

Emergency Management in Saudi Arabia: Past, Present and Future

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“He who is secure in his house, healthy in his body and has his food for the day, has owned the world” - Prophet Mohammed

Introduction

The management of potentially hazardous situations such as religious mass gatherings has been the duty of the people of Makkah (now part of Saudi Arabia) for many centuries. Inhabitants of Makkah used to evacuate their houses to accommodate the incoming pilgrims, and servants of the Holy Mosque used to distribute cold water to quench pilgrims' thirst. This concept of serving mass gatherings formed the nucleus of the first emergency management plans in the Kingdom of Saudi Arabia. Today, Saudi Arabia covers most of the Arabian Peninsula and has faced many other risks in addition to those arising from religious mass gatherings.

In order to improve on the existing emergency management policies and plans, it is of crucial importance to examine the current emergency management system. It is also pivotal to reflect back on previous disasters and learn lessons from them to avoid committing the same mistakes again. It is saddening to discover that most emergency policies implemented are either out-of-date, not fully documented or not easily obtainable.

This chapter will look at current hazards and vulnerabilities in Saudi Arabia. It will also provide a list of major disasters in Saudi history, and describe the current emergency management policies in the country. Finally, lessons learned from these disasters and areas of improvement will be critically discussed.

The Kingdom of Saudi Arabia

The Kingdom of Saudi Arabia is located in western Asia. It takes up most of the Arabian Peninsula, with a surface area of 2,149,690 km² and a population of 27.137 million (Central Department of Statistics and Information, 2010, United Nations: Statistics Division, 2008). Of this population, 30% are 14 years or younger and only 4.75% are 60 years or older. International migrant stock, such as guest workers, represent 27.8% of the total population (Ministry of Economy and Planning, 2010-2014). Saudi Arabia's population living in rural areas makes up 18.6% of the total population. The geography is varied, from coastal regions in the eastern and western parts, to mountainous regions in the south-west, and finally to the Rub' al Khali desert running along the country's southern borders where almost no life exists. The country is divided into 13 provinces which are further divided into governorates; each of these has a capital that is headed by a governor. Figure 1 shows a simplified map of Saudi Arabia and its major cities.

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Figure 1. Map of Kingdom of Saudi Arabia
 (source: United States Central Intelligence Agency)

Hazards in Saudi Arabia

A hazard can be thought of as a potential risk endangering human life or health, property or the environment. However, if this risk does lead to an incident, it is referred to as an emergency situation or, if the damage is overwhelming, a disaster. Such events are often the result of human factors, environmental hazards or natural causes. Although considerable overlap occurs between these factors, there is usually one factor that contributes significantly more than the others. This section will review hazards in Saudi Arabia classified according to the main contributory factor.

1. Human-related risks:

- Terrorist attacks: Up until recent years, terrorist attacks have very rarely, if at all, been heard of in Saudi Arabia. Citizens and foreigners have co-habitated for decades, even before the foundation of the current Saudi Arabia. This was especially the case in areas known for trade, such as Jiddah on the Red Sea, where merchants from Syria, Lebanon, Jordan, Egypt, Yemen, Oman, and India regularly mingled and traded with local merchants.

With the rapid modernization that occurred to the country, more and more citizen-foreigner interactions were formed. This increased presence and power of foreigners in the Kingdom is viewed by some extremists as posing a “threat.” Lacking adequate knowledge of Islamic laws, they took out-of-context quotes from Holy Scriptures to

justify taking their souls, along with many others' of their fellow citizens and foreigners. This has resulted in the unfortunate occurrence of several terrorist attacks in Saudi Arabia in the past few years (discussed later on in the chapter). Added to the human and structural losses, these bombings resulted in transient internal instability in the country, albeit brief, as well as interrupting public and international relations leading to an unprecedented shift in regional and international political dynamics.

- **Motor Vehicle Crashes (MVCs):** MVCs are the leading cause of mortality and morbidity in Saudi Arabia. There have been almost 500,000 MVCs in 2008 alone, resulting in over 6,000 deaths (Ministry of Interior, 2008). This means that there are 1,350 MVCs, 101 people injured and 18 people killed everyday! This, in part, has been attributed to the social and economic development in the country, leading to a considerable increase in the numbers of drivers and vehicles. In turn, this has overwhelmed traffic services in urban and rural areas. Supporting this theory is the notable increase in MVCs and deaths seen during the special seasons on the Islamic calendar (discussed next). For example, the province of Makkah has witnessed more MVC-related deaths (26.02%) in 2008 than the rest of the 13 provinces of Saudi Arabia. The vast majority of MVCs result from driver-related offences, as opposed to road- or vehicle-related causes (Ministry of Interior, 2008). Driver-related offences can be divided into the following categories: road-code offences, vehicle misuse, driving misjudgments and other offences. Of these categories, road-code offences have been the most common, with overspeeding and running red lights having accounted for more than 50% of all MVAs in 2008. Of note, more than one-third of all MVA-related deaths are seen in the 18-29 years age group (which is most expected to undertake such driving stunts). Targeting such risk factors, therefore, has the potential of dramatically improving morbidity and mortality resulting from MVCs in Saudi Arabia. MVCs are on the rise internationally, but they are particularly problematic in Saudi Arabia. In a review of MVCs from all Gulf countries, Saudi Arabia had the highest incidence of accidents including pedestrians (Al-Tukhi, 1990). Not only has this been claiming the lives of many people in Saudi Arabia, but it has also been exhausting national resources that could be better utilized.

