

## **SESSION 5: Accidents Emergency Management and Cases Analysis**

### **议程五：突发灾害事件应急管理与 处置案例分析**

## 在 EOC 设计的新理念： 印度拉贾斯坦状态为例

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**【摘要】**拉贾斯坦是印度最大的州，77%的人口生活在农村。从家到社会，已定的经济落后种姓和部落的人口占 30%，并是印度文盲率最高的州之一。国家很容易受到洪水泛滥和地震。

在紧急情况下，响应组织通常集中在应急行动中心（EOC），协调救灾，恢复，信息共享和资源。截至 2007 年，已经有 33 个地区中 31 个非永久性应急行动基地，作者被委托设计他们。为了使财政困难的收税员（管理者）便利，一个概念说明被送给征求意见他们。实地考察选定地区，并重点考察。

在任何灾难中，最穷的穷人，妇女，儿童和老人谁是最脆弱的。一个应急行动中心的设计是为那些最能遭受灾难的人民服务。它应该是可能的，甚至在文盲的公民中进行沟通。该应急行动中心已从市民的角度被用户看好。

区应急指挥中心被设计成多种用途，包括行动，训练和会议。建议的设备优先获取清单。人员编制模式和具体的培训方案建议。在这些建议的基础上，EOC 已经在拉贾斯坦邦的所有 313 地区成立。

本文的目的是同与会者分享：

- 设计在一个发展中国家 EOC 的经验，
- 当设计一个 EOC，管理理论，实践，战略和结构设计需要遵守，
- 资源限制下满足目标的优化方法。

**【关键词】**应急行动中心（平）；应急行动中心设计；拉贾斯坦邦；区；收税员

## A NEW PHILOSOPHY IN EOC DESIGN: THE CASE OF RAJASTHAN STATE IN INDIA

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### Keywords

Emergency Operations Center (EOC), EOC Design, Rajasthan state, District, District Collector

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## Abstract

Rajasthan is the largest state in India with 77% of its population living in rural areas. It has been home to socio-economically backward scheduled caste and scheduled tribes constituting 30% of the population and has one of the lowest literacy rates in India. The state is vulnerable to floods, recurrent draughts, and earthquakes.

Responding organizations typically converge at an Emergency Operations Center (EOC) during an emergency to coordinate response, recovery, information sharing, and resources. As of 2007, there were no permanent EOC's in 31 of the 33 districts of Rajasthan and the author was commissioned to design them. To facilitate the involvement of District Collectors (administrators) in this process, a concept note was sent to them asking for suggestions. Site visits to selected districts were made and focus groups were conducted.

In any disaster it is the poorest of the poor, women, children and elderly who are the most vulnerable. The design of an EOC is to serve the people who are likely to be worst hit. It should be possible even for the illiterate citizens to communicate with the officials manning the EOC. The EOC has to be user friendly from the perspective of the citizens.

The District EOC was designed to serve a number of uses, including operation, training, and meetings. A list of priority equipment to be acquired was suggested. The staffing pattern and specific training programs were suggested. On the basis of the recommendations, EOCs have been set up in 3 districts of Rajasthan state.

The objectives of this paper are to share with the participants

- The experiences of designing EOCs in a developing country,
- The management theories, practices, strategies, and structure to be adhered while designing an EOC, and
- The methods of optimization for meeting objectives under resource constraints.

## Introduction

Under the British Raj, the Indian Famine Commission in 1878 pioneered the famine relief management system. In recent times internationally, and particularly in India, there is paradigm shift from post-disaster relief to pre-disaster prevention, preparedness and mitigation. Therefore, the State Government of Rajasthan in India appointed the author as a consultant to design Emergency Operations Centers (EOC) at the district level. This is a best practice paper, aimed at sharing the experiences and hoping that it will benefit other countries and states within the countries that are planning to establish EOCs.

The paper starts with the genesis of the idea of having district EOCs, and then goes to situation analysis, sources of information, thesis, EOC design philosophy in Rajasthan, methods / process, the Incident Command System, Emergency Support Functions, findings, application, limitations, discussion, and ends with conclusion.

## Genesis

In India, the National Disaster Management Authority (NDMA) was set up under the Disaster Management Act of 2005. As the apex body for disaster management, it is headed by the Prime Minister and has the responsibility for laying down policies, plans and guidelines for disaster management. The National Institute of Disaster Management (NIDM) was created to facilitate capacity building, training community stakeholders, conduct research, documentation, and a national repository of information. The NIDM, in partnership with other research institutions works within the framework of broad policies and guidelines laid down by the NDMA (Ministry of Home Affairs n.d.) The different states have separate disaster management institutes or disaster management centers within the state administrative training institutes for government employees.

There is a Calamity Relief Fund (CRF) for meeting the expenditure for providing immediate relief to the victims of natural disasters. The Government of India contributes 75% of the yearly allocation, and the

balance is met by the respective state governments. “A total of Rs. 11,007.59 Crore (nearly \$ 2.2 billion) was provided for the Calamity Relief fund from 2000-05” (National Disaster Management Division 2004, 72). It is not known how much was provided for pre-disaster prevention, preparedness, and mitigation; but it would be miniscule, compared to post-disaster relief.

In 2004 Government of India increased its assistance to Rs. 1.5 million (about \$ 30,000) from Rs. 1.0 million (about \$ 20,000) for the four disaster management faculty in each state (Ministry of Home Affairs 2004). At the Center for Disaster Management (CDM), HCM Rajasthan State Institute of Public Administration (HCM RIPA), Jaipur; three faculty positions were vacant. In 2006, I unsuccessfully, approached the Principal Secretary, Disaster Management and Relief Department, Government of Rajasthan offering my services as a disaster management faculty member for which Government of India was willing to pay.

The Disaster Management Act of 2005 mandated setting up EOCs at various levels and the Government of India was persuading the state governments to set up the EOCs expeditiously. When the Government of India changed the norms allowing for procurement of essential search, rescue and evacuation equipments including communication equipments subject to a ceiling of 10% from the CRF allocation of the year (National Disaster Management Division 2003) the Government of Rajasthan seized the opportunity to establish the district level EOCs and appointed the author as a consultant in 2007. The brief given to me was to prepare an actionable / implementable report on EOC design and set-up

## Situation Analysis

The State of Rajasthan is the largest in India in terms of geographical area (342,239 sq km) among 35 states and federally administered union territories of India. Rajasthan is divided into 33 administrative districts. Seventy-seven percent of the population (57 million in 2001) of Rajasthan live in rural areas. The population density is 165 persons per sq. km, compared to 324 per sq. km. for India. Historically, socio-economically backward *scheduled caste and scheduled tribe*<sup>3</sup> communities constitute 30% of the population. Rajasthan has one of the lowest literacy rates in India (overall 61%, of which 76 % for male and 44% for female - 2001 census). Rajasthan is vulnerable to floods, recurrent draught, and earthquakes. During the last 60 years there have been only 6 years when some or the other part of the state did not suffer from a drought. The Collector and District Magistrate (popularly called Collector or District Collector) is the administrative head of a district. The District Collector is responsible for disaster management within the district. However, below him there was no government official who was employed fulltime for disaster management and there were no functioning permanent EOCs in the 33 districts of Rajasthan, except in Jaipur and Hanumangarh districts. Temporary district EOCs were set-up duration monsoon season for flood control by temporarily transferring people from Public Works Department, Irrigation, and other departments.

## Sources of information

Kendra and Wachtendorf (2003, 52) studied reconstruction of the New York City's EOC after 9/11, and came to the conclusion that training and preparation are fundamental for a resilient organization. However, “creative thinking, flexibility, and ability to improvise in newly emergent situations are vital”. The pre-existing relationships helped in meeting the communication challenges.

EOCs have been in existence in the USA since the 1970s as focal points for disaster response. According to Quarentelli (1979) the six functions that an EOC performs are coordination, policymaking, operations management, information gathering, public information, and hosting visitors. Neal (2003) reviewed literature on EOCs, and concluded that, “little systematic or empirical information is available to guide their effective design...a systematic analysis is needed to determine how to design and configure effective EOCs” (p 35). He continued by saying that we need objective data to improve EOC design and effectiveness. “At this time we do not know what does work and does not” (p 38). Comparing the American and Canadian experience

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<sup>3</sup> Schedule Cast and Scheduled Tribes are specifically designated different communities by the Government of India on the request of the State Government. Those classified under these categories have special privileges and reservations in education, government appointments and promotion as an affirmative action.

about the role of EOCs in emergency management, Scanlon (1994) confirmed that the Canadian experience coincided with the American regarding the problems faced by the EOCs. These problems included EOCs in the disaster impact area being forced to relocate, and in many instances it is not being clear who was managing the EOC (Quarantelli 1978). Scanlon examined 19 incidents in Canada, and concluded that the need for an EOC was being increasingly accepted in Canada.

Review of disaster literature led to an understanding that an EOC is a pre-designated facility established in a community for centralized direction and coordination to the overall response and to support the administration during an emergency. Responding organizations converge at the EOC during an emergency to coordinate response, recovery, information, and resources. EOC is “a function, a place, and a structure” (Perry 1991, 204). The EOC optimizes communications and coordinates efficient resource allocation and information presentation. The EOC also helps in executive decision making for disaster management in all the four phases of response, recovery, preparedness, and mitigation. The EOC needs to have an inbuilt capacity of scaling up according to the requirements in case of activation.

## Thesis

The use of EOCs in smaller jurisdictions remains sporadic, sometimes improvisational and poorly understood (Wenger et al. 1989). Perry (2003, 151) noted that, “EOC standards and use are challenges in the United Kingdom (Alexander 2003), Europe (Triglia 1996), and Australia (Emergency Management Australia 1996).” According to Perry emergency managers do not understand the functions and structure of an EOC.

There is hardly any literature systematically describing the creation and design of EOCs in a developing country. This paper aims to fill this gap in literature by describing the process by which district level EOCs were designed and created in Rajasthan to meet the goals stated in the design philosophy.

## EOC Design Philosophy in Rajasthan

In any disaster it is the poorest of the poor who die. Women, children and elderly are the worst sufferers. The overriding principle for the design of an EOC for a district in Rajasthan is to serve the vulnerable populations who are likely to be worst sufferers in any disaster. It is intended that the EOC would serve even the illiterate women in the veil or a child. This is contrary to what Quarantelli (1979) meant by hosting visitors. Quarantelli was referring to hosting politicians and VIPs. Our philosophy was that vulnerable communities need to be involved in the decision making process. The existing systems and procedures should not be a hindrance in the effective and efficient user-friendly operation of EOCs that is to say that an EOC exists for the people, and not for the officials. Therefore, the design of the EOC is focused on its functionality from a citizen’s perspective. Again this philosophy is different from the normally perceived Western concept of secure EOCs designed for officials alone, where the public have no access or role to play

## Methods / Process

A *concept note* on EOC was prepared by the author, and was sent to the District Collectors by the Principal Secretary, Disaster Management and Relief Department. To get the *involvement* of Collectors, a questionnaire was attached to the concept note, asking for the existing facilities and practices, and their suggestions in terms of equipment, staffing, and training needs. Twelve of the 33 districts returned usable responses.

The EOC designer conducted field visit to 11 districts for understanding the situation on the ground. Informational group interviews were held with Collectors and disaster management related staff. With the help of the Collectors in five districts, focus groups were held with memberships including from the district officials, nonprofit organizations, Red Cross, Scouts, National Cadet Corps, Civil Defence personnel, and others involved in disaster management in the districts. Consultant met Divisional Commissioner (Bikaner), one of the seven Divisional Commissioners of Rajasthan.

