Abu Dhabi National Oil Company
Strategy for Enhancement of Oil Spill Response Capability

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Supreme Petroleum Council
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Contents

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Abstract

In 2004, the Code of Practice governing Crisis and Emergency Management Systems across the entire Abu Dhabi National Oil Company (ADNOC) enterprise was signed into effect by the ADNOC Chief Executive Officer (CEO). This executive endorsement provided the catalyst for extensive development and growth of the oil spill response capability within the ADNOC organization. Over the last two years the 18 ADNOC Group Companies have begun a journey to ensure a realistic evaluation and understanding of spill risk and their operating environment. This evidence has become the foundation for the development of a sustainable response capability in place to safeguard people, the environment and the business and economics of the UAE. The following report highlights many of the actions initiated or completed over the last two years but more importantly represents ADNOC's commitment toward continual improvement of our Crisis Management and Emergency Response capabilities.

Historical Context

Over the last 35 years the United Arab Emirates (UAE) has evolved from relative obscurity to a thriving international leader in tourism, trade and the global hydrocarbon industry. Prior to 1971 the nation of UAE did not exist. Before 1971, the UAE could not be found on any world map, its history, culture and people were virtually unknown to all but a select few who had come to visit its sandy shores. Without the development of the oil

industry it is likely that the UAE today would look quite similar to the Trucial States of the early 20th century.

Following World War I the race for oil concessions in the Middle East began. In December of 1938 the Petroleum Development (Trucial Coast) – a joint venture between various large international oil companies signed concession agreements with the Rulers of Ras al Khaimah and Kalba. In January 1939, the Ruler of Abu Dhabi signed a similar concession agreement.[1] These early agreements would eventually transition to become the Abu Dhabi Company for Onshore Oil Operations (ADCO) as it remains today as one of the 18 Abu Dhabi National Oil Company (ADNOC) Group Companies.

The outbreak of World War II disrupted the concession attempts for oil exploration and it wasn't until 1958 that commercial quantities of oil were discovered. While ADCO was busily searching for oil onshore Sheikh Shakhbut, Ruler of Abu Dhabi, awarded another concession to form the Abu Dhabi Marine Areas (ADMA) company originally owned by British Petroleum and TOTAL.[2] ADMA built its headquarters on the largely uninhabited Das Island approximately 165 km NW of the island of Abu Dhabi. ADMA, like ADCO, represents the foundation of the current ADNOC enterprise.

With both ADMA and ADCO striking oil in 1958 the race was on and the growth of a Global energy leader had begun. The first commercial shipment of Abu Dhabi oil left Das Island in July 1962 on its way to Europe. This shipment was followed closely by the initial onshore oil shipment from the Bab field in December of 1963.

From these humble beginnings, under the vision and benevolent leadership of the late Sheikh Zayed bin Sultan Al Nahyan, the federation of the United Arab Emirates and the ADNOC Group Companies were born. Figure 1, provided by the Japan Oil Development

Company – Abu Dhabi, provides a graphic illustration of the extensive level of growth and development that has occurred in Abu Dhabi over the last 35 years.

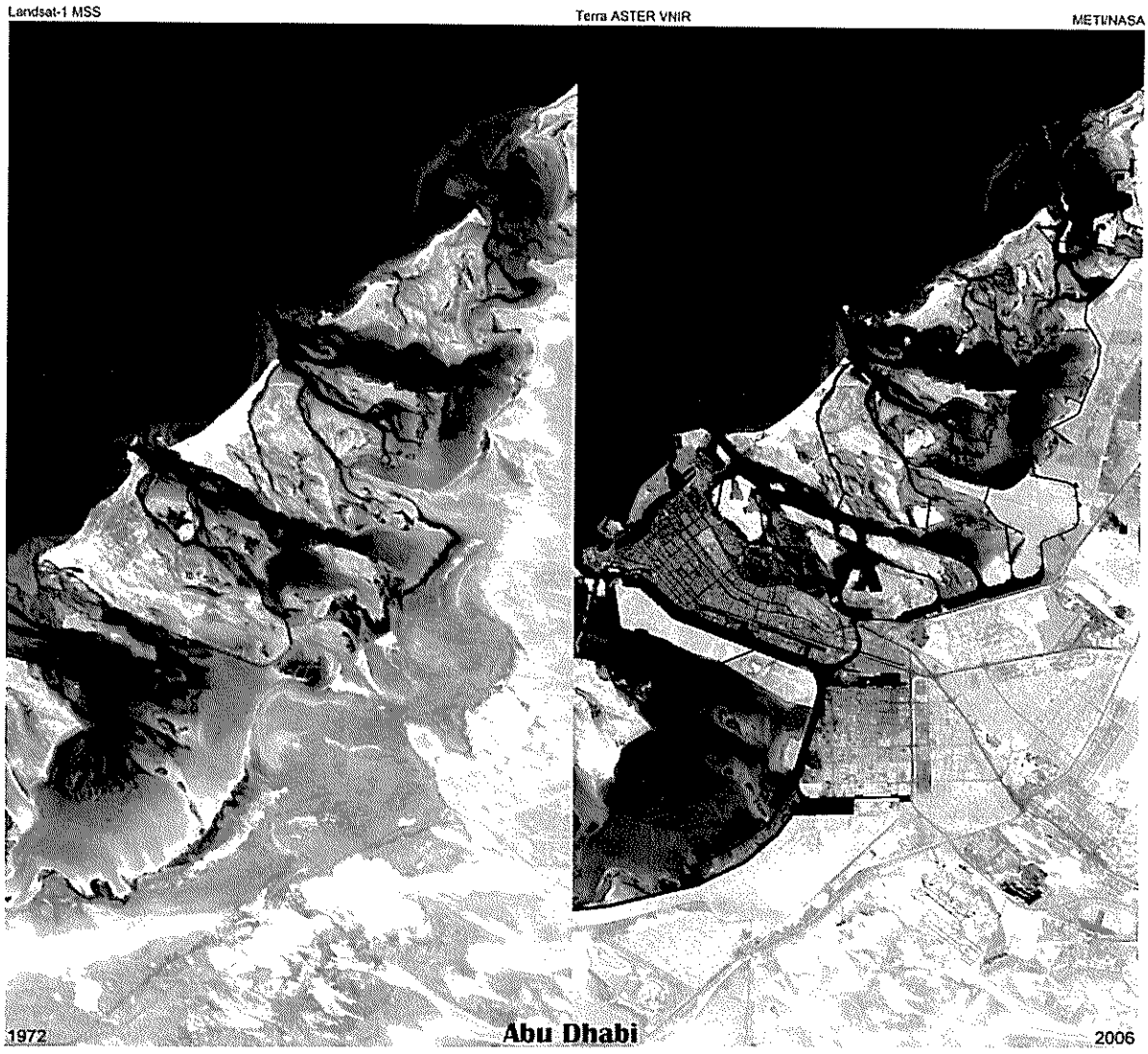

Figure 1: Satellite Images of Abu Dhabi 1972 and 2006

Regulatory Environment

As the young nation of UAE began to grow on the wealth generated by the oil and gas business, the emphasis for quality operations and HSE performance was openly expressed and continually reinforced. During this period of rapid growth ADNOC depended on the selection and placement of key personnel from the participating group of Industry Share

Holders to help set standards and drive performance. As a result, many of the corporate policies, procedures and guidelines have been developed from the existing set of best practices utilized within the Industry Share Holder group.

To further the sustainable development and exploitation of hydrocarbons in Abu Dhabi and at the same time provide assurance for the protection of the natural environment the Supreme Petroleum Council (SPC) was established on the 5 June, 1988. The SPC, initially chaired by the late H.H. Sheikh Zayed Bin Sultan Al-Nahyan, was granted full and complete authority to formulate and oversee implementation of all Petroleum Policy in Abu Dhabi. [3] The relevance and influence of the SPC continues today under the vision and leadership of the UAE President, H.H. Sheikh Khalifa Bin Zayed Al-Nahyan.

For over three decades, ADNOC has continued a steady pace of growth and development under the oversight of the SPC. As the company has diversified and the worldwide focus on HSE performance has rightfully become a key performance indicator, the challenges of operating a self-regulated oil and gas industry have intensified. Today, under the license of ADNOC, 18 operating companies compete on a global scale in oil and gas exploration and production, oil refining, gas processing, chemical and petrochemical production, maritime transportation and support services, and the public marketing and distribution of refined products. To underpin and facilitate continual improvement of HSE performance across a fully diversified oil and gas enterprise, ADNOC began the structured and prioritized development of Corporate HSE Codes of Practice to serve as the regulatory license-to-operate requirements for all ADNOC licensed operating companies. In June 2004 the ADNOC CEO, H.E. Yousef Omair Bin Yousef, executed the ADNOC Corporate Code of Practice (CoP) governing Crisis and Emergency Management Systems (see Attachment). The executive commitment to the protection of human life and the environment, embodied in

this CoP, has provided the focus and initiative for the response preparedness improvements detailed in this report.

Setting the Stage for Change

Upon the approval of the Crisis and Emergency Management Systems CoP the task at hand was the development of an implementation strategy. Organizationally, the talent and expertise required to successfully implement the new CoP was not fully aligned within the ADNOC corporate structure. Figure 2 is provided to help illustrate the key response management positions within ADNOC in June of 2004.