- **Ramadan and Hajj seasons:** Ramadan and Hajj are two special seasons on the Islamic calendar, for which a massive influx of people from all over the world come to Saudi Arabia. Ramadan is the ninth month on the Islamic calendar, while Hajj occurs on the 12th month. Given that the Islamic calendar employs a lunar cycle, these events do not equate to a particular time on the Gregorian solar calendar (which is usually 11-12 days longer). This also means that these events cycle between seasons (i.e. summer, fall, winter and spring) every few years.

During the fasting month of Ramadan, it is an Islamic belief that good deeds are exponentially greater. As a result, many Muslims from around the world make an effort to visit the Holy Mosques in Makkah and Medina to perform prayers and other rituals. This leads to a cumulative number of visitors of about 2 million people over a period of only 30 days. With this number of visitors, simple practicalities, such as when to perform physical prayers, can result in profound adverse effects that can exhaust available resources. For example, an observational study from Al-Noor Specialist Hospital in

Makkah has shown that most emergency department admissions were during the evening shift (4pm-12am). This was attributed to the fact that most patients were fasting and had been exposed to the high temperatures of summer while performing prayers during the day (Dhaffar et al., 2005).

Hajj refers to the major pilgrimage to the Holy Mosque in Makkah, carried out over 5 days on the 12th month of the Islamic calendar. It is obligatory for each adult Muslim, physically and financially capable, to perform Hajj at least once in their lifetime. During Hajj season, there is an almost sudden increase in Makkah's population from 200,000 permanent inhabitants to well over 3 million people. This increase puts major stress on Makkah's modest supplies of food and water as well as its health services. In addition, the limited space in Makkah has raised concerns about pilgrim overcrowding and trampling, increased MVCs, spread of infectious diseases and other public health implications.

2. Technological hazards: Technological hazards refer to the partial malfunction or total breakdown of equipment leading to the early cessation of an operation short of its intended goal. Technological hazard is increasingly becoming a recognized separate category of hazards. Depending upon the type of operation ceased, technological hazards can result in power outages, environmental damage or health risks for the human workforce. Since Saudi Arabia is one of the leading oil-producing countries, this paragraph will focus on the risks posed by technological hazards in the oil industry.

Technological hazards in the oil industry can occur at any stage of oil processing: from extraction to refinement to exportation. Some of the incidents that can occur include damage to oil wells, leaking pipelines, accidental ballast water discharge from loading terminals and accidental oil spillages.

All Saudi factories involved in oil-related operations are very active in the protection and maintenance of the equipment in accordance with SASO (Saudi Standards, Metrology and Quality Organization) standards. Unfortunately, however, incidents still occur in spite of all precautionary measures, and there have been about 36 recorded oil spills in the Arabian Gulf alone as of 2005 (Al-Suwian, 2001). Several field studies from King Fahad University of Petroleum and Minerals have not shown any significant pollution of the Arabian Gulf by heavy metals or hydrocarbons (Al-Suwian, 2001). However, the Arabian Gulf is especially likely to become more polluted since it is enclosed and receives only a slow rate of water exchange with the open sea. It also has a high salinity and a rapid rate of water evaporation leading to an even higher salinity. All of this poses a great threat to living marine species, the ecological structure of the Gulf, as well as people working in the area.

3. Natural disasters: Saudi Arabia has recently become known for media-attracting incidents such as terrorist attacks and major MVCs. However, less attention has been given to natural disasters, even though their incidence has been on the rise. Floods are the most frequently encountered natural disaster in Saudi Arabia. They have been the cause of 7 of the 10 most damaging natural disasters in the history of the country between 1900 and 2010 (refer to Table 1).

The reason behind floods being a major threat in Saudi Arabia is multi-faceted. Rains have been relatively scarce in the area, and this has led to the under-development

of a proper drainage system in the country. Compounding this problem is the geography of some of the most populated cities in Saudi Arabia. Cities, such as Jiddah and Makkah, are on low ground and are surrounded by mountains. When rains fall on these mountains, water runs in valleys towards these cities. With poor drainage systems, this continuous flow of water could easily lead to a flash flood.

| Disaster | Date | No. Killed |
|-----------------|-------------|-------------------|
| Flood | 24/11/2009 | 163 |
| Epidemic | 11/09/2000 | 76 |
| Epidemic | 03/2000 | 57 |
| Epidemic | 9/02/2001 | 35 |
| Flood | 28/04/2005 | 34 |
| Flood | 24/12/1985 | 32 |
| Flood | 22/01/2005 | 29 |
| Flood | 4/04/1964 | 20 |
| Flood | 8/04/2002 | 19 |
| Flood | 11/11/2003 | 12 |

Table 1. Top 10 natural disasters in Saudi Arabia for the period 1964 to 2010, sorted by the number of people killed (source: International Disaster Database)

Vulnerability in Saudi Arabia

Vulnerability in any country can be gauged by how it prepares for and reacts to emergency situations and hazards. This section will examine vulnerabilities in Saudi Arabia in terms of emergency preparedness and reaction to emergencies once they occur.