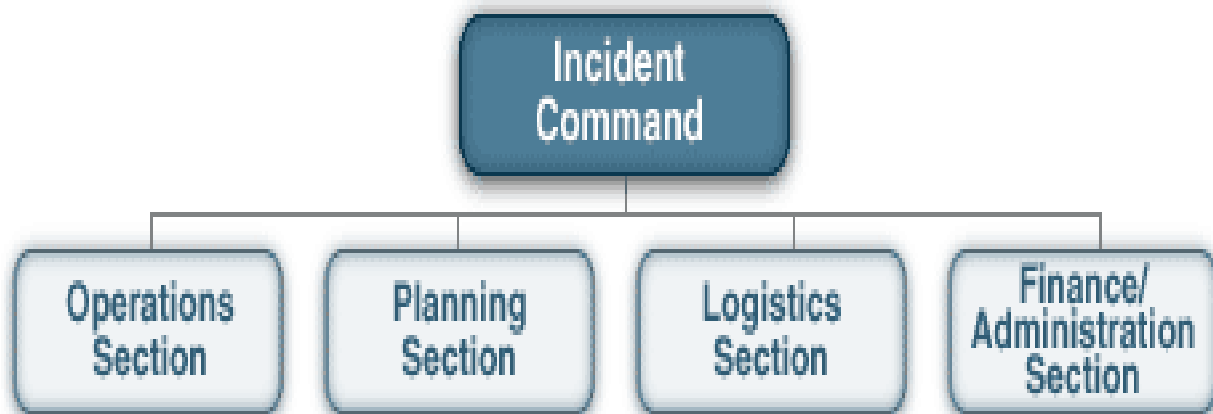
The Consultant interacted with the Civil Defense Volunteers who were undergoing the initial training. Discussions were also held with the Dy. Controller, Civil Defense, Jaipur; Civil Defense and Home Guard

Instructors, and in charge of Civil Defense and / or Home Guard in the districts visited. The Consultant attended video conferences and had discussions with the officials of the National Informatics Center (NIC)<sup>4</sup> in Rajasthan. Meetings were also held with the Director and officials of the IT & Communication Department of Govt. of Rajasthan.

The research methodology was qualitative in nature using primary and secondary data, document analysis of the relevant official files, survey questionnaires, face-to-face interviews, focus groups, field observations, field research, case study, and Internet research.

### The Incident Command System (ICS)

According to IS-100 Introduction to Incident Command System course of the Federal Emergency Management Authority (FEMA), “an incident is an occurrence, either caused by humans or a natural phenomenon, that requires response actions to prevent or minimize loss of life or damage to property and/or the environment” (Emergency Management Institute 2007). The ICS, is a standardized, on-scene, all-hazard incident management concept. ICS allows its users to adopt an integrated organizational structure. It can grow or shrink to meet different needs. There are four major management functions, apart from the integrating incident command function that is the foundation upon which the ICS organization develops.



Source: Independent Study Course IS-100 Introduction to Incident Command System, Emergency Management Institute, Emmitsberg

The functions of an EOC and Incident Command Post complement each other. Therefore, an EOC needs to have facilities for Incident Commander, four Section Chiefs and additional persons to perform their duties. Unlike in USA, where the first senior person who is in EOC takes over the role of the Incident Commander, in India, the District Collector is the Incident Commander as mandated by the Disaster Management Act of 2005.

### Emergency Support Functions (ESF)

The Emergency Support Functions (ESF) have been conceptualized as an integral part to carry out response activities. The High Powered Committee on Disaster Management in its report submitted to Government of India in 2001 came out with fourteen ESF in the National Disaster Response Plan (Ministry of Home Affairs 2001). These were:

ESF No. 1 – Communication

ESF No. 2 - Public Health and Sanitation

ESF No. 3 – Power

<sup>4</sup> National Informatics Center (NIC) is the premiere Science & Technology institution of the Government of India, for providing e-Government / e- Governance Solutions adopting best practices, integrated services and global solutions in Government Sector.

ESF No. 4 – Transport  
ESF No. 5 - Search and Rescue  
ESF No. 6 – Donation  
ESF No. 7 - Public Works and Engineering  
ESF No. 8 - Information and Planning  
ESF No. 9 - Relief Supplies  
ESF No. 10 - Food  
ESF No. 11 - Drinking Water  
ESF No. 12 - Shelter  
ESF No. 13 - Media  
ESF No. 14 - Helplines

The EOC needs to have equipments, facilities, and resources for each of the above ESFs.

### **Findings**

In 1991, Barmer district of Rajasthan had the lowest female literacy rate of 7.7% among the 612 districts of India. As per 1991 census the literacy rate for Scheduled Caste females in Rajasthan was 8.31% and for Scheduled Tribe females it was extremely low 4.4%. For Scheduled Tribe females in Jalore district of Rajasthan it was a dismal 0.55%. I could not find the relevant 2001 census data.

The Government of India has designated telephone number 1077 for emergency call to the district EOCs in India. The research revealed that the district emergency call number 1077 was not known to most of the district level disaster related officers, let alone the citizens. This number was not serving the purpose for which it was intended. There was no one to take calls at this number during non-office hours in most of the districts and even during the office hours there were no trained personnel to take the calls and deal with the seriousness this number deserved. Public warning sirens were generally not working even in activated Civil Defense notified towns, including at the office of the Collector of the state capital Jaipur. The government notified certain towns under the Civil Defense Act and there were norms for having Civil Defense Instructors, Wardens, and volunteers.

### **Application**

Based on results from the research, a consultancy report was presented to the Government of Rajasthan. The main recommendations are given below:

#### I. The Role of the District EOC

1. The District EOC will play a key role in district disaster planning, response, and recovery.
2. The District EOC shall pull together people and resources to handle emergencies that are outside the ability of single department to handle.
3. The District EOC is the key to managing the district's disaster efforts through the centralized, coordinated efforts of government officials, response agencies, and community volunteers by establishing priorities.
4. The District EOC will provide a means of centralizing and managing communications and information within the EOC, between the EOC and the Incident Commander in the field, and between the EOC and the public. The EOC provides ready access to all available information and simplifies information verification, evaluation and display.
5. The EOC will have the resources and trained personnel to handle not only sudden catastrophe but also creeping disasters, like draught. It helps in resource acquisition, re-allocation, and management. The EOC also provides staff continuity and facilitates staff changes.
6. Regular training and exercises will be conducted by the District EOC.

7. Documentation management will safeguard documents generated or received by the EOC for use after an emergency.
8. The Alternate EOC, backup power, and communications equipment will ensure continued operations in even the worst conditions (If the main District EOC becomes dysfunctional or inaccessible, it would be possible to perform the emergency operations from the Alternative EOC).

## II. Equipment Recommended for EOC

In case of activation of the EOC, the Incident Commander needs to come to the EOC. The ESF coordinators also need to come to the EOC for proper response. Special emphasis needs to be given to communication and database equipments. The EOC should have a radio system, a media interface emergency broadcast system, a mobile communication van & mobile command center to which essential function can be transferred immediately in an emergency, if necessary. In case of a catastrophic incident, helicopter surveillance facility should be available. There has to be a seamless, robustness and inbuilt redundancy in the equipments so that in case of failure of one equipment or system another equipment and system could take over and increase the reliability. A public emergency call system was recommended. The EOC should have facilities to telecast / broadcast warnings to the public without the intervention of the public or private controlled TV Channels or radio stations. All district EOCs should be equipped to trigger public warning sirens. Runners, traditional drum beaters (*Suno, suno, suno...*)<sup>5</sup>, vehicle mounted public address system, and public address systems used for *namaz* by the mosques may also be used for warning.

Ironic in a high-tech communications age, in a disaster, internationally the most reliable and helpful communication system has proved to be the amateur radio communications. With the Automatic Position Reporting System (APRS), HAMs exchange their longitude, latitude, altitude, speed of movement, direction of movement, send data, and could see positions on the map. A fully equipped amateur radio station may be set up in each district EOC after sorting out legal problems.

The use of GIS and GPS with six vehicle tracking units is recommended for the state. The EOC may be equipped to make reverse emergency calls and send SMS messages on the cell phones in the district. The District Alternative EOC should have at the least basic minimum functionality for responding to disasters. The Alternative EOC for the Jaipur district and the state may be set up at the CDM, HCM RIPA; which could also be used for training. A list of equipment with priorities was suggested for procurement.

## III. Staffing Pattern for EOC

There was need for standard staffing patterns at all the 33 districts of Rajasthan. The Staffing pattern could be District Disaster Management Coordinator, IT & Communication Officer, and four Dispatchers for 24x7 Emergency Call Center. The EOC staff could be used for preparation and updating of district disaster management plans, creation of data bases, preparation of a history of incidents, training and related activities. The EOC is to be continuously used to be effective during disasters.

## IV. Training of EOC Personnel

The need for training cannot be over emphasized. During a disaster the Incident Commander does not generally know what the needs are (demands); where the resources (supplies) are; when and how the goods and services will arrive (logistics); and yet he has to take decisions. In a disaster every second counts and it is a matter of life and death. Disaster management requires one of the highest levels of professional competence.

To start off, there is a need for training the District Collectors. The design of a training program on emergency response, complete with duration, and contents of each session for District Collectors, and Additional District Magistrates was given in the report (Khanna and Gupta 2004). A list of fifty most recommended books for graduate students in emergency management and related fields by the disaster

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<sup>5</sup> Traditional drum beaters attracting the attention of citizenry used to go to around the town for making public announcements in India. They would shout *suno, suno, suno* in Hindi language, which means listen, listen, listen. Subsequently when people are gathered, they would make the public announcement.



researchers and emergency management faculty in USA was included in the consultant's report (Gupta 2005). Disaster management is every body's business and many a times it is the community action which works initially. Thus a proposal for training Community Disaster Response Teams was given.

### **Limitations**

I did not face any major challenges or limitations in conduct of the study. The officials at the State government, District Collectors, and others were very helpful. Only limitation and challenge appears to be lack of understanding and knowledge about the disaster management in general, and the functioning of EOC in particular. My findings confirm Perry's findings that emergency managers do not understand the functions and structure of an EOC (Perry 2003, 151). There is a ban on fresh recruitment of government employees in Rajasthan for many years. It would be interesting to find out how the government has tackled the suggestion of appointments of staff for the district EOCs. Transfer of employees would have been one of the options.

### **Discussion**

The EOC Design philosophy adopted for Rajasthan was totally different from the one normally used in developed countries. In the developed countries the EOC are generally designed as a converging ground for policy makers, first responders, media, non-profit organization officials etc. The EOCs are treated as secured places, where entry of the public is highly restricted. Our concept of EOC in Rajasthan was that EOC exists for the citizens, and their visits or calls are not a hindrance in the work of the EOC, but the very purpose of its existence.

The dismal low literacy rate in sections of the population has implications on the design of an EOC. It is a challenge on how to communicate disaster preparedness messages to them, and how they can access the EOC, when the culture does not allow females to go out of their homes, and mingle outside the community. As Wisner et al. (2004) say disasters occur because people live in unsafe conditions, due to dynamic pressure, which have root causes. To increase resiliency to disasters, the challenge is to remove the root causes, including illiteracy and poverty.

