CHAPTER III

Potential Risk Scenarios

Introduction

This panel was moderated by Brigadier General Hamad Ali Al-Hinzab from the Qatar Armed Forces. The objectives of the session were to provide the basis for work group discussion, to institute a regional approach to security cooperation on environmental issues, to strengthen the GCC capability to respond to environmental events that may degrade regional stability, to explore the processes and mechanisms available to address consequence management planning at a regional level, and to promote environmental cooperation between defense and environmental authorities taking advantage of opportunities for multilateral and interagency cooperation. The regional environmental challenges include: water shortages, hazardous materials and waste, oil spills in the Gulf, shipping incidents, industrial accidents, desertification, environmental terrorism, weapons of mass destruction, regional earthquakes, and transmission of new diseases. This session was tailored to engage the interests of environment, industry, and defense representatives on environmental management.

Petro-Chemical Environmental Concerns: Managing Environmental Pollution Resulting from Chemical and Hydrocarbon Materials

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Qatar Ministry of Energy
Manager, Safety, Quality and the Environment
Qatar Petroleum Company

It gives me great pleasure to be here, and it is an honor to be with you for this very important event. This is a landmark event for the State of Qatar and for the civilian and military personnel of the Qatar Armed Forces. This is an opportunity put us together in one boat to handle all types of disasters. We have a civil challenge to respond to civil and other disasters and a need to work together toward a solution to handle these kinds of emergencies.

My presentation on "Managing Environmental Pollution Resulting from Chemical and Hydrocarbon Materials," focuses on the Safety, Quality, and Environment program of Qatar Petroleum (QP). There are several departments of Qatar Petroleum that handle the various activities of the oil and gas industry of the State of Qatar. Figure 3-1 shows the State of Qatar and our operational areas in the North Gas Field, with three operational platforms and at least six off-shore stations located near Halul Island.

These operational areas are critical to our operation. Qatar Petroleum maintains a reserve of more than one hundred trillion cubic feet of gas. Qatar ranks second in the world, after Russia, in natural gas reserves. The North Gas Field covers an area of approximately 6,000 square kilometers and has known proven gas reserves of 900 trillion standard cubic feet, which represents half the land area of Qatar. The main off-shore drilling sites are concentrated in the Mayden Mahzam Arab Fields C and D, Uwainat Reservoir, and Bulhanine Field. Qatar Petroleum has over seventy boats and barges involved in various marine, safety, and oilspill response.

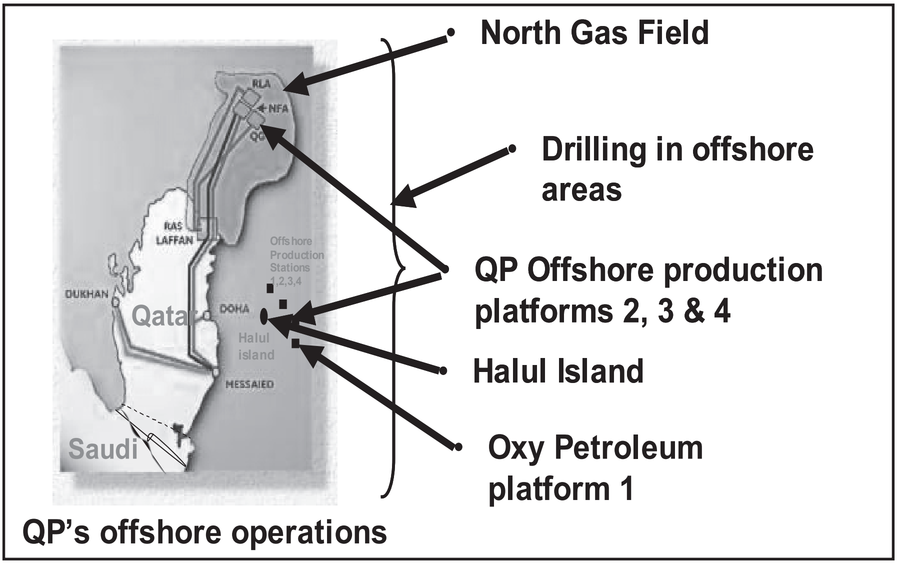


FIGURE 3-1: Qatar Petroleum Facilities

Qatar Petroleum and our partners Occidental Petroleum, Maersk Oil-Qatar, Elf Totale, and other partners operate numerous off-shore platforms. Halul Island is our primary off-shore export station. Qatar Petroleum exports almost half of our production from this station and has crude oil storage capacity of 1.2 million barrels of oil. The oil is only stored for two to three days, because of our active marketing policy. The island has on-site waste incinerators and air quality monitoring stations. There are on-site accommodations for more than five hundred staff personnel on the island.

The on-shore facility, located in Dukhan, consists of three oil reservoirs and one non-associated gas reservoir. Qatar Petroleum produces 335,000 barrel per day of oil and 330 million standard cubic feet per day (MMscfd) of gas production. The Dukhan oil and gas facility consists of a 60x25 kilometer area. The field has known reserves of 1,945 million barrels of oil and 211 million condensate.

Qatar Petroleum exports most or all of our on-shore oil and petrochemical production through our Mesaieed Port facility. This is a very essential industrial area. The facility consists of our refinery, port facility, and our petrochemical companies, QAPCO (Qatar Petrochemical Company) and QAFCO (Qatar Fertilizer Company). Qatar Petroleum operates the Ras Laffan Port, our only export facility for liquefied natural gas (LNG) in Qatar. The port has a current capacity of about twenty million tons of LNG, and efforts have begun to upgrade the capacity. The major producers located at the Ras Laffan facility are Qatar Liquified Gas Company (Qatar Gas) and Ras Laffan Liquified Natural Gas Company (RASGAS). They are the main producers of liquefied natural gas in the State of Qatar.

