

**Oil Spill Preparedness Response Capability and Capacity:
Do we know what we want and how do we get what we need?**

David Salt - Director - Spill Consult

Rob Cox - Technical Director - IPIECA

Marty Cramer - Emergency Response Coordinator - Conoco Philips

Dave Davidson - Emergency Response Advisor - Chevron

ABSTRACT 300263:

The oil industry has relied on the tiered response structure for over forty years to meet its oil spill response and preparedness needs. Over this time there have been significant changes in the oil spill threat potential and the expectations of stakeholders and regulators in respect of what represents acceptable levels of response preparedness and planning. Many of the existing Tier 2 and Tier 3 response equipment bases were developed based on the perceived threat from oil tanker spills, however the following decade saw rapid expansion of offshore exploration and production and the advent of using FPSOs and FSOs to enable rapid development of oil production facilities with limited shore support & infrastructure. The recent offshore incidents in Australia, UK and United States have altered perspectives on spill response and preparedness requirements, in particular in response to offshore operations. Many OSROs have changed little since their inception and the response arrangements have remained fixed to the original design criteria, in spite of changes in their operating and risk environment. Through the OGP-IPIECA Joint Industry Project on Oil Spill Response, an OSRO capability assessment tool has been developed based on the assessment protocols commonly used in military and defence operations, known as “Capability Management” frameworks. In a Capability Management framework, the interlinking functions and activities of an enterprise may be defined under several best-practice paradigms or frameworks, such as the Balanced Scorecard (BSC), the US Department of Defence Architecture Framework (DoDAF), the Ministry of Defence Architecture Framework (MODAF), and many other similar systems. The UK Ministry of Defence uses a similar breakdown of Defence Lines of Development (DLoDs) encompassing Training, Equipment, Personnel, Information, Concepts and Doctrine, Organisation, Infrastructure, and Logistics, known by the acronym “Tepidoil”. The assessment protocol described in this paper uses the “Tepidoil” methodology, modified for use in an oil spill response context with the addition of a safety component to enable assessment of Tier 2 (and possibly Tier 3) facilities. The purpose of this work was to develop a comprehensive and objective tool that can be used by industry members to ensure that OSRO facilities have the resources and infrastructure to address their current risk profile. In addition, it can potentially be modified for use as an OSRO “self-assessment” tool. The assessment criteria include:

- Training
- Equipment
- Personnel
- Infrastructure
- Doctrine – translates into Response Philosophy
- Organization
- Information
- Logistics
- Safety

INTRODUCTION: WHERE IT ALL BEGAN

The issues surrounding oil spill response first came into prominence in the late 60's and 70's with a number of high profile incidents such as the Torrey Canyon, Christos Bitas, Andros Patria, Amoco Cadiz, Urqiola, Betelgeuse to name but a few. What became apparent to the oil and shipping industry was that a system of response was needed to counter these incidents whilst at the same time preventing a proliferation of oil spill response assets. Experience had shown that equipment that was not regularly maintained, personnel that were not trained and systems that were not exercised soon became ineffective when brought together for a response.

The resulting response methodology that was evolved and adopted by the international oil industry (Industry) was the Tiered Preparedness and Response system. The system was effectively a risk-based approach to the response to oil spills whose aim was to ensure that correct resources were available to respond to an oil spill whilst recognising that the probability of various categories of oil spills had a correlation to the frequency at which the operations were conducted. It categorized the spills into three response tiers.