There are different wireless networks working in the public and private sector in Rajasthan, but there is no interoperability. In the government sector in India there is Police Wireless system called POLNET. Defence forces have their own wireless network. The Railways have their wireless system. Electricity Transmission companies have their own communication system known as Power Line Carrier Communication (PLCC). Some private companies are also allotted frequencies for commercial purpose by the Wireless Planning and Coordination wing of the Ministry of Communications & IT, Govt. of India. The Government has discretionary powers under various acts, rules, regulations and provisions that allow it to acquire and use even private wireless communication and transport facilities during disasters, if required. It is generally not known that there exists in the country an excellent PLCC communication system, which the electricity transmission engineers routinely use. In case the normal communication system fails, it may be possible for the EOC to relay outgoing communications using PLCC and receive incoming communications. However, I am not aware if PLCC has ever been explored for use in emergency communications during and after a disaster. There is a need for research on this topic.

As the 9/11 Commission in USA reported, interoperability is a serious concern in disasters. However, attempts are being made to solve this problem of interoperability of different government organizations, such as fire, and police; but excluding private licensed wireless networks. It is a matter of further research why different wireless communication facilities with government and private organizations are not used in response to disasters.

In the down town four square kilometre area of Jaipur, the capital of Rajasthan, around 7:15 PM in a span of 15 minutes on May 13, 2008 there were 8 bomb blasts. The bomb containing ammonium nitrate and ball bearings were left by terrorists in bags on the bicycles, resulting in the death of about 65 people. On October 29, 2009 there was explosion in the Indian Oil Corporation depot of Jaipur that raged for 11 days, killing 11 people, evacuating thousands, and keeping the city in smoke for the duration. The explosion was equivalent

to 20 tonnes of TNT, and created an earthquake of 4.2 on the Richter scale. The army was pressed into action for response (MSN 2010). It would be interesting to find out the role played by the Jaipur District EOC in these two incidents, and what could be done to improve the design.

## Conclusions

On the basis of the consultant's recommendations EOCs in 3 districts of Rajasthan were set up by procuring equipment by 2008, and two existing EOCs were upgraded. Unlike in USA, where the first senior person who is in EOC takes over the role of the Incident Commander, in India, the District Collector is the Incident Commander as mandated by the Disaster Management Act of 2005. A follow up research on the actual role played by the Jaipur district EOC during May 2008 bomb blasts, and October 2009 oil storage tanker explosion will help in understanding the effectiveness of the EOC, and improvement in design. A comparative study of setting up EOCs in other states of India, and even in other developing countries would also be of interest. The proper use of different communication facilities with governmental and private organizations during disaster response need to be researched. Another direction for future research is the use of PLCC in emergency response by EOC. A properly functioning EOC in disaster response is important to save lives, property, and environment during and after a disaster. This paper is expected to help in better understanding of issues involved in design of EOCs under resource constraints for the benefit of administrators, emergency / disaster managers, researchers, and students.

## References

- Alexander, D. A. (2003). Towards the Development of Standards in Emergency Management Training and Education. *Disaster Prevention and Management*. Vol. 12, Issue 2, pp 113-123, United Kingdom
- Emergency Management Australia. (1996). *Australian Emergency Manual*. Emergency Management Australia, Canberra
- Emergency Management Institute (2007), IS-100 Introduction to Incident Command System, I-100. Emergency Management Institute, Emmitsburg, USA. <http://training.fema.gov/EMIWeb/IS/is100.asp>. Last Accessed 30 May 2008.
- Gupta, Kailash. (2007). Design of Emergency Operations Center at District Level, Consultancy Report submitted to the Disaster Management and Relief Department, Government of Rajasthan, Jaipur, India. Unpublished
- Gupta, Kailash. (2005). Graduate Level: Body of Knowledge – 50 Most Recommended Books for Graduate Students in Emergency Management and Related Fields. Emergency Management Institute, Emmitsburg, USA. <http://www.training.fema.gov/EMIWeb/edm/readinglist.asp>. Last Accessed 30 May 2008.
- Kendra, James M. and Tricia Wachtendorf. (2003). Elements of Resilience after the World Trade Center Disaster: Reconstituting New York City's Emergency Operations Center. *Disasters*, Vol. 27, No. 1, pp 37-53. Malden, MA, USA
- Khanna, B. K. and Kailash Gupta. (2004). Training Program on Emergency Response submitted to National Institute of Disaster Management, Government of India, New Delhi, Unpublished
- Ministry of Home Affairs, Government of India. (n.d.). National Disaster Management Policy. <http://www.ndmindia.nic.in/> Last Accessed 12 February 2010
- Ministry of Home Affairs, Government of India. (2004). Revised Guidelines for Availing Central Assistance for Operation of a Faculty of Disaster Management in State Level Training Institutes. DO Letter No. 35/4/2004 NDM III dated the 7<sup>th</sup> December, 2004. Ministry of Home Affairs, New Delhi, India
- Ministry of Home Affairs, Government of India. (2001). High Power Committee on Disaster Management Report. Center for Disaster Management, Indian Institute of Public Administration, New Delhi, India

MSN News. 2010. Human Error Caused Jaipur IOC Terminal Fire, Probe Shows. Feb. 02.

<http://news.in.msn.com/business/article.aspx?cp-documentid=3598500> Last Accessed 14 February 2010

National Disaster Management Division, Ministry of Home Affairs, Government of India. (2004). Disaster Management in India: A Status Report. National Disaster Management Division, New Delhi, India

National Disaster Management Division, Ministry of Home Affairs, Government of India. (2003). The List of Items and Norms of Expenditure to be followed by the States for incurring expenditure from the Calamity Relief fund (CRF) and the National calamity contingency Fund (NCCF) for the period between 2000-2005-Revision thereof. DO Letter No. 32-3//2003- NDM I dated April 23, 2003. NDM Division, New Delhi, India

Neal, David M. (2003). Design Characteristics of Emergency Operating Centers: What We Know and Don't Know. *Journal of Emergency Management*, Vol. 1, No. 2, Summer 2003, Weston Medical Publishing, USA

Perry, Ronald W. (2003). Emergency Operations Centers in an Era of Terrorism: Policy and Management Functions

Perry, Ronald W. (1991). Managing Disaster Response Operations. In T. E. Drabak, and G. Hoetmer (Eds.) *Emergency Management Principles and Practice for Local Government*. International City Management Association, Washington, DC, USA

Quarantelli, E. L. (1979). Studies in Disaster Response and Planning Final Project Report No. 24. Disaster Research Center, Newark, Delaware, USA

Quarantelli, E. L. (1978). Uses and Problems of Local EOCs in Disasters. Disaster Research Center, Newark, Delaware, USA

Scanlon, Joseph. (1994). The Role of EOCs in Emergency Management: A Comparison of American and Canadian Experience. *International Journal of Mass Emergencies and Disasters*, vol. 12, No. 1, pp 51-75. Bryan, Texas, USA

Triligia, A. (1996). Training Policy and Civil Protection in Italy. *Stop Disasters*, Vol. 20, Issue 29, pp 20-31

Wenger, D., E. L. Quarantelli, and R. Dynes. (1989). *Disaster Analysis*. Disaster Research Center, Newark, Delaware, USA

Wisner, Ben, Piers Blaikie, Terry Cannon, and Ian Davis. (2004). *At Risk: Natural Hazards, People's Vulnerability and Disasters*. Second Edition. Routledge. London, United Kingdom

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Quick Response Research to Haiti; all funded by the National Science Foundation. Kailash has held senior management positions in public organizations, private companies, nonprofit organizations, and has also been an entrepreneur.

## 捷克共和国-迅速恢复供电的试点国家

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**【摘要】**对于民众来说，停电总是让人提心吊胆的。电力中断在几秒钟内就可以威胁到依靠电力生活的人们。没电，基本的生理需要和安全需要就没法得到满足。在用电上供求的失衡如果不马上解决的话，电力供应不上，停电就会发生。这种情况通常情况下可能会持续几天甚至几星期。现在的供电分配系统基本上处于被动状态，因为没有和输电网连接，就不能把本地的电源供应上去。电力调度人员是可以解除影响所有地区的长时间停电的风险的。万一输电系统故障，调度员需提供本地可提供的电源。电网的孤岛抑控和防火墙在电脑系统中的作用很相似。推荐这个方案是因为它包含了新能源政策。几乎所有的大城市都具有强大的用电分配系统，在发生全国性停电的时候有能力转变孤岛程序。通过主要架构优化，研究也解决了危机用电需求管理。文章将介绍孤岛电力分配案例。

**【关键词】**能源；电力；停电；孤岛控制；危机基础设施建设；风险管理；危机管理；人身安全；可迅速恢复电力；智能电网

## CZECH REPUBLIC – PILOT COUNTRY IN THE RESILIENT POWER

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### Keywords

Energy, power, black-out, grey-out, island operation, critical infrastructure, risk management, crisis management, human safety, resilient power, smart grids.

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## Abstract

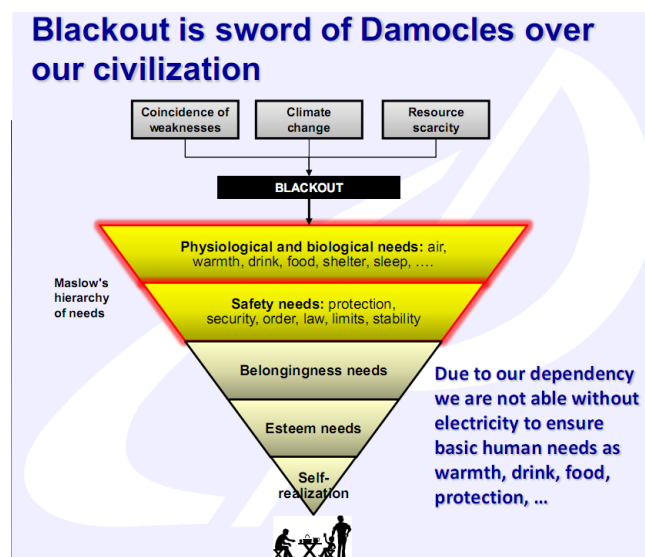
Blackout is a "Sword of Damocles" of our civilization. Due to dependence on electricity the society could be threatened within a few seconds. Basic physiological needs and safety needs would not be possible to satisfy without electricity. If the imbalance of production and consumption in the electricity supply is not immediately removed, the power system breaks down in a few seconds and results into blackout. This situation may then last for days or weeks. The current public distribution networks are passive and they are not able to provide electricity supply from local sources without connection to the transmission grid. Power distributors can remove the unacceptable risk of long-term blackout affecting all regions. The power distributors should be able to provide islanding with utilization of local generation in case the transmission system breaks down (i.e. the system failure). Island operation of electrical networks has a similar function as a firewall in computer networks. Recommendation based on this research was included into new energy policy. All bigger cities should have resilient distribution system with ability to switch into island operation during national blackout. Research solves also crisis demand side management according to prioritization of critical infrastructure. Paper will present the case study of power distribution resilience based on islanding supported by black start.

## Introduction

Energy flows and exchanges determines the life of all living organisms on the Earth. The same mechanism can be seen at such a super-organisms as is the human society and civilization. Any human activity cannot stand without energy and its transformation. From the point of view of a basic biophysics and thermodynamics the wealth of a specific society is primarily determined by size and effectiveness of its energy transformations.