I have provided a background of Qatar Petroleum's oil and gas production and now will discuss the five elements of Qatar Petroleum's Environmental Security Management Plan, consisting of a Chemical Material Management System, Oil Spill Contingency Plan, Risk Assessment, and Monitoring/Control of Discharges.

The Chemical Material Management System is an on-line database for all chemicals handled by Qatar Petroleum. An individual can conduct a search of the database for information on any material purchased or used by Qatar Petroleum. For example, caustic soda (sodium hydroxide), the database provides data from the Material Safety Data Sheet (MSDS) on the physical and chemical dangers, occupational exposure limits, fire properties and fire fighting procedures, acute hazards and symptoms, prevention and first aid, storage and spill procedures, clean-up and disposal information, and other items of interest.

Qatar Petroleum has an on-line Emergency Response Card (ERC). This card provides all the information required regarding a small or large fire or tanker fire, flammability of the material, methods of handling, procedures in case of a small and large spill, and first aid procedures. Again, all of our materials are covered by this system.

Qatar Petroleum has developed a waste management chart for each type of waste. All of our waste produced, solid or liquid, is categorized, and a chart is produced for the system. Each chart consists of twenty-six entries: description, classification, hazard rating, composition, appearance, toxicity index, environmental performance indicator, safety hazards, safety precautions, fire extinguishing agents, health hazards, first aid, personnel protection, environmental hazards, spillage mitigation, prevention at source, recycling, recovery opportunities, disposal method, treatment method, storage, labeling, container and packaging, and transport. It also provides the method for the proper handling of the waste. Most of our hazardous material is being stored within until a hazardous waste treatment center is built. Qatar Petroleum will operate a waste treatment facility by the end of 2004. This facility will assist the State of Qatar in handling the chemicals that it uses.

The next area of the company's Environmental Security management plan is Oil Spill Contingency planning. Each of our operational on-shore and off-shore facilities has oil spill contingency plans. The company conducts periodic drills and has a good idea of the capability of our personnel to respond to a spill. Qatar Petroleum has the equipment and resources to handle up to a ten-thousand-barrel off-shore oil spill. We are also in active cooperation with other regional operators in the Gulf to handle bigger oil spills.

We have established a Permanent Oil Spill Committee, which meets regularly to review and update the Oil Spill Contingency Plans. Qatar

Petroleum is working with the Qater Supreme Council to upgrade our organization, planning, and resources to enable us to handle either an on-shore or off-shore national disaster. Qatar Petroleum actively participates in regional and international organizations who deal with environmental disasters and pollution controls, i.e. Marine Emergency Mutual Center (MEMAC), the Emergency Response Center in Bahrain, Gulf Area Oil Companies Mutual Aid Organization (GAOCMAO), recently renamed Regional Clean Sea Organization (RECSO), Regional Organization for the Protection of the Marine Environment (ROPME), and the International Oil Pollution Compensation (IOPC) Fund.

Another very important dimension of our Environmental Security Management Plan is the Emergency Response Plan. We have area-specific emergency response plans for all of our areas: Mesaieed, Dukhan, Ras Laffan, and the off-shore facilities. These plans cover all types of emergencies and are designed to protect assets, the environment and first of all, the people concerned. The Emergency Response Plan includes command and control rooms that are continuously manned with secure communications to marine, air, and state agencies. In Doha, we have a control room that controls air operations, primarily helicopters, to locate and track oil spill movement. These control rooms are an essential backbone of our oil spill and emergency response plan. Qatar Petroleum assets are protected by state-of-the-art fire and safety detection and protection systems.

The previous discussions were on the reactive or response type of operations. The Environmental Security Management Plan also includes proactive measures. Qatar Petroleum conducts Quantitative Risk Assessment (QRA) for all our projects and stations. QRA estimates the magnitude and significance of risks (fire, explosion, and hence the impact on the environment) and assesses the viability of proposed risk reduction measures for all risks. Qatar Petroleum uses internationally recognized bodies and consultants assist in the QRA process.

Qatar Petroleum has an active Monitoring and Control of Discharge program. Each facility has an air monitoring station. We use the Best Available Technique Not Entailing Excessive Cost (BATNEEC) in all of our projects and for any modifications to the plans in order to minimize the impact on the environment. We are developing plans to reduce fugitive emissions and flaring, which is one of the most important activities within Qatar Petroleum.

In conclusion, Qatar Petroleum is doing its best to improve and minimize emissions. We are monitoring all of our discharges. This is really a mandate that we have to stand behind. We try to reduce our risks of incidents and accidents, including safety risks and other risks. We are trying to finalize the national contingency plan. Qatar Petroleum is linking its operations with the Supreme Council and with others, like the Qatari Armed Forces. We have our own contingency plan and emergency agreement with the Qatar Air Force and with the Ministry of Interior in case of emergencies, but we need to go further in this regard. We try to integrate of all our local plans and national emergency response plans with the permanent committees and emergency committees.

The Gulf Region is dependent on the oil and gas industry, which face similar Environmental Security risks. We need to work hard to protect this product and protect the environment, you know, without affecting the environment. In this regard, the establishment of a Regional Emergency Response Center is highly desirable, as it would facilitate more effective and speedy emergency response and coordination.