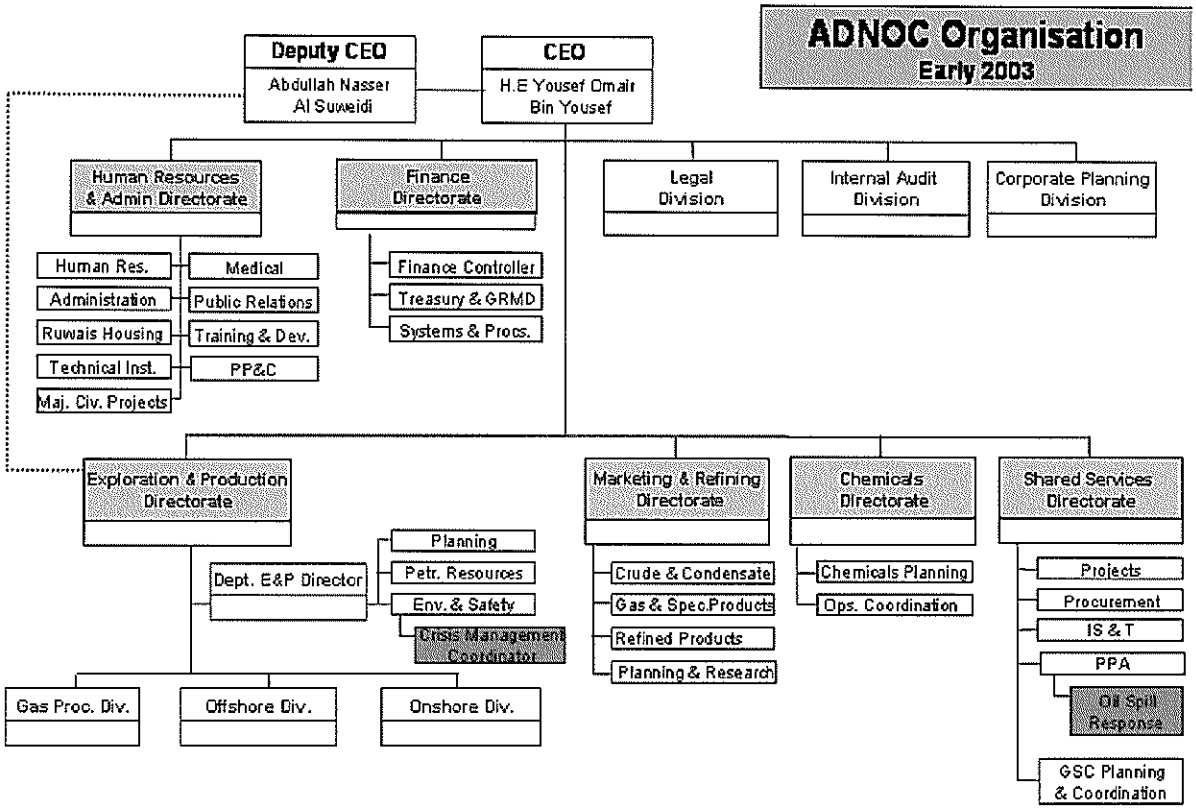

Figure 2: Crisis Management and Oil Spill Response in ADNOC, 2003

The ADNOC Crisis Management function was embedded as a support position in the Environmental, Health & Safety (EH&S) Division. The EH&S Division was a part of the Exploration & Production Directorate and therefore did not have a direct link to the operating companies that operated under the guidance of the Marketing & Refining, Chemicals or Shared Services Directorates. The other key Corporate function for implementation of the CoP was the oil spill response organization. This service did not have dedicated leadership but was managed as an additional responsibility for the Petroleum Ports Authority (PPA) within the Shared Services Directorate.

To ensure the best opportunity for success and alignment, the ADNOC CEO thoughtfully directed that the Crisis Management position and the Oil Spill Response function be joined together under a dedicated management Team. To further ensure the proper visibility and emphasis of the implementation efforts, the CEO also chose to place the newly consolidated Team in a direct reporting relationship to the SPC. The positive influence of this decision was immediately recognized and ultimately led to the reassignment of the entire EH&S Division and the PPA to the Supreme Petroleum Council as well.

Oil Spill Response Preparedness Strategy

Assessment & Assurance Elements

Proper implementation of the newly executed response regulations required a thorough and thoughtful analysis of the range of potential ADNOC response scenarios, an assessment of potential impacts, and the development of a strategic response philosophy to underpin tactical response operations. Additionally, but equally important, the leadership within ADNOC had to take a cold hard look at the existing corporate response capability to ensure that all potential opportunities for improvement were identified and prioritized for action.

Spill Threat

The potential spill threat for ADNOC exists not only within our operations but perhaps to an even larger degree from the industrial, commercial and political activities surrounding the ADNOC area of operations. It is almost startling to acknowledge that roughly 30% of the worlds oil production comes from the countries surrounding the Arabian Gulf.[4] This activity transitions to a marine risk as 45% of the worlds oil tanker traffic passes through the Straights of Hormuz into the Gulf.[5] Additionally, the Gulf States represent the worlds 3rd largest concentration of active offshore drilling rigs.[6]

Over the last decade the Gulf States have experienced almost overwhelming growth. You only have to view the skylines of many of the countries coastal cities to feel the change that is underway. All along the coast you find new high rise buildings, new industrial complexes, new recreational areas, and free trade zones. Billion dollar project announcements are becoming almost commonplace. The primary mode of logistical supply and support for these coastal activities are marine based. In the last two years the ADNOC emergency response organization has responded to three 3rd party marine causalities from ships and barges transiting Abu Dhabi waters.

While the UAE is a very safe and secure business and social environment we cannot fully insulate ourselves from the threats posed by the potential for political or social insurgency within the Gulf Region.

Internally, ADNOC operations themselves represent a significant potential for oil spills. Abu Dhabi represents the world's 4th largest oil reserve and the 5th largest gas reserve generating approximately 2.7 mmbpd today and with plans to reach 4.5 mmbpd by 2015. Gas and gas liquids production generate an additional 1.2 mmbpd oil equivalent with a predicted 50% increase in gas liquids by 2010. Additionally, ADNOC also produces and

transports over 500 mbpd of refined products. Supporting these core assets ADNOC Group Companies own and operate 4 petroleum port facilities, over 60 marine support vessels, over 25 drilling rigs, 8 LNG tankers, and 8 crude/product tankers.

Socioeconomic Considerations

The value of the ADNOC enterprise cannot be overstressed as it represents a direct link to the overall social and economic health of the UAE. The oil and gas sector not only provides a valuable contribution to the UAE Gross Domestic Product (GDP) but is provides an essential link to domestic water production, and the gas and power distribution networks. Any significant impact to the oil and gas production processes could have a downstream effect on the residents of UAE.

As the ADNOC businesses are government owned and operated the reality is that ADNOC resources are likely to be called on to assist any other government sector in the event of a crisis. Given the natural focus on emergency response in the oil and gas industry the resources within the ADNOC Group Companies are considered the primary resource for oil spill response services in Abu Dhabi and the UAE. The need to deliver these services from a self-regulated industry is a task that requires constant pressure on the business processes to ensure the ability to maintain let alone improve the quality of response services.

Politically, ADNOC is considered a leader in setting policy and practices across the hydrocarbon industry in the Middle East. Likewise the UAE Government is also considered an influential contributor to the political stability of the Gulf. The foundation of UAE foreign policy is centered on a philosophy that disagreements should be resolved through the calm pursuit of dialogue and consensus. The cooperative nature of UAE also played a central role in the creation of the Gulf Cooperation Council (GCC), founded during a summit conference

held in Abu Dhabi in May 1981, with the intention of promoting security in the Gulf through strong intergovernmental relationships. [2]

Abu Dhabi, prior to the discovery of oil and gas, was among the most impoverished along the Gulf coast as it had very little in the way of land based natural resources to build strong local economies. Therefore, the fishing and pearling activities were the primary providers for both food and income to the people of Abu Dhabi. While Abu Dhabi is now a modern and thriving metropolis the people still consider the sea the lifeblood of their society. The emotional attachment to the sea creates an even greater priority for the oil and gas business to protect the Arabian Gulf and the coastlines of Abu Dhabi from harm associated with oil and gas production.

Marine Environment Considerations

Marine response operations must also consider the hydrodynamic and bathometric features of the potential response theater. The natural marine environment in the Arabian Gulf has historically provided abundant fishing grounds, coral communities and pearl oyster beds. It is home to the second largest dugong population in the world [7] and the Gulf's delicate mangrove wetlands provide some of the world's greatest nesting and nursery areas.

The general current circulation pattern in the Gulf is counter clockwise as water enters through the northern side of the Straits of Hormuz and exits through the deep water channel along the southern coastline. The coastline of Abu Dhabi acts as a settling basin in the downstream eddy of the Qatar peninsula. The coastline of UAE is sheltered by a collection of over 200 coastal islands and is protected by an extensive shallow water shelf.

The ADNOC operating facility locations and shipping lanes contribute heavily to response plans in terms of strategic positioning and sensitive area protection. All shoreside production, roughly 1.5 mmbpd, is loaded into VLCCs (Very Large Crude Carriers) from 3

Single Point Mooring (SPM) systems in Jebel Dhanna. The tanker route servicing the Jebel Dhanna area represents one of the most challenging oil tanker lanes in the industry with tight turns, narrow lanes and limited draft restrictions. The approach to the Jebel Dhanna SPMs passes along the northern end of Sir Bani Yas Island, one of the UAE's most important archeological sites and the private wildlife reserve created by H.H. Sheikh Zayed.

ADNOC also licenses the operation of two oil production facilities within or adjacent to the Marawah Marine Protection Area. The Emiri Decree No. 18 of 2001 issued by the President His Highness Sheikh Khalifa Bin Zayed Al Nahyan, declared Murrwah Island a marine protected area and entrusted the Environment Agency-Abu Dhabi (EAD) with the responsibility of administering and managing it as part of its commitment to uphold the conservation of natural resources, ecosystems, wildlife and wildlife habitats. The Marawah Marine Protected Area is home to a number of endangered and threatened species, including Dugong, turtles and dolphins that occur in the surrounding waters, with the vast extent of intertidal mudflats host to internationally important numbers of migratory waterbirds in winter and during passage periods, including many hundreds of great knot (Calidris tenuirostris), a species which breeds only in far eastern Siberia and which otherwise migrates to Australia for the winter. Mangrove trees, many apparently of considerable age, grow along sheltered shorelines and bays, with numerous tidal channels fringed by healthy stands. Marawah is one of few sites in the UAE where mangrove is spreading naturally. Little green herons (Butorides striatus), western reef herons (Egretta gularis) and clamorous reed warblers (Acrocephalus stentoreus) all feed and nest in this habitat. [8]

In effect, the combination of the prevailing winds and currents, the magnitude of potential 3rd party spill risk in the Gulf, the extensive shallow water shelf, and the location of ADNOC operating facilities and shipping lanes to numerous sensitive areas creates a

significant incentive for ADNOC to deliver the best possible overall response planning and capability for the UAE.