- Tier 1 – small operational spills that can be handled by the facility and/or local contractors with no other external assistance. Implicit in the statement is the requirement for the facility to have a functioning response capability that could deal with operational spills such as tank overflows, hose burst, incorrect valve setting etc. These spills are generally small but response times need to be short to gain control of the situation in an effective manner. Typically response management of these spills is left in the hands of the industry with only a reporting requirement to the Authorities
- Tier 2 – spills that exceed the capability of the facility/local contractors and are not able to be controlled by the resources immediately available. In this situation there are a number of regional or national response solutions. In some locations Governments have worked together to provide a regional response, Helsinki Commission, (HELCOMM) in the Baltic being a shining example. In others, industry has developed a capability to mutually support operators, the Norwegian Clean Seas Association for Operating Companies, (NOFO), in Norway and Petroleum Association Of Japan, (PAJ) being prime examples. In others Mutual Aid agreements have been developed, such as ANG 212 in Angola, and lastly in others, commercial providers have developed regional arrangements to provide response services. Tier 2 spills usually attract much more interest from the local Authorities in management of the response.
- Tier 3 – spills that exceed the local and regional capability and require external national and often international assistance. To service this requirement Industry developed a global network of industry funded response organisations. These organisations have personnel, expertise, response equipment and logistics infrastructure to deliver response equipment to respond to incidents. The benefit of the approach was that Industry could mutually fund a cooperative response capability and, more importantly, the response readiness could be better assured by having access to well-maintained equipment and trained personnel with response experience. Government will have a strong role and interest in the management of Tier 3 oil spill incidents.

The boundaries between Tier 1, 2 and 3 are not definitive but are affected by many factors. Tier 1 is generally easy to define as it is based on a response to an operational spill that can be easily described. The Tier 2 boundaries, however, are flexible based on the risk and operational setting. If Tier 1 help is readily at hand, plentiful and accessible, the Tier 2 operating environment can be quite narrow, but if local resources are not available or access is restricted the Tier 2 boundary is much wider or a more immediate Tier 3 response will be required, as illustrated in Figure 1.