Water: Distribution and Water Quality in Qatar

Abdul Rahman Ali Al-Naama
Water Quality Engineer, Environment, Safety, and Quality Department
Qatar General Electricity and Water Corporation (Kahramaa)

Thank you Mr. Chairman, and on behalf of Kahramaa, I would like to thank you and the organizers.

First, what is drinking water? Drinking water is, "pure water, used by people without any negative stress on the human or on lives, and it is considered to be that which has low levels of dissolved and suspended solids and obnoxious gases, as well as low levels of biological life."

Therefore, one of the main objectives for Kahramaa is to provide high quality drinking water to our consumers. In addition, Kahramaa's other objectives are to provide electricity for the consumer and the State of Qatar Development Projects at reasonable prices, increase the level of Qatarization, preserve the environment and support water quality excellence, upgrade the level of safety and occupation health, develop and modify water and electric networks, upgrade consumer service, and this is a very important point, conduct business planning and development.

Why am I concentrating on water? Our region is very poor in natural drinking water sources. Kahramaa uses 95% desalinated water in the production and delivery of drinking water. Kahramaa's water supply network consists of approximately 3,300 kilometers of pipeline and 1,350 tankers. Kahramaa serves approximately 136,500 consumers through pipeline service and approximately 7,700 consumers by tanker service. Additionally, Kahramaa uses wells for rural areas and reverse osmosis technology in areas like Abu Samra and Al-Shamal North Camp.

The water network begins at the desalination plant. The fresh water is transported through the pipeline to main storage tanks or reservoirs. The water is pumped from the storage tanks or reservoirs to the distribution towers. The water is transported by pipeline or water tankers to the consumers. Water sampling points are located at each point in the distribution process and at water wells to monitor water quality throughout the system.

Reservoir	Storage Capacity
Ras Abu Fontas (RAF) A	38.5
Ras Abu Fontas (RAF) B	19.5
Old Salwa Road	9.0
New Salwa Road	36.0
Old Air Port	24.0
Al Guwaria	36.0
West Bay	30.0
Messaied	6.0
MIC	16.0
Al-Wakrah	4.0
Industrial City – Doha	6.0
Al Shamal City	4.0
Al Khor	4.0
Al Wasail	1.0
Bain Hager	6.0
Mazrouah	1.5
Al Shahania	1.5
Al Ghwaria	0.6
Abu Samra	0.6
TOTAL	**240.0**

Figure 3-2: Major Water Reservoirs and Storage Capacity (Millions of Gallons) in Qatar

There are many reservoirs located in the State of Qatar. The major reservoirs and storage capacity in Qatar are listed in figure 3-2.

The company's total water production has increased annually to meet increased consumer demand from an increasing number of consumers. Total water production has increased from 58 million cubic meters in 1982 to approximately 150 million cubic meters in 2000 (figure 3-3).

During the same period, the number of consumers has increased from 38,000 to 100,000. The company has increased monthly water production to meet the demand. For example, figure 3-4 indicates the monthly water production in the year 2000. As stated earlier, Kahramma serves approximately 7,700 consumers by water tanker service. The company anticipates eliminating the tanker service over the next three or four years as additional pipelines are manufactured.

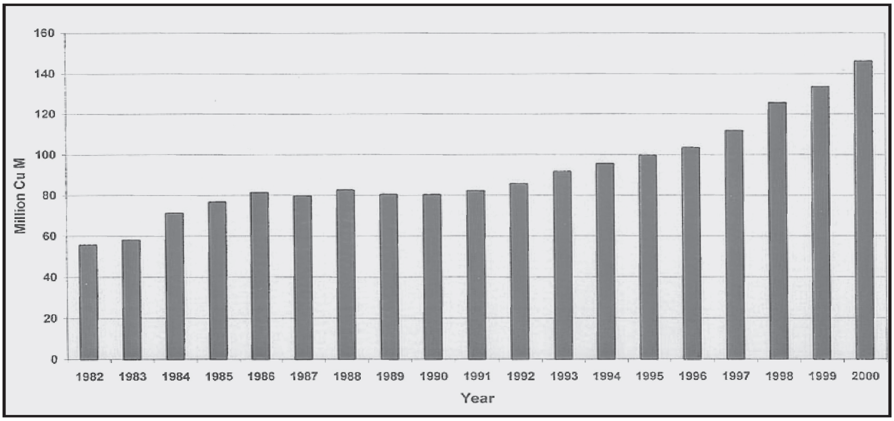


FIGURE 3-3: YEARLY TOTAL WATER PRODUCTION

Kahramaa is concentrating its efforts on reducing water pollution during water production and distribution. The major sources of pollutants that the company is trying to eliminate are desalination unit discharges, industrial waste water, activities near the stations, discharges and landfills from the cities, accidents—to include oil accidents—and port channel activities. There are many types of pollutants, but the company is primarily focused on two types of pollutants, chemical and biological. Chemical pollutants include volatile organic contaminants (industrial and chemical solvents), inorganic contaminants (including heavy metals), and synthetic organic contaminants.

