Validating Marine Oil Spill Response Planning Assumptions and Execution with Analytics Model

 # 2017-209

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ABSTRACT

Running a full-scale emergency response operation involves coordinated and interdependent workstreams that must be sufficiently resourced and supported to ensure that objectives are accomplished. Oil spill response planning provides the framework to rapidly scale up those operations and enable essential workstreams through pre-identified resources, facilities, logistics and capabilities. A systematic analysis of response plans can be used to validate an executable tier 1 response based on local capabilities, and provide a basis for planning the strategic cascading of additional resources for tier 2 and 3 responses with consideration for the limiting factors identified through analytics.

A proprietary analytics model was developed to examine and validate planning assumptions, resources and logistics against response requirements. The analysis includes a facilitated cross functional plan review using pre-defined response “workstreams” (e.g., shoreline protection and clean-up) broken down by tasks (e.g., SCAT or beach clean-up). For each task, the resources and logistics needed to accomplish the task are defined and evaluated to

identify the limited or critical resources (e.g., supervisor qualifications, waste capacity, transportation, etc.). The resource requirements and constraining factors identified through the analysis are compared to the resourcing identified in existing plans and validated by business function representatives to highlight resource gaps and areas for planning and capability improvements.

The emergency response planning analytics model was tested using existing oil spill response plans from two business units within the organization. A worst case scenario oil spill simulation was used as the basis for the plan analysis. The analysis produced findings indicating that existing plans were insufficient in specific areas and existing resources would be exhausted before cascaded resources could arrive to support a longer-term response to a major oil spill on water unless alternative resourcing plans were established. Specific gaps in planning, trained personnel, equipment, logistics and support facilities were identified along with recommendations for gap closure. Pilot testing of the analysis tools suggests that effective planning requires a detailed understanding of critical resources, limiting factors and workstream interdependencies so that that the strategies and tactics defined in planning (and those developed during an active response) optimize their use. Additionally, outputs from the model may be used as the basis for increasing local reserves of response equipment and supplies, developing regional mutual aid capabilities and establishing training and exercise objectives.

INTRODUCTION

The increase in deep water and remote oil production sites brings an increase in the potential for much larger, more complex and longer duration oil spills, such as Ixtoc 1, Deep Water Horizon, Montara and others. The effectiveness and timeliness of a response to such an event will significantly affect the resultant environmental, social and economic damages. Being prepared to face the potential challenges of a major spill requires response organizations to invest in specialized capabilities, resourcing, mutual aid coordination and advance logistical planning. This paper presents a systematic method for analyzing existing oil spill response plans to test their viability to support a long-term response. The analysis method breaks down the general operations and activities of a response over time to compare the logistical and resource demands accounted for in existing plans with those predicted by a team of local functional experts. An analysis of the existing oil spill response plans looks into the specific resource demands of the response divided into major categories of activities (in this model called "workstreams") and how they overlap. Critical resources and capabilities are identified to pinpoint the limiting factors that could inhibit the ability of a response organization to carry out operations. The analysis is then used to produce a detailed set of strategic recommendations for augmenting plans, capabilities and resourcing that will enable teams to quickly scale up operations by tier, overcome resourcing constraints and respond more efficiently and effectively.

While much has been written on the need for logistical analysis with the use of dispersants in an oil spill response and more recently on the significant need for extensive logistical planning for arctic regions, little has been written about the logistical challenges presented by the simultaneous subsea (well capping and containment) and surface response activities for a long-term response (National Research Council, 2014) (Foley, 2013). This assessment model seeks to review the resource and support requirements for a broad scope of response activities typically seen in a surface response to validate planning assumptions, determine where resource draws overlap and identify the supply constraints that will have the greatest negative impact to response operations.

A logistical model was developed to address the challenge of scaling existing oil spill response plans from a typical 4-10 day duration scenario to a 30 to 45-day scenario while enabling simultaneous sub-sea, on-water, aerial and on-shore operations. A primary challenge to such extensive planning is identifying and resourcing the logistics needed to sustain these operations and overcoming constraints caused by the long-term and simultaneous resource draws and simultaneous operations encountered during the response.

The logistical model used for this study applies a method of analytics typically used for understanding and diagramming business functions, their interactions and their resource demands. Local response organizations draw on the manpower, contracts, services and supplies of the existing business as well as those from other spill response organizations and networks. The model therefore focuses on local supply chain and logistical considerations that have the potential to limit, hamper or stop response operations.