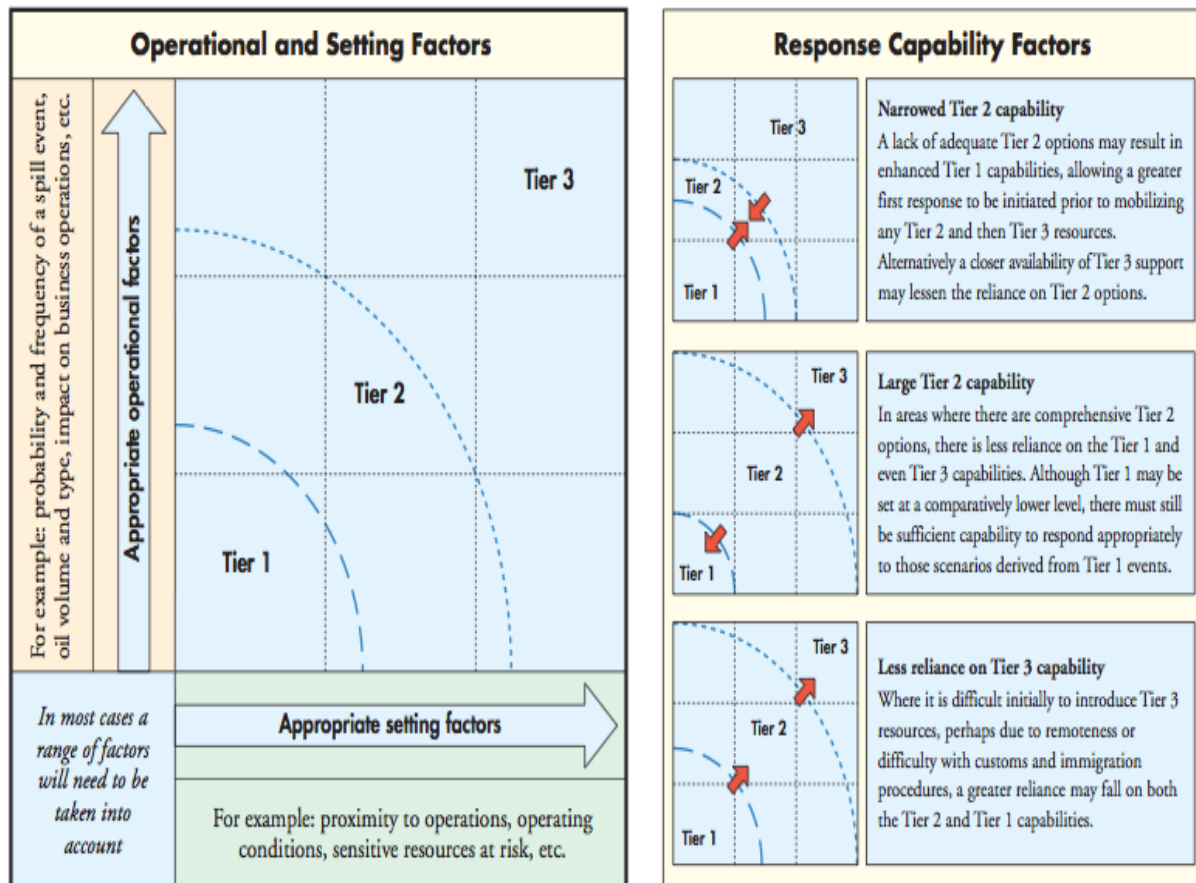


Figure 1 : Tiered response concept

It should be noted that the definitions above make no reference to spill size. This is deliberate. To categorize a spill by volume can create an environment for underreporting, as well as delay the cascading in of Tier 2 or 3 resources. If the Tier 1 threshold value is say, 50 bbls, many spills will be reported as 49 bbls and only Tier 1 resources will be mobilized even though the consequences could require Tier 2 equipment and personnel. The classification should be more about an 'ability to handle' a spill and the associated consequences than the volume. A spill of 10 bbls of highly pernicious oil in a highly sensitive environment could represent a serious problem and require significant resources, rendering the spill size as an unimportant factor.

This tiered system of response has served the industry well over the past forty years, and over that time the response network has evolved geographically to fill perceived gaps. However, the definition of what constitutes an effective response paradigm, and how we

define capability is one that has escaped the industry over the years. There has been a caution about trying to define response capability, the concern being that if it is defined, it can become a stick with which to be beaten. This makes it difficult for OSROs to define or calibrate their response capability. Some jurisdictions have tried to define it purely by equipment capability but the problem is more complex than that, with so many variables that might come into play that might compromise the effectiveness of performance. The determination of a what constitutes an 'adequate' response capability should be based on a proper assessment of risk, the requirement to meet regulatory compliance. This requirement should be defined by the response users for delivery by the response providers and reviewed periodically as the threat and operational environment changes. Throughout this period the focus was almost entirely on the shipping industry, significant incidents within the Exploration and Production sector being rare and isolated events.

What happened next.....a changing risk profile:

A famous law says that every action has an equal and opposite reaction. This is also true of oil spills, a series of serious oil spill incidents in the late 80's lead to a host of regulation, legislation and awareness of the problem of oil spills. The Oil Pollution Act 1990, International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), IMO ship construction rules, International Ship Management code, increased ship vetting and increased scrutiny by the Authorities and Classification societies all lead to improvements and a reduction of incidents as the statistics shown in Figure 2 below from the International Tanker Owners Pollution Federation illustrate vividly.