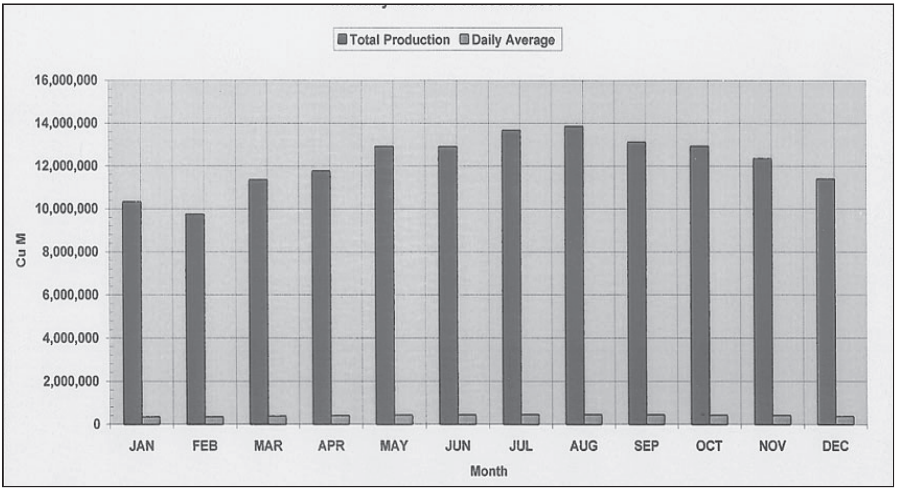


FIGURE 3-4: MONTHLY WATER PRODUCTION IN 2000

The Arabian Gulf Region has a long history of water pollution as a result of oil pollution resulting from water ballast, tanker accidents, off-shore drilling accidents and activities, oil production accidents, terminal operations, and bilge water. Since 1979, there have been twelve major accidents and spills involving oil pollution (figure 3- 5). The two major accidents resulted from from the oil well fires during the Gulf War in 1991 and from an oil tanker spill near the United Arab Emirates in 2000.

Water is sensitive to oil pollutants. What happens to oil spilled in a marine environment? The oil spreads in a slick formation and begins drifting with the ocean current. As the spread drifts, the oil begins to evaporate, dissolve, and disperse as it mixes with the water, emulsifies, begins the process of photo oxidation and micro-biodegradation, and finally settles as sediment. Some of the effects of hydrocarbon pollutants and heavy metals pollutants on humans are an increased risk of cancers, anemia, damage to the nervous systems, kidney and liver problems, reproductive difficulties, hair and fingernail loss, bone problems, blood problems, and eye, nose, and stomach discomfort.

Kahramaa checks the physical characteristics of water (color, taste, odors, temperatures, and turbidity) and inorganic compounds (aluminum, sulfate, copper, zinc, fluoride, sodium, iron, chloride, and total dissolved solids (TDS)) that lead to increased human complaints. Kahramaa conducts chemical sampling for heavy metals like arsenic,

- **1979- Oil Tanker Crashed in KSA, 111 t/d**
- **1980- Oil Spilled from Abadan Port. Iran**
- **1980- Oil Spilled from Hasba Well, KSA**
- **1982- Oil Spilled from Al Ahmadi Port, Kuwait**
- **1982- Oil Spilled from Niroz Well, Iran 7m t/d**
- **1987- Oil Spilled from Pivot Tanker, UAE**
- **1987- Oil Spilled from Safaniyah Well, KSA**
- **1988- Oil Spilled from 5 Tankers in the Gulf**
- **1991- Oil Spilled from all Wells in Kuwait,(Gulf War)**
- **1994- Oil Spilled from Off-shore wells in KSA.**
- **1996- Oil Spilled from Oil Jetty in KSA**
- **2000- Oil Spilled from Tanker in UAE**

FIGURE 3-5: OIL POLLUTION IN ARABIAN GULF HISTORY cyanide, barium, lead, beryllium, mercury, boron, nickel, cadmium, nitrate, chromium, and nitrite. Lastly, water samples are checked for organic chemicals from pesticides, polyaromatic hydrocarbons, organic halogen compounds, chlorinated alkanes, chlorinated alkenes, and phonemic compounds. The results from each sample are annotated on a Water Analysis Report (figure 3-6). The form, normally issued by our central labs, lists the most common contaminates in water and the results compared to World Health Organization (WHO) standards. The report has an area for biological tests and results. Finally, the form indicates whether the water is suitable for use or not.

The company takes water samples throughout the desalination process. It begins with samples from the sea, then samples are taken after the chlorination units, of the desalinated water, and after that, from the final product and before pumping through the system. The management of water in Qatar is divided into three main sectors: the production of water by private companies, distribution by the government, and waste-water management by the government. Figure 3-7 is a sample taken from

		mg / l		mg / l
Sent by:	Total Hardness as $CaCO_3$		Free Carbon Dioxide (CO_2)	
Reference No:	Total Alkalinity as $CaCO_3$		Dissolved Oxygen (O_2)	
Nature of Sample:	BOD		Hydrogen Sulfide (H_2S)	
Where Collected:	COD		Free Chlorine (as Cl_2)	
Date of Collection / Production:	TOC		Total Chlorine (as Cl_2)	
Date of Analysis:				

		mg / l	Microbiological Examination	
Temperature : °C at time of collection				
Appearance:	Albuminoid Nitrogen as N		Std. Plate Counts / ml	
Turbidity: (NTU). Salinity: (ppt)	Phenolic Compounds as Phenol		Total Coliform / 100 ml	
Colour: Hazen Units	Anionic Detergents as ABS		Fecal Coliform / 100 ml	
Odour: Taste:	Polynuclear Aromatic Hydrocarbons, as PAH		E – Coli / 100 ml	
Electrical Conductivity: µS / cm.	Petroleum Hydrocarbons			
pH: TDS: mg/l				