The model uses pre-identified workstreams (or workflows) developed for this model to categorize the types of activities typically required in a response. Within each workstream, activities listed in existing plans are analyzed and recorded, and gaps are identified. In a separate exercise, resources required for each activity are listed, and workflow interdependencies identified (e.g., on-water operations, shoreline clean-up and decontamination are all dependent on waste management). The model is used to flag specific critical response resources or capabilities. Critical resources and capabilities are defined as those that have the potential (due to limited availability or capacity) to restrict or even stop response operations as activities scale up. For example, when the waste produced by all the simultaneous response operations reaches the maximum amount that can be processed by waste management systems for a given time period, response operations may be forced to stop. By identifying which specific resources are critical and limiting to the response, organizations are better equipped to strategically apply their emergency management funds to achieve the greatest impact in expanding their response capabilities or plan in advance for workarounds to anticipated resource shortfalls. Additionally, organizations are equipped with information that can be used to make informed decisions about where to most effectively apply limited resources during a response.

Figure 1 shows how multiple workstreams can occur simultaneously and draw from the same pool of critical resources. In the simplified example depicted below, four simultaneous workstreams require the use of vessels, but only 3 are available. By understanding this limiting factor, response planners have a more accurate picture of real capability and can develop strategic and tactical response plans that make the best use of available resources (local, mutual aid, government and OSRO resources).