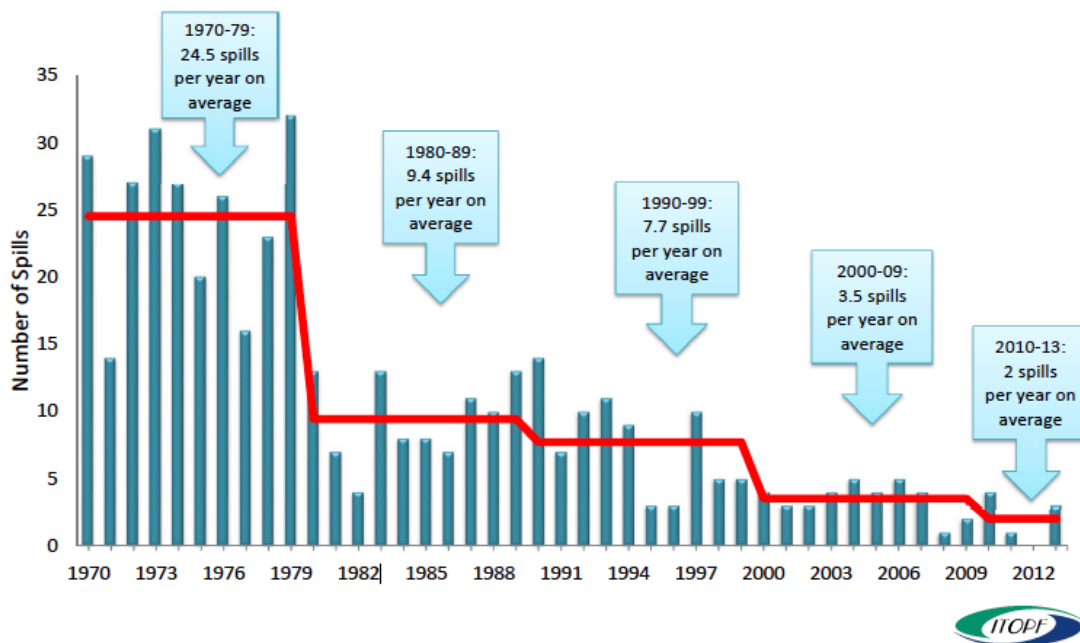


Figure 2 : Spill Incidents > 700 tons 1970 - 2013

The improvements that had been achieved over this period were significant in terms of the shipping industry and there was a good sense of getting the situation under control. However, nothing stays the same. At the same time as the shipping industry was congratulating itself on a job well done, another problem was beginning to loom larger. Changes in the industry were creating different risks and the Exploration and Production

sectors were beginning to suffer from an increase in incidents in a world where global news travels much more quickly thus bringing the incidents to prominence.

The typical incidents that might lead to spills within each particular tier level for Exploration and Production activities are well understood, they can generally be summarised as:

- Tier 1 - Small spills of diesel, drilling mud or utility oils.
- Tier 2 - Moderate flow line/export pipeline or FPSO related oil spills.
- Tier 3 - Potentially very large spills arising from a loss of well control.

The main difference being that, compared to shipping spills that will have a finite volume, a major spill resulting from a loss of well control could result in a much larger volume and longer duration until the source is secured. As the upstream industry moves into new areas, it has developed more offshore fields using FPSO technology. The rationale behind this mode of development might be because there is a lack of offshore pipeline or onshore processing infrastructure to support production operations, the political situation onshore might be a difficult operating environment or quite simply the development might be in deep water far offshore and out of reach of shore-side support. Regardless of the reason why, the consequence is a very different spill risk profile that can create a number of new response issues.

Response at a Tier 1 level is generally maintained in line with the tiered response philosophy, but delivering that response in a remote offshore location is difficult. The deployment of response equipment from FPSOs or production platforms is problematic and the availability of suitable marine support platforms can be limited in some areas. In some cases the 'monitored natural degradation' option is the only one available. For small spills that will naturally dissipate this is a perfectly reasonable approach, but for spills of persistent oil or those that emulsify it may not be a satisfactory solution.

Even more difficulties arise in the case of a 'Tier 2' incident. The oil inventories and transfer rates when producing into FPSO's and lifting cargoes from offshore installations are significant, often in the thousands of cubic metres per hour. The possibility of a significant oil spill is very real and has been demonstrated in recent years in Angola, Nigeria and Norway. The response to such an incident can automatically become a Tier 3 response if the local resources are overwhelmed and there is a limited Tier 2 capability. The ability to deliver the Tier 3 response into these locations can be logistically and operationally very challenging due to the lack of infrastructure support. They generally require a much higher degree of planning but are certainly feasible as demonstrated by the response to the aforementioned Angola spill.