Parameter	WHO	mg / l	Parameter	WHO	mg / l	Toxic Substances	WHO	mg/l	Remarks
Aluminium	0.20		Bicarbonate	-		Arsenic	0.01		1 – WHO guideline values given in WHO column.
Ammonia	1.50		Bromide	-		Cadmium	0.003		
Calcium	-		Carbonate	-		Cyanide	0.07		2 – All species determined as written
Chromium	0.05		Chloride	250		Lead	0.01		
Copper	1.00		Fluoride	1.50		Mercury	0.001		3 – Sample suitable for drinking ☐
Iron	0.30		Nitrate	50.00		Selenium	0.01		
Magnesium	-		Nitrite	3.00		Total organic carbon	-		4 – Sample not suitable for drinking ☐
Manganese	0.10		Phosphate	-					
Potassium	-		Silica	-					5 – Resample ☐
Sodium	200		Sulphate	250		Disinfectant by-products (ppb)			
Zinc	3.00					Carbon tetrachloride:	(WHO-2.00)		
						Chloroform:	(WHO-200)		
						Bromodichloromethane:	(WHO-60)		
						Dibromochloromethane:	(WHO-100)		
						Bromoform:	(WHO-100)		

Figure 3-6: Water Analysis Report

the Ras Abu Fontas and network in the past three months. The results are compared to the Gulf Cooperation Council (GCC), United States Environmental Protection Agency (EPA) and World Health Organization (WHO). Based on the comparisons, the purity of our drinking water is well above the minimum GCC, EPA, and WHO standards. Our drinking water is better than bottled water.

Figures 3-8, 3-9, and 3-10 show the results of the sample for inorganic chemicals, heavy metals, and organic compounds. Compare our sample for heavy metals with the previously stated organizations. For example, the level of arsenic in our sample is 0.001 compared to the GCC 0.01, U.S. EPA 0.04, and WHO 0.01. Based on these comparisons, our drinking water quality is well above the minimum GCC, EPA, and WHO standards.

In conclusion, Kahramaa will continue to conduct monitoring and sampling of our drinking water to ensure a safe supply of water for our consumers. We have established a central lab for testing drinking water, and have instituted very restrictive rules to save or control pollutants near our waters, and choose the right places for new desalination plants for the future.

	GCC	EPA	WHO	Potable Water from RAF & Network (ave.) 2-5/2002
Components	Max. limit Mg/Liter	Max. limit Mg/Liter	Max. limit Mg/Liter	Max. limit Mg/Liter
pH	6.5–8.5	6.5–8.5	<8	8.13
TDS	100–1000	500	<1000	150–180
Magnesium	150	140	140	4.5–4.8
Calcium	200	200	200	20–30
$CaCO_3$	500	450	450	69.6–80
Sodium	200	200	200	19.2–30

FIGURE 3-7: CHEMICAL RESULTS FOR GENERAL SUBSTANCES

	GCC	EPA	WHO	Potable Water from RAF & Network (ave.) 2-5/2002
Components	Max. limit Mg/Liter	Max. limit Mg/Liter	Max. limit Mg/Liter	Max. limit Mg/Liter
Sulfate	400	250	500	5.3–10
Chloride	250	250	250	5.3–10
Iron	0.3	0.3	0.3	0.0016–0.025
Copper	1	1	1	0.0157–0.028

FIGURE 3-8: CHEMICAL CHARACTERISTICS: INORGANIC CHEMICALS

	GCC	EPA	WHO	Potable Water from RAF & Network (ave.) 2-5/2002
Components	Max. limit Mg/Liter	Max. limit Mg/Liter	Max. limit Mg/Liter	Max. limit Mg/Liter
Arsenic	0.01	0.05	0.01	0.001
Barium	2	2	0.7	0.0009
Beryllium	N/D	0.003	N/D	N/D
Cadmium	0.003	0.005	0.003	N/D
Chromium	0.005	0.005	0.005	N/D
Cyanide	0.07	0.2	0.07	N/D
Nickel	0.02	0.02	0.02	N/D
Nitrate	5	10	3	0.001
Mercury	0.001	0.002	0.001	0.0001
Lead	0.1	0	0.1	0.003

FIGURE 3-9: CHEMICALS OF HEALTH SIGNIFICANCE IN DRINKING WATER (HEAVY METALS)

	GCC	EPA	WHO	Potable Water from RAF & Network (ave.) 2-5/2002
Components	Max. limit Mg/Liter	Max. limit Mg/Liter	Max. limit Mg/Liter	Max. limit Mg/Liter
Carbon Tetra Chloride	0.02	0.02	0.02	0.01
Chloroform	40	44	<40	36.5
TTHM	0.1	0.1	0.1	0.05
PCB	0.0002	0.0002	0.0002	N/D
Benzene	0.001	0.001	0.001	N/D
Oil & Grease	0.0	0.0	0.0	N/D

FIGURE 3-10: CHEMICALS OF HEALTH SIGNIFICANCE IN DRINKING WATER (ORGANIC)

Health and Disease Response

Brigadier General Annette L. Sobel, M.D.
Assistant to the Chief,
United States National Guard Bureau
for Weapons of Mass Destruction and
Civilian Support

Mr. Chairman and honored guests. I am honored to be here, especially honored, as we are members of our respective Air Forces. I would like to talk a little bit at a fairly high level to discuss some ideas and concepts from the standpoint of my personal expertise, but you are really the experts. The message I am trying to get across in my talk today is that there is a continuing need for information sharing and partnering in the areas of health and disease response.

I will try and address some very broad issues, not only weapons of mass destruction—and what we also refer to as weapons of mass effect—because from a medical perspective, and certainly from a commander's perspective, the impact of these issues on your operations, on your day to day activities is important, not only for national security concerns, but for regional operations. How can we prepare and respond? What infrastructure and potential assets are available that we can use jointly? I will provide some overarching thoughts that hopefully we can expand on in our workshops.