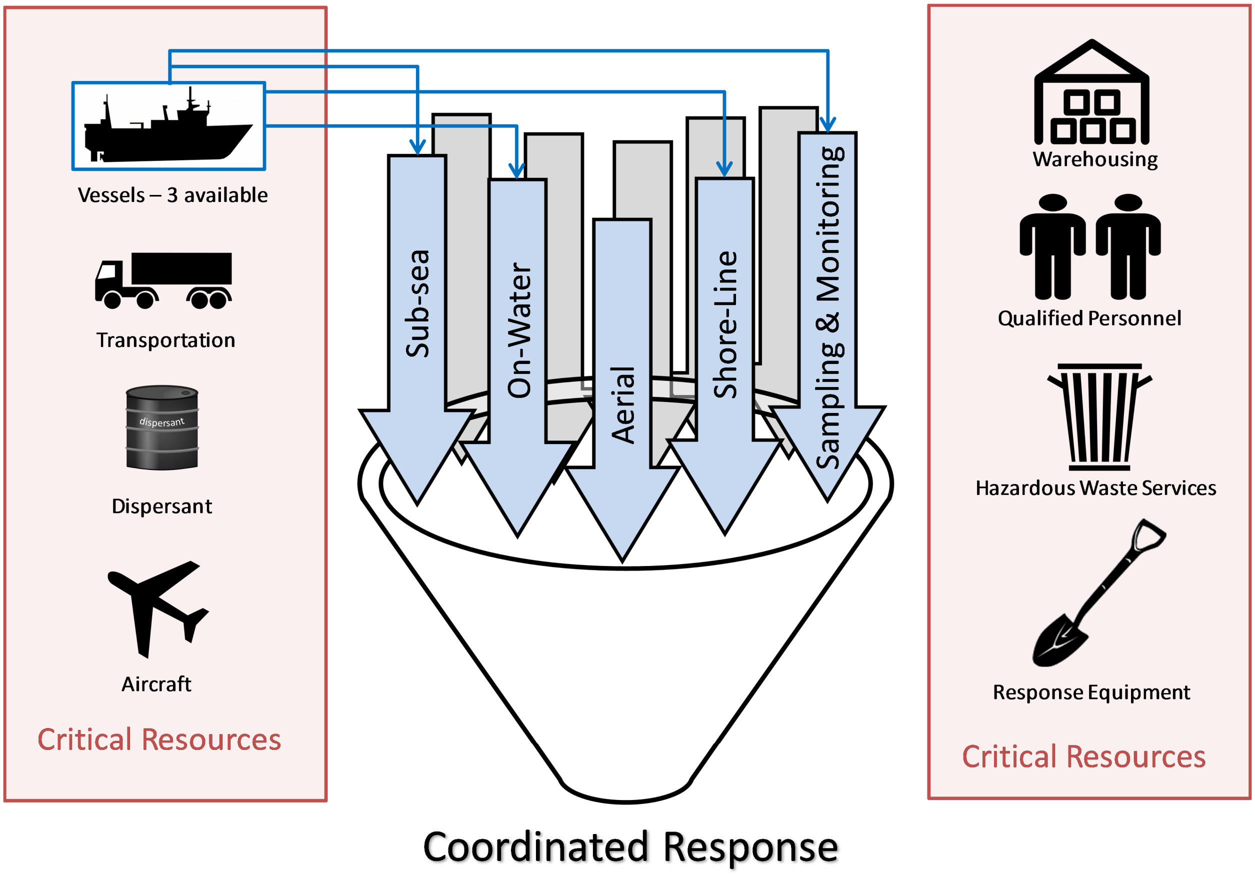

Figure 1. Workstreams & Critical Resources needed for a Coordinated Response

The use of systematic predictive modeling to determine in advance what resources will be in short supply and what limited resources will hinder the response organization's ability to scale up operations is critical for addressing the increased risk from expanding portfolios of remote and complex oil extraction operations.

The ultimate findings of the analysis are based on the outcomes of the model and the best professional judgement of the assessment team and the workshop facilitators. The output of the model will provide information that can be used to reduce or eliminate delays in mobilizing, transporting, and deploying response equipment, personnel or providing other supporting services (such as waste management, hospitality, etc.).

METHODS

The oil spill planning analysis model employs a business analytics methodology that examines basic workstreams and their resource requirements as they phase in and out during the course of a response. High-level workflows or workstreams are pre-identified in the model for the primary functions undertaken by a typical oil spill response. Within each workstream, basic activities and assumptions associated with each activity are listed, and then the high-level resources (people, equipment, facilities, services, etc.) required to carry out each activity are identified and their availability is validated. This type of analysis allows planners to extrapolate and examine resource draws from a broad perspective, highlight when and where those workstream resource draws overlap, and identify when and where resource constraints will be encountered. The workstreams that have the potential to be dependent upon one another are also identified so that planners can understand how a restriction in one workstream may influence another, or how by adding capacity to one workstream, others will be impacted (such as security).

The analysis model is used in a facilitated multi-day workshop setting. The workshop is based on a simulated worst-case discharge incident and assumes that the response will be relying on local business unit functions, contracts, resources and facilities as well as cascaded resources to meet logistical needs. It is assumed that well-capping response efforts to a well blow out scenario are occurring simultaneously with the surface response. Representatives from business functions such as supply chain management, operations, facilities, public affairs and others participate in the workshop and are queried about what resources would be immediately available, how long is required to bring in additional supplies and resources, what facilities are available and what contracts are valid.

Extensive pre-workshop analysis of existing plans and relevant government plans is needed to make the workshop productive. This pre-work also clarifies or orients the workstreams within the context of the local response frameworks (i.e., the roles of the government and responsible parties). Data gathered during workshop preparation and during the workshop is recorded in one of the two primary tools used to organize and analyze the data: Workstreams workbook and "Segments" Workbook. After the workshop, facilitation staff summarize the findings and present recommendations in a report format.

Workstreams Tool

The workstreams are discrete pre-identified workflows (for example, shoreline cleanup) that typically occur simultaneously, although sometimes staggered, during oil spill response operations. The Workstreams Workbook is based on 11 workstreams which are depicted in the diagram below. The workstreams here represent general categories of work typically phased in during a response to a subsea well loss of containment incident.