One outcome of the recent upstream incidents is an increased desire by the oil industry not just to have a plan, but to be able to see how the plan and the response is delivered. This puts a whole new level of detail and complexity on preparedness considerations. It is no longer a case of 'what' is going to be done; it is also a detailed tactical plan to show 'how' it will be done. This requirement has not been lost on the regulators either, with an ever-increasing demand for the industry to demonstrate the effectiveness of delivery of their response or face political pressure to place additional response resources more local to the operation. Similarly some Governments have used the opportunity to leverage more resources into their National environments to enhance their response capability.

What does it all mean..... What should today's oil spill response capability look like?

It became apparent that the world had changed in the aftermath of the Montara and Macondo incidents and Industry responded by establishing the Global Industry Response Group [GIRG] to identify improvement opportunities for oil spill preparedness and response. The subsequent GIRG report identified, among other things, a need to review the current oil spill preparedness and response arrangements to assess what, if any, changes might need to be made to the industry response structure. When we assess the industry response capability, assuming that the tiered preparedness structure remains valid, and there is no reason to think why it should not, we need to consider each of the response tiers.

Tier 1 remains relatively easy to define, the nature of the operation will determine the risk profile in terms of spill volume, oil type and the resources at risk. The capability held within a Tier 1 capability should be limited to providing an immediate response to an incident that might occur at the source. The scope should be restricted to providing an adequate response to the credible operational event. Once this is done it is a case of ensuring that procedures, personnel, equipment, logistics, exercises and training are provided, and maintained, to service the requirements. The challenge in today's industry world is in ensuring that the capability is suitably resourced exercised and maintained. It is crucial to have sufficient trained response personnel available to mount the response in a timely manner. By definition the reach of Tier 1 is limited to the locale of the operation, the movement of a small oil spill away from the source might escalate it to the next Tier level, even if it is only a small quantity of oil.

Tier 2 is a more difficult capability to define, once a spill escalates, either because of its size, or because of its remoteness from the facility it automatically becomes a Tier 2 spill. Over the years, Tier 2 response capabilities have been established to meet the demand, either by Industry, governments or commercial contractors. These have evolved as a result of the resident risk, a requirement by legislation, industry demand or recognition of the benefit of mutual aid industry co-operation. Similarly the scope and scale of Tier 2 response capabilities has been defined by the criteria defined by the Tiered Response and Preparedness guidance. In some remote difficult to access location the Tier 1 / 2 capability has been extended to ensure that a credible response can be delivered, the scale being determined by the time it might take to mobilise and deploy Tier 3 resources. Some of the original Tier 2 facilities were resourced to respond to historical risk profiles, it is important that scope and scale and location of these Tier 2 capabilities are reviewed on regular basis to ensure they remain relevant to the current industry risk profile and needs.

This requires a programmed periodic investigation of the risks, operations, locations, and resources required by the owners or customers of the capability. In any case it should be done as a matter of course when new operating paradigms emerge.

The Tier 3 response network of oil spill capability has evolved over time as a consequence of changing industry needs, regulatory changes and new operational environments. The system began with the Oil Spill Service Centre that was originally established in 1981, which later evolved into the present Oil Spill Response Limited, a cooperative currently owned by over 40 oil companies. Shipping incidents in the 1980's led to the development of the Marine Spill Response Corporation (MSRC) in the United States, East Asia Response Limited, (EARL) in Singapore, Australian Maritime Oil Spill Centre (AMOSC) in Australia and a major regeneration of the Clean Caribbean and Americas Co-operative (CCA). Recently there has been a consolidation of the network, OSRL, CCA and

