of the facility
- Environmental concerns and effects

Topic	Suggested Frequency As Major Exercise Scenario	Lightweight Steel Jacket Platform - Sample Items covered
Ignited Hydrocarbons	Two every year	Pool Fires Jet Fires Explosions F&G overridden Deluge isolated Poor isolations Structural Damage Injuries Medevac Medreascue Downmanning Abandonment
Unignited Hydrocarbons	Once every 2 years	Gas Cloud F&G overridden Deluge isolated Poor isolations Drains HVAC Structural Damage Injuries Medevac Medrescue Downmanning Abandonment
Occupational	Once every 2 years	Scaffold collapse Dropped objects Crane failure Electrocution Chemical Spill Diving injuries Radioactive material Injuries Medevac Medrescue
Helicopter Crash	Once every 3.5 years	Helicopter crash on helideck Helicopter crash on platform Helicopter crash into sea Aviation fuel Spill Search and Rescue Injuries Medevac Medrescue
	Once every 5 years	Pool Fires
Blowout		Jet Fires Explosions Structural Damage Injuries Medevac Medrescue Downmanning Abandonment
Ship Collision	One every 5 years	Rogue Vessel Drifting Vessel DSV incident Communications Structural Damage Injuries Medevac Medreascue Downmanning Abandonment

Assumptions;

1. 2 and 3 offshore shift rota
2. 1 major offshore exercise linked to onshore team/shift/year

Figure 4. Sample offshore steel jacket platform.

Whilst the MEM-IRT is designed to teach and practice the principles of decision-making under stress and the function of the Emergency Management Team, because the scenarios are normally based upon a generic platform or installation, many of the nuances related to a specific location are lost. This not only misses a training opportunity but also can engender a feeling of "well that wouldn't happen on our platform/location/facility " and so the individual 'switches off' and can miss some vital aspects of the training. There are many examples of this but the most common are those where perhaps there is a bridge-linked structure to which personnel could evacuate rather than going to lifeboats or the routine is for personnel to muster straight to their lifeboats rather than to a muster station within the Temporary Refuge or accommodation.

Incident studies show that in an emergency personnel tend to react in the manner in which they were initially trained, which in many cases has been inappropriate to the circumstances in which they find themselves, and thus it is important that the training scenarios are as realistic as possible. The military have recognised this for many years and though one could argue that "Emergency Response" is their key role whilst yours is to produce or process hydrocarbons, it is precisely because Emergency Response is a minor part of your role and only infrequently invoked (hopefully never!) that it needs to be trained correctly. Basic training design methodology indicates that if a task is important but only conducted infrequently, then it should be "over-trained" so that even with 'skill fade' it can still be performed when required.

This highlights the benefit of being able to tailor the exercise scenarios used in training to the specific site and in particular to the hazards associated with that site. In many cases the changes needed to make a scenario site specific, and therefore more relevant to the personnel being trained, is minor, it may simply need a change of location or terminology. Similarly, a minor change in the start conditions can have a dramatic effect upon the way the scenario unfolds – one example is in the wind direction in relation to a drifting vessel – is there a risk of collision, in which case the OIM will have to follow the Platform Abandonment route, or will it pass clear, requiring the OIM and his team just to coordinate the operations of external assets? Another example is the direction and strength of the wind or the existence of an ignition source when considering the response to a gas release.