Emergency preparedness vulnerabilities

Saudi Arabia has certain vulnerabilities that can hinder the country's ability to be better prepared for hazards discussed previously. One of these is the short time available to prepare for high risk seasons, namely, Hajj and Ramadan season. This line-up of mass gathering seasons leaves no time for proper emergency preparedness projects. Usually, preparations of these seasons start at least a month before Ramadan. As people start to leave after the Ramadan season, more and more people arrive in Makkah in preparation for Hajj. This takes up the period leading to the actual Hajj season. After Hajj, at least two to four weeks are spent on cleaning the Holy Mosque and fixing any damage caused by the season itself rather than initiating new emergency preparedness projects.

The scale and timing of these mass gathering seasons leave no choice for emergency planners but to operate on full capacity, and surge capacity of human and physical resources is almost null. Any extra resources are only used for increasing the operating capacity to handle more visitors rather than to increase the surge capacity.

Furthermore, with all the crowding during these mass gathering seasons, emergency preparedness activities take longer to establish and are more expensive to run because of the logistics and practicalities of establishing a preparedness program in a very crowded city (i.e. Makkah). Basically, the nature and timing of high risk seasons in Makkah make the population of Makkah and its visitors more vulnerable to disasters and its impact.

Another, although less significant, factor to exacerbate the vulnerability of Saudi Arabia to the impact of potential disasters is the recent trend of reluctance from international experts, including emergency planners, to work in the country especially after the recent terrorist attacks (Maben et al., 2010). This has affected the progress of a wide range of collaborative developmental projects including emergency preparedness projects, for which more expertise and skill than available in the country is required. Emergency preparedness is based on experience-sharing, and international expertise is central to any readiness activities and without such expertise the vulnerability to the effect of disasters is multiplied.

Vulnerabilities in reaction to emergencies

A country's reaction to emergencies once they strike determines the extent of the damage. Multiple factors could improve or hinder the reaction to emergencies. Saudi Arabia has several factors that could hinder recovery efforts and increase the vulnerability to disasters impact. These are usually social and demographic factors, such as the high rate of illiteracy and language barriers among vulnerable populations.

Illiteracy and lack of proper education can negatively affect people's attitudes towards emergency preparedness. In 2007, illiteracy rates were 23.6% in females and 8.6% of males over 15 years (Ministry of Economy and Planning, 2010-2014). Not being able to read safety brochures or use the internet and other media resources for public announcements can have adverse consequences and place the population on higher risk of being a victim of disasters. For example, during the rainfall that resulted in the flood in Jiddah in 2009 (discussed in the next section), many people ignored warnings about using motor vehicles for unnecessary trips simply because illiteracy means less attention to such messages. Some people under-estimated the risk and decided to take a trip in their cars to "enjoy" the rain, and these were the cars that were swept away by the flood and clogged main streets. Moreover, some people have the attitude that "what God wills to happen, will happen"; however, this contradicts Islamic beliefs. Islamic teachings state that every person has to do their best in taking precautions, as well as believing in God and relying on Him. In short, lower education level and illiteracy leads to less effective risk-communication and under-appreciation of the power of disasters. Many communities in Saudi Arabia have a higher vulnerability to the impact of disaster because people do not appreciate risks and ignore official messages.

Another problem is the language barrier among immigrant workers in Saudi Arabia. Immigrant workers made up 53.1% of the workforce in Saudi Arabia in 2008 (Ministry of Economy and Planning, 2010-2014). In spite of this large number, most precautionary warnings issued by officials during disasters are still publicized in Arabic! There has been a call for occupational emergency personnel who can speak languages most commonly used by foreign workers (e.g. Urdu and Filipino); attempts to date have been unsuccessful. The media is still largely in Arabic and less of other languages. This

miscommunication leads to increased vulnerability of minority groups in Saudi Arabia who are labor workers living in high risk areas.

In summary, the vulnerability to disasters and their impact is compounded in Saudi Arabia by multiple factors, such as the nature of the mass gatherings, the high illiteracy rate and miscommunication of risk to minority groups. These factors all tend to slow down preparedness activities and make recovery after disasters even slower.

History of disasters in Saudi Arabia

Almost all major disasters in Saudi Arabia can be attributed to one or more of the hazards and vulnerabilities mentioned in the previous sections. Unfortunately, there is no official publicly-available database that keeps a record of disasters in the country. Most official information available comes from newspapers local to the region where the disaster occurred. The International Disaster Database (IDD) of the WHO provides the best record of disasters in Saudi Arabia (International Disaster Database, 2010). For this section, data recorded in the IDD have been compared to information published in the relevant medical literature as well as in local newspapers around the time of any given disaster to check for accuracy (2000, Aguilera et al., 2002, Almulla, 2008, Lerner et al., 2007, Thompson et al., 2004). Table 2 shows a chronological list of major disasters in the past 50 years in Saudi Arabia. The following is a description of the most significant disasters in the history of Saudi Arabia:

1964 rains: this is the earliest recorded account of a natural disaster in Saudi Arabia. Heavy rains poured continuously on parts of the country leading to a flood that killed 20 people and left about 1,000 people either injured or homeless. No further details are recorded.

Fire incident in Hajj season 1975: during Hajj season in 1975, a fire broke out in one of the pilgrim's tents near Makkah and quickly spread to other tents. The fire was caused by an explosion of a gas cylinder, and led to the death of 200 pilgrims.

