Defining response capability: effectiveness, limitations and determining ALARP

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Introduction

Globally, oil spill preparedness and capability is under increasing scrutiny from Regulators and Stakeholders. Risk-based regulatory regimes require justification that the capability available is commensurate with the risk and that all options have been considered to reduce risks and impacts to a level that is As Low As Reasonably Practicable (ALARP).

However, the cost of implementing and maintaining resources for a major oil spill event, such as a loss of well control or tanker incident, will test and often exceed the capability of any organisation, be it Government or Industry.

Electronic tools currently exist that enable spill planners to calculate potential effectiveness of response strategies when dealing with offshore spills. However, some of these tools and determinations of response strategy effectiveness include conditions that are unlikely to be replicated in field response such as skimmer recovery rates obtained in 50-75mm of oil or laboratory testing of dispersants in ideal conditions.

Over the past five years, both the Bureau of Safety and Environmental Enforcement (BSEE) and the US Coast Guard (USCG) have been attempting to improve the Estimated Daily Removal Capability (EDRC) approach. This has resulted in the development of the Estimated Removal System Potential (ERSP) and Estimated Dispersant System Potential (EDSP) tools, based on encounter-rate and systems-based methodology that is much improved over EDRC and more likely to simulate field conditions.

This paper discusses development of a similar tool integrated with a standard capability model for assurance with standard terminology and agreed performance standards based on a widely used Incident Management System (IMS).

Main Results

In developing a model to calculate capability, it is also important to determine timing and performance metrics for typical response strategies including but not limited to; Incident Management, Source Control, Subsea Dispersant Injection, Surface Dispersant Spraying, Mechanical Recovery, Shoreline Protection & Deflection, Shoreline Cleanup, Wildlife Response, and Waste Management.

Timing and availability of response resources is essential in deploying a successful response. Understanding logistics limitations and the remote nature of the Australian coastline allows realistic planning and management of stakeholder expectations. Unlike parts of Europe and the United States, Australia is sparsely populated in some key offshore basins with limited aerial, marine and personnel resources. For this reason, standard terminology is used to describe the different stages of response activities including;

- Activation: defined as, the time taken once the Incident Management Team has been mobilised to the EOC/ICC, for a duly authorised person to formally activate contracts for goods or services,
- Mobilisation: defined as, the time taken to mobilise resources from home/storage location to identified laydown/staging area (expected to be airport or sea port) close to response. This

includes all necessary permits, approvals, transit and support logistics (loading, unloading) required.

- Deployment: defined as, the time taken to deploy the capability with all required constituent and supporting elements to the location where it is used. Ie, aerial surveillance platform to spill location, Oiled Shoreline Assessment Team to impacted shoreline, etc.

This standardised approach to response management, included the generation of performance standards and measurement criteria for key phases of Incident Management including initial response and ongoing Incident Action Planning (IAP). These were developed in alignment with a common industry Incident Management System (IPIECA, 2014) to ensure interoperability with existing systems and processes.

Many of the existing approaches to determining response capability overstate the effectiveness of various strategies. There are a considerable number of variables related to the operating environment (daylight, wind, waves, sea temperature, air temperature) as well as changes to the chemical and physical properties of the oil (surface concentration, viscosity, VOCs) that effect these calculations. For these reasons, conservative ranges of effectiveness and encounter rates were determined and used, rather than single figures, as this is intended to cover the wide array of response conditions and operations found in offshore spills.

Using these performance ranges with stochastic and deterministic modelling to simulate surface and subsea releases, lower and upper limits where offshore, nearshore and onshore response strategies may be most effective can be established. These limits were derived from oil spill response planning literature and industry guidance including NOAA (NOAA 2013), EMSA (EMSA, 2012), ITOPF (ITOPF, 2011) and IPIECA (IPIECA, 2015). Based on a review of multiple actual responses and desktop analysis of simulated responses, the following conservative, predicted levels of performance were determined.

- Subsea Dispersant Injection – 20%-36% of total oil release rate
    - Where subsea inspection observes oil release and strategy safe for deployment, dispersant to oil application at 1:60-1:100, predicted dispersant effectiveness of 50-60% of contacted subsea oil and subsea injection encounter rate of approximately 40-60%.
- Surface Dispersant Spraying – 10%-30% of available surface oil
    - Where remote sensing or aerial surveillance operations observe surface oil at minimum BAOAC 4 (discontinuous true oil colour 50-200g/m^2) or BAOAC 5 (continuous true oil colour ->200g/m^2); viscosity <10,000 cSt; dispersant to oil application at 1:20-1:25; predicted dispersant effectiveness of 40-60% of contacted surface oil; and spraying encounter rate of approximately 25-50%.
- Mechanical Recovery – 5%-10% of available surface oil
    - Where remote sensing or aerial surveillance operations observe surface oil at minimum BAOAC 4 (discontinuous true oil colour 50-200g/m^2) or BAOAC 5 (continuous true oil colour ->200g/m^2); <10,000 cSt; encounter rate of approximately 25-50% floating surface oil at threshold concentrations.
- Shoreline Clean-up – 60-80% of stranded shoreline oil
    - Based on stranded shoreline oil available for manual shoreline clean-up, M&E operations observing shoreline oil at minimum 250g/m^2 on accessible shorelines and clean-up effectiveness of 60-80% of available stranded oil.

These performance ranges provide spatial and temporal bounds for different response strategies using multiple deterministic scenarios. They are intended to provide guidance for response planning to determine required capability, compare it to the level of capability available, and consider alternative, improved or additional measures to close the gap. These control measures for each response strategy are arranged around a standard capability model (P^2OST^2E) common in Emergency Services and Military operations as outlined below (AFAC, 2011).

Element	Description
People	Roles, responsibilities, accountabilities
Process	Policy, procedures or processes required for conduct of tasks (e.g. specific standard operating procedures, concepts of operation)
Organisation	The structures required for completion of task (e.g. team structure and higher-level support structures) Jurisdiction and national-level structures
Support/ Logistics	Infrastructure, facilities, maintenance, logistics, communications Significant areas of support for conduct of operational tasks
Technology/ Equipment	Technology, equipment, systems, standards, security, interoperability
Training and Exercises	Capability qualifications/skill levels, identification of required training and development

Each identified alternative, improved or additional measure is then reviewed against criteria such as feasibility, expected performance, safety, implementation cost, maintenance cost, and environmental benefit to determine whether it should be carried through to implementation. Considering these factors and the cost-benefit approach for these control measures provides us with the opportunity to reduce risks and impacts to an As Low As Reasonably Practicable (ALARP) position for any offshore scenario.

Conclusion

In summary, understanding and defining the required scale, effectiveness and limitations of the response capability, from source control through to shoreline clean-up, enables a more realistic expectation of response timing, resourcing and effectiveness. Fundamental to the success of this work is a clear understanding of where the response strategy will be most effective, based on modelling during the planning phase and field observations during the response phase.

Combining a semi-quantitative response capability planning tool with industry agreed planning assumptions within a defined ALARP framework, allows organisations to compare available internal and external response capability, and consider options to meet the required need identified.

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