Without energy there is not possible to secure neither some basic physiological human needs nor the need of being safe. Access to the energy in its various forms creates a basic condition for the "life" of any society. That's why governments of various countries pay so high attention to the energy availability.

The strategic planning of resources goes together with ensuring of their availability in the time and at the place they are required. The "smartest" kind of energy – electric power – can be very quickly distributed and switched over to any place where the power line is installed and can be transformed easily to any other kind of energy. But electrical power has one unpleasant feature: cannot be stored and the consumption and production must be balanced all the time. All the networks and switches are capable to redirect the energy in seconds, but when such a permanently running super-system breaks, it means that (also in seconds) millions of people and all the key businesses may be out of energy for a long time – plunge into black-out.



There are various strategies how to avoid such a collapses, from the simple and expensive ones ... having a surplus of energy, which might be available in critical moments, up to the smart ones, which try to utilize the most from the existing resources and networks.

One of methods available – the support of islanded operation of electrical network, together with the demand-side smart management is going to be tested in the Czech Republic, based on the research project RESPO (Resilient Power), which was financed by the Czech government.

### Energy strategy

There is an updated energy concept of the Czech Republic and the ability to assure the necessary energy supply is one of the six strategic priorities.

External conditions analysis emphasized the global competition for the primary energy resources, which is raised by the increasing demand of developing countries. That means the commodity markets will be influenced by international politics and diplomacy towards the producing countries and their alliances.

The analysis shows the threat to Europe in lack of own non-recoverable resources and also the possible vulnerability due to the fact, that the pure market models of energy supply are not able properly acknowledge the reliability and energy security. The rising pressure to the climate protection and utilization of renewable energy resources will invoke the change in the distribution networks structure across Europe. There is expected the need of building international trans-Europe power grids.

The Czech Republic, being in the middle of Europe, plays an important role in this development as a power transit country. The key innovation in the concept is the priority to **Increase the energetic security and resilience of the Czech Republic to assure the necessary supply of energy in cases of failures cumulation, multiple attacks to critical infrastructure and long-term crisis in the fuel supplies.**

This priority results from the previous research and asks for the multiple-fuel systems and ability to operate in emergency in the form of island operation, supported by the resources capable to start from the dark.

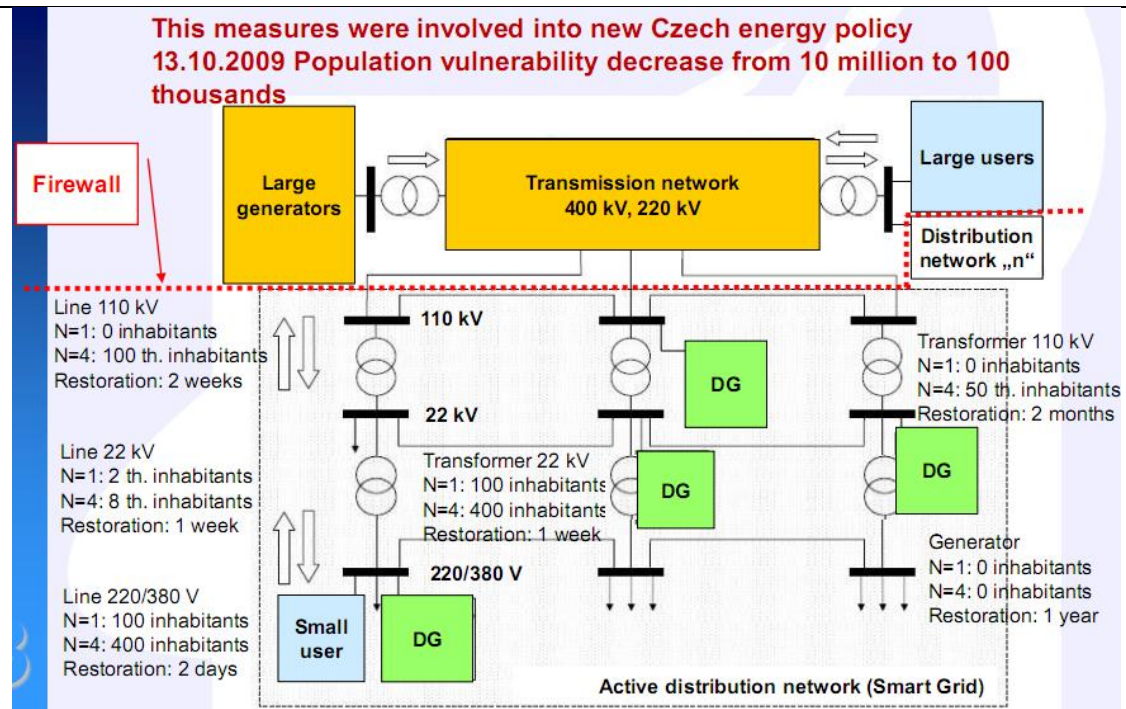
Some of the conclusions envision the introduction of smart networks, which will start by gradual change of power-meters to intelligent measuring systems and their incorporation to the control systems.

Important is also the need to assure the preparedness for the emergency operation of the country economy, which must secure the basic needs of the citizens and thus support the operation of key parts of the critical infrastructure in the declared crisis situation. It is clear, that after the state of crisis has been declared, the supply priorities change and the infrastructure has to adapt to this situation in order to avoid black-out.

The main intentions to the future can be described as

- Increase the ratio of multi-fuel sources capable quickly change the fuel in case of deficiency
- Build the control systems and interconnections capable to handle the island operation in all agglomerations above 50 thousands of citizens
- Assure the implementation intelligent networks and decentralized control for remote control of all sources above 1 MW and substantial part of consumption
- Implement effective tools for preventing the propagation of failures and for controlled transition to the island operation and the possibility to start from the dark for those islands.
- Update regional energy policies to reflect the necessary energy supply in the crisis situations.





Active distribution networks (Smart grids) allow assuring the flexible distribution network islanding and black start ability.

So there is a possibility to pilot-test the results of the RESPO projects in favor of the future implementation and synergy of all the above mentioned measures.

## RESPO

The idea is simple – when the “large super-system” breaks, there still might be parts of it (islands) which are capable to keep up with the balanced demand/production need and thus preserve the acceptable living conditions until the normal state is restored.

From the global perspective, we may think about changing the status of “black-out” to the status of “gray-out”, when the energy flow is minimized to the level allowed by the resources available. The “big structure” breaks to the set of smaller islands, which might operate autonomously and have sufficient resources to “stay alive”.

We may take as an example a city, where are some heating plants and businesses with their own power resources capable to produce electrical energy from alternative supply (gas, petrol, coal).

In the current situation these resources can contribute to the distribution network, but only as another element of the main network - there are no means how to reconfigure the distribution network the way it creates independent island. It basically means to cut the city off the main distribution network and leave just the local distribution and also be capable to start the local resources from the dark (no network available) and synchronize them within the islanded network.

This is one important obstacle, which needs to be overcome. And it will take a lot of energy to persuade the distributor companies that such a feature might not only raise their costs, but also bring some additional business.

Another part of the game is the need to arrange the regulation of power consumption at the demand side. There are two essential groups which have to be taken care of:

1. Citizens



2. Subjects of critical infrastructure

**Citizens**

At the citizens' part the solution is in the change of the distribution policy. In case of emergency, the distributor will be able (instead of switch off the power) to set the power consumption to a limited level. It was identified by analysis that an average household can do with 2 Amperes current for the basic operation (fridges, heating control, light, and communication).

So when the smart power-meters will be installed, the distributor can remotely switch the households to the emergency level, without the material loss, keeping the people the basic living conditions.

**Critical infrastructure**

There are companies and organization at the territory of the island, which are critical to assure the basic functions. (Energy supply itself, communications, water and food supplies, health-care, emergency services, garbage collection ...).

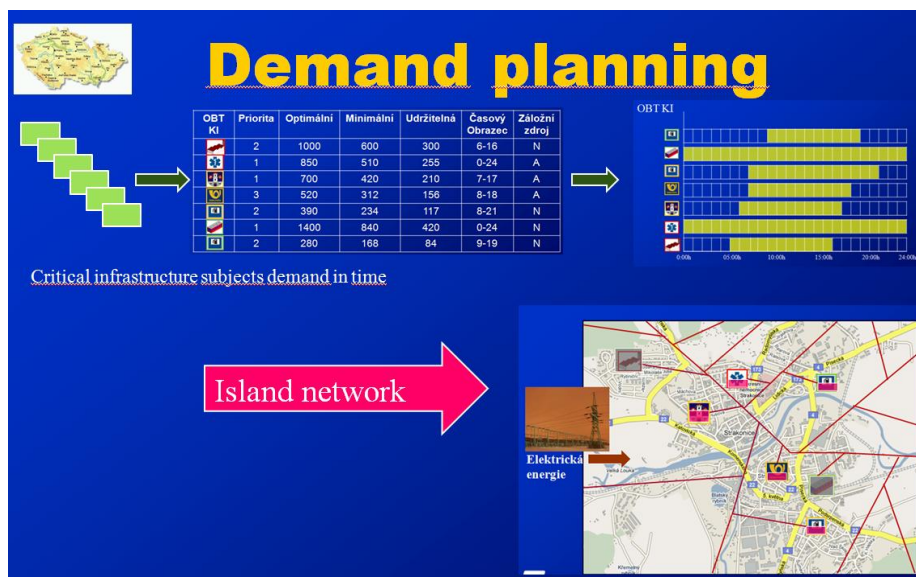
To keep those subjects "alive" means to assure the necessary supply in specific time. Due to the seasonal nature of power consumption, there is a possibility to prepare a time plan to keep the balance in the island.

The extended risk evaluation method was developed and supported by the software, which allows assessing the island region from the point of view of the time-dependent power consumption.

There are three basic situations of the subject, which mean different requirement to the electric power.

1. Normal operation (practically unlimited power consumption)
2. Minimal operation – the subject functionality maintained (this means minimal power needed to keep the functionality of the subject as an infrastructure element, for example the ability of the bakery to make bread, but with the consumption purely targeted to the baking)
3. Minimal operation – the subject functionality reduced or none, keeping the subject safe of damage (this means the minimal energy which avoids the permanent damage of the subject, but does not allow its production).

Within the analytical phase there is a collection of the time – related characteristics of all the subjects, then the summary of the needs in different categories is done and then there is a space for planning and negotiation. The people from the regional management, responsible for the operations in crisis, can plan for the balanced power distribution and consumption in the island.



The result of their work is a plan for the Time T, how to reconfigure and put into operation the islanded structure.

## **Time T**

Let's suppose there is a nationwide failure of the energy supply, the backbone network shuts off and there is a black-out under normal conditions.

What happens in the city, which was prepared to the islanded operation?

1. The city is disconnected from the backbone network.
2. The local sources are started on from the dark
3. The critical infrastructure subjects are connected by planned priorities and by a time diagram prepared upfront.
4. The households are remotely switched to emergency consumption and connected to the power
5. All the time there is a control of balanced consumption with a possibility of connect or disconnect the excessive demand.
6. After the black-out is over, the island is dismantled and the normal power grid connection established.

The description here is extremely simplified. There are many technical, business and other problems on the way, but in principle the situation might work like that.

## **Strakonice**

Strakonice is a city at South of the Czech Republic. The local heating plant has a capability to fully saturate the island by electric power.

So as the result of the RESPO project the exercise has been planned to simulate the black-out and island operation. The critical infrastructure subjects were visited and their daily power needs diagrams were collected. The consolidated diagrams were assessed from the point of view of the respective crisis situation and island operation and the switching plan was prepared.