EARL have been consolidated under the management leadership of OSRL with the recognition that the goals and objectives are identical, as in many cases are the users. Logically by having an overarching management structure, the goals and objectives can be kept fully aligned in the industries best interest and a globally integrated approach taken. The scope and scale of these Tier 3 facilities has either been industry driven or through regulation such as the Oil Pollution Act of 1990. Experiences during incidents has also shaped industry response, one of the follow up actions after the Macondo incident was a review of response capability by the Tier 3 cooperatives. The result was an enhancement in capability across the board, with response strategies such as in situ burning being introduced as a mainstream response technology, in addition there was a general enhancement of response capability around the globe by the industry. The response time for delivery of response is an important facet. Over the past three years OSRL has been developing a jet aircraft, [Boeing 727], based spray systems to enable dispersants to be delivered more rapidly. The aspect of response delivery is increasingly a key one, the industry is demanding that its response organisations, and being required by regulators, to demonstrate that not only are the response resources available but also that they can be delivered to the incident site and put to use. This paradigm shift is leading to a need for a much more detailed response planning regime.

The nature of incidents in recent years has also shaped industry preparedness, whilst historically shipping based, the experiences in response to a number of serious upstream incidents has been the introduction of the Subsea Well Intervention Service, (SWIS), led by OSRL. The SWIS service provides access to capping devices located strategically around the globe. The introduction of this programme has added an additional three response bases in Norway, Brazil, and South Africa provided an opportunity to enhance the capability in Singapore. The geographical distribution improves response logistics and provides additional expertise and resources in more locations. The programme is to be complemented in the very near future with the introduction of a 5000 cu m global dispersant stockpile.

The industry has also combined its response resources to become more efficient, the Global Response Network has evolved over recent years to enable industry funded Tier 2 and Tier 3 bases to collaborate and co-operate in order to maximise, value, benefit and effectiveness of the industry oil spill response commitment that has been made to providing oil spill response. The network permits the sharing of resources, experience, training and knowledge throughout the community to enhance overall response capability. The locations of the various global equipment bases, including the OSRL capping and containment facilities, are shown below in Figure 3.