We have three broad areas of threat: natural, technologic, and terrorism. These areas have been touched on earlier by other speakers, and they are very similar in many ways in terms of prevention and preparedness. In many of these areas it is not only the baseline capability, but how rapidly you can expand your capability and surge to deal with a crisis situation.

Historically, there are many examples, and I will just touch on a few, because it is important for us to understand as nations, as we go through exercises, response, and regional capacity building, that we need to build on lessons learned from the past. Without an ability to learn and share learning from our joint exercises, unfortunately, we relive things, and so we go back hundreds, perhaps thousands of years, when the whole concept of biology and biological weapons was certainly employed. In more recent history, there have been industrial accidents that we have had to grapple with. How do we, as responders and commanders and national-level decision makers, actually deal with these occurrences from the standpoint of the information that we share with the public and our level of preparedness in terms of not only responding rapidly, but also mitigating and, hopefully, preventing.

In recent history, we all had to deal with the Aum Shinrikyo Tokyo subway attack, in which we began to learn again about the terrible effects of chemical agents. But I would like you not only to think of this as a response, an incident that had to be dealt with immediately, with managing casualties, but think of how we deal with the psychology and terror of such a situation. How do we convince our citizens that as governments and as senior leaders in the medical field and other related health fields, that we are not only prepared, but we are confident in our levels of preparedness?

In the United States, we have experienced various politically motivated acts of terror whose primary effects were intended to result from the use of biological agents. There was, for example, a well-known, well-publicized incident of salad bar contamination where the sole intent was to influence a political decision. There are many different types of scenarios that can occur. We must not only recognize the differentiating factors, but also understand the common basis for many of these acts. As senior leaders, we must also recognize that, as we move into the future, having a baseline of understanding in our countries of what is normal and what is not—in terms of the status of health of a population—is critical for determining whether something is unusual or unexplained in nature. In many situations, what we really need to understand is the unusual indicators and warnings that some occurrence is not consistent with a naturally occurring event.

Certainly in a technologic disaster, such as one that perhaps may affect water, oil, and natural gas, many of these indicators are much more obvious. However, there are times that the indicators may be much more subtle.

How, as medical providers, can we be part of the senior leadership team? How can we assist, by using the information that we have access to routinely, in understanding what is significant and unusual? That is what I hope we can go into in more detail tomorrow. Often it is not just a situation of understanding an unusual case here or there, but it is something that doesn't quite fit a pattern. The difficulty comes when we don’t understand what is naturally occurring. Where I live in the U.S. southwestern region, anthrax is not unusual. We have seen cases of anthrax and plague for decades. However, a case of pulmonary anthrax is unusual. Therefore, I would submit that you have to understand what is endemic in your region before you can determine whether an occurence was an unusual event or something that you would consider highly suspicious.

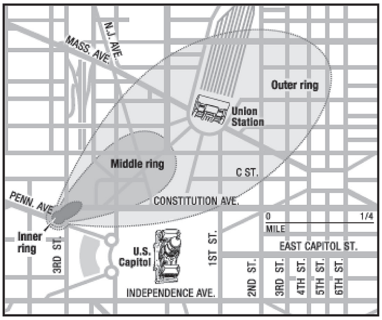
We are also concerned about the concept of “all hazards,” hazards that may not only affect a day-to-day operations, but the long term ability of an environment to recover. So we are critically concerned about a number of areas. Psychology and working closely with the media and public affairs is something that we have learned is crucial. We have started developing checklists and templates for basic information that we know will be helpful in getting consistent, unambiguous information out to the people. This will reassure the public that we have a plan in place. It is also important for the public to understand, from the medical standpoint the limitations of our ability to respond and the areas in which they may contribute.

There are, I realize, very hard leadership issues that need to be addressed and often, as scientists, engineers, physicians, we get too immersed in detail. But how do we address the general good? How do we address taking care of the largest number of people and optimizing or having the best outcome? Ultimately, this is what is reassuring to the population. More importantly, how do we determine when we have done enough? Often, for medical providers, this is a very difficult decision to make. We have decision-making tiers to our medical operations, to include response and support to commanders. This process applies equally as well to real world operations such as oil drilling. I have worked closely in the past with people from Galveston, Texas, in understanding some of their oil drilling operations, how the operators work hand in hand with medical responders to assure that the best care is given to the greatest number in the event of an accident or disaster and to assure that

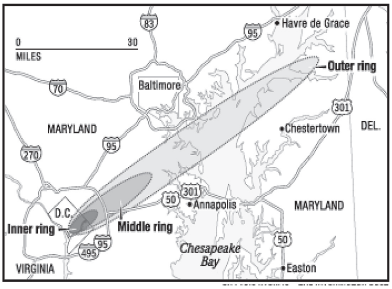
Hypothetical Contamination

Following are case studies showing radiation contamination that could result from two types of "dirty bombs." The models were generated by the Federation of American Scientists based on government data. In both scenarios, the immediate threat from radiation is small, but extensive cleanup and evacuation to guard against long-term exposure would be needed.

Long-term contamination risk from remaining radiation (without cleanup).
- *One cancer death per 100 people.*
- *One cancer death per 1,000 people.*
- *One cancer death per 10,000 people.*



Cesium Bomb: The small amount of cesium that could be found in a medical gauge is exploded in Washington D.C.



Cobalt Bomb: A cobalt 1x12 inch "pencil" from a food-irradiation facility is exploded in the same location. While more powerful than the cesium device, this material would be much harder to acquire and use.

FIGURE 3-11: DIRTY BOMBS CASE STUDY

there is minimal disruption of their capability to continue safe operations while continuing to protect the environment.