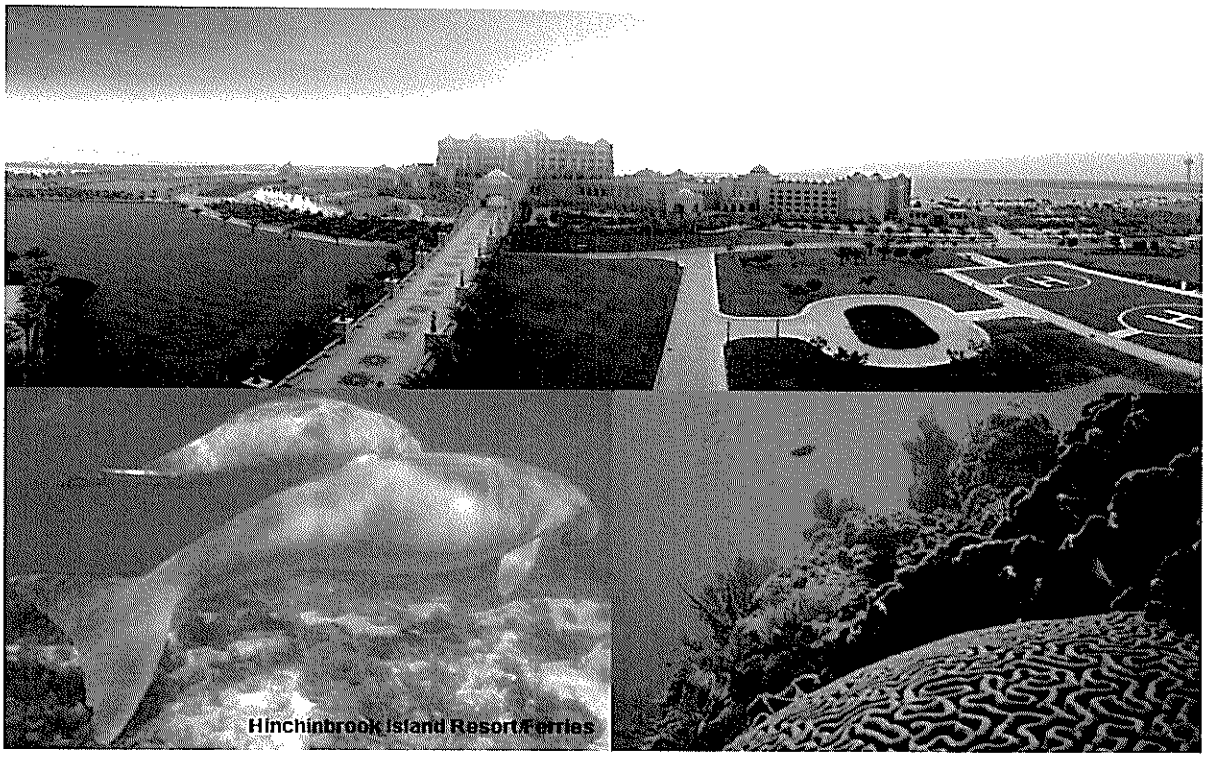

Figure 3: Picture of Abu Dhabi Coastal Development (upper), Dugong (lower left), and the Coral Sea Bed off the Coast of Abu Dhabi (lower right).

Areas of Potential Impact

Marine oil spill recovery operations are extremely challenging and the opportunities for high rates of mechanical recovery are quite rare. The physical and environmental influences are dynamic and may become a barrier to recovery operations. Therefore, most response plans spend an equal or greater level of planning effort to design protection strategies to mitigate the potential impacts caused by uncontained oil. Often the degree of sensitivity associated with these areas dictates a certain level of dedicated resources and prioritized response actions.

Over 98% of all of the power distribution, domestic water production, and industrial activity within the UAE depends on the processing of seawater. [9] The coastline of Abu Dhabi and the UAE is dotted with seawater intakes serving a variety of purposes and ranging from small portable desalinization units supplying private coastal villas to some of the largest desalinization plants in the world. The extensive shallow water shelf of Abu Dhabi raises the level of risk for fouling or contamination during an oil spill as many of these seawater intakes are placed in relatively shallow water with no civil protection to ensure their continuous safe operation. As an example, on the 14th April, 2001, the M/T Zaynab sunk approximately 25 miles off the coast of Dubai releasing an estimated 300t – 400t of Iranian crude oil. As the spill reached the Dubai/Sharjah coastline the desalinization plant in Sharjah had to be shut down several times to prevent fouling the intake facilities. This relatively small spill, occurring many miles offshore, caused significant disruption and a severe water shortage for 500,000 people living in Sharjah.

Undoubtedly the explosive growth of tourism in the UAE, a multi billion dollar annual industry, could be significantly impacted by a large scale marine pollution incident. Dubai has clearly set the pace for tourism in the Middle East. In 2006 over 6.3 million visitors came to Dubai and these numbers are expected to continue to increase at a pace of approximately 4% each year. The economic influx associated with tourism has sparked a huge investment campaign to ensure the facilities and tourist industry can maintain the pace associated with this growth. One project alone, announced the investment of $27 billion USD to develop 13 million square meters of land creating a cluster of 31 hotels and over 29,000 new hotel rooms. [10] The sandy beaches, clean and calm waters, and sunshine are key attractions to visitors. Any impacts to the tourism reputation in the UAE as a result of extensive shoreline contamination could take years to recover.

Understanding ADNOC Marine Risk Oils

In 2004 ADNOC initiated a phased study of the marine risk oils associated with their crude oil production and transportation business. A total of 16 different oils were identified for analysis and testing. The purpose of the program was to gain a better understanding of the fate, behavior, and dispersability of these oils when exposed to the sea and to utilize this data to optimize ADNOC's mechanical recovery and chemical dispersant response strategies. Phase 2 of the program, initiated in late 2006, extends the initial findings on oil dispersability to analyze the efficacy of six (6) Regional Organization for Protection of the Marine Environment (ROPME) approved chemical dispersants on the 16 ADNOC marine risk oils. Phase 3 will be initiated in late 2007 to design and implement a centralized dispersant management system across the ADNOC enterprise.

Phase 1 of the testing program was structured to provide response managers with reliable data, based on experimental studies with all 16 ADNOC marine risk crude oils, at the laboratory scale, to determine physical properties and oil dispersability of fresh, weathered and emulsified oils over time. [11]

- In a first step, oils were artificially weathered in order to simulate evolutions after 6 and 36 hours at sea for local weather conditions. These simulations were achieved by topping and emulsifying oils at respectively 250°C and 66 % water content to mimic a 36 hour weathering period (respectively 200°C and 50 % for 6 hours).
- In a second step, at 3 representative temperatures (20, 25 and 32°C) and on 3 samples per oil (fresh oil and weathered samples), dispersability tests were conducted according to the Warren Spring Laboratory protocol in combination with physical characterisations.

The general operational guidelines which result from this study are that the dispersability of the oil is high during the first hours of weathering in relationship with moderate viscosities. A regular dispersant/oil ratio (DOR) of 1:20 can be applied. Results also showed high evaporation rates with average values close to 34 % and 46 % after respectively 6 hours and 36 hours. Most of the emulsions formed from these residues proved to be stable and corresponding viscosities were in the range 2000 mPa.s to10000 mPa.s at 20°C. The majority of the oils could then be treated with dispersants within the first 36 hours of weathering while some windows of opportunity for dispersant use were defined for the most viscous emulsions. Figure 4 illustrates the range of testing applied to the 16 ADNOC oils. [11]

		SAMPLES				
		Fresh Oil	Residue @ 200°C	Residue @ 250°C	Emulsion @ 50%	Emulsion @ 66%
MEASUREMENTS	Viscosity	☑	☑	☑	☑	☑
	Density	☑	☑	☑		
	Flash Point	☑	☑	☑		
	Pour Point	☑	☑	☑		
	Interfacial Tensions	☑	☑	☑	☑	☑
	Emulsion Stability	☑	☑	☑	☑	☑

Figure 4: Set of Oil Tests Performed in Phase 1, ADNOC Marine Risk Oils

As ADNOC oil viscosity increases, the dispersability is reduced but, in most of cases, the oils remain dispersible with a dispersant/emulsion ratio (DER) of 1:20. However, this dosage is relatively high and an alternative could be a double treatment strategy: as all the weathered oils proved to remain sensitive to demulsifiers, a first application at a DER of 1:100 could separate a part of water, thus reducing viscosity, followed by a regular dispersant

application (DOR = 1:20) that should be more efficient. Finally, some oils proved to become poorly dispersible and time windows for dispersant use were defined.

In case of recovery by using oleophilic skimmers, the sea condition will be a key parameter, as well as the storage capacities. The pollutant volume will be at least up to 1.5 times as much as it was initially (average evaporation rate of 50% and emulsification rate of 66%). The efficiency of the skimmer increases with the viscosity and consequently, the weathering time. On the other hand, the emulsion gets generally more stable with time but experimental results proved that demulsifier could remain efficient.

However, for safety reasons (the flash point remains below respectively 32°C and 100°C within the first 2 and 6 hours of weathering) recovery operations or dispersant application from a boat should not be conducted during the first 6 hours following the spill, particularly for low wind speeds and high local temperatures. Figure 5 is provided to illustrate the initial volatility of the ANDOC risk oil as represented by evaporative loss. [11]

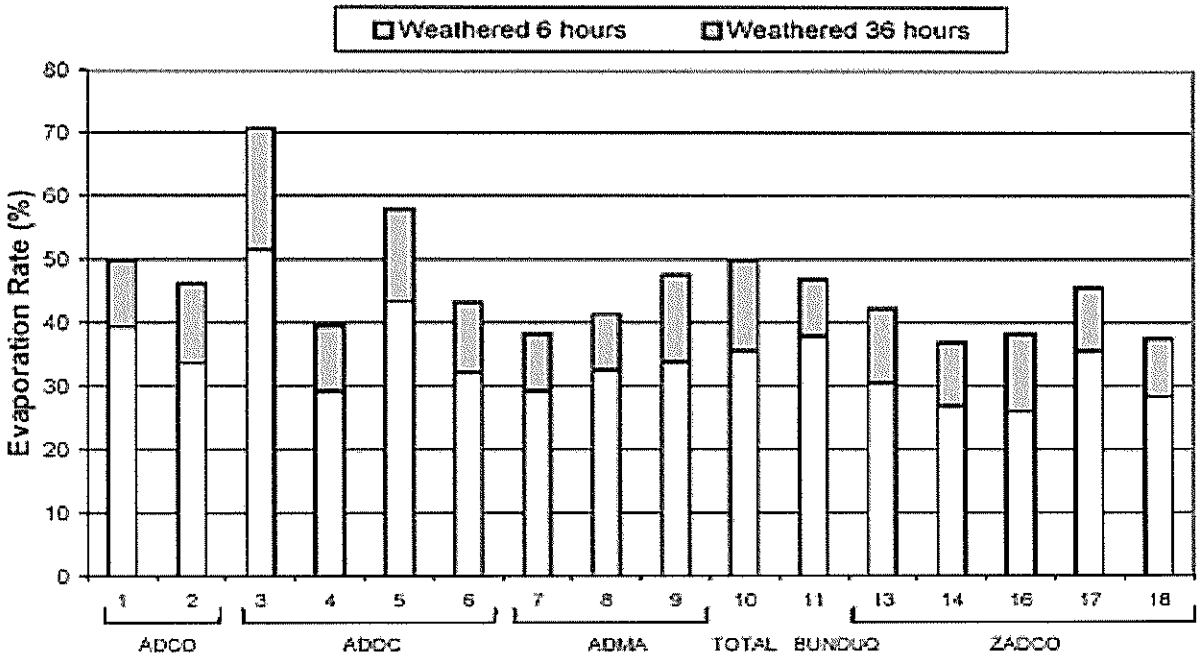

Figure 5: Evaporative Loss Rates of ADNOC Marine Risk Oil at 6 and 36 hours

The data and information derived from this study provide a basis for continued improvement of oil spill response planning and readiness within the ADNOC Group of Companies. The key points of emphasis include, but are not limited to the following:

1. The effective implementation of a dispersant strategy requires a streamlined dispersant application approval process to optimize the potential benefits during a response.
2. Further investigation and action is required to ensure to proper selection, storage, and maintenance of chemical dispersants across the ADNOC Group of Companies.
3. Prioritization and consideration for airborne application devices may reduce human exposure to potentially explosive or hazardous atmospheres while expanding the window of opportunity for effective dispersant operations.
4. The evolution of oil viscosity and emulsification may be used to develop a corresponding evolution of mechanical recovery tactics and equipment inventories.
5. Recognition of the anticipated fate and behavior of the ADNOC marine risk crude oils has highlighted the potential benefits of further studies regarding the use of demulsifiers and a two-stage dispersant application tactic for prolonged response actions.

Tiered Response Philosophy

Understanding oil spill threats and the operating environment are essential requirements in the development of effective response plans but the actual response capability lies with the human resources dedicated to managing and conducting response operations. Prior to 2004, the entire ANDOC enterprise relied on two corporate oil spill response centers located in Mussaffah and Ruwais. Each center was minimally staffed with three (3) full time responders. Following the approval of the new corporate CoP establishing

regulations governing response preparedness ADNOC began a focused effort to establish a fully integrated tiered response organization. The philosophy of the ADNOC tiered response structure is:

- Ensure that all operating facilities maintain a local Tier 1 spill response team and inventory capable of mechanically recovering their realistic, most probable, maximum oil spill.
- Enhance the corporate response capability to effectively provide Tier 2 support with a comprehensive inventory and trained staff to cover the entire ADNOC operating area.
- Provide common training, strategies, tactics and incident management practices to all operating companies and create an enhanced response capability and reliability in the ANDOC Mutual Aid organization.
- Promote and expand relationships and common interests with oil spill response resources/service providers in the UAE, the Gulf Region and the international response community (Tier 3).

The key efforts, initiated by ADNOC, associated with the development and implementation of the fully integrated and functional Tiered Response Organization are presented as the balance of this report.

Opportunities and Actions for Continual Improvement

A comprehensive assessment of opportunities to enhance the Tiered Response capability of the ADNOC Group of Companies required a thorough review of staffing, equipment, logistics, and specialized support services applicable to all Tiers of response. The interdependency of success at all levels of response cannot be overstressed. The benefits of the immediate response efforts provided by Tier 1 response teams will be diminished if the Tier 2 support is not well orchestrated and delivered in a timely manner. Likewise, no

industry maintained spill response organization can expect to employ all of the necessary resources required to sustain a large scale marine/shoreline oil spill response action. Therefore without the development of relationships and agreements with a suite of local, regional and international oil spill response providers/specialists the corporate investment in organic response preparedness can never be fully optimized. Throughout the balance of this paper we have highlighted many of the key activities initiated as a result of the aforementioned operational review. These actions and those identified in the future represent the credibility of ADNOC and the ADNOC Group of Companies as we attempt to systematically develop a world class response organization in Abu Dhabi.

Enhancement of Mechanical Response Capabilities

The first step taken to evaluate the mechanical response capability of the existing ADNOC oil spill response centers was to evaluate the strategic value of the warehouse locations. The Ruwais warehouse is co-located within the industrial complex with immediate access to the sea. This positioning is well suited to support immediate response efforts to any spill events from the three product jettys, the three crude oil Single Point Mooring (SPM) systems, and the adjacent tanker traffic lanes. However the facility is also responsible for providing response support for the offshore operating facilities as well. These offshore facilities are 40 – 80 nautical miles away from the Ruwais warehouse. While the distance provides some challenge in mounting an effective initial supporting response, the greater concern is that the Ruwais warehouse is located on the western edge of the ADNOC area of operations and all of the offshore facilities are located from due north to east-north-east and the prevailing wind and current will drive any oil spills in a southeasterly direction. Given the general speed of oil service vessels between 8 – 10 knots and the desire to position response operations down current of the spill location we find these distances and the adverse

trajectory to be less than ideal. The oil spill response center in Mussaffah is located in an industrial warehouse area on the Mussaffah channel 15 nautical miles from the open sea and 30 to 100 nautical miles from the offshore facilities it is intended to support.

Two specific actions have been taken to address the response vulnerability associated with the response base locations. The first is to charter a 38m tug into the organization for use as a dedicated Oil Spill Response Vessel. Her deck has been fitted with an offshore response package and her mission is to move between all of the offshore facilities to provide response equipment maintenance services, response related training, and on water exercises with the local attending vessels. Two shifts of eight trained responders operate the vessel within the offshore area 365 days per year in an effort to improve local response capability and significantly reduce the initial response support mobilization times. The second action taken is to gain the approvals necessary to establish a third Tier 2 oil spill response center on Zirku Island (see Figure 6).

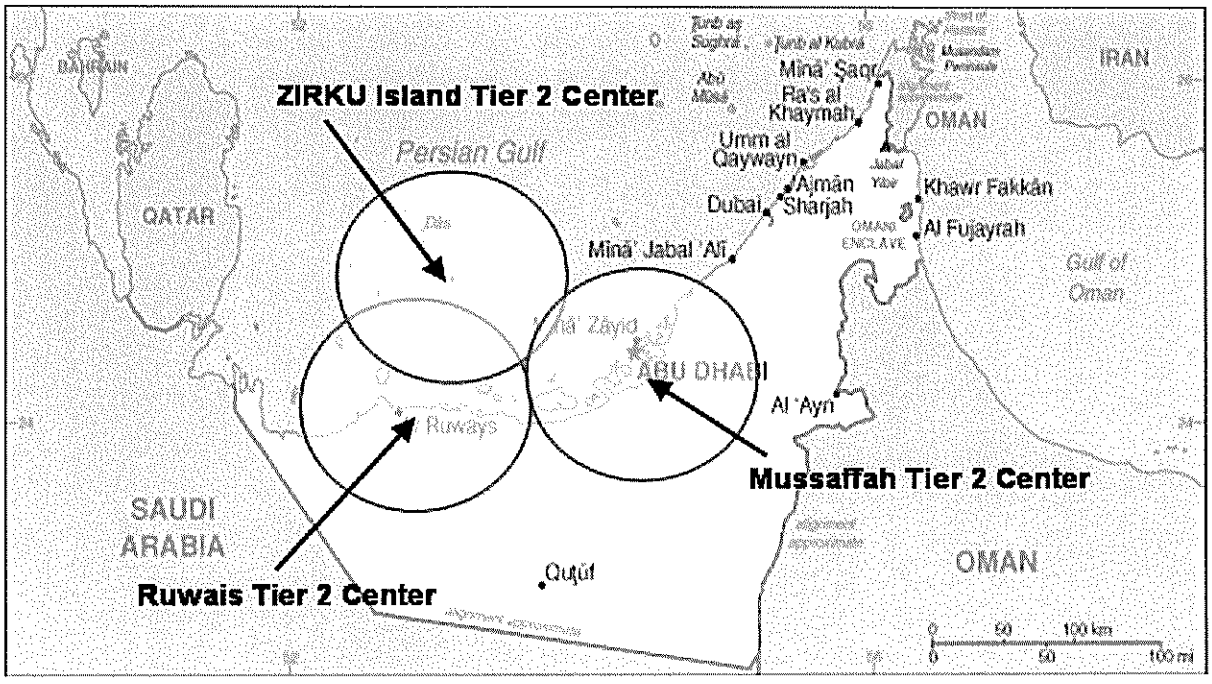

Figure 6: 80km Response Radius for ADNOC Tier 2 Response Centers

Zirku Island not only supports the ZADCO offshore exploration and production operations it also provides a centralized location to the offshore operating facilities. The placement of additional personnel and an offshore response inventory on Zirku Island provides a similar reduction to ongoing support and re-supply times associated with an offshore oil spill response.

The boom inventory at the existing ADNOC oil spill response centers provided a reasonable level of coverage for all operating environments. The potential enhancements included some diversification to expand the overall utility of the boom inventory and to increase the quantity of some boom types to support the addition of the third oil spill response center.

A similar review of the oil recovery systems found a greater opportunity for improvement. Three skimmer types were identified as representing opportunities to enhance the current recovery equipment inventory: viscous oil skimmers, high volume weir skimmers, and hi-speed skimmers. The oil fate and behavior study in combination with the recognized level of ADNOC bunkering activities provided the justification to support the expansion of ADNOC's viscous oil recovery capability. Currently one large viscous oil skimming system is present in the ADNOC inventory. Several types of additional viscous oil recovery systems have been identified and reviewed for incorporation into the inventory. Four (4) Vikoma Star Disc systems have been selected for purchase in 2007 to enhance the current viscous oil recovery capability.

Given the scale of daily crude oil production and transportation that could potentially impact ADNOC operations or the coastal communities of the UAE, the benefit of having a high volume weir recovery capability is quite clear. While these may not be the most efficient recovery devices they are invaluable in removing oil from the waters surface when

large volumes of spilled oil are contained. A large offshore weir skimmer is considered an essential asset and is scheduled to be added to the ADNOC inventory during 2007.