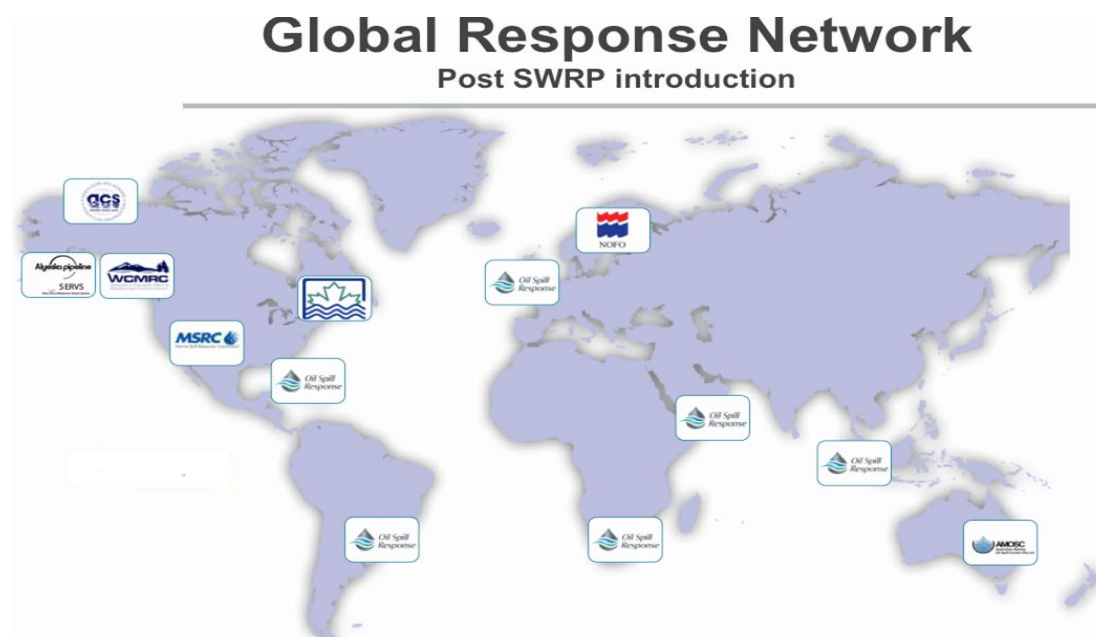


Figure 3 : Global Response Network

Any plan to update the industry response capability will require not only a look at the risk profile but also a view as to what constitutes an effective response. Some companies have established corporate standards and criteria to define response expectations for businesses but this approach is by no means universal. There have been other models such as the Best Response Model and a number of preparedness assessment tools used to help industry establish these criteria.

It is important to recognise that operating environments change, many of the existing Exploration and Production focussed response capabilities established previously now find themselves less suited to today's risk profile. For example, a response capability might have been established for response into the inshore environment whilst the operations have now moved to deep water offshore. This is becoming increasingly common around the globe. When this happens it is important to reassess the operational arrangements, and if required, modify them. The energy to drive changes in capability within these organisations has to come from Government Regulation, the Corporate body or from within the business unit. The politics of these changes can be difficult to manage. External pressure might be resented because it imposes cost and work on the entity to drive the change. There might be internal resistance to change as it can represent cost, work and might upset the status quo with regulators. Given these impediments it is not surprising that change might be difficult to bring about. Notwithstanding these difficulties, it is imperative that the scope, capability and suitability of response operations are reviewed and evaluated on a periodic basis.

How can we evaluate a response capability?

If we acknowledge that the world has changed, then we also need to acknowledge that there is now a need to periodically revisit response capability, owners, operators and for users to be more pro-active in the assessment of changing risk. Once we have evaluated the risk profile and defined what the response capability should look like the next step has to be to evaluate it on a periodic basis to assess whether it is adequate. This is important at all of the response Tier levels but becomes particularly important for the Tier 2 response providers as

the risk profile will be constantly changing over time as new operations and operators come on stream. Over the years auditors or consultants or response organisations themselves have tools to try and monitor or assess response capability. These generally have been individually developed as ad hoc worksheets, which do not work within a common framework to assess the dimensions of a response capability. This can lead to a situation where ‘apples and pears’ are often being compared.

Recognising that the world has changed, there was a need to find a tool to assess the suitability and operational capability of a response capability, once it had been defined and established that could be universally applied to an organisation at any Tier level. To find such a model, an area of activity that was considered was the military. The Defence Lines of Development (DLODs) are used extensively in the UK Ministry of Defence in the field of Capability Management across the three services. The tool is used to ensure that an existing, new, or future, capability meets operational requirements. It is a proven methodology with an established track record of informing policy-making at a national level, particularly in strategic planning and equipment procurement. DLODs form part of the overarching Ministry of Defence Architectural Framework (MoDAF) and are defined as “the elements that must be brought together to deliver military capability to operational users”. DLODs are a holistic, flexible and adaptive tool, which assesses the human, technology and policy implications. The lines of development are classified by the acronym TEPIDOILS, which stands for:

- a) Training
- b) Equipment
- c) Personnel
- d) Infrastructure
- e) Doctrine and concepts
- f) Organization
- g) Information
- h) Logistics

It is believed there is merit in the application of such a model in the sphere of assessing oil spill response capability as many of the dimensions and criteria have similar importance. For the purposes of this paper, the following definitions have been derived, transposing them from the military & strategic policy environment into the oil spill response arena. It was found useful to add a further assessment dimension of Safety into the framework, as this is a critical component of response planning and operations that must be considered. Definitions of the TEPIDOILS lines of development, as modified for application to oil spill response capabilities, are provided in Figure 4.