From a standpoint of training and joint operations, we try to address the full spectrum of potential disasters, from ones that we know that we obviously can contain and control, to those that are well beyond our abilities to control. We then address some of the critical shortfalls in our training.

One specific area that recently has received a lot of media attention is the whole concept of "Dirty Bomb" devices, which spread contaminated, aerosolized matter. These are devices that combine radioactive materials, such as spent nuclear fuel rods, and employ high energy explosives to detonate and cause broad scale contamination. What I would like to show you very quickly are two models—which are very dependent on meteorological conditions—that actually show a comparison of a Cesium versus a Cobalt incident (figure 3-11). The model takes place in an urban setting, one of the most difficult to model because of various air flow and laminar flow issues. We take these models in the context of training people to respond intelligently, to prioritize their care in a setting where you may not have enough resources to go everywhere. How do you effectively and efficiently use those resources.

Is this a credible fear, or is it based on paranoid thought? Well, we go through a step-by-step analysis to determine if are there any credible reasons for this concern. I was very surprised when I saw some of the initial statistics that referred to an estimated 1,500 pieces of equipment, with radioactive parts, missing since 1996. This raises concerns about potential radioactive materials that cross borders and may go unrecognized as potential sources of a dirty bomb. There was a recent discovery of ten radioactive containers at a border crossing in Kazakhstan and a report of forty Russian suitcase nuclear bombs still missing.

I am now going to show you some of the medical capability that we have that is available for partnerships and joint training. The concept of modular health care that we use today, in which available assets are deployed in phases, evolved from a model developed by the United States Army a long time ago (figure 3-12). You use pieces and parts of critical skills that are necessary. Some may be public health, some may be laboratory, some may be environmental monitoring capability, and others may be modules such as surgical capabilities or preventive medicine.

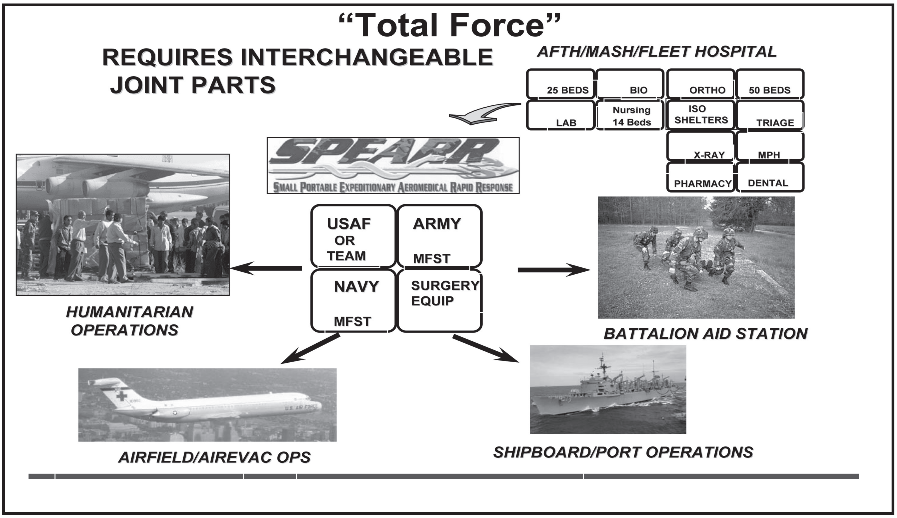


FIGURE 3-12: MULTIPLE SUPPORT ROLES; JOINT MEDICAL OPERATIONS

FIGURE 3-13: REGIONAL RESPONSE AND POTENTIAL PARTNERS

The number of partnerships that have developed here is certainly an evolution in promoting joint activities, whether they are in the context of exercises or regional response plans. We are trying to move forward in the future, recognizing that airlift may not be available and certainly may not be desirable in some settings. However, we want to be able to develop a medical capability that can be there to support the commander's needs as well as national needs if necessary. Again, there is much potential for regional partnerships in this area as well as increasing interest in partnering and exercises and in building templates that we all can benefit from. Figure 3-13 diagrams the concept of regionalization of the response and some of the critical infrastructure issues that are necessary for medical support.

Figure 3-14 shows the concept that I have just discussed. This is what we call the Red Wedge, which reflects the ability to surge capacity rapidly when you have early indicator that will be a problem. This concept may be employed during a crisis when you have to very rapidly decide what is necessary. It involves a fair amount of understanding and advance planning, given a whole host of potential scenarios, from natural to man-made disasters.

I want to quickly show you an example of a medical situation in Afghanistan that illustrates the use of our modular health care system in