The heating plant has a capability to start from the dark and is equipped with all the necessary control systems for the island operation.

The exercise will be held without physical switching of the network, so it will not hit the public, but all the necessary mechanisms will be tested to enable the further research and development of the tools capable to introduce a real pilot site for the island operation in the Czech Republic.

## **Conclusion**

The results of various analyses shown that (not only in the Czech Republic) the black-out might become a reality and that it might be caused by several reasons. Even that the current high-voltage network is reliable, it may break due to for example excessive demand for transfer of wind-generated power from one part of Europe to another or due to a hostile attack.

The concept of "Islands of life" comes out of the threats and risks assessment. It decreases the vulnerability of citizens by decreasing the impact of the long-term break of the transmission network. The distribution network is from the global point of view safer, because its failure has only regional impact. The solution in RESPO project is based on the fact that the island-type of operation existed already 100 years ago, when there was no global transmission system. (The negative of this situation was that the quality of the power supply was poor).

The utilization of local sources together with upgrade of current equipment and distribution networks may help to progressively decrease the impact of possible national black-out.

The exercise in the city of Strakonice will help to establish a pilot site for the island operation and to increase the resiliency of the power supply to the territory.

## References

- Brown, C.F.E. 2007. *Powering the city planning for the future* Vancouver, University of British Columbia.
- European Commission, B. & Directorate Energy 2002. *Protecting Europe Ensuring the security of energy and transport services across the European Union* Luxembourg, Office for Official Publications of the European Communities.
- Heinberg, R. 2009. *Blackout coal, climate and the last energy crisis* Gabriola Island, BC, New Society Publishers.
- Li, J. & Li, P. 2009. *Scenarios for crisis in European critical energy infrastructure* Grimstad, Forfatterne.
- Silver, S., Espallat, A., New York (State), Legislature, Assembly, New York (State), Legislature, Assembly, Standing Committee on Energy, New York (State), Legislature, Assembly, Committee on Corporations, A.a.C., New York (State), Legislature, Assembly, & Committee on Ways and Means 1999. *Public hearing, New York City power black-out of July 6 and July 7, 1999* Mineola, N.Y, EN-DE Reporting Services.
- Sullivant, J. 2007. *Strategies for protecting national critical infrastructure assets a focus on problem-solving* Hoboken, NJ, Wiley-Interscience.
- United States, Congress, House, Committee on Interstate and Foreign Commerce, & Subcommittee on Energy and Power 1978. *The New York City blackout of July 13, 1977 hearings before the on Energy and Power of the Committee on Interstate and Foreign Commerce, House of Representatives, Ninety-fifth Congress, first session ... October 13, 1977* Washington, U.S. Govt. Print. Off.
- United States, Congress, Senate, & Committee on Energy and Natural Resources 2004. *Blackout in the Northeast and Midwest hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundred Eighth Congress, second session, on the reliability of the nation's electricity grid, February 24, 2004* Washington, U.S. G.P.O.
- United States, Congress, House, & Committee on Energy and Commerce 2004. *Blackout 2003 how did it happen and why? : hearing before the Committee on Energy and Commerce, House of Representatives, One Hundred Eighth Congress, first session, September 3 and September 4, 2003* Washington, U.S. G.P.O.
- Welch, C. 2007. *Protecting critical energy infrastructure* Denver, Colo, National Conference of State Legislatures.

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## 孟加拉国更新灾害管理规程的建议

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Mehedi Ahmed Ansary

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**【摘要】**孟加拉国是世界上遭受自然灾害最多的国家之一。每年在孟加拉国自然灾害都造成巨大的经济损失和人员伤亡。完备的灾害管理计划是减灾和成功实施灾害响应的重要因素。基于这个目的孟加拉国粮食和灾害管理部在 1999 年出版了灾害管理规程 (SOD), SOD 的目的是让各个灾害管理层面的相关人员理解他们各自的责任和职责。按照 SOD 希望所有的政府部门、机构能够按各自的职责准备他们自己的行动计划。在现有的 SOD 中不同组织的角色有相应阶段层次的定位。当实际灾害发生时这些阶段有时并不被不同组织角色所理解。除此之外, 现有的 SOD 并不包含建筑结构和地球技术方面的应对策略, 而且也不包含地震方面议题。因此有必要对现有的 SOD 进行更新和调整以更好的实现灾害响应行动。本文中, 作者对灾害管理模型进行了讨论以最大限度的弥补现有 SOD 的不足。并基于这个目的对现有 SOD 和实际操作进行了讨论。以 2007 年 Sidr 飓风作为实际运作研究的个案进行研究。作者注意到现有 SOD 不同组织的不同行为归到 15 个不同的类别里, 并找到不同行动间的差距, 提出了缩小这些差距的方法。不同组织在震前、震中和震后的行动都被涵盖其中。作者认为这些提议将有助于加强灾害管理并提高孟加拉国的灾害管理操作的效率。

**【关键词】**灾害管理; 灾害阶段; 行动类别; 规程; 对策

## PROPOSAL FOR UPDATING THE STANDING ORDERS ON DISASTER MANAGEMENT, BANGLADESH

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## Abstract

Bangladesh is one of the most disaster prone countries in the world. Natural disasters have been causing huge economic and human losses every year in Bangladesh. Well prepared disaster management plan is an essential element to mitigate damage and to implement disaster response operations successfully. For this purpose the Ministry of Food and Disaster Management, Govt of Bangladesh have published the Standing Orders on Disaster Management (SOD) in 1999. The SOD has been prepared with the objective of making the concerned persons understand their duties and responsibilities regarding disaster management at all levels. According to SOD all Ministries, Divisions/Departments and Agencies is supposed to prepare their own action plans with respect to their responsibilities under SOD for efficient implementation. In the existing SOD, the roles of different organizations are described in different phases. These phases are sometimes not understandable with the role of different organizations when the actual situation occurs. Besides in the existing SOD, no structural and geotechnical countermeasure are included. Also earthquake issues are not covered in the existing SOD. It is needed to update and harmonize the existing SOD to implement disaster response operations effectively. In this paper, the authors discuss the proposed disaster management model which will minimize the lacking of the existing SOD. For this purpose, present situations of SOD and actual operations are discussed. The 2007 Cyclone Sidr is taken as a case study for actual situation analysis. The authors observed that the different activities of different organizations in the existing SOD fall under fifteen different categories. Gaps of different activities are found and ways to minimize these gaps are proposed. The activities of different organizations before, during and after an earthquake are included. The authors believe these proposals will contribute to enhance disaster management plan and increase efficiency of disaster management operations in Bangladesh.

## Keywords

Disaster Management, Disaster Phases, Operation Category, Standing Orders, Countermeasures

### 1. Introduction

Bangladesh is a disaster prone country where natural disaster occurs frequently. Millions of people of the country as well as development activities are affected by the disastrous effects of cyclones, floods, earthquake and other natural hazards. Although it is not possible to prevent such calamities, it is however, possible to mitigate the impacts of the calamities significantly with improved preparedness and well planned management to cope with the emergency situation. Many activities have to be undertaken in order to combat the natural disasters towards reducing the loss of lives and properties and allowing quick rehabilitation. Present capacities of disaster management in Bangladesh are largely centred on emergency response and post disaster recovery, which is evident from the recent occurrence of flood and cyclone events of high magnitude. For the low frequency high magnitude events, which occur without warning such as an earthquake there is a need for a comprehensive geo-hazard risk reduction strategy.

### 2. Standing Order on Disaster Management, Bangladesh (SOD)

The Standing Orders (SOD) on Disaster Management of Bangladesh have been prepared with the objective of making the concerned persons understand their duties and responsibilities regarding disaster management at all levels. All Ministries, Divisions/Departments and Agencies have a mandate to prepare their own action plans with respect of their responsibilities under the SOD for efficient implementation. According to the SOD, the National Disaster Management Council (NDMC) and Inter-Ministerial Disaster Management Coordination Committee (IMDMCC) will ensure coordination of disaster related activities at the National level. The Disaster Management Bureau will render all assistance to them by facilitating the process. The Ministries, Divisions/Departments and Agencies will organize proper training of their officers and staff employed at District, Thana, Union and village levels according to their own action plans so that they can help in rescue, evacuation and relief work at different stages of disaster. The different activities of different organizations are described at different Phases namely, Normal Phase, Alert and Warning Phase, Disaster

Phase and Recovery Phase (GoB, 1999).

### 2.1 Review of SOD

The SOD outlines the disaster management arrangements of Bangladesh and describes the detail roles and responsibilities of Committees, Ministries, Departments and other organizations involved in disaster risk reduction and emergency response management, and establishes the necessary actions required in implementing Bangladesh's Disaster Management Model, e.g., defining the risk environment, managing the risk environment, and responding to the threat environment. The existing SOD has five phases as defined below:

Normal Phase is a period when there is no immediate threat but long-term actions are required in anticipation of the impact, at some unknown time in the future, of known hazards. Alert and Warning Phase is the period from the issuing of an alert or public warning of an imminent disaster threat to its actual impact, or the passage of the threat and the lifting of the warning. The period during which pre-impact precautionary or disaster containment measures are taken. Disaster Phase is the period during which direct impact of a natural calamity is felt. Disaster phase is long in case of slow on-set disasters (draughts, normal monsoon flood) and short in case of rapid on-set disasters (flash flood, cyclone, earthquake, fire, industrial accident, landslide etc). Recovery Phase is the period, following the disaster phase, during which actions are to be taken to enable victims to resume normal lives and means of livelihood, and to restore infrastructure, services and the economy in a manner appropriate to long-term needs and defined development objectives.

The existing SOD is divided in to following parts: part 1: introduction, part 2: national policy and coordination, part 3: local level coordination, part 4: roles and responsibilities, part 5: other matters (GoB, 2008). Also in the SOD, overlapping of the different activities among the different organizations can be observed (Ansary and Hore, 2009). Different organizations have different activities during the five phases.

### 2.2 Lacking of SOD

No structural and geotechnical solution are described in our existing SOD (GoB, 1999). Although in the SOD (GoB, 2008) at Appendix-13 "Guidelines for construction, management, maintenance and use of multipurpose shelters in coastal areas of Bangladesh" are included. Information on estimated cost of killa and cyclone shelter, design of different types of cyclone shelters, design consideration and materials specification are found there. It is not enough. The design consideration of the road links, culverts and bridges, canals, drains, and surface water tanks, communication towers and power transmission networks are not mentioned.

The structural solutions as well as the geotechnical solutions need to be considered for earthquake resistant design (GoI, 2008). Liquefaction has to be considered for the earthquake resistant structure. These are not mentioned in the existing SOD. The different organizations are supposed to develop their own contingency plan. Time frame for different phases/activities is not mentioned in the SOD. Overlapping of the different activities among the different organizations can be observed.

In the SOD (GoB, 2008) at Appendix-21, "Specific roles and responsibilities relating to earthquake and tsunami hazard" are included. Also different roles of the various organizations are described (GoB, 2008). These roles are not divided into different phases of the disaster (normal, disaster and rehabilitation stages).

Considering all the above features, the authors aim to figure out future agenda of disaster management plan and analysis of actual situation. Appropriate countermeasures against these agendas and upgrading disaster management plan are also aimed. In this study planned and actual operations during and just after the 2007 Cyclone Sidr (Ansary, et al, 2008) are compared. Through this analysis future agendas are pointed out.