Similarly, the review of the expansive operating environment found many areas where currents could exceed 2-3 knots and the recognition that the tolerance of high-speed oil recovery devices creates a distinct advantage when mounting on-water response operations. Two systems were identified for purchase: the LAMOR Side Collectors and the NOFI Current Buster. Within ADNOC there is a significant experience level with the LAMOR Side Collecting systems. A high level decision was made to demand that the ADNOC new build tugs, currently under construction, that will support both escort and hold back operations at the Petroleum Ports would include an immediate response capability. Working directly with the Petroleum Port Authority we were able to incorporate the LAMOR Side Collectors into the vessel tender packages. ADNOC is currently constructing six 30m hold back tugs each with built in LAMOR Side Collectors and three 45m escort tugs with over-the side systems permanently on the deck. Figure 7 represents a general arrangement drawing for the placement of the LAMOR Side Collector in the 30m tug. All tugs are also equipped with bladders for temporary recovered oil storage. When all new build activities are complete there is intended to be a total of 12 LAMOR Side Collection systems strategically placed throughout the Petroleum Ports to facilitate immediate response in those areas in the event of a spill.

In November 2006, ADNOC and AllMaritim AS coordinated the delivery and demonstration of the NOFI Current Buster system in Abu Dhabi. A total of 4 days of on water deployment was conducted utilizing two 30m UAE Coast Guard tugs and crews. The final day of demonstration was opened to interested parties and a total of 64 persons attended representing over 20 different companies or agencies. The exercises were conducted in the

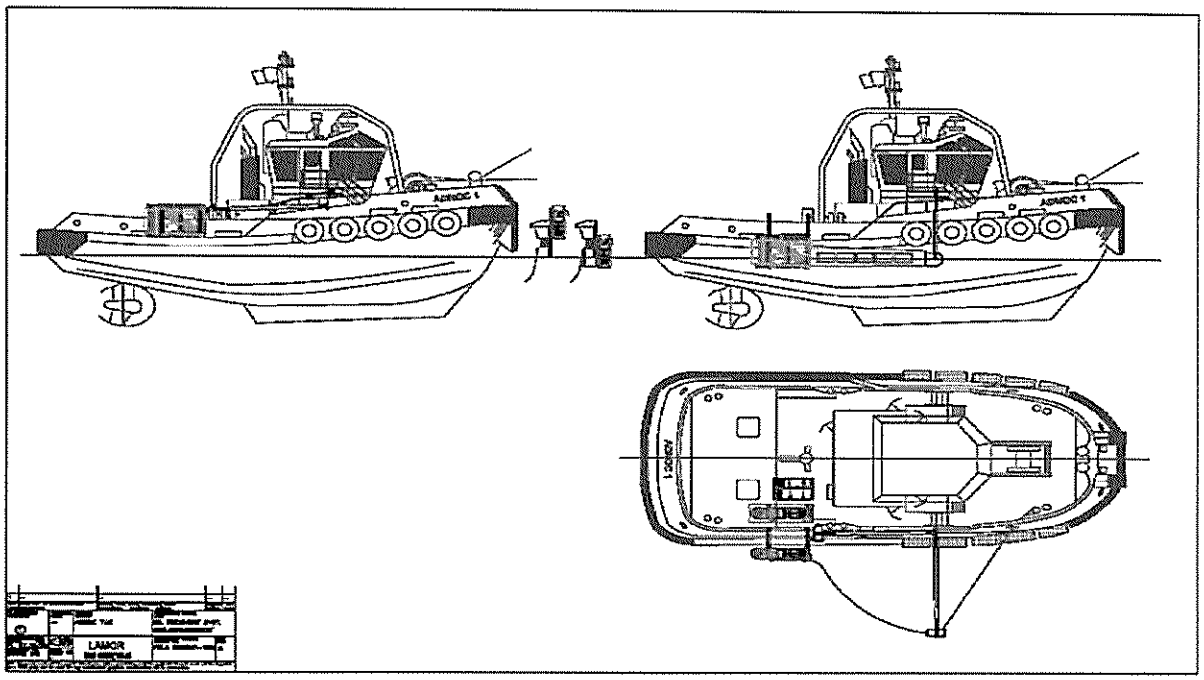

Figure 7: General Arrangement of LAMOR Skimmer in ADNOC 30m Tug

Mussaffah channel which commonly experiences currents in excess of 3 knots. The outstanding success of the demonstration in a challenging high current environment provided the justification for adding the Current Buster system to the ANDOC inventory. The Current Buster purchase is scheduled for purchase and delivery in 2007.

Figure 8: Current Buster Demonstration Response Team, September 2006

Corresponding to the increases in recovery utility and capacity we have also studied our temporary storage and disposal options. As you might expect from the description of the operating environment the opportunities to spot charter tank barges and coastal tankers are very good. Additionally, ADNOC operates a fleet of coastal tankers that could be prioritized and repositioned for support if needed. This helps resolve the mid-term temporary storage challenge but does not satisfy the need for immediate temporary storage of recovered oil and the ultimate disposal of the potential quantities of oil, oily water, and solid oily waste that is expected to be generated from a large scale marine response. The gap identified in the immediate storage capability is addressed through the purchase of a number of floating bladders, with a range of capacities, and a 2006 tender to construct aluminum mini-barges. ADNOC initially plans to build four (4) 250 bbl aluminum mini-barges (see Figure 9) for placement in Ruwais, Mussaffah, Al Dabbiya and Zirku Island. Additional units may be considered for construction based on the experience and utility demonstrated during the deployment and use of these mini-barges.

Figure 9: 250 bbl Mini-Barge (typ.) Photo Courtesy of Alaska Clean Seas

The challenge to define legitimate disposal options is at times a critical element of response operations. All of the ADNOC oil facilities have some built in capacity to recycle recovered oil and oily water. However these recovery rates are not sufficient to handle large volumes and are limited to certain levels of solids and water content. To avoid the need to construct temporary holding facilities or extend vessel charters ADNOC is currently constructing a new state of the art hazardous material disposal facility within the Ruwais Industrial Complex. This facility is incorporated eight (8) separate treatment and disposal processes designed to accept a variety of waste materials anticipated from ADNOC Group Company operations. Originally sanctioned in 2001 the project is scheduled for completion and commissioning in 2007. The following Figure provides a listing of the planned treatment and disposal processes along with the designed annual throughput capacity for each process.

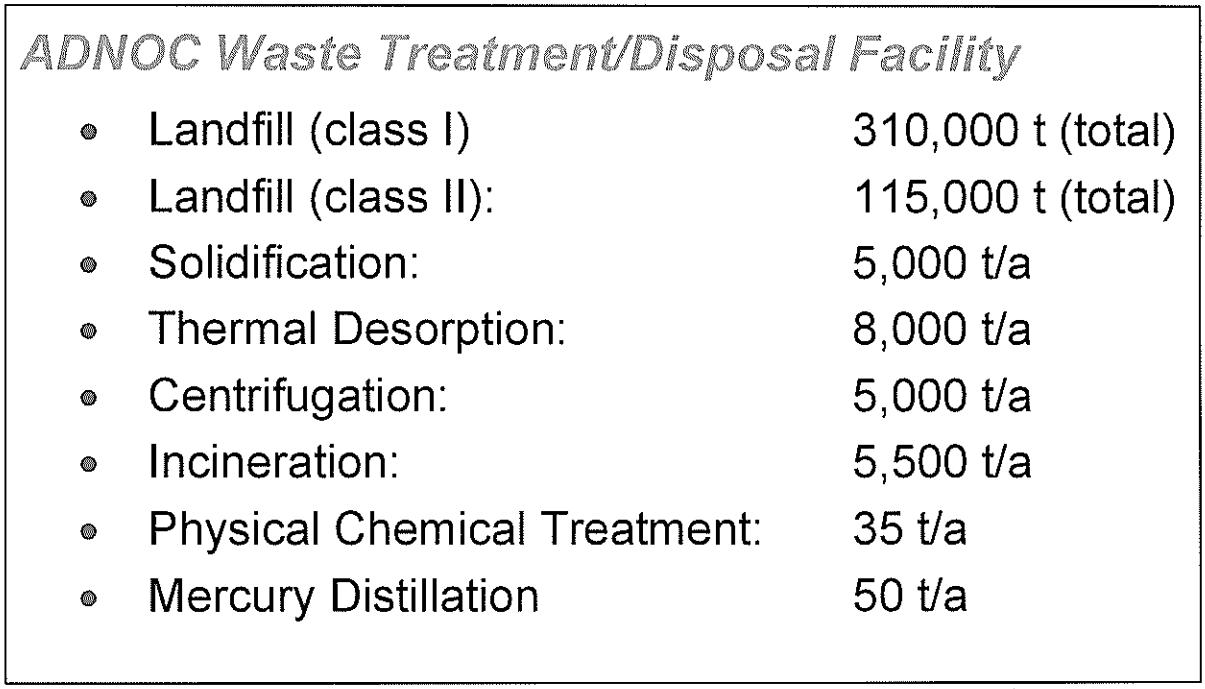

Figure 10: ADNOC Waste Disposal Facility Design Annual Throughputs

ADNOC recognizes the potential volumes of waste associated with large marine clean operations and has developed relationships with other waste disposal facilities in the UAE that can be contracted to assist in the disposal or recycle of recovered oil. Fairdeal, with UAE offices in Fujairah and Kalba, operates one of the world's largest floating slop oil recovery systems. These high capacity reclamation systems could be made available as well to help handle the disposal and recycling of recovered oil.

The examples provided above are only a few of the notable activities undertaken by ANDOC since 2004 to help ensure response readiness and create an environment for continual improvement of the Company's mechanical response capability.

Organizational Staffing

Building the response equipment inventory best suited to a company's scope of operation and operating environment requires considerable study to ensure the maximum value for the capital investment. Perhaps even more challenge is presented in the human component of response planning. As the cost to maintain a dedicated staff of response personnel can be quite costly the right-sizing of response teams is often a balance of annual expense, supplemental manpower schemes, regulatory requirements, and the company risk/benefit analysis. Within ADNOC we have approached response manning on three levels: facility response teams (Tier 1), ADNOC Tier 2 Response Centers, and relationships with the contract/response community (Tiers 2 & 3).

With the execution of the CoP governing Crisis and Emergency Management Systems came the requirement for Tier 1 response teams at every facility. Within the ADNOC Group of Companies we manage over 50 facilities throughout the area of operations. Each local Tier 1 response team is sized according to the scope of local operations, the Tier 1 risk assessment, and the available staffing at the facility. Other factors include proximity to other

dedicated response resources, ease of logistical support, potential impact to sensitive areas, etc.. On average we expect that 10 individuals per facility will be available at any time for response. Compliance with this expectation will provide the ADNOC Group of Companies with an excess of 500 Mutual Aid responders, all of which are trained in the same command system, response strategies and field tactics.