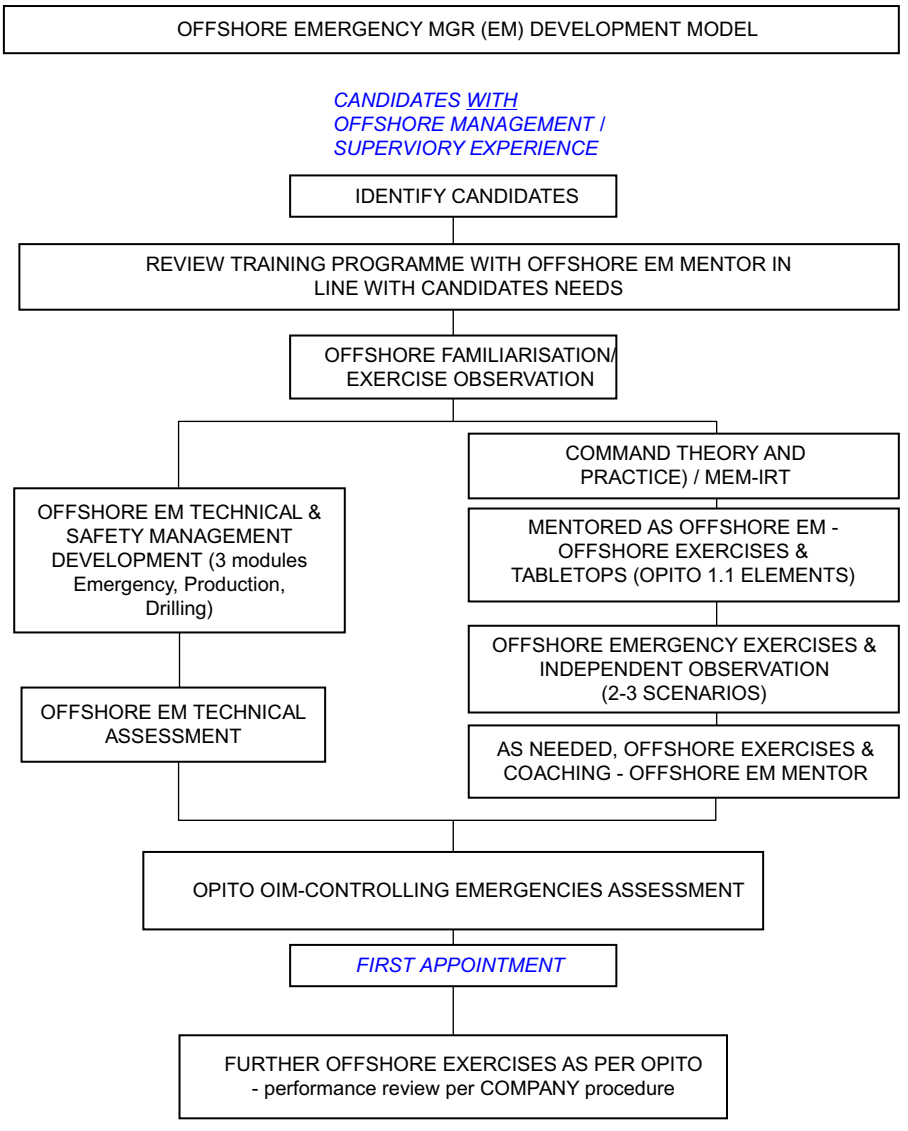
The selection and manipulation of scenarios to maximise the training benefit is not, in our experience, a trivial task and is one that needs carefully to be considered. The amount of effort, and time, that must be expended to produce credible scenarios should not be underestimated. Ideally there should be input from a technical specialist who needs to be a 'trusted agent' and sworn to secrecy to prevent a loss of realism in the exercise. If this person is a member of the Emergency Management Team then not only can the outcome be artificial but also that individual does not get training as a Emergency Management Team member themselves. One solution can be to have one shift prepare the scenario for their back-to-back shift and the spirit of competition that that can engender can also be beneficial!

We have repeatedly seen that having a small 'external' team visit a site to run a training exercise has significant benefits over an internally-generated exercise. Firstly, as mentioned above, it means that the whole Emergency Management Team get training benefit, secondly the conduct of role-play and exercise injects requires a level of expertise and commitment that is not always available on-site and finally, the very fact that it is an external team means that it is less likely for 'short-cuts' to be made or 'operational pressures' to be used to excuse non-participation by some members.

Whilst much of the emphasis on Emergency Response Training and Assessment is geared towards the offshore industry, there is a similar requirement to establish and exercise the competence of the onshore teams and Development Models for onshore Managers are also available (see Appendix 3). Experience has shown that the decision-making, leadership and stress-management skills required to handle one type of emergency in one field are readily translatable to another – this was highlighted in a paper presented at the first OIM Conference in 1992 and quoted in Professor Rhona Flinn's Book 'Sitting in the Hot Seat' (Reference 1). The training required for onshore EM managers should also be based upon the assessment of the specific hazards but the main difference is normally the availability of support. A major factor is the risk, or perceived risk, to one's own life – if you are actually controlling the incident from within the incident plant then it 'concentrates the mind' rather more than if you are merely providing support and assistance to a remote location!