## **3. Operation Category Analysis**

Operation category analysis makes it possible to get an overview of the total disaster management operations, and this analysis makes it easier to point out insufficient descriptions in the existing SOD. These processes

help the SOD to be more collectively exhaustive. In addition, this analysis makes it possible to figure out other actors implementing cognate disaster management operations. The authors selected fifteen operational categories as shown in Figure 1 (Kou and Meguro, 2009). The different activities of the different organizations are described with respect to fifteen different operational categories as presented in Figure 2. Using the operational category analysis the planned roles of different actors in the existing SOD are plotted as shown in Figure 3. During 2007 Cyclone SIDR different agencies played significant roles. Figure 4 shows the actual roles played by different actors during SIDR (Ansary, et al, 2008; CDMP, 2008). From the above analysis, the following points can be indicated:

- 1) Disaster management operations were not or could not be implemented, nor was there a mechanism of information transmittance to the upper organization even though the operations were done
- 2) Disaster management operations were mainly done within normal time's operation fields of each organization
- 3) Only limited organizations were able to implement measures in the operation field while several organizations were supposed to implement the operation.

From the insight of field survey, the reason for point 1) and 2) could be divided into two aspects. One was a human resource problem, involving insufficient numbers of public officers or officer's affliction. The other was physical problem: insufficient number of motor boats to distribute the relief materials or shortage of budget to keep up a distribution operations.

Related to 2), it could be indicated that there was no room to enlarge the operation field to disaster-particular operation fields, such as rescue or relief operations for the problem of the scarcity of human or physical resource problem. About 3), in 2007 Cyclone Sidr case, Armed Force Division (AFD) played a leading role of operations in the field just after the cyclone. Especially, long-range transportation of relief materials was almost totally implemented only by AFD.

Besides, the blank areas of the Figure 4, which means that planned operations were not done, were substituted by internal/international aid agencies, NGOs or NPOs.' relief operations. These situations could be realized by analyzing not only records but also field surveys.

Figure 1: Selected operational categories

Countermeasures before the disaster	Collecting information, ensuring liaison	Building up the operation system
Preparedness and prevention of disaster	Rescue, relief and medical treatment	Ensuring and implementing emergency transportation
Evacuation, accommodation	Procurement of relief materials	Health, Sanitation, Body treatment
Maintenance of social order	Emergency Rehabilitation	Information Dissemination
Voluntary aid acceptance (International aid)	Victim assistance	Restoration of urban service





#### 4. Three Dimensional Analysis

To visualize operational activities in the SOD for each phase, three dimensional analyses are conducted. In order to express and analyze disaster management operations described in the SOD along with more precise time line, relative time axis are introduced which divides five phases of SOD into eight phases, which is from disaster preparedness phase up to assistance beginning phase as shown in Table 1. To visualize the amount of disaster management operation descriptions for each phase, attribution data of relative time axis is added into each description in the SOD as shown in Figure 5 left. Choosing actors, time axis and amount of operational description, each actor's amount of operations relative to time is visualized as shown in Figure 5 right.

#### 5. Proposed SOD

In the proposed SOD there are ninety organizations. Different activities of different organizations are described in eight phases. Each phase describes the definite activities over a time line. In the existing SOD no time line is mentioned. In the proposed SOD activities of different organizations with respect to earthquake are included. Structural and geotechnical considerations are also included in the proposed SOD.

Figures 6 and 7 compares actual and planned operations. From the result of the analysis, not fully achieved situation of disaster management operations can be seen as same as the result of operation category analysis. In addition to that point, from this analysis, situation such that a small portion of central organizations were forced to implement more operations than the Order provisioned is observed. Such situation was can be seen at the central disaster management organizations such as Ministry of Food and Disaster Management (MoFDM) or Disaster Management Bureau (DMB). The reasons for the excess amount of operations, which were confirmed by the field survey, were the concentration of operations such as coordination operations with several donors and UN agencies or operation works at field emergency operation center (at Barisal).

Table 1: Proposed phase and corresponding time axis

Phase in SOD	Relative Time Axis
Normal Stage	1.Preparedness
Alert Stage	2.Disaster Prediction Stage (prediction to preparation of warning) (More than two days before hazard attack)*
Warning Stage	2.Warning Announcement Stage (Admonishment of evacuation) (Within two days before hazard attack)*
	3.Airing Warning Stage (Within 24 hrs before the hazard attack)*
Disaster Stage	2.Initial Emergency Response and Damage Information Collection Stage (Within 24 hrs after the hazard attack)
	3.Emergency Disaster Management Operation Stage (Within two days after hazards attack)
	4.Disaster information consolidating and Emergency Response Stage (Within three days after hazards attack)
	5.Assistance Beginning Stage (Within a week after hazard attack)#

\*

Not valid for earthquake

#After this stage, international coordination relief operations called "Cluster Approach" started during SIDR