The dedicated ADNOC Tier 2 organization is established to provide a minimum of 10 full time responders at each of the three bases. This minimum of 30 dedicated full-time response personnel is further supplemented by an aggressive National Development Program. Currently there are an additional 10 UAE National Developees assigned to these facilities with a plan to bring in an additional 10 – 15 Developees in 2007. Figure 12 represents the functional organization chart for each of the three (3) Tier 2 response centers.

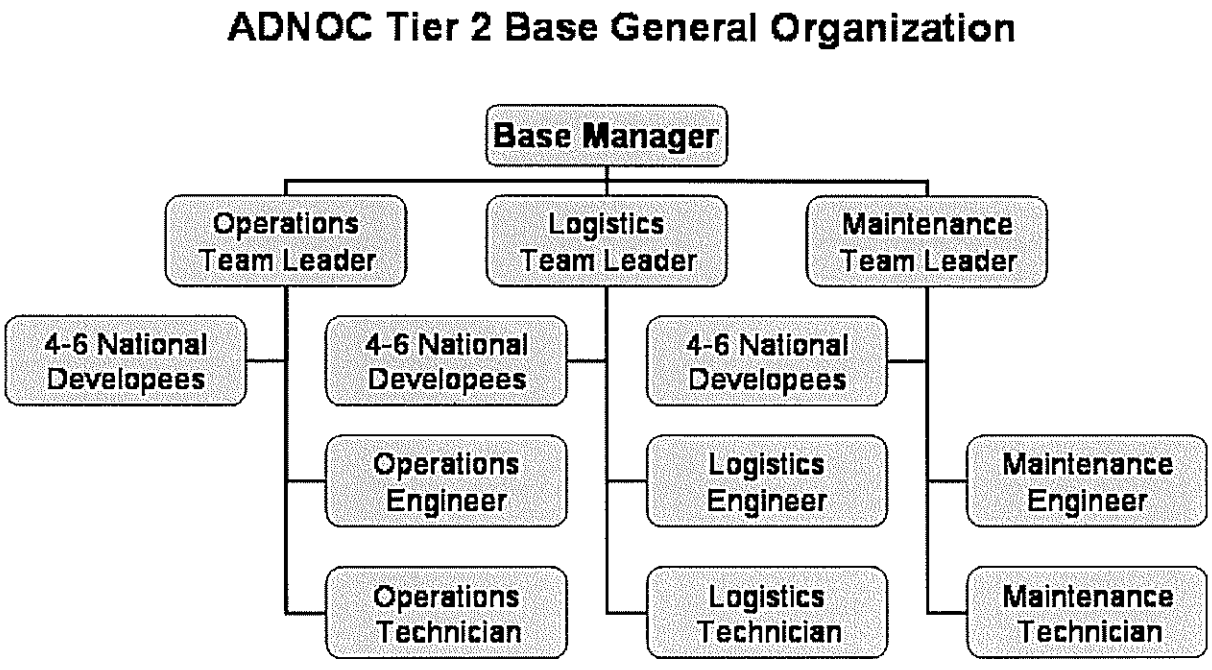

Figure 12: Primary Functional Organization in ADNOC Tier 2 Response Centers

To support the Tier 2 field organizations there are five staff positions and two administrative positions reporting to a single program manager. The dedicated staff positions include an Operations Team Leader, Safety Officer, Training Officer, Projects Officer, and Crisis Management Coordinator. The program manager is the Crisis Management & Emergency Response Team Leader.

The support requirements for multiple or extended response operations are planned to be delivered by local response organizations, local contractors, regional response service providers, and the international response community. Two key response relationships were established in early 2005, with Seacor Environmental Services Middle East (SESME) and Petroleum Environmental Service Company (PESCo), to ensure the ability to effectively utilize the existing stockpile of Tier 2 equipment. SESME, with an office and staff in Fujairah, UAE, entered into a phased development agreement with ADNOC. In the implementation of this agreement SESME established a local Abu Dhabi oil and HAZMAT response center. The center includes positioning of personnel and equipment, collocated with the ADNOC Tier 2 base in Mussaffah. The current SESME staffing in the Mussaffah facility is 10 and they have a total of 32 response personnel in the UAE.

The second key agreement was executed with PESCo. PESCo operates 5 oil spill response centers throughout Egypt and employs roughly 220 full time response personnel. To help ADNOC provide the personnel required to ensure an immediate response capability at their Tier 2 bases, PESCo assigned 20 full time responders to a rotational, 3-year assignment with ADNOC. This contract provided ADNOC with the immediate personnel capability to mount a response with the Tier 2 equipment already in place. Discussions are currently underway to re-negotiate the PESCo agreement to expand the current commitment to a total of 30 trained and qualified responders.

Additional actions have been taken to provide a wider base of Tier 2 and Tier 3 response support. ADNOC has drafted and vetted two types of contracts to facilitate agreements with other response organizations. These contract documents are a Response Action Contract (RAC) and a Master Service Agreement (MSA). The RAC is prepared to administer an ad-hoc response support relationship between ADNOC and other entities in the event of an emergency or spill. The contract is structured to allow service flow to ADNOC and to allow ADNOC to provide support services to others. The MSA is an advance planning contract document that allows ADNOC to pre-identify suppliers, consultant, response service providers, and contractors that may be called upon during a response. The MSA is a non-binding agreement as all services will be provided on an as-available basis. The primary benefit of the MSA is to establish a good company relationship during peacetime and to have an executed contract in place that can be mobilized quickly with a simple service order should an incident occur. To achieve this objective all rates, terms, conditions, indemnification, liability and insurance requirements must be agreed and established in the MSA.

As ADNOC's internal response capability continues to grow, we want to simultaneously establish our professional reputation in the world response community as a potential Mutual Aid participant. The recent exercise conducted with the Petroleum Association of Japan (PAJ) is an excellent example of international cooperation among two National spill response service providers. The time and expense invested in these types of joint exercises help us build personal relationships that we can call on for assistance in a time of need.

In 2005 and 2006, ADNOC responders have been engaged in response seminars, site visits, response training, and actual response actions in England, Scotland, Norway, USA,

Egypt, Lebanon, South Africa, and Indonesia. A similar range of activities are planned for 2007 to give our personnel the greatest opportunity to learn from the established global response community and to begin to contribute effectively in the mitigation of oil pollution impacts in the UAE and abroad.

Priority for Immediate Response

The ADNOC response preparedness philosophy clearly establishes the priority for immediate response in the governing CoP. Every operating facility is required to ensure that the equipment and personnel are in place, ready and available to immediately respond to incidents generated from or threatening their facilities. Facilities are not expected to be self sufficient in emergency response actions but rather design a system scaled to the scope of their operations and the resources they have employed on the site. In all cases the Facilities are required to initiate response actions by assessing the situation, providing for personnel safety, securing the scene, communicating the incident, and initiating source control and/or response as the actual conditions dictate. ADNOC has taken very clear and specific actions to ensure continuity of response across the range of operating facilities and to provide an element of quality control/assurance in the process.

ADNOC has established a Crisis Management Steering Committee with representatives from each of the 18 ADNOC Group Companies. The purpose of this Committee is to provide consistent communications to all Mutual Aid partners and to prioritize corporate actions to provide the best overall benefit to the Companies. The Committee provides a direct link to Company Management on key issues and helps streamline the process for consensus and collective action.

As a result of Committee efforts, a 3-year contract was awarded for the facilitation of a Group wide training program on the ADNOC Incident Command System (ICS). Since the

initial course conducted in November 2004, there have been over 2,400 personnel participating in the training program. Courses range from a 2 hour orientation course to 8-hour function specific courses concentrating on position roles, responsibilities and deliverables during a response. Courses are conducted both in Company Headquarter buildings and in the field at the facilities. Tabletop exercises are conducted with the Facility Incident Management Teams and Tactical Response Teams to provide an opportunity to walk through response actions associated with facility scenarios. To help optimize our Mutual Aid relationships and provide a resource for incident information management, ADNOC has also licensed and installed a Group wide incident information management software package. The software, WebEOC, is accessible via the internet and the ADNOC intranet simultaneously. There are no limitations as to the number or location of the participants. All participants, based on the established privileges, will have access to incident information in real time as if they were in the Incident Command Post. The greatest feature of the program is that it is very intuitive and requires little training to participate effectively. The program is fully compliant with ADNOC ICS requirements and is connectable to supporting software such as GIS, oil spill trajectory models, gas dispersion models, and search and rescue planning software. Figure 13 provides a picture of the WebEOC software display capabilities in a command post.

The prioritization for immediate response is also supplemented with direct services provided to the operating facilities. The ADNOC Tier 2 Team conducts on site training, drills and exercises throughout the operating area. The Tier 2 Staff provide consulting and auditing services for the Group Companies to promote consistency and ensure compliance with ADNOC performance expectations.