Seizure of the Holy Mosque in Makkah: on 20 November 1979 the Holy Mosque in Makkah was occupied by a group of armed Muslim extremists. The attackers had planned to seize the Mosque by filling coffins with weapons and smuggled them into the Mosque. On the morning of the day of seizure, they chained the gates of the Mosque, killed the two guards on-duty at the time, and held present worshippers hostages. They called on the people to revoke the current Saudi Monarchy and obey their leader, Abdullah Hamid Al-Qahtani. After more than two weeks of cross-fire with the Saudi Army, and with the help of Pakistani and French forces, the siege of the Mosque was ended. At least 250 people were killed and 600 injured, including worshippers, troops and insurgents. The surviving insurgents were captured by Saudi authorities and later executed.

Ras al-Khafji thunderstorm: in October 1982, a severe thunderstorm hit Ras al-Khafji city on the east coast of Saudi Arabia. Hail stones were reported to be as big as tennis balls. This was followed by four hours of heavy rains. The net damage included 11 fatalities.

| Type of disaster | Date | No. affected | No. killed | Effect estimates |
|---|----------------|------------------|-------------|---|
| Heavy rains | April 1964 | 1,000 | 20 | NDA |
| Fire during Hajj | December 1975 | NDA | 200 | NDA |
| Militant occupation of Holy Mosque in Makkah | November 1979 | 600 | 250 | Help from Pakistani and French forces |
| Floods in north-western Saudi | December 1985 | 5,000 | At least 32 | \$450,000 |
| Iranian riots during Hajj | July 1987 | 649 | 402 | NDA |
| Stampede inside pedestrian tunnel during Hajj | July 1990 | NDA | 1,426 | Compounded by failure of ventilation system inside the tunnel |
| Fire during Hajj | April 1997 | More than 1,500 | 343 | |
| Rift Valley Fever outbreak | September 2000 | 500 | 87 | NDA |
| Jizan floods | April 2004 | 430 | 5 | Destroyed 2,680 km ² of hoses, lands and roads |
| Jiddah floods | November 2009 | More than 10,000 | 163 | \$900,000 |

Table 2. Top 10 disasters causing major damages in Saudi Arabia between 1960 and 2010 (NDA = No Data Available)

1985 flood: on 24 December 1985, heavy rains poured on north-western regions of Saudi Arabia, leading to what has been described as the worst flood in the area in 50 years. Estimates of damage were not recorded, except that there were at least 32 people killed from the flood.

Iranian riots in Hajj 1987: in July 1987, the Civil Defense forces and Saudi Police had to open fire against Iranian demonstrators after arguments escalated to fights between the two parties. This incident claimed the lives of 402 people, and wounded 649. This led to political tension between the two countries, and Iranian pilgrims were held from entering Saudi Arabia for Hajj seasons 1988 and 1989.

Stampede in Hajj season 1990: as pilgrims were moving between the sacred sites on the second day of Hajj season in 1990, a massive stampede occurred in a tunnel south of Makkah. The stampede occurred after what is thought to be a failure in the ventilation system inside the tunnel. This led to the suffocation and death of 1,426 pilgrims, most of whom were from south-east Asia.

Stampede in Hajj season 1994: During one of the rituals of Hajj, a stampede occurred as pilgrims leaving the site crossed roads with those coming in. This led to a massive disorder culminating in the death of 270 pilgrims, most of whom were trampled.

Khobar tower attack: on 25 June 1996, a terrorist truck bomb (estimated to carry 20,000 pounds of TNT equivalents) exploded in Dhahran, eastern Saudi Arabia. The attack was aimed against troops of US Air Forces, US Army and coalition forces who billeted in Khobar towers military compounds. The attack resulted in the death of 19 people and the injury of 555 people.

1996 Charkhi Dadri mid-air collision: even though this tragic event occurred outside the country, it deserves to be mentioned since it is considered the deadliest mid-air collision in history. On 12 November 1996, Saudi flight 763 was en route to Saudi Arabia from India when it collided with Kazakhstan Airlines flight 1907. All 349 people on-board both flights were killed.

Yanbu flood: heavy rains poured on western Saudi Arabia in January 1997, mainly affecting Yanbu and peripheries of Jiddah. The rain lasted for 24 hours, killing 10 people and causing damage to an area of over 130,000 km² of land.

Asir flood: Asir is a province in the Southwest of Saudi Arabia. On Monday 25 March 1997, heavy rains poured on the region, leading to floods that resulted in 16 fatalities and damaged an area of just below 100,000 km² of land.

Fire incident in Hajj season 1997: in April 1997, a gas stove exploded in one of the pilgrim's tents, leading to a massive fire that quickly spread to other nearby tents. It claimed the lives of 343 pilgrims, and more than 1,500 were wounded. This stimulated authorities to design the currently used fire-proof tents, as well as banning gas-operated material.

Meningitis outbreaks in Hajj and Ramadan: outbreaks of *N. meningitides* serogroup W135 have been reported from as early as 1987. In the Ramadan of 1992, an epidemic occurred, but all cases have been confined to residents of Saudi Arabia. However, in Hajj season 2000, another outbreak of the same infection occurred, only to include pilgrims from various countries this time. This had led to the spread of the infection to countries from which those infected pilgrims came. The reported cumulative number of deaths is 57, but is likely to be considerably higher.

The 2000 Rift Valley Fever outbreak: beginning in early September 2000, it had been noticed that goats and sheep were being found dead in some areas of the far south of Saudi Arabia. Soon after, reports of hemorrhagic fevers from the same region started to increase, which had subsequently been identified as Rift Valley Fever. The Saudi Ministry of Health declared an epidemic (i.e. the first of its kind in Saudi Arabia), and advised citizens to wear mosquito repellants. Areas where dead animals were found were quarantined; live stock in endemic areas were checked and exterminated if found ill. At least 87 people died and more than 500 people were afflicted by this infection.