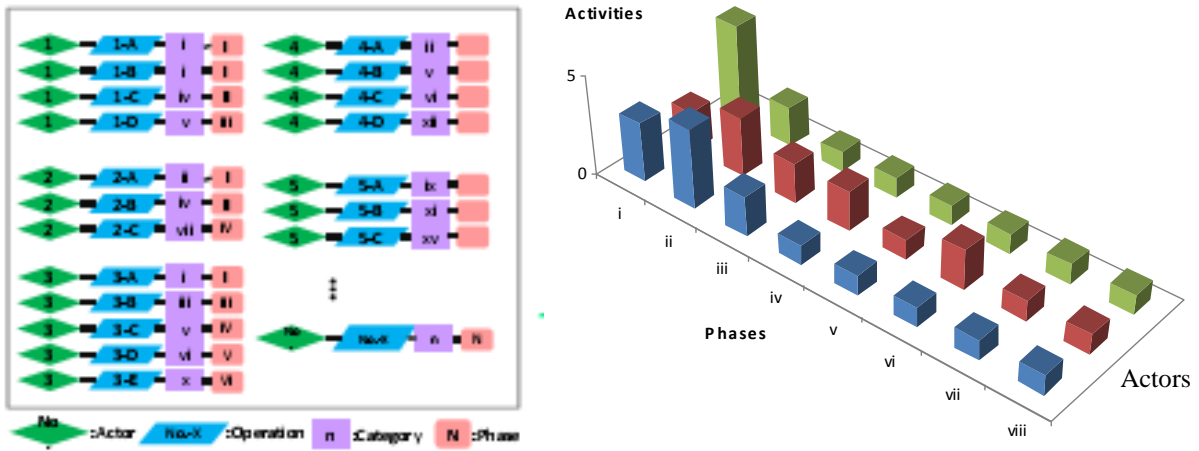


Figure 5: Overview of three dimensional analyses

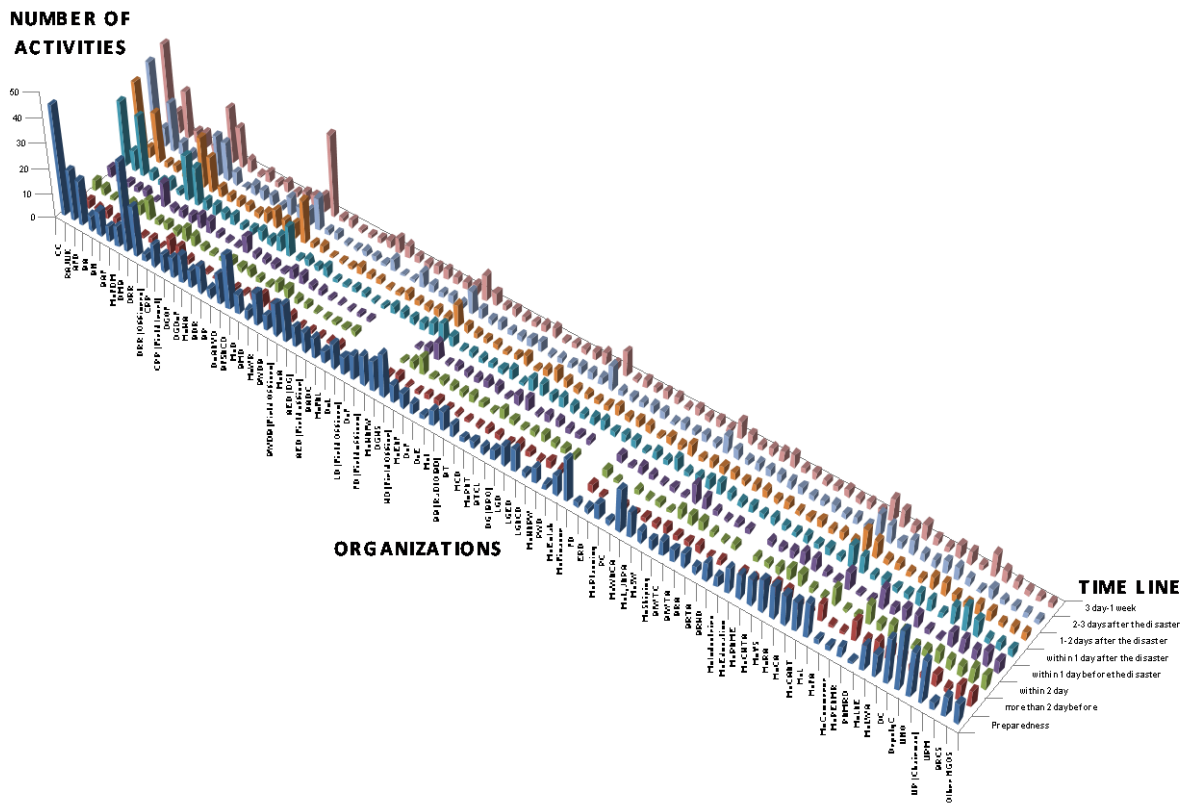


Figure 6: Three dimensional analysis of activities according to SOD

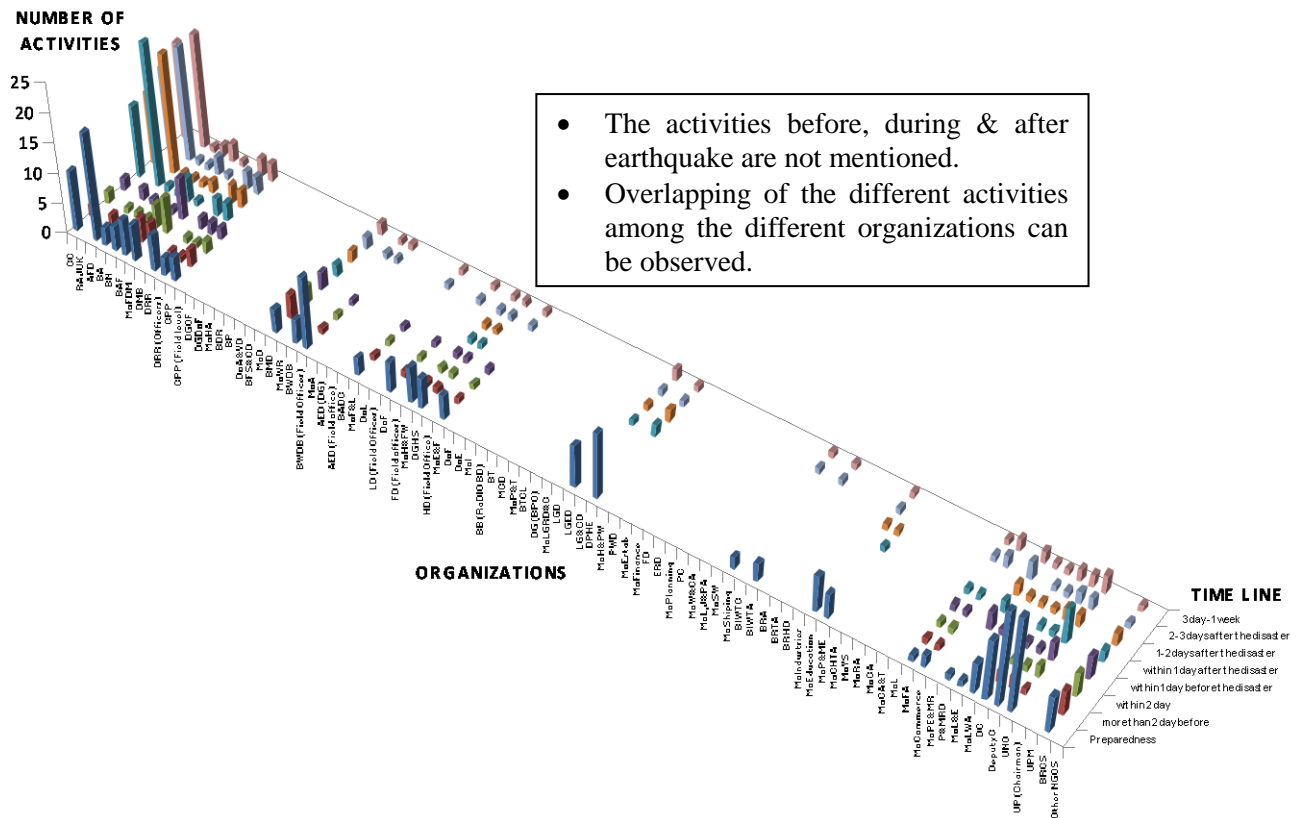


Figure 7: Three dimensional analysis of activities for 2007 Cyclone SIDR

5.1 Structural countermeasures (Cyclone/Flood)

It is very important to provide safe shelters to protect human life at the time of cyclones. Many cyclone shelters constructed earlier were not connected by all-weather roads with nearby habitats from where affected people need to be shifted during emergency evacuation (CDMP, 2008). Besides these there is a need to improve the existing road network and provide at least one link road, in all- weather conditions, for each village that is accessible during cyclone or flooding periods as well. The importance of coastal canals need not be over-emphasized as it serves as an alternative to road communication in the event of a cyclone or flood. Failure of even well-engineered structures such as communication and transmission towers during past cyclones brings the importance of the structural safety of such structures to the forefront. It is important to construct Cyclone Shelters, Road Links, Culverts and Bridges, Canals, Drains and Tanks etc with proper design considerations (GoI, 2008). Hence the design considerations which are included in the draft SOD (GoB, 2008) are described below.

Cyclone shelters:

Adequate number of cyclone shelters is important to reduce loss of life. Apart from the cyclone shelters, many other buildings have been used to provide shelter to people evacuated from affected areas (World Bank, 2008). These include schools, places of worship, community halls, etc. An inventory of all such available buildings is generally maintained by the district administration. However, with more multi-purpose cyclone shelters being constructed, the relief operations can get streamlined. For this reason some design considerations and materials specification in the draft SOD are proposed which help different organizations (related to these activities) to properly carry out the action plans. Proposed Design consideration and materials specification:

- Coarse aggregate-stone chips.
- Cement-ASTM type-II (moderate sulphate resistant).
- Comprehensive strength of concrete – minimum 24 mpa (3500psi)
- M.S Rod: 40 grade for slab, stirrup, tie and pile. 60 grade for Foundation, Column and Beam.
- Use admixture in plaster and concrete.
- Water cement ratio : max .4
- To ensure saline free water in the construction work.
- To provide clear cover of R.C.C member considering salinity in the coastal areas.
- Considering local availability and easy repair/ maintenance wooden door and window has been recommended. For external door necessary hinges and braces are to be provided.
- As Chittagong and Cox's bazar lies in earthquake prone area special provision in the soft story of the ground floor are to be provided in the structural design of the shelters.

Road links, culverts and bridges:

Roads/culverts/bridges in the cyclone prone areas need to be well maintained and given utmost attention. Roads are always associated with culverts and bridges as the terrain demands, and routine maintenance of these structures is crucial for post-cyclone response. Where the general road condition is found to be bad due to poor sub-grade and the bridges and culverts are in a distressed condition, their restoration work has to be accorded high priority. Repair and retrofitting work is a specialized job and requires the use of special materials and expertise. Before taking up the work, one has to complete visual inspection, find the causes of distress, establish the degree of distress through relevant tests, and work out the appropriate remedial measures to be taken. Proposed design Considerations for Roads, Culverts and Bridges:

- Efforts will be made to provide at least one link road for each village that is accessible even during the cyclone and flood inundation periods.
- The link road and the culverts on the road will be with requisite hazard resistant structural design specifications and planning.
- Each link road to the village and to the shelter will be identified and marked for mandatory maintenance as per the requirement.
- The link road and culverts will be designed and laid with road level 0.5 m above the possible flood level.
- Embankment of the road will be well protected, preferably by revetment.
- The minimum width of the culvert will be for two-lane traffic even if the road is of one lane.

To ensure proper functioning of canals/ drains/tanks during storm surge due to cyclone, the following measures are required:

- Branches to the canal drain are to be closed.
- The embankments will be strengthened.
- The condition of the passage-bridge and channels will be checked.
- Obstructions in the canals/drains will be removed periodically to enable free flow of water.
- The blocks and shutters of the canals are to be checked for satisfactory performance.
- The instruments and materials required for attending to immediate repairs, breach of closures, etc., will be stacked in advance at places where they may be required.
- Navigation in the canal will be stopped.

Proposed design and maintenance considerations of communication and transmission line towers:

- The towers will be designed using their dynamic analysis with suitable wind gust loading.
- The structural steel used in the towers will be galvanized to withstand the corrosive exposure condition.
- The foundation depth will be taken at least 1 m below the scour level and the stability of the towers will be standalone without depending on the filling weight of the soil.
- The design of a communication/transmission tower, including its foundation, is checked by a competent authority.

## 5.2 Structural countermeasures (Earthquake)

Earthquake is important topic with respect to geographic condition of our country. Earthquake causes huge damage without warning. For that purpose some guidelines have to be followed. Some guidelines are included in the draft SOD (2008):

- All new construction will be made to comply with earthquake-resistant building codes. For this purpose a proper monitoring / supervision units must be built in the related organization/ Agency (RAJUK, City Corporation).
- All central ministries and departments will facilitate the implementation and enforcement of relevant standards for seismically safe design and construction of buildings, bridges, flyovers, ports, lifeline and commercially important structures falling within their administrative control.
- Faculty members in Engineering University and polytechnics will also be provided adequate exposure to earthquake-resistant design and construction techniques, so that students are made aware of earthquake-resistant design and construction.
- The governments will organize capacity building programmes among professionals and masons for the design and construction of new buildings as per earthquake-resistant building codes.
- The governments will take up selected critical lifeline structures in some of these high-risk areas as pilot projects in a phased manner.

## 5.3 Geotechnical countermeasures

In the existing SOD no Geotechnical solutions are provided. It is very important with respect of our country. In Dhaka, many buildings are built filling the big hole, pond. Upper layer of the Dhaka soil is silty sand. Proper soil improvement techniques are not practiced in our country. Although some structure may be structurally safe; than may not be safe with respect to Geotechnical point of view. Some guidelines are included in the draft SOD (2008):

- Avoiding very soft / organic/ liquefaction susceptible soils to construct building/bridge/ dam etc.
- If it is necessary to construct on soft / organic/ liquefaction susceptible soil because of space restrictions, favorable location, or other reasons, soil improvement technique (Mitchell, 1981) must be applied.
- Awareness must be built among the stakeholders about the importance of soil improvement technique. Training program may be arranged for stakeholders.
- Use of jute geotextile instead of foreign geotextile to construct roads, bridge, and dam should be made popular.

## **6. Conclusions**

In this study the gaps in the roles of different organizations by operation category analysis is found in the existing SOD. These are rectified with suitable additional roles of the different organizations. Some structural and geotechnical solution/recommendation are also proposed which may be included at the appendix. This will help our Govt to switch from Disaster Response (relief) mode to Disaster Prevention mode. In the existing SOD, the different roles of different organizations about earthquake are not included. In the proposed SOD the activities of different organization in pre, during and post earthquake stages are added. It is hoped that if these proposals would be put into effect, disaster management plan and reviewing process of actual disaster management operation would be much more effective.

## **References**

- Ansary, M.A, Das, R, Imtiaz, A (2008). Role of logistics during Cyclone SIDR, Proceedings of USMCA 2008, Beijing, China, pp.249-254.
- Ansary, M.A. and Hore, R. (2009). Critical Review of the Standing orders on Disaster Management, Bangladesh, Proceedings of USMCA 2009, Incheon, South Korea, pp.445-451.
- CDMP (2008). DRAFT Report on Cyclone SIDR in Bangladesh, Damage, Loss and Needs Assessment for Disaster Recovery and Reconstruction.

- Government of the People's Republic of Bangladesh (GoB) (1999). Standing Orders on Disasters, Ministry of Food and Disaster Management, Bangladesh.
- Government of the People's Republic of Bangladesh (GoB) (2008). Draft Standing Orders on Disasters, Ministry of Food and Disaster Management, Bangladesh.
- Government of India (GoI) (2008). National Disaster Management Guidelines, National Disaster Management Authority
- Kou, T. and Meguro, K. (2009), Proposal For Reviewing And Revision process of Disaster Management Plan in Bangladesh-2007 Cyclone SIDR as a case study, Proceedings of USMCA 2009, Incheon, South Korea, pp.193-209.
- Mitchell J. K. (1981). Soil Improvement-State of the Art Report, 10<sup>th</sup> ICSMFE, Stockholm pp.506-530.
- World Bank (2008). Cyclone Sidr in Bangladesh, World Bank Report, April, 2008.

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# 14 年加勒比海域地区强龙卷风的经验对于古巴减灾防灾的启示

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**【摘要】**热带气旋灾害是加勒比海域国家的主要灾害之一。从 1995 年至 2008 年 14 年期间是自 1886 年至今在大西洋盆地中最活跃的大飓风时期。这些飓风造成死亡人数之高达数百人甚至更多, 不仅在加勒比地区, 而且在美国也同样发生过例如卡特里娜。但在古巴的相关减灾措施之下, 保护人民取得了巨大成功: 古巴的死亡人数是该地区(加勒比海域)最低, 每个飓风季节中死亡人数在 3 人, 尽管古巴在近几年一直饱受强大飓风的袭击。

古巴减灾系统是基于国家预报中心、民防和媒体的通力无间的合作, 并有着相关立法的支持。

一篇关于古巴国家减灾体系如何抗击热带气旋系统的介绍已经完成, 其中最激烈的叫飓风, 同时考虑到与其有关的三大危害, 如大风, 风暴潮和沿海洪水, 及暴雨大雨引发的洪水。这项工作涉及减灾全过程, 如预防, 应对和缓解周期。通过教育, 事前准备, 更好的建筑物编码, 广播和气象及飓风的教训电视普及, 这些都对减灾工作起着巨大的作用, 包括每年的国家建在演练。它也简单介绍了一切相关工作在早期预警, 警告和响应阶段, 以及风暴后的恢复阶段, 涉及到一些保障人民生活的基本设施及服务, 如卫生、电力和水供应。

**【关键词】**热带气旋 ; 飓风 ; 影响; 风险 ; 降低; 适应性

## **REDUCING RISK BY ADAPTATION TO TROPICAL CYCLONES IN CUBA EXPERIENCE OF CUBA DURING 14 YEARS OF STRONG TROPICAL CYCLONE ACTIVITY IN THE CARIBBEAN**

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### **Keywords**

Tropical Cyclone, Hurricane, Impact, Risk, Reduction, Adaptation

### **Abstract**

Tropical Cyclones are the main cause of disaster in Caribbean Countries. The 14-year period from 1995 to 2008 has been the most active period since 1886 in the Atlantic Basin and also the period with more intense major hurricanes in record. The number of people dead by these hurricane impacts is high, amounting hundreds, and sometimes more, not only in the Caribbean, but also in



the United States, like it happened with Katrina. But the implementation in Cuba of a National System designed to protect the people has achieved great success: the numbers of death in Cuba is the lowest of the region, averaging 3 per hurricanes season, notwithstanding the fact that Cuba has been impacted by several intense major hurricanes in recent years.