TEPIDOILS	
Definitions	
Training	The provision of necessary skills to personnel to permit safe, competent & effective delivery of a response capability.
Equipment	The provision of oil spill response apparatus (eg: Skimmers) including expendable and non-expendable consumables, needed to outfit/equip an individual, group or organisation to conduct response operations
Personnel	The provision of sufficient, capable and motivated personnel to deliver the response management supervision and operations, both now and in the future.

Infrastructure	The acquisition, development, management of all fixed, permanent buildings and structures, land, utilities and facility management services in support of the response capability.
Doctrine & Concepts [Response Philosophy]	Doctrine (Response Philosophy) is an expression of the principles that guide an oil spill response and is a codification of how activity is conducted. A concept is an expression of the capabilities that are likely to be used to accomplish an activity in the future. A concept may be a particular technology, policy or idea.
Organisation	Relates to the operational and non-operational organisational relationships of people. It typically includes internal corporate structures, incident response & reporting structures, and liaison with external parties that provide support.
Information	The provision of a coherent system to gather and manage data, information and knowledge to support the response capability.
Logistics	The systems to support the operational movement and maintenance of responders, response equipment and supporting operations in the field.
Safety	The system in place to assess and manage the safety of responders and response workers.

Figure 4 : TEPIDOILS Definitions

The intent is to translate the dimensions listed above into a questionnaire that permits either an external or a self-assessment of a response capability to determine whether it has the requisite components in place to effectively deliver its response Service Level Agreement. By compartmentalising the various elements it allows areas of interest to be individually identified and specific action plans devised. Draft examples of the work sheets, and guidance on how to complete the assessment are included in Figure 5 below.

1.0 PURPOSE OF THE ASSESSMENT TOOL
This tool is intended to allow the user to conduct an assessment of the oil spill response capability of an oil spill response organisation. It is not intended to provide an in depth audit of an organisation but to act as an indicator for which areas of activity, if any, might warrant further investigation or discussion based on the findings.
2.0 WHO SHOULD CONDUCT THE ASSESSMENT
The assessment should be carried out by either a representative of the membership of the organisation or by an external organization. It is important that the person conducting the assessment has a good understanding of the issues surrounding oil spill preparedness, risk profile, response equipment and response operations a clear knowledge of the expected service level agreement and the industry response requirements and expectations of the facility.
3.0 HOW TO CONDUCT THE ASSESSMENT
The assessment process will involve a question and answer session dealing with the topics and questions outlined in the assessment model and an inspection of the response capability and records. Each of the questions is then allocated a RED or GREEN ‘tag’, depending on the findings. The summary finding ‘tag’ at the foot of each table is an overall rating of the assessment element that is carried through to the summary findings table at the back of the report. Additional photographic and documentary evidence should be gathered where possible and appropriate to support the findings.

been many changes brought about by where and how the industry operates. What is important is to stay ahead of these changes by proactive review and adjustment, rather than reacting after incidents happen. Industry will always be held to account in the Tier 1 environment and has taken significant steps to react to the changing world in the Tier 3 environment. There is a need to ensure that Tier 2 operators and commercial response providers also continue to deliver the response that is suited to the operational needs of industry as it changes. The arrangements and institutions established in the past need to be evaluated to assess their suitability to today's risk environment and adjusted if required. This process must be evergreen to ensure that the response capability remains credible to meet the operational risks. The TEPIDOILS tool is proposed as one that can be used to conduct these reviews, having a credible heritage and a set of assessment criteria that are consistent with oil spill response activities to assess a capability once designed and defined.

The expectation of industry and governments increases in terms of what they deem as a credible and effective response. There are some regions where the delivery of response is difficult due to administrative, bureaucratic, political or sheer logistical obstacles. These problems may never be solved and ultimately local response capabilities will evolve that the industry has to be part of. To ensure that the concept of the tiered response remains valid there is a need to demonstrate an increasingly high level of planning and ability to physically deliver an effective response from out of region. Failure to do so will lead to inexorable pressure from Governments to establish larger response facilities closer to the operational sites.