Makkah 2002 flood: heavy rains started falling on Makkah area on 8 April 2002 and lasted for a whole week. This led to flooding of water in some areas, claiming the lives of 19 people; hundreds of Makkah residents were rescued by the GDCD that week.

Makkah 2003 flood: not quite recovered from previous year's rain, Makkah experienced yet another heavy shower described as the worst rains in Makkah in 25 years. Water levels were reported to have reached 6 meters. Twelve people were killed; however, estimates of physical damage are not available.

Riyadh 2003 bombings: on 12 May 2003, attacks on three different housing compounds were conducted by a group of nine radical terrorists. These sites are thought to have been chosen because they contained a large number of Westerners and non-Muslims. Seven vehicles, packed with explosives, gained entry into the compounds after attackers killed the guards. The attackers then detonated their bombs and the vehicles, resulting in a significant damage to buildings and vehicles and leaving large craters. Thirty-four people were killed and 194 were injured.

Jizan 2004 floods: less than four months apart, two floods hit the Jizan region, leading to what has been described as Jizan's worst floods in 45 years. The floods left over 400 people homeless, killed 13 people and devastated many roads and farms.

Medina 2005 flood: very heavy showers fell on Medina region in January 2005. This resulted in a flood that caused the Yatamah dam to fail, killing 29 people. Seventeen people were injured, 50 were left homeless and 43 had to be evacuated.

Riyadh 2005 flood: heavy rains poured on the Riyadh region of Saudi Arabia, as well as on other areas in neighboring countries (i.e. Oman and the United Arab Emirates). The resultant flood claimed the lives of seven people; 700 people had to be evacuated via GDCD helicopters and another 700 were left homeless.

Hostel collapse in Makkah: in Hajj season 2006, a hostel near the Holy Mosque collapsed after a fire had spread in lower floors of the building. Most pilgrims were out in the Mosque as it was time for the noon prayer. The collapse killed 76 people, most of whom were people passing by the building, and another 64 were injured.

Jiddah 2009 flood: at around 6:30 a.m. on Wednesday 25 November 2009, rain started falling heavily in Jiddah, and continued for around 12 hours. The amount of water in this relatively brief downpour (around 90 mm³) doubled the average annual rainfall in Jiddah. With a sound infrastructure and a proper drainage system lacking, this rain turned into the worst disaster that Jiddah has experienced in 27 years or so. The downpour resulted in the formation of water tides coming from the hills on the east of the city, heading west towards the Red Sea and cutting their way through the city.

Several residential houses collapsed, forcing many inhabitants to upper floors and roofs. Labs and databases at King Abdulaziz University and King Abdulaziz Hospital were destroyed, wasting valuable resources, specimens and medical records.

Major roads of the city were blocked by meters-high of water waves or by cars that have been washed out. As a result, thousands of pilgrims had to wait in buses for hours before getting to Makkah for the first day of Hajj. Furthermore, King Abdullah

Bridge on the South of Jiddah had partially collapsed, adding to the chaos and fright to the situation.

Power and telecommunication services were not spared either. As early as 11 a.m., floods had already resulted in a temporary power outage on the whole western region of Saudi Arabia (i.e. Makkah, Medina and Jiddah). Many people were not even able to call for help as communication with emergency services (e.g. civil defense forces, police or emergency medical services) failed due to the overwhelmed network and power outage.

Overall, 161 people lost their lives as a result of the floods, either drowning or from car crashes. This disaster had an estimated cost of around US\$900 million to reconstruct Jiddah and help its victims.





Photos of Jiddah 2009 flood (source: personal communication)

Riyadh 2010 flood: on 3 May 2010, Riyadh city experienced a brief 45-minute water shower, accompanied by light hail and winds gusting up to 24 km/hour. As brief as the downpour was, however, it resulted in floods and car crashes across the city.

Local newspapers reported that at least two people were killed, and that the floods caused around 275 car crashes. Even though King Khalid International Airport was not affected, many people missed their scheduled flights due to poor road conditions. A survey committee, appointed by the Governor of Riyadh, has started assessing the extent of and the reasons behind the damage that resulted from the rain.

Development of emergency management plans in Saudi Arabia

The development of emergency management plans in Saudi Arabia started more than 80 years ago, and has been progressing slowly since then. The first nucleus of an emergency management body was a fire brigade that was formed in Makkah in 1927 (Ministry of Interior, 2001). Its purpose was to serve pilgrims that came to Makkah every year. It was the first of its kind in Saudi Arabia, and it was managed by the Makkah

Provincial Council. In 1948, the Makkah Fire Brigade joined the later-established Center of General Security to form the General Security and Fire Services. Over the following 32 years, the General Security and Fire Services grew to include 5 fire brigades in Makkah alone. Meanwhile, fire brigades formed in a number of other cities including: Medina, Jiddah, Riyadh, Qasim, and Dammam.

In 1965, a Royal Decree by King Faisal dissolved the General Security and Fire Services, and instead formed the current General Directorate of Civil Defense (GDCCD). This was following recommendations by the International Association of Fire Fighters. The scope of the GDCCD was wider than previous emergency management bodies because it was made the official body of civilian defense during peace and in times of instability. During this time, the GDCCD received generous funds to expand its human and material resources. In addition, the GDCCG centers started operating in more and more urban and rural areas in the Kingdom with the help of the evolving telecommunication networks.