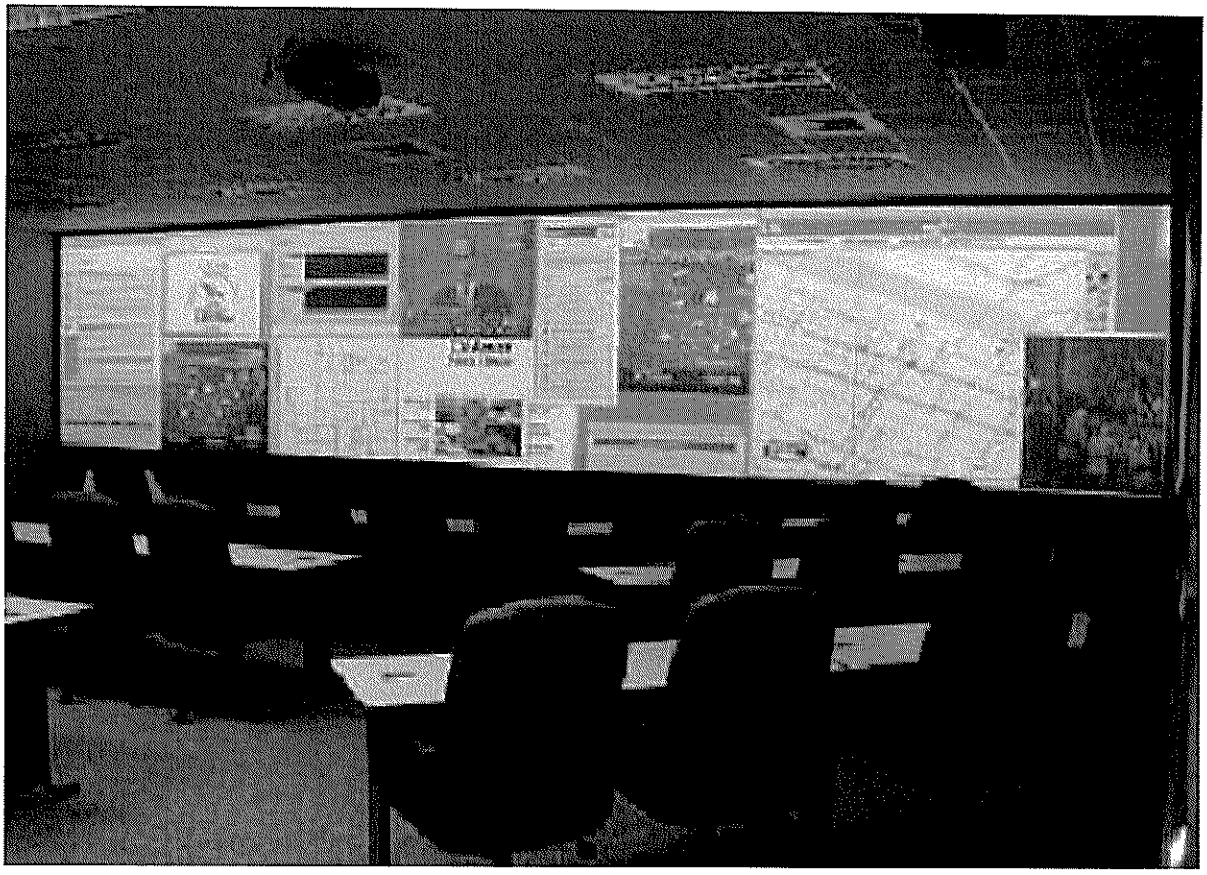

Figure 13: Illustration of Multiple Document Display Capability of WebEOC

Responder Training & Experience

With the realization of the growing numbers of dedicated response staff ADNOC implemented an organized and prioritized program for responder training. Figure 14 is listing of the range of mandatory training for all response personnel. Individuals with specialized interests or talents are also identified for specialist training courses such as Training-The-Trainer, computer courses, outboard motor repair, hydraulics repair, public speaking, etc...

The primary focus during the initial training is on safety and hazard/risk recognition. Many of our new Developee employees are new hires with no previous experience. We start with the basics of job safety, first aid, CPR, fire extinguisher training, and other similar industry courses to provide a good base of general safety knowledge. This training is supplemented with a 5-day orientation course to ADNOC and the ADNOC affiliated

SAFETY & ENVIRONMENT	RESPONSE OPERATIONS	
PRINCIPLES OF SAFETY	HAZWOPER 40 Hour	HAZWOPER Supervisor 24 Hour
HAZCOM	HAZMAT 80 HOUR	IMO I
FIRST AID	IMO II	IMO III
CPR	ICS 2 HOUR ORIENTATION	ICS 8 HOUR GENERAL
H_2S	BASIC RADIO PROCEDURES	SAFE BOAT HANDLING
SCBA	KNOTS & LINE HANDLING	GPS, CHARTING & NAVIGATION
DRIVING SAFETY	OFFSHORE RESPONSE	NEARSHORE RESPONSE
FORKLIFT OPERATIONS	SHORELINE RESPONSE	SENSITIVE AREA PROTECTION
HEAVY TRUCK OPERATIONS	WASTE MANAGEMENT	DECON OPERATIONS
RESPIRATORY PROTECTION	STAGING AREA MANAGEMENT	DISPERSANT OPERATIONS
HEARING CONSERVATION	AERIAL SURVIELLANCE	WORKSITE SAFETY
CONFINED SPACE ENTRY		
ENERGY ISOLATION		
WORKING AT HEIGHTS		
BASIC FIRE FIGHTING		
SLINGING & LIFTING		
SEA SURVIVAL		
BASIC OFFSHORE SAFETY		

Figure 14: Basic Safety and Response Training for ADNOC Response Team

operating companies. This orientation provides a good overview of the oil and gas exploration and production business, refineries, chemical plants, and pipeline and marine transportation. Once the initial safety and familiarization training is provided the new responder is able to join the workforce as he begins a series of response related training courses prepared to increase his knowledge and capabilities, continuously stressing the fundamentals of job safety, leadership, and command. These courses are prioritized and provided over the course of 2 years on the job. Initial training begins with Hazard Awareness, IMO Level 1, and HAZWOPER and is organized to provide all of the necessary training and experience to allow the individual to gradually gain the competence and skills of a HAZMAT Technician.

Throughout the year ADNOC looks for opportunities to provide additional learning experiences for our response staff. Attendance and participation in response related conferences, seminars and demonstrations is encouraged as a way to gain experience and knowledge across the international response community. To further support these efforts ADNOC has collaborated with SEACOR and VIKOMA to provide a short term residence internship with their respective companies. SEACOR has arranged a 6-month curriculum of activities across their response affiliated operations in the USA. Two ADNOC Team Leaders have been selected to participate in this program in 2007. VIKOMA has provided an opportunity for ADNOC Mechanics/Technicians to participate in a 1 - 2 month hands on internship in their factory in England. The success of these programs in 2007 is likely to generate an ongoing program of sharing and cooperation between our organizations and hopefully generate new opportunities for sharing between ADNOC and other international response organizations as well.

ADNOC has also demonstrated their commitment to responder training by proactively seeking opportunities to participate in spill response actions around the world. In 2006 ADNOC sent response teams to IRAQ, Egypt and Lebanon to engage in the oil spill combat operations. Without questions the learnings and experiences from participation in these spill response actions have provided an exponential growth in the knowledge, confidence and understanding of tactical oil spill response. ADNOC will continue to seek these types of opportunities, not at a revenue stream, but purely as a training opportunity for our Team.

The final plank in the ADNOC responder development program is the latitude to practice, practice, practice. Every week the Response Base Manager assembles and submits a work program for the upcoming week. In each weekly plan the Base Manager identifies the tactical deployment training and technical skill enhancement training opportunities for the

week. The tactical deployment training sessions are intended to stretch to abilities of the team to response to a broad range of scenarios across a full spectrum of operating environments. Our goal is to challenge our Team to learn from experience what works and what does not based on the conditions at hand. The technical skill enhancement training is provided as the opportunity to sharpen the personal skills required for success during a response. These sessions are intended to cover a broad range of personal skills from boat handling, knot tying/line handling, and radio communication protocols to activities such as aerial surveillance and formulating site safety plans.

Building Assurance in the Chemical Dispersant Strategy

Based on the scientific evidence provided in the fate, behavior, and dispersability analysis completed in 2006 we recognize that the opportunity to utilize dispersants to combat a large marine oil spill incident is likely to play a significant role in reducing the overall environmental and cultural impact generated by the spill. However, the conditions for effective use of dispersants and the specific requirements for a successful application are quite often underplayed as dispersants can create the perception of a "magic potion".

In July 2004, ADNOC executed a CoP for the Use of Oil Spill Dispersant. The document provides the regulatory framework and tactical requirements associated with the application of dispersants by any ADNOC Operating Company. The demonstration of compliance with the CoP has highlighted several opportunities for enhancement of the dispersant response strategy for ADNOC.

Dispersant inventory and inventory management practices across the ADNOC Group have been studied. We find that each Operating Company, and in some cases individual facilities within the Operating Company, have a dispersant program that is isolated from the collective dispersant capability of the ANDOC Group. In our joint efforts for alignment we

find that the ADNOC Group currently inventories over 38,000 gallons of dispersant throughout the area of operations. In this inventory there are 5 different types of dispersants, some of which are no longer approved for re-purchase. The dispersant maintenance practices vary widely as well and the end result is some deterioration in the efficacy of the ADNOC dispersant stockpile.

A second dispersant study is currently underway by SLRoss Laboratories in Ottawa, Canada, to provide a series of blind dispersant tests across all 16 ADNOC marine risk oils using six (6) of the ROPME approved dispersants. The intent of this study is to determine if a single dispersant can be proven most effective across the range of ANDOC risk oils under simulated environmental conditions anticipated in the Arabian Gulf. The completion of this program in June 2007 is expected to provide the foundation for the development of a centralized dispersant management program within ADNOC. The program will outline the management of a single centralized stockpile and allocate local inventories based on the available application equipment and realistic re-supply times. Dispersant storage, maintenance and testing will be standardized throughout the Operating Companies. Dispersant spray equipment will be centrally maintained to provide the greatest level of operational assurance. To underpin performance ADNOC will deliver annual training, testing and exercises to all Operating Companies on dispersant management, aerial support for dispersant operations, and practical training with the aerial and vessel mounted spray systems. Through these efforts we hope to deliver the greatest overall return on the investment in our dispersant response strategy.

Promoting Sensitive Area Protection

With our practical achievements over the last two years we are now able to effectively shift our focus toward one of our highest priorities, protection of the sensitive areas in Abu

Dhabi. The Environmental Agency Abu Dhabi (EAD) has provided the groundwork for this effort in their publication of the Abu Dhabi Coastline Oil Spill Protection Priorities 2000 Atlas. The publication provides environmental sensitivity indexing for approximately 340km of contiguous coastline of Abu Dhabi. The Atlas summarizes the extensive studies of the diverse coastal environments, flora, and wildlife that inhabit these areas in two series of complementary maps. Natural Resource maps are provided to identify the distribution of shoreline types, cultural sensitivities, archaeological sensitivities, vegetation and wildlife throughout the Abu Dhabi coastline. A corresponding set of Protection Priority maps are then provided to assist in the evaluation of potential impacts and the appropriate development of protection strategies.

In 2007, ADNOC intends to initiate a study to create a sensitive area protection strategy and tactical guidelines, using the information published by EAD and providing coverage for the entire ADNOC area of operations. The primary deliverable of the program is an operations manual that can be employed by all ADNOC Group Companies to guide their decisions and required commitments to sensitive area protection. The anticipated outcome is a methodical and prioritized approach to the challenges of sensitive area protection to include, but not be limited to, dedicated equipment inventories, strategic staging of equipment, detailed protection tactics, and a training program for responders and response managers.