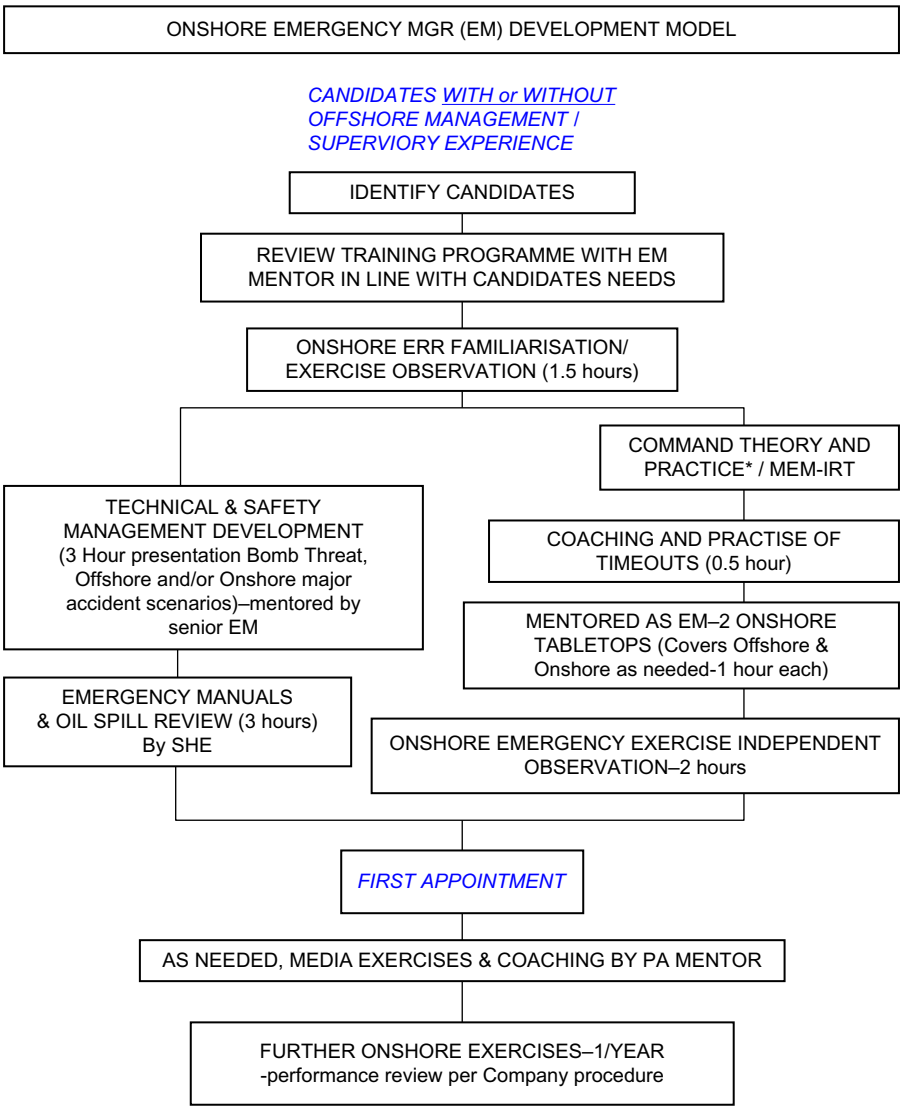
To summarise, we titled this presentation "Using Oil & Gas Emergency Response Training to help ensure the understanding of the major hazards of Hydrocarbon Industries" and I hope that in fact we have shown that in fact "Understanding the major hazards of Hydrocarbon Industries enhances the effectiveness of Oil & Gas Emergency Response Training" and that, actually, the two concepts should be synergistic. From our experience of conducting Emergency Response training onshore and offshore in a variety of industries around the world we believe that the concept of a targeted training programme that results not in "more training" but in "more ***effective*** training" and where "less can be more" is the answer to the exam question: "How do I know that I am not going to have a major accident tomorrow?"

Appendix 1 Offshore Emergency Manager (EM) Development Model



1. Individual changes to the program must be proposed by the Mentor OFFSHORE EM and approved by the training Co-ordinator
2. OFFSHORE EM Mentor reviews the candidates performance the above process and sets the pace and progress through each site

Appendix 2 Onshore Emergency Manager (EM) Development Model



1. Individual changes to the program must be proposed by the Mentor EM and approved by the Training Co-ordinator
2. EM Mentor reviews the candidates performance the above process and sets the pace and progress through each step

* = ex-offshore OIMs having done a Command Theory or MEM-IRT course are exempted this course

REFERENCES

1. "*Sitting in the Hot Seat: Leaders and Teams for Critical Incident Management: Leadership for Critical Incidents*" – Professor Rhona Flin – John Wiley & Sons (28 Oct 1996) ISBN-10: 0471957968 ('OIM Emergency Assessment & Development' – J. Sinclair & D.Cook and 'Training and Assessing Submarine Commanders on the Submarine Command Course' – D.Charlton).
2. UK Oil and Gas Guidelines – OIM Assessment.
3. OPITO Approved Standards – 'OIM Controlling Emergencies'.