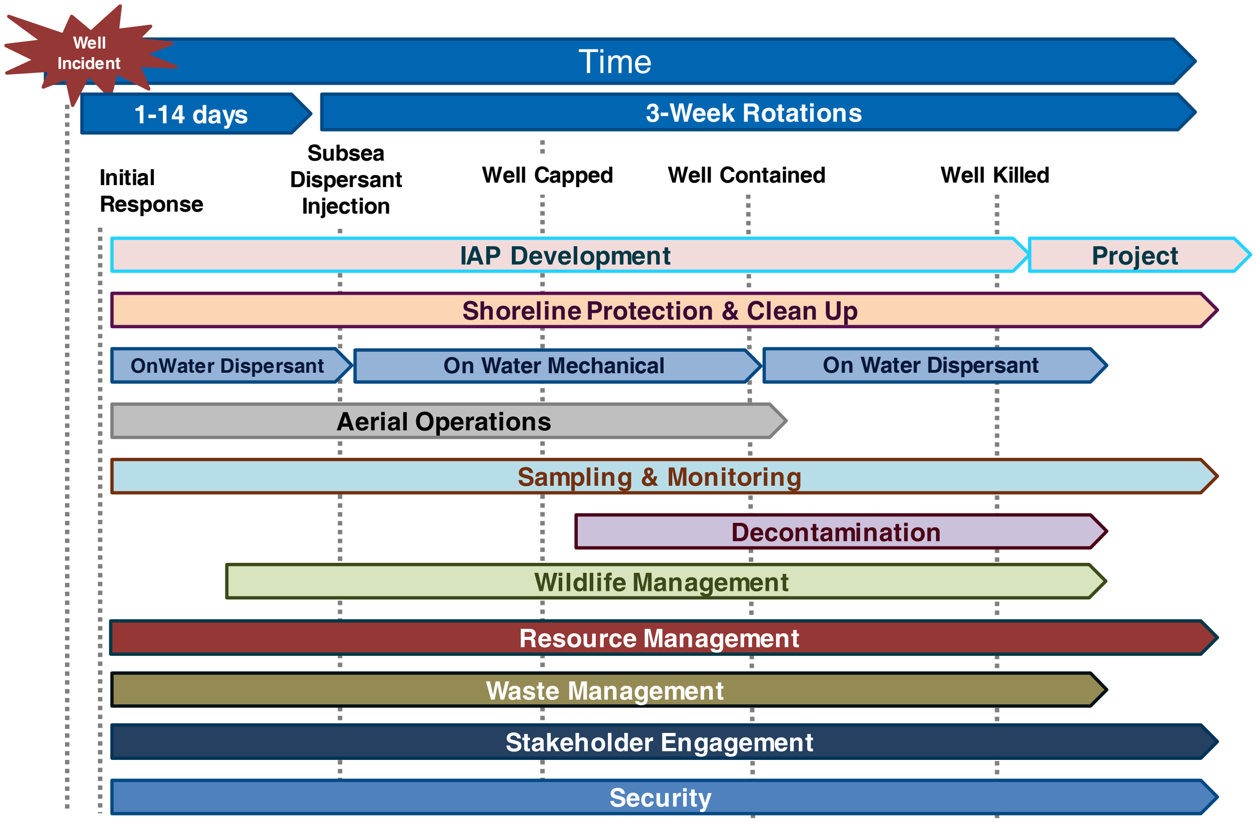

Figure 2. Response Workstreams Over Time

The Workstreams Tool is an MS Excel™ workbook that includes one sheet for each workstream. The workstreams may vary depending upon the operating environment, and can be modified for specialized environments, such as for an arctic response where there may be need of an On-Ice Clean-Up workstream.

Before the workshop, existing plans (including relevant government plan) are analyzed to extract actual planning elements specific to the site under review. Plan elements by tier and by workstream are then recorded in the Workstreams worksheet. The workstreams tool can also be provided to business functional groups before the workshop to capture internal or functional procedures that are applicable to a response to avoid redundant work during the workshop. These business procedures can be brought into the advance planning process.

The following diagram depicts the Workstreams worksheet for "Protect the Shoreline." In this example, the existing plan defines the anticipated shoreline impact, location of response teams, procedure for identifying resources at risk and the team responsible for response management. As much as possible, existing plan elements need to be recorded in the tool before the workshop and shared with participants as pre-read. This will help to identify gaps, such as other plans that need to be included in the emergency response plans. If the facilitators discover that there are components missing from the existing plans, those gaps should also be recorded in the tool. If gaps in organizational capability are identified those are also listed in the tool so that they can be addressed through training and exercise plans or through the sourcing of services. According to NUKA, "*it is critical to verify the information and assumptions in this and other oil spill response plans and analyses through field deployments and response exercises. Assumptions regarding equipment mobilization, transportation, and deployment timetables could be refined through field exercises. The capability of response systems to operate in different environmental conditions could be tested to ground truth assumptions about operating limits*." (Nuka, 2015).

Conduct On Water Containment and Recovery Operations

Workshop Scenario:

	Plan / Tactic / Activity	National Plan	Verify	Resources Immediately available	Resources Needed	Alternate Source	Functional Support	Limiting Factors / Critical Resources	On Water Key Decisions	Training/ Org. Capability Needs	Comments
Tier 1 resources (initial stand-up, on-scene)	• Supply Vessel #1	• Initial on-scene response actions, supporting the operation observes the spill and begins to respond (if safe to do so).	• Homebase at Port Caroline supply base. • First strike capability.	• Marine contract in place • Contracted Supply Vessel and crew • Basic oil spill training provided	Resource requirements - per Supply Vessel • 30m3 dispersant • AFEDO or VIKO nozzle / spray arms • 2 x 200m length ro-boom or similar • Skimmer unit • Basic (Tier 1) Field Dispersant Effectiveness Testing kits o Emergency response teams are familiar with testing procedure • Appropriate number of vessel crew trained as Oil Spill Responders (OSR) to conduct field observation and equipment deployment e.g. master, first mate.	• On-scene standby vessel	• Activation and Notification Procedures completed on rig • Emergency Management Team call out.	• Purchase of dispersant and Oil Spill response equipment prior to commencing drill campaign and ability to retrofit vessel of opportunity	• Determine response capability for initial response with equipment on board to determine duration response activities can be maintained (before relief vessel needed)	• Vessel crew trained as Oil spill responder (OSR) to conduct observation and equipment deployment to use on-board first strike oil spill equipment e.g. AFEDO nozzles, boom deployment	• Confirm Supply Vessel first strike oil spill equipment and dispersant capability
Tier 2 resources (Chevron Australia BU /Asia Pacific, National plan)	• Offshore Command and Communication	• Ability to provide communications and support to the Taskforce.	• Commencing Day 5 • Potential for 1 x existing Supply Vessel to coordinate operations.	• Supply Vessels in service to operations in field Alpha							
	• Offshore tanker	• Ability to receive oily liquid waste from strike teams for transfer to onshore facility	• Commissioning date	• None	• Aframax or panamax tanker or equivalent • Transfer hose and spare • Transfer coordinator stationed on tanker						
	• Strike Teams (estimate need 15)	• Ability to provide sufficient offshore containment operations as per the Incident Action Plan • Planning for recovery potential up to 15 strike teams across Offshore and Nearshore	• Commencing Day 5 - weather dependent • Tasked with recovery of highest concentration of oil in areas of operations • Each strike team will be dependent on resources available in the field. As example o 3 x Vessels of Opportunity and 1 x Supply Vessel or barge for oily waste temporary storage • Strike team Oil Spill equipment resources are available from National Stockpile equipment	• OSRO and Coast Guard equipment stockpiles	Resource Requirements (per operation) - for Offshore Strike team - The operation requires o Minimum 1 x appropriate trained OSR person per vessel to oversee deployment and communications per strike team o A lead pair of vessels o A tow pair of vessels o Vessels to have storage capacity for oily waste o All vessels in survey class appropriate to area of operations and can conduct the following as required; tow, store, deploy, tow and/or recover boom on existing reel and/or has deck space on stern to mount a deck reel o 2 x 200m offshore boom, secured to deck ready to deploy o 2 x 20m chain to create open boom end connection via top and bottom tow bridle connections o Recovery System o Skimmer o Ancillary equipment (Transfer hoses, hydraulic hoses, power pack, etc) o Temporary Waste Storage o Vessel tankage plus deck bladders or similar The operation would be conducted as follows: o A lead pair of vessels to tow and recover boom. o A tow pair of vessels to tow boom and skimmer deployment and recovery o Deployment either from a single vessel deploying all boom, or either lead vessel deploying boom each, connecting up. o Deployment could be enhanced 'V' shape boom configuration (open ended) using 2 x lead vessels with 2 x trailing vessels conducting recovery in J-sweep formation, or alternatively, smaller 'J' or 'U' operations	• OSRL additional resources for boom and skimmers • Marine contractors, fishing fleet for Vessel of Opportunity	Legal PGPA	• Possible number of Enhanced strike teams is limited by total boom available in Operating Area. • Possible number of strike teams using J-Sweep formation • How does the Emergency Mangement Team staff for a protracted response? • Weather limitations of abiity to deploy boom (90% >2m Hs).	• Determine Weather limitations for strategy • What is Availability of vessels for strategy • Limitations of equipment in offshore conditions • Determine Oily water storage on recovery vessels		• Determine capacity of boats and teams. Match up capability so vessel complement • Purchase/rental of equipment • Pre-position equipment at Port Caroline or other strategic locations • Vessel availability and mobilisation for enhanced operations o Consider risk of secondary spill during lightering operations. Safety concern is vessel crew exposure to VOC's while skimming Consider zoning for on water recovery or circles, aerial dispersant, insitu burning, mechanical recovery.
	• Nearshore CAR - Offshore Command and Communication Support Facility (OCCSF)	• Ability to provide communications and support to the Taskforce.	• Commencing Day 10 • PSV equivalent	• Nil							
	• Nearshore CAR - Vessels storage capability	• Ability to store and transfer liquid oily waste to Port for tanker disposal	• Homebase near Port • Sail as required dictated by weather • Disposal of oily waste back to shore/site facility	• Nil	• Adequate ORO capacity • Large or smaller capacity						
	• Nearshore Strike Team 1	• Ability to protect designated shoreline areas in conjunction with the Shoreline Response as per the Incident Action Plan • Planning for recovery potential up to 15 strike teams across Offshore and Nearshore • Determine Total Nearshore Strike Teams	• Commencing Day 10 - weather dependent • Tasked with protection of areas e.g. within both Bravo Gulf and Gulf St David • Each strike team will be dependent on resources available in the field.	• OSRO and NatPlan equipment stockpiles accounted for	Resource Requirements (per operation) - for Nearshore Strike team - The operation requires o Minimum 1 x appropriate trained OSR person per vessel to oversee deployment and communications per strike team o A lead pair of vessels o A tow pair of vessels o Vessels to have storage capacity for oily waste o All vessels in survey class appropriate to area of operations and can conduct the following as required; tow, store, deploy, tow and/or recover boom on existing reel and/or has deck space on stern to mount a deck reel o 2 x 200m offshore boom, secured to deck ready to deploy o 2 x 20m chain to create open boom end connection via top and bottom tow bridle connections o Recovery System	• OSRL additional resources for boom and skimmers • Marine contractors, fishing fleet for Vessels of Opportunity			• Availability of vessels for strategy • Vessel of Opportunity program including training • Oily water storage on recovery vessels		• Prioritize tactical response plans to include equipment requirements • Purchase/rental of equipment • Pre-position equipment at Adelaide/other strategic locations • Vessel availability and mobilisation for enhanced operations o Determine travel time of secondary contract vessels to response site from likely ports. Consider mechanical recovery operations in nearshore to engage with local fishing fleet