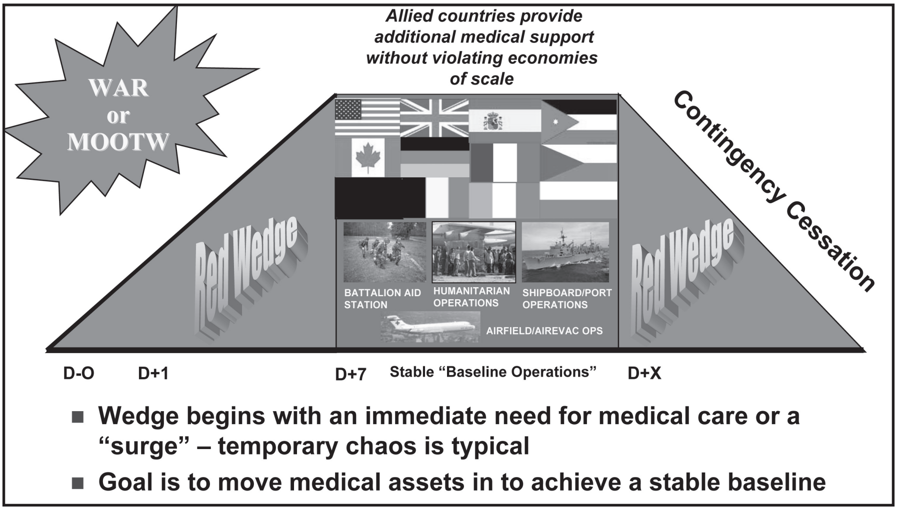


FIGURE 3-14: THE "RED WEDGE" SURGE CAPACITY MODEL

a forward staging operation (figure 3-15). The illustration uses a joint operations timeline. To minimize the impact to an ongoing operation, we strive to assure mission success. The first column deals with the time required for the care that was actually administered. The span of operation civil-military options for the rescue. In less than an hour, the rescue occurred, and within an eight-hour time frame, the casualties were stabilized. The ability to project care and optimally engage on a very

Injury Scenario: Military and Civilian Care Comparison

	Elapsed Time Post Injury	Care Received	Military Setting	Civilian Setting
1	50 minutes	Rescue	ParaRescue	EMT-P
2	1.9 hours	Intubation/ Fracture Stb / Blood / Volume Expansion	Army Forward Surgical Team	Level I Trauma Center
3	6.9 - 8.1 hours	Stabilization / ICU Care in Air on C-130	CCATT/ AE enroute	Level I Trauma Center
4	8.1 - 9.2 hours (transload to C-17) 9.2 - 16.5 hrs	ICU Care in Air Arrival in Germany	CCATT / AE enroute	Level I Trauma Center

Currently in Hospital in Germany

* Times & locations are **estimated**

FIGURE 3-15: RECENT SUPPORT OF WAR EFFORT: APACHE CRASH, 10 APR 02 local level was life saving. All of the patients have been released from the hospital and have returned to functional lives.

The concept of EMEDS (the expeditionary medical system) is an agile, mission-responsive modular functionality that can be adapted to meet real world needs, as illustrated in figure 3-16.

I have tried to describe the U.S. Air Force's global health program framework and partnerships that are still emerging. The United States has a number of educational programs across all services that seek partnerships and worldwide deployable programs that can be customized. The Air Force's flagship mobile education course is the Leadership Program in Regional Disaster Response and Trauma System Management. Since 1999, the Air Force has taught this course in twenty-six countries with over 1,200 participants. Several countries have hosted follow-on civilian-military courses, established trauma institutes, and incorporated the curriculum into their military medical academy as a result of the course. Trauma care has potentially far-reaching effects. The Air Force offers courses on International Aero-medical Evacuation, Critical Care Transport Course, Forensic Science and International Law for Public Health Officials and Health Care Providers, and a Trauma and Critical Care Pararescue Course. There are seven additional mobile education courses in development: trauma nursing; chemical, biological, radiological, nuclear, and high-yield explosive (CBRNE) military-civilian

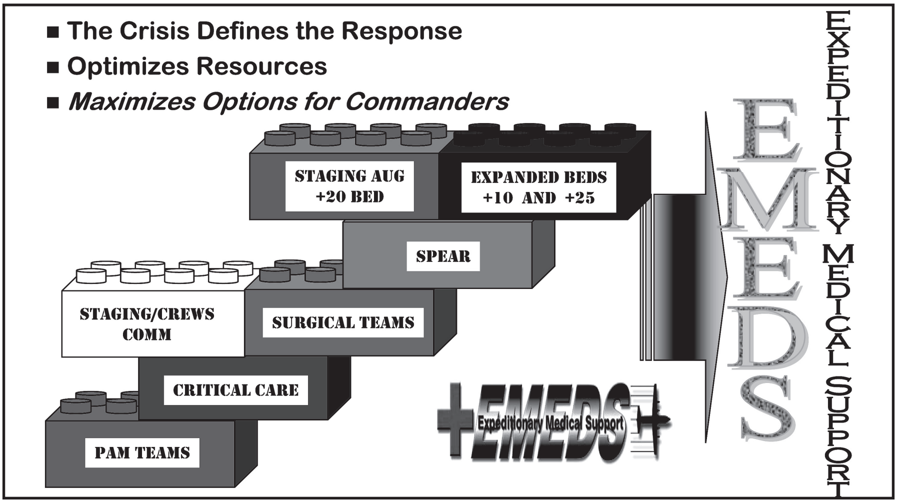


Figure 3-16: EMEDS (the Expeditionary Medical System)

exercises; dental healthcare course; maternal-child healthcare course; pre-hospital care systems; HIV/AIDS; and sustainment of trauma and readiness skills. As you see, it's a spectrum, from the most common and basic of health care needs, such as in a humanitarian mission, to the full span of operations that might be necessary.

So what are the opportunities that exist? From a U.S. perspective, one of our interests is to understand coalition partnership needs and how to partner effectively in regional activities that can assist us in enabling the reduction and future elimination of the existing gaps and shortfalls in our system. The idea is to build a framework for capacity and resilience, moving beyond our response as medical providers to a focus on prevention.

In summary, as nations we have amazing capacity for response preparedness. We are trying to enable expanded prediction, prevention, and preparedness to the response cycle. But in many situations, that is not possible. So if we employ risk-assessment-based capacity building, we will have the ability to surge if needed. The true focus is regional response capacity-building. A parting challenge that I would like to submit to senior leadership is raise the bar of preparedness and embrace the medical community as an equal partner to mitigate the effects of environmental disasters, both natural and man-made.