Later on, in 1987, King Fahad ordered a reform of the GDCCD's structure, goals and responsibilities. As a result, staff from the GDCCD administration paid several visits to neighboring and other friend countries to investigate civil defense advancements and useful experiences in these countries. After extensive meetings, the current Civil Defense Law was decreed, which included 36 sections. The following is a translation of two sections relevant to emergency management:

Section one defines "civil defense" as protocols and operations required to protect civilians as well as public and private properties from the dangers of fires, natural disasters, wars and other accidents. It also encompasses rescuing those afflicted by such catastrophes, ensuring transportation safety, and protecting national resources in times of peace and emergency.

Article four of section two defines the role of the GDCCD in emergencies and wars as:

1. Organizing and operating the national alarm system in cases of emergencies or attacks by a foreign army.
2. Managing electrical power, and organizing evacuation and shelter plans.
3. Extinguishing fires and rescuing civilians and providing basic life-support measures in damaged areas.
4. Marking areas afflicted by nuclear damage, and directing civilians away from them.
5. Corresponding with other governmental bodies (e.g. Ministry of Transportation) to ensure safe transportation of civilians.
6. Removing debris from damaged areas, and rehabilitating them for safe use as soon as possible.

Current structure of the General Directorate of Civil Defense

The current structure of the GDCCD is divided into three levels: Board of GDCCD, Executive Committee, and volunteers (Ministry of Interior, 2001). The following is a description of the members of each level, and the most important roles for which each level is responsible. Figure 2 shows a schema of the current structure of the GDCCD.

1. Board of GDCCD:

This is made up of the Minister of Interior as Chairman, Assistant Minister of Interior as Deputy-Chairman and a number of members who represent divisions of the GDCD or sectors that work closely with the GDCD, such as fire services, police and emergency medical services. Those members are appointed by a Royal Decree often after the recommendation of the Chairman or his deputy.

The Board of GDCD is responsible for:

1. Establishing general GDCD policies and planning future projects.
2. Establishing safety and fitness standards that must be met in all projects to ensure civilian safety and protect public and private properties.
3. Establishing guidelines for training programs for GDCD personnel.
4. Establishing policies for the recruitment of GDCD volunteers and defining their roles and rights.
5. Forming divisions of the GDCD, defining their responsibilities and appointing a manager to each division.
6. Reviewing the suggested budget annually before seeking approval from the Ministry of Finance.

2. Executive Committee:

This committee consists of members appointed by the Board according to GDCD policies. A president of the committee ensures that projects are executed in a timely and efficient manner, and that the workload is divided equally between all members.

The Executive Committee is responsible for:

1. Enacting policies established by the GDCD Board, following up on current projects.
2. Suggesting new or alternative projects and liaising with Ministries and other governmental bodies for cooperation.
3. Enacting safety measures in response to emergencies (once declared by the Board).
4. Providing food, clothes, shelter and first aid for those in need in times of emergencies.
5. Representing Saudi Arabia in national and international conferences and courses.
6. Providing the Board with a suggested budget on an annual basis.

3. GDCD volunteers:

These are citizens and residents who are willing to help with the GDCD tasks during times of increased demand, such as natural disasters. They can apply online through the GDCD's website, and receive some training upon acceptance.