Influencing Response Capability Growth in UAE and the Gulf Region

Over the last two years ADNOC and the ADNOC Group of Companies has demonstrated tremendous progress in their dedicated efforts to enhance the collective oil spill response capability of the ADNOC Group. While ADNOC is fully committed to continual

improvement of our response capabilities we are now confident that our Tier 1 and Tier 2 programs are well on their way to our vision of world class performance.

ADNOC strongly believes that the Nations of the Gulf must be fully responsible for protecting their people and our shared marine environment. The wealth and corresponding growth of the Gulf States is derived from our oil, gas and petrochemical industries. These activities also present a significant threat should a large scale incident occur. Therefore, ADNOC is 100% committed to the development of additional response capability in the UAE and the Gulf Region. ADNOC representation in the Regional Clean Seas Organization (RECSO) has championed the discussions promoting the development of a functional response facility under the RECSO agreement. Additionally, ADNOC is carrying this same message forward through our representation within the Organization of Petroleum Exporting Countries (OPEC) and the GCC.

The foundation for this endeavor lies in the enormous collection of response equipment that currently exists throughout the Gulf based oil producers and transporters. Currently these companies have committed 20% of their response inventories to Mutual Aid in the Gulf through the RECSO agreement. A Regional Tier 3 Response center could be established and managed through a cooperative structure, such as RECSO, or it could be independently contracted to an existing international response service provider. This vision includes the use of this Regional facility as a world class training center where the Gulf oil producers and transporters could send interns for extensive response management and tactics training. The collection of interns would then make up the bulk of the manpower needs for the center which could be managed and operated by a smaller core staff. The benefits of this arrangement are many but highlighted in the cooperation between a collection of the largest oil companies in the world. This Center could also provide the opportunity for development

of regionally accepted response management system, response protocols and field tactics which would only serve to benefit the outcome of a large scale Mutual Aid response. The organization could also help share the costs associated with some of the larger systems that benefit response actions such as: satellite surveillance, a broad area dispersant application system, a regional dispersant stockpile, a regional emergency communication system, etc... As of today the concept of a Gulf Region Response Center is only a vision but one that ADNOC believes to be worth the pursuit.

Other current actions are also contributing to the development of regional response capabilities. ADNOC is actively pursuing opportunities with a variety of response organizations and manufacturers to sponsor field demonstrations of response equipment, technologies, and tactics that we believe could contribute to our goal of continual improvement. Likewise we are also promoting practical field exercises with other stakeholders to provide us with joint experiences that will serve to enhance our performance if called upon. ADNOC commonly invites a broad audience to attend and participate in these events. We have conducted recent exercises involving the UAE Coast Guard, EAD, UAE Navy, equipment manufacturers, and other oil spill response organizations. The value of our joint participation in these types of planned events is illustrated in the following summary of a recent exercise conducted with the Petroleum Association of Japan on the 22nd and 23rd of January, 2007.

PAJ Open Water Exercise – A Demonstration of Joint Commitment

One of the three primary mission elements of the PAJ is Preparedness and Response. To fulfill this mission element the PAJ maintains six equipment bases in Japan and five international equipment bases spread to help protect the marine environment from oil pollution effects all along the primary oil tanker routes from the Middle East to Japan. The

international equipment stockpiles are regularly maintained by local contractors. To help ensure the adequacy of these stockpiles and the health of company relationships the PAJ periodically conducts joint exercises with stakeholders in the local area. On January 22nd and 23rd the PAJ and ADNOC cooperated to organize and conduct an offshore response exercise utilizing the PAJ equipment located in Abu Dhabi, UA.E. The primary objectives of the exercise were:

1. Demonstrate the practical value of the PAJ response equipment stockpile commitment to the Gulf Region.
2. Coordinate a Mutual Aid deployment of the PAJ equipment stockpile in an offshore response exercise.
3. Demonstrate the ability to access, mobilize and engage the PAJ response equipment stockpile in a timely manner.
4. Create an opportunity for sharing of response strategies, tactics, and develop relationships among companies with common interests for the protection of the Arabian Gulf.

At 0930 hours on the morning of the 22nd January a simulated approval was provided by PAJ to ADNOC to allow the actual mobilization and deployment of the PAJ equipment stockpile in Abu Dhabi to respond to an incident scenario. ADNOC, in contact with the PAJ local maintenance contractor, Lamnalco Ltd., agreed that ADNOC would conduct the equipment mobilization while the Lamnalco team of responders was moved from their base in Sharjah to the ESNAAD marine logistics base in Mussaffah. The primary purpose if the mobilization component of the exercise was to test the ability of the ESNAAD Logistics Team to respond to a no-notice callout and deliver the selected equipment to the deck of a vessel of opportunity at the ESNAAD jetty. Within 20 minutes of the unannounced request

for support the ESNAAD Logistic Team had secured the selected equipment to the deck of a trailer and had begun moving the equipment to the jetty. (see Figure 15)

Figure 15: PAJ Equipment Packages Loaded and Ready for Transfer to the Vessel

At just over 1 hour and 40 minutes after the callout, the equipment had been lifted from the deck of the trailer and securely fastened to the deck of the 38m tug, Rabebba, owned and operated by the ADNOC marine service company IRSHAD. This signaled the conclusion of the Day 1 exercise elements and the PAJ Team boarded the Rabebba and sailed to the Abu Dhabi Free Port where the Day 2 activities were planned to begin.

At 0700 hours on the morning of the 23rd January the responders representing PAJ, Lamnalco, IRSHAD, VIKOMA, and ADNOC assembled on the deck of the Rabebba to receive a safety briefing and an outline of the intended tactical exercise. Simultaneously, the

ADNOC 12m workboat Jamilah and crew along with the U.A.E. Coast Guard 30m tug Ras Gharib and crew held a similar pre-start safety and operational briefing on the deck of the Ras Gharib. The command organization utilized during the Day 2 field deployment is provided in Figure 16.

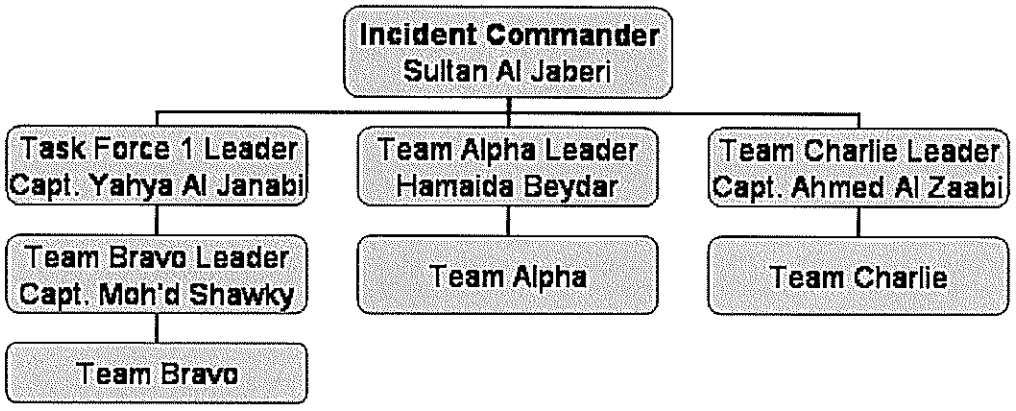

Figure 16: ICS Organization Utilized during PAJ Exercise

The beautiful UAE weather experienced on Day 1 had now deteriorated and the forecast predicted a continuing build of winds and seas for the next 24 hours. The conditions at 0700 were winds 15 – 20 and seas 3 – 5 ft. All response leaders reviewed the weather and collectively decided to proceed offshore but with a watchful eye on the wind and sea conditions. All responders were excited to be able to demonstrate their capabilities in these less than ideal conditions. As the two tugs cleared the buoys at the port entrance they faced the set of standing waves that commonly builds as the winds and current push against the narrowed entrance. The smaller jet drive workboat, Jamilah, found the wave and wind conditions outside of the harbor to be beyond the vessel's safe operating conditions. The steep standing waves caused the shallow draft jets to cavitate at each crest resulting in a loss of power and steering. It was decided that the conditions presented an unnecessary level of risk to the Jamilah and her crew. The Jamilah was ordered to return to port.

As the Rabebba neared the deployment zone, approximately 8 nm from the port, Team Alpha (on the deck of the Rabebba) elected to try a single boom lay in an effort to reduce the time required for the tug Ras Gharib to be stationed alongside. Sailing into the wind the single boom lay encountered problems as the wind and sea conditions would not allow the boom to open up thereby pinching off the inflation tube along the top of the VIKOMA Hi-Sprint 1500 boom. Team Alpha released one end of the boom to complete the inflation as Team Bravo, on the deck of the tug Ras Gharib, prepared to pick up the tow line.

With the boom securely fastened to both tugs a U-Shape formation was made and the simulated collection of oil began. Wind conditions were now worsening with constant winds at 23 – 25 kts. The wave height was growing but the period was long enough to allow the boom to remain effective in the 4 – 6 ft conditions. With periodic gusts now exceeding 25 kts the Incident Commander ordered the Desmi 250 skimmer to be stowed back into the container. The concern for safety overroad the responders desire to continue on as planned.

PAJ and ADNOC conferred and we decided to continue practicing the rough water booming formations and to continue to watch the weather. By 1030 the periodic gusts were now exceeding 30 kts and the seas a steady 5 - 6 ft but the boom was still performing well. The Incident Commander gave the order to initiate a coordinated 180 turn with the two tugs and to sail with the weather for a period. During the execution of the turn the tow line connecting the boom to the Ras Gharib parted. All present agreed that this would signal the end of the exercise and we would begin the boom recovery operation. The Ras Gharib returned to port and the Rabebba Captain set a heading toward the Free Port and a speed of about 2 knots while the deck crew began the boom recovery operations in the following seas. Figure 17 illustrates the conditions on the deck of the 38m tug Rabebba.

Figure 17: The Deck of the Rabebba Awash During the PAJ Exercise.

During the exercise debriefing it was unanimously agreed that the exercise, while failing to meet all of the equipment deployment objectives, was an outstanding success. The challenges and experience of deploying and maintaining tactical response configurations in rough weather conditions was considered an extremely valuable experience for all responders. Perhaps the greatest success of the exercise was the professionalism and skill of the multi-national Mutual Aid response team assembled for the exercise which overcame all potential language barriers and proved our ability to effectively work together as a single team should the need ever arise.

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