Overview | Participants | Emergency Mgt | Security | ICP & IAP | Subsea intervention | Subsea containment | Relief well drilling | Air_Ops | OnWater | Shoreline | Resource_Mgmt | ...

Figure 3. Workstreams Capture Tool with Example Data

In some cases, plan components can be linked to planning assumptions. For example, if the plan indicates that the shoreline will be cleaned up using personnel typically employed in facilities maintenance, then planners need to confirm that those personnel have received HAZMAT training and that their collective bargaining agreement enables them to engage in clean-up activities. As another example, plans may be based on an assumption that the government will provide all site security. This assumption needs to be cross-checked and verified with government plans or governmental departments to confirm that this is accurate. Planning assumptions that need to be verified should be identified in the tool. Assumptions may be incorporated into training and exercise programs for verification, become a subject for future engagement with government agencies or identify contract restrictions that may need to be renegotiated or augmented. Assumptions that are found to be false should be flagged so that plans can be added, amended or re-resourced.

The workstreams tool includes columns for the review team to capture data on resource requirements, sourcing, workstream interdependence, resultant decisions (including expanded organizational capabilities) and any other comments. Key Decisions captured in the tool are compiled in a Key Decision Summary tab so that they can be reviewed, compared and prioritized and assigned for action.

Segments Tool

The Segments Workbook is used in conjunction with the workstreams tool to break down each workstream into activities or tasks within the workstream and define specific resource requirements for each activity. In many cases, use of the segments tool highlights which resources will be in short supply for a given activity and workstream. The most limiting resource is then used as the starting point for defining a unit for measuring work. For the purposes of this paper, that unit of measure is defined as a 'segment'.

Segments are a useful way to measure work including all resources that are needed to perform the work. Segments vary by workstream and may be defined by factors such as time, number of sorties, or length of beach. A single workstream will likely have more than one segment. In the case of shoreline protection and cleanup workstream, for example, a segment of work may be defined as the length of beach that can be cleaned by a single team. The resources within that team will include all the personnel (in their various functions), equipment, services and support needed to complete a defined length of beach. In one case study, the analysis showed that qualified Beach Masters were the most limited resource for beach clean-up activities. The segment was then re-defined by the length of beach that could be cleaned by a team lead by a single Beach Master.

The use of segments provides a way for emergency management (EM) personnel to systematically plan for scaling up or down response operations with a full understanding of the resources required or released by escalating or de-escalating workflow operations. Figure 4 depicts a sheet of the segment tool for on-water containment and recovery operations.