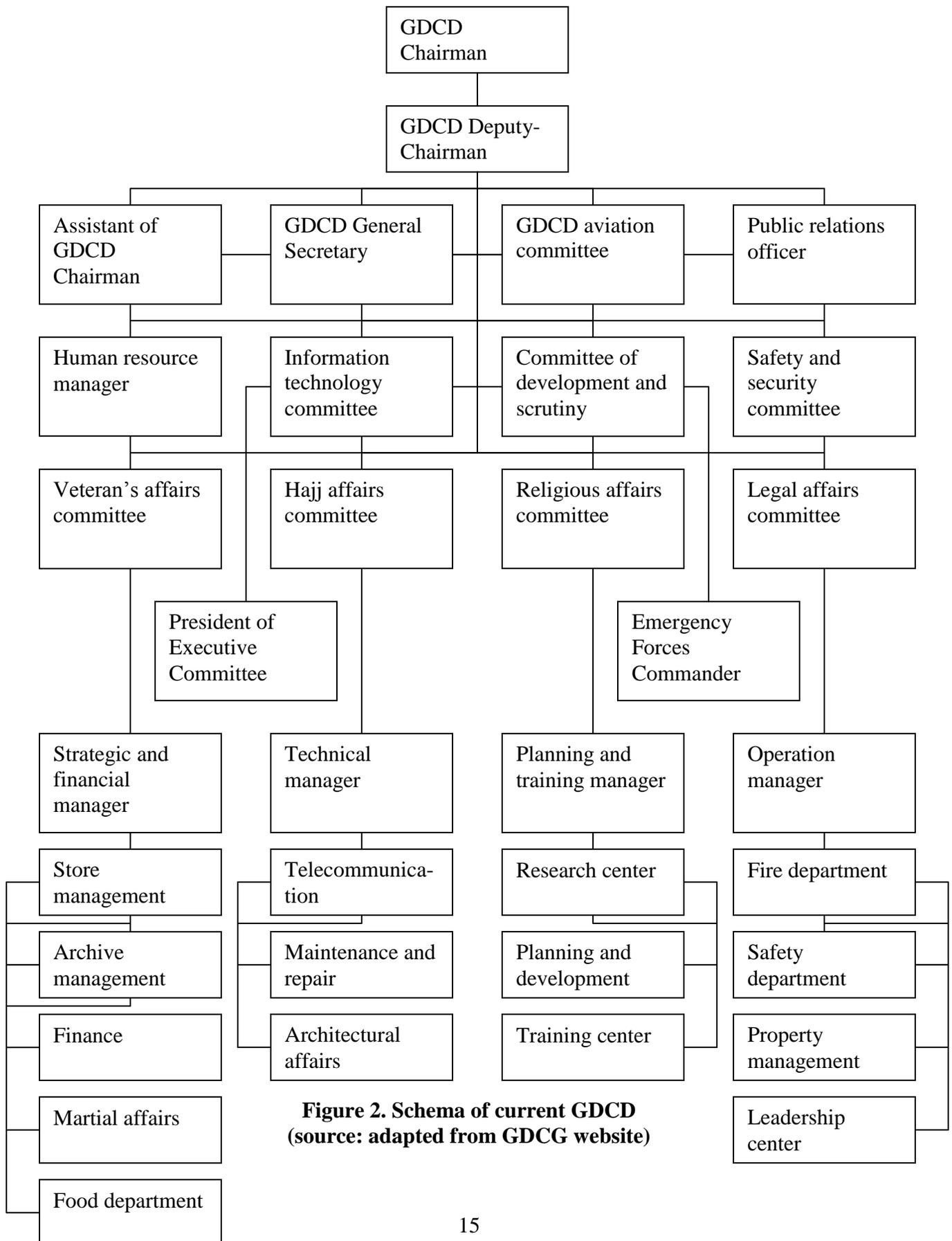


Figure 2. Schema of current GDCD (source: adapted from GDCG website)

Lessons learned and policies implemented

Saudi Arabia's history is rich in emergencies and disasters that took their toll on the people and the country's resources. Saudi Arabia's extended geography, being the destination of two important religious mass gatherings, and the unfortunate occurrence of recent terrorist attacks, have all posed significant challenges to the country's relatively new emergency management plans. As different disasters struck, lessons have been slowly learned and emergency policies implemented. Below is a list of the most significant and recent lessons. It is critical to note that official policies are not easily accessible to the public or researchers as it is considered a national security issue.

1. After the recent increase in insurgency attacks in the country, authorities have become more vigilant in trying to detect any suspected activities and arresting offenders before tragedies occur. A list of suspects, which contains background information and/or suspects' photos, is now published regularly in all major newspapers, as well as being televised on national TV. A designated emergency hotline, fax number and email are now available to the public if any person has information about those suspects, or anything that might threaten national security. A monetary award is given to individuals who help or supply information about such offenders.
2. A new comprehensive digital traffic control system has just been introduced to try to limit the high number of MVCs and the subsequent damage. It is now available in eight major cities around the county. The system has been named *Saher*, which translates to "watchful and napless" to imply its coverage of all roads within a city, 24 hours a day. The new system employs digital camera networks that connect to the local command and control center in each city. Information is then sent to the National Information Center of the Ministry of Interior for statistical purposes, and to issue traffic violation tickets and identify wanted or stolen vehicles (Saher, 2010).
3. Over the years, projects and developments to make the Hajj process easier have been slowly implemented, and some have now been completed. Most tunnels and sacred sites where stampedes happened now operate on a one-way system. Also, some of the sacred sites have been re-organized into floors to maximize space efficiency and facilitate one-way travel. Moreover, fire-proof tents have been built, and all gas-operated tools have been banned to minimize the chance of fires. Expansions to the Holy Mosque and nearby sacred sites are still underway, all in an effort to avoid previous disasters.
4. One of the current developmental projects in Makkah that deserves special attention is Makkah Metro (Adasah and Hamed, 2010). The metro is intended to connect the Holy Mosque and other sacred places which pilgrims have to visit during their Hajj journey. Costing more than US \$1.5 billion, the metro will work on full capacity during Hajj season 2011. It is projected to decrease the traffic jams that occur every year when pilgrims move between sacred site on cars and buses. It will

also reinforce the one-way system already in use for pedestrians. Although the project started in February 2009, it will only operate on 35% capacity for Hajj season 2010. Constraints in time between Hajj seasons have hindered its timely completion, even though the 5,000 workers are said to have taken shifts to work 24 hours a day, seven days a week. Once fully operational, the metro is expected to transport 72,000 pilgrims per hour (Adasah and Hamed, 2010).

5. As a result of previous infectious outbreaks, the Saudi Ministry of Health has understandably been vigilant about health measures and safety before, during and after Ramadan and Hajj seasons. It has issued preventative measures and recommendations for mass gathering-associated health risks. General measures before the mass gathering include routine physical examinations, and advice to the worshippers to carry a thermometer, a 3-day course of ciprofloxacin, and loperamide, as well as getting tested for tuberculosis. Furthermore, specific health measures (i.e. screening and vaccination) for yellow fever, meningitis W135 and poliomyelitis also apply for people coming from areas of higher risk. During mass gatherings, worshippers are advised to continue using their usual medications, maintain hand hygiene, increase dietary salt intake, perform rituals at night if possible, seek shade, apply sunscreen, maintain adequate hydration, use facemasks and initiate self-treatment if needed. After the mass gathering is over, health measures should include medical follow-up, seeking early medical help if ill, as well as testing for tuberculosis for possible exposure.
6. With the increasing numbers of worshippers coming to perform Hajj every year, there has been an anticipated increase in difficulty in case a medical evacuation is needed. This led to the recent introduction of a new system of aero-medical helicopters. The Saudi Red Crescent Society has just implemented this program, and currently possesses four helicopters. The goal is to reach a total of 25 helicopters to cover the whole of the country, and to facilitate better and faster acute care during busier periods, such as Hajj.