Conduct On Water Containment and Recovery Operations

Task	Personnel	#	Equipment Type	#	Transit time to Site	Workstream Interface	Limiting Factors / Critical Resource
On-Water Dispersant Application							
Dispersant Application and Tier 1 monitoring	Vessel crew 2 x Trained responder		1x Vessel 15m3 dispersant 1x potable boat spray system 1 x dispersant pump Ancillaries and hoses 1 x dispersant effectivenss sampling kit			Air Ops, ICP	Dispersants; vessels
Dispersant Monitoring (Tier 2)	Vessel crew 2x Trained responder		1x Vessel 1x Fluorometer+other monitoring tools available (check with Env guys) 1 x tough weather laptop with software to process data 1 x satellite wifi to tranmit data if can't get from the vessel	1 per zone of operation	Check with Chevron marine specialist	Air Ops, ICP	fluorometer; vessels
Retrieve dispersant from Staging and loading	Forklift operator Banksman Trailer driver Crane operator signal man/rigger		Forklifts Trailers (18-20IBC per 40ft trailer) Crane Lifting gear	per staging area	Check with ABU	Resource Mgmt	Trailers
Fuel Vessel	Crew		1xBunker Barge Fuel	per zone	Check with ABU		
Engage Spotter Plane						air Ops.	
Establish Communications	N.A.	N.A.	1x VHF set 1x satellite phone	per vessel			satellite phone
Fuel aircraft							
Common Operating Picture							
Charter additional							
Impacts to home FPSO							
IH Equipment							
On-Water Mechanical Recovery							
Retrieve equipment from Staging and loading	Forklift operator Banksman Trailer driver Crane operator signal man/rigger Lifting supervisor		Forklifts Trailers (40ft) Crane Lifting gear				skimmers,
Fuel Boat							Fuel
Manage temporary storage	1 x temp storage manager 2 x additional manpower to help with the waste transfer		1 x tanker/barge for liquid waste Waste containment tanks IBCs				vessel, method of tranfer
Coastal Tanker or Sea-going barge	Vessel crew		sea going barge				barge

... Shoreline | OnWater | Air_Ops | Sample_Monitor | Decon | Wildlife | Resource_Mgmt | Waste_Mgmt | Stake

Figure 4. Segment Capture Tool with Example Data

Each task is analyzed so that detailed personnel, equipment and time requirements can be recorded and compared. Overlaps with other workstreams is also noted. If other workstreams require use of the same equipment, personnel, facility or service, it is indicated in the tool and response activities can be prioritized based on the use or assignment of these critical resources.

RESULTS / DISCUSSION

Limitations and/or delays in responding to an oil spill means longer response times, greater environmental impact and increased response costs and spill liabilities. According to a NUKA's logistical study produced for Canada, "*There is a tendency for oil spill contingency* *plans to overstate response capacity. The disconnect between planning assumptions and reality was made clear in the aftermath of the Deepwater Horizon well blowout, where the reality of the spill response did not align with published contingency plans*" (Nuka, 2015) (USCG and USDHS, 2011).

With this in mind, existing plans were analyzed and plan assumptions and gaps recorded in the analysis tools. During the workshop portion of the analysis, personnel with logistics, supply chain management, operations, field and other business and functional expertise were interviewed with the goal of verifying assumptions, identifying gaps and brainstorming to find workable solutions to identified gaps. It was found that the analysis also was very beneficial as an awareness building exercise for the functional personnel involved in the workshop. By becoming familiar with emergency planning scenarios and procedures and their logistical demands, business support functions will know how to apply their expertise more effectively during actual responses and will be more prepared to onboard new functional team members for this collateral responsibility. Functional groups can plan ahead for how best to streamline certain process, scale up processes that can anticipate increased demand, or have new and alternate suppliers pre-approved for quick activation.

The workstreams model has been applied in two locations with existing plans in place. Each of these locations has the potential of experiencing a major spill from complex operations. Additionally, both locations are constrained by limitations in the transport of personnel and supplies due to geographic and other issues. The worst case scenario used for these analyses included sub-sea and surface response operations that lasted over 60 days, as shown in Figure 5 below.