The Flying Ambulance (source: personal communication)

7. After the 9/11 attacks in the US and terrorist attacks in Saudi, the rate of visiting skilled workers and experts, especially from “Western” countries, has dramatically decreased. Compounded with the high rate of unemployment in the country, this left many developmental projects on paper. As a result, there has been a recent movement in the country to send its students on scholarships for tertiary education. This strategic plan not only aims to increase opportunities for students beyond secondary schooling, but also to invest in those students to bring back experience and skills from outside. This way Saudi Arabia would use its own skilled workers and experts instead.
8. There has also been a move to “Saudiize” available jobs and to recruit more citizens into the workforce (Maben et al., 2010). This has decreased the need to employ expatriates and their subsequent needs, such as accommodating for language differences. With that in place, however, there has been a move to increase the use of English language in all official electronic and published materials in an effort to keep the wider community informed.

Challenges and Future Opportunities

Emergency management in Saudi Arabia has advanced a long way compared to some of its neighboring countries. Unfortunately, however, it is still struggling to proactively manage current risks and vulnerabilities, let alone preparing for potential future disasters. Such potential disasters include effects of climate change and political instability in the region. Since we still have the time to prepare for such emergencies, it might be wise to invest the time and money to do so. Otherwise, we would have learned

nothing from history, and the cost of this is nothing less than more lost lives and wasted resources.

MVCs are still on the rise, both in Saudi Arabia and worldwide. With the new introduction of the *Saher* system, it is hoped that it will slow down the alarming rate at which fatalities and damages currently occur. However, nothing comes without downsides. For example, some people have been complaining that speed limits have not been set in all streets covered by *Saher* cameras. This leaves the driver puzzled as to whether it is a 60 km/hour area or a 40 km/hour area. Other concerns have been that the *Saher* system only covers certain vehicles (e.g. cars and trucks), but not motorbikes, limiting some of its potentials. However, the project is still young and more developments are likely to occur in the near future if it proves to be beneficial and cost-effective.

Management of religious mass gatherings (i.e. Ramadan and Hajj) has substantially improved compared to the situation as little as 10 years ago. Recent developments, such as Makkah metro and the flying ambulance, are projected to help and ease the trip of Hajj to the millions of pilgrims every year. On the other hand, significant improvements still need to take place before such facilities can be safely used on such a large scale. For example, helicopter bases, where patients can be received and flown, have not been established yet. This can prove difficult, especially with the already limited space available around the crowded sacred sites. Some critics have argued that the establishment of a metro that runs for only five days per year is a waste of money and resources. They have suggested that the project should be expanded to serve during other busier times, such as Ramadan, and serve potentially larger areas, such as between Makkah and Medina.

As far as managing natural disasters is concerned (especially floods), there has been frustratingly very little done. This might be because natural disasters are still viewed as rare and “low-impact” types of emergency. Also, trying to establish drainage systems in an already heavily-populated city, such as Jiddah, has proven difficult. Many roads will have to be closed down for extended periods; there is also little coordination between different parties providing infrastructural services, such as power cables, telephone cables and draining pipes. All of these factors have contributed to the delay in finding a solution to such a significant threat. However, Jiddah 2009 floods have shocked policy-makers and encouraged them to initiate new developmental projects and to hasten already existing ones. All of this is in the hopes of finding a practical solution to prevent similar tragedies in the future.

Finally, illiteracy and the subsequent lack of professional and skilled national workforce have taken their toll on the country. With under 50% of the current workforce being Saudi, it is estimated that as much as US\$60 billion are sent out of the country as remittances by foreign workers (Maben et al., 2010). Not only has this been draining the country’s money and resources, but it has also increased dependence on such immigrant workers in a country whose more than 30% of its youth is unemployed! This, unfortunately, has not been limited to professional and skilled jobs only, but also includes other more laborious jobs. Occupations such as plumbing, carpentry and nursing are perceived by many to be demeaning or degrading for Saudis. This perception might have arisen from the fact that this class of society has long been mistreated and underpaid. However, this has recently been changing as more and more people are struggling to find

“clean” jobs to support their families. It is hoped that the increase in the Saudi workforce will strengthen the country’s economy and keep the money within the country where it can be directed into such projects as better education, infrastructure, and disaster management plans.

Conclusion

In conclusion, this chapter has shed some light on the current hazards and vulnerabilities in Saudi Arabia. A list of almost all major disasters recorded to date has been provided, and the chapter also described how policy-makers and emergency planners have reacted when they occurred. Even though not much progress has been done in terms of natural disasters (namely floods), the Jiddah 2009 flood has certainly served as a wake-up call, and the pace on emergency management has started to pick up.

Saudi Arabia is often highly looked upon in the region. This, among other factors, ought to encourage policy-makers and planners to intensify their efforts to make the Saudi emergence management program a model to be followed by other countries in the region. It is hoped that this chapter will serve as a first step in the path of documenting current policies and provide a rich resource to build up upon.

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