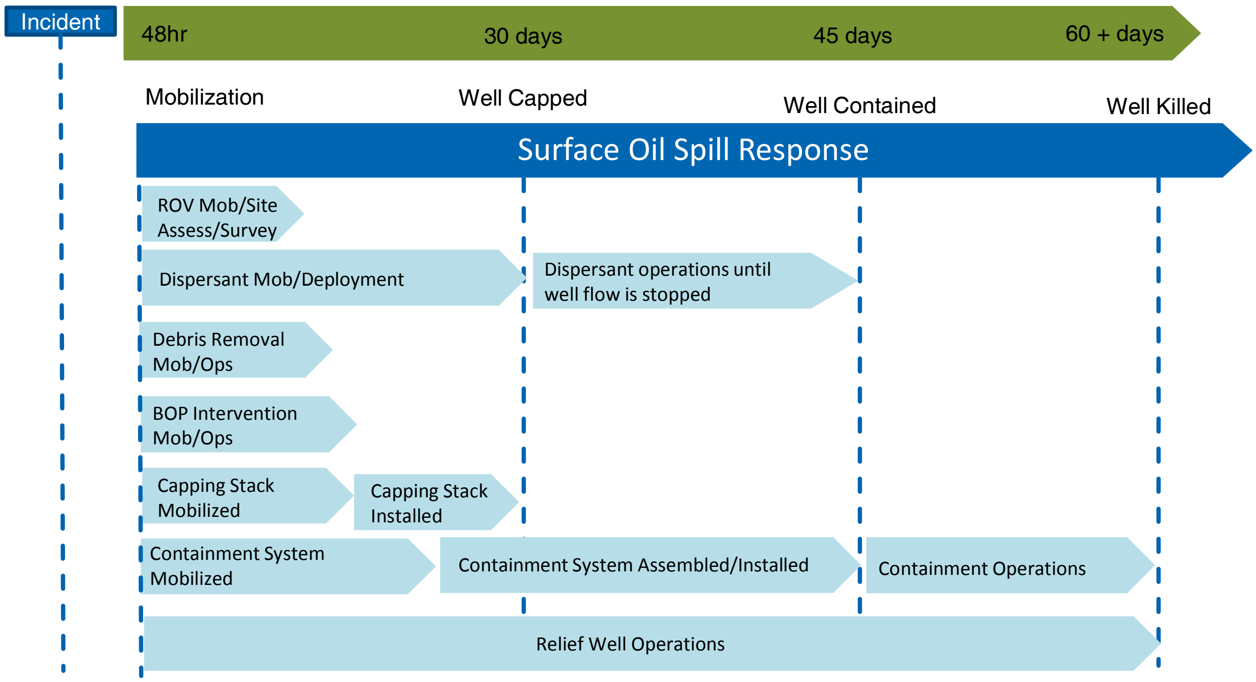

Figure 5. Sub-Sea and Surface Response Operations for WCS

The analysis found that in one location, long-term response operations would be restricted by limitations in the number of personnel trained in incident management. The solution to this limitation was surprisingly not necessarily to train additional personnel, but in the short term to enable the mobilization of trained rotational personnel who already had clearance for immediate transit in the host country and in the longer term to call on mutual aid help from other operators in the region. The analysis at another location found that the ability to cascade additional resources for shoreline clean-up operations hinged on the availability of personnel trained to fill a particular role. In this second case, training additional personnel to fill the critical role was the most expedient way to close that gap.

At the time of the writing of the paper, the model is being applied to the creation of a new set of oil spill response plans to address risks from future deep water exploration and production operations. Oil spill calculations are being used to assess the potential resource needs by segment. Extensive workshop pre-work has been done by the business organization to predict response resource requirements for both the on-water response activities and for those that would be required for sub-sea operations. To integrate the response requirements for these two response operations additional workstream tabs were added to the Excel™ WorkStreams Workbook. During a workshop, the calculation results from the integrated workstreams will be used to determine oil spill response organization (OSRO) and cascaded resource needs. Additionally, a timeline feature was added to the suite of tools so that response requirements could be mapped out over time to reflect the fluctuation in resource demand as individual activities ramp up and then are scaled down.

The extensive pre-work and the workshop itself were found to be very effective in onboarding personnel from various business functions to new projects and to their role in emergency response operations.

CONCLUSION

The use of analytic models for business processes and manufacturing operations is a well-established and accepted best practice. This paper found that a modified and tailored version of such a model can be successfully applied to spill response planning. A systematic analysis of response plans can be used to validate an executable tier 1 response based on local capabilities and provide a basis for planning the strategic cascading of additional resources for tier 2 and 3 responses with consideration for the limiting factors identified through analytics.

By pre-identifying resources needed for a tier 3 response, organizations can make the activation and cascading of additional resources timely and smooth. Planners can also dovetail the tier 1, 2 and 3 planning and resourcing to maximize membership agreements (such as with equipment suppliers) and strategically use all resources at their disposal to the greatest effect.

Working through the detailed logistics of response operations builds the overall organizational capability and applies the expertise found in the business functions to emergency scenarios and risks. This kind of detailed cross-functional planning during peacetime enables organizations to coordinate smoothly during crisis.

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