The Cuban System is based on a strong partnership between the National Forecast Centre, the Civil Defence and the Media, backed by appropriate legislation.

A description is made of the National System for the Protection against Tropical Cyclones in Cuba, and the most intense of them called hurricanes, taking into account the three major hazards related to them, such as strong winds, storm surge and coastal flooding, and torrential rains related floods. This work covers all phases of disaster reduction, such as prevention, response and mitigation cycles. It is explained how prevention is made from well before the storm onset through education, preparedness, better buildings codes, radio and TV with popular lessons in meteorology and hurricanes, and national drilling exercises before the beginning of every hurricane season each year. It is also explained all the work that is done during the Early Warning, the Warnings and the Response phases, as well as the Recovery phase after the Storm, to keep working all primary basic services to the population, such as health, power and water supply.

### **Background in the establishment of EWS in Cuba**

Hydro-meteorological events, specifically tropical cyclones, pose the greatest hazard for Cuba. In the last 158 years, Cuba has been affected by 205 cyclones for an average of 1.2924 annually. There is a 60 percent probability for a tropical cyclone to hit Cuba in any one year while that probability is 71.3 percent with regards to the cyclone affecting Cuba without the eye making land fall on the island.

The probability for a major hurricane striking Cuba is only 13.3 percent in a year while that of it only coming close to Cuba grows to 17.3 percent. So, on average a major hurricane passes over Cuba every 7.5 seasons and one comes close to Cuban territory every 5.8 seasons.

October is the most hazardous month for Cuba, both in terms of the frequency and the intensity of the tropical cyclones, followed by August and September with a hazard probability that is quite similar between them. All the tropical cyclones that have affected the country in October have made landfall from the south coast, with most of them getting formed in the central and western zones of the Caribbean Sea, while 97.3 percent of the tropical cyclones that have hit Cuba have done so within the season.

In October 1963, Hurricane Flora affected the eastern region of the country for 5 days with heavy rains, unleashing great floods in the Cauto River Basin. Over one thousand people died, and the economy and environment were seriously damaged. Addressing the causes for the disaster, then Prime Minister Fidel Castro outlined steps to take to begin building reservoirs, canals and other water works, regulate flows and to avoid floods from taking place in future. The policy quickly spread all over the country, which today boasts 239 water dams, hundreds of kilometers of canals and other works, all of which are daily measured in terms of their operating standards and receive appropriate technical maintenance.

In October 2007, the combination of a long spell of rain plus intense precipitations associated with the passage of tropical storm Noel resulted in the accumulation, in the same place, of a volume of water similar to that of 1963. This time, however, the water works built in previous years and the prompt and organized action of the population and the authorities avoided the loss of human life.

Before 1995, tropical cyclone activity in the Atlantic, Gulf of Mexico and Caribbean basins was relatively low. In the decade of the 80's only hurricane "Kate" in 1985 hit Cuba, and it was a weak storm. An active period began in 1995, and that year registered the second most active hurricane season on the XX Century, while the one in 1933 had the first place. Although Cuba was not affected by any hurricane in 1995, some of them badly hit neighboring countries, and due to it the Cuban National Meteorological Service foresaw the need to have an early alert on tropical cyclones to increase the time of preparation and awareness, and not only issuing information when the hurricane was directly threatening the country. With this in mind, Early

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Warning messages were started from 1996, when it was added to the regular warnings system. The first Early Warning Message was issued on 14 October, 1996, when an Early Warning Message was issued several days before hurricane "Lili" crossed over the central provinces of Cuba. The success was immediate, and starting from then, the Early Warnings were developed and institutionalized, until our days, when there is not only textual information but also graph depicting probabilities, with a continuous interaction with the Civil Defense, the Central Government of the country other interested organizations.

A set of institutions was entrusted with the monitoring of all events threatening the country. They guarantee surveillance against hydro-meteorological events, and keep systematically informed the relevant state authorities, with reporting frequency going from daily to monthly according to the variables and phenomena involved.

These institutions have branches in all provinces, and some have municipal representations, which supply data on the variables they measure to both the national and the territorial authorities. This surveillance network makes up the base of Cuba's Early Warning System and is part of its Civil Defense System.

In the case of hydro-meteorological hazardous events such as tropical storms and hurricanes, a very strong partnership has been developed among the Cuban Meteorological Service, The

Civil defense and the Media, to keep everybody informed and guide the actions for protection.

### **Legal frameworks to support emergency planning and response**

Cuba has a wide legal basis regulating the functioning of Early Warning Systems at all levels. Only those which have a guiding character are mentioned below:

Law No. 75 / 94 (December 21, 1994) of National Defense establishes the main missions and measures of the Civil Defense System and the principles for its territorial and institutional organization.

Decree-law No. 170 / 97 (May 8, 1997) on the Civil Defense system of measures, as a complementary document to Law 75, regulates the role and position of state agencies and organizations, economic entities and social institutions in the disaster reduction process; the organization and implementation of these measures to protect the people and the economy; the establishment of phases during the response and the funding for disaster reduction plans.

Guideline No. 1 / 05 (June 20, 1995) of the Vice President of the National Defense Council<sup>14</sup> on the planning, organizing and preparing by the country for disaster situations establishes the regulations for the disaster reduction process and the guidelines to organize response and recovery at all levels. This document provides for the supply of updated information by the surveillance and early warning systems and its contribution to the actions implemented during the response, as one of the most important elements within disaster reduction plans

Resolution No. 43 / 06 (August 8, 2006) of the Ministry of Science, Technology and the Environment establishes that the Environment Agency is the body that has the mandate to organize, lead and conduct the hazard, vulnerability and disaster risk studies.

There are other legal texts that complement this guiding document at all levels. These include: Law No. 81 / 97 (July 11, 1997) on the Environment, Law No. 41 / 83 (July 13, 1993) on Public Healthcare, Law No. 77 / 95 (September 5, 1995) on Foreign Investment and Law No.85 / 98 (July 21, 1998) on Forestry, as well as ministerial and local resolutions which address specific aspects regarding the functioning of the early warning system for tropical cyclones and other hydro-meteorological events. Resolution 106 /99 (December 6, 1999) of the Ministry of Science, Technology and Environment establishes the General Norms of Direction, Organization and Operation of National Meteorological Service, the Institute of Meteorology (INSMET), subordinated to the Ministry of Science, Technology and the Environment (CITMA).

Among the Attributions and Functions of the Institute of Meteorology in this Resolution, is to give this

institution State responsibilities and to issue through the Media, as the only authorized institution, meteorological and climatic information that be required, especially the warnings and forecasts of variables, processes and meteorological phenomena that constitute a hazard for human life, material goods, the economy and for the development of the country.

Something similar is settled down for Provincial Meteorological Centers in their attributions and functions, as the ones to be allowed to give out and to issue through the provincial Media meteorological and climatic information that be required, as the only institution authorized in the territory, especially the warnings and forecasts, processes and meteorological phenomena that could constitute a hazard for human life, the loss of material goods, the economy and for the development of the county.

### Elements of the Cuban EWS.

The EWS for tropical cyclones in Cuba includes the following elements:

- An effective meteorological and hydrologic surveillance system, with the appropriate human and material resources for guaranteeing permanent monitoring and timely warning, both at the national and local levels.
- Effective communication between meteorological and hydrologic surveillance systems and Civil Defense institutions, both at the national and local levels.
- An effective network for transmitting information supported by secure communication systems.
- The use of all the mass media for spreading warning notices, including radio, television, newspapers, alternative means and people, both at the national and local levels.
- Plans designed for the different situations on the basis of likely pre-disaster scenarios and assisted by all resources available in each territory, in order to guarantee the effective protection of people under different levels of risk.
- The people, who is well organized and prepared. They are fundamentally people of the already mentioned previous mass and social organizations that get ready to disseminate the messages of alert, in communities far from the main cities and towns. There also people in charge of the operational spots for early warning located in key places, with difficult access, that are prepared to measure rainfall and the level and flow of the rivers. They have means of communication to rapidly inform the center of risk management located at the municipal government site.

All these elements are linked by a functional structure that is shown in Fig.1

**FUNCTIONAL STRUCTURE OF EARLY WARNING SYSTEM FOR TROPICAL CYCLONE IN CUBA**

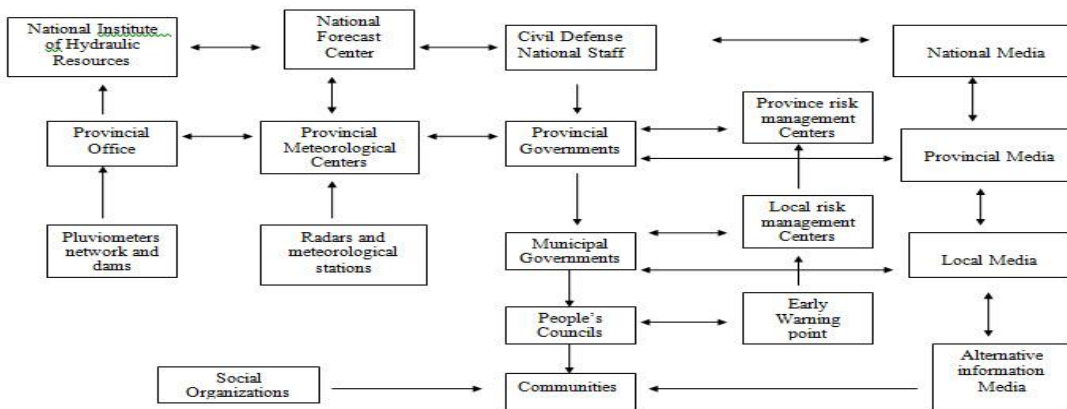


Fig 1. Functional Structure of EWS in Cuba (From Rubiera, Puig, 2010).

In the context of Risk Management and the handling of disaster hazards, the EWS plays an important role in

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reducing the loss of human lives and material losses. In Cuba, the EWS is considered a major Civil Defense asset and is systematically used and strengthened.

The Cuban EWS takes advantage of the existing socio-economic structure, the strength of the institutions, and the levels of organization and education of both the authorities and the general population, among other aspects that help its functioning.

The EWS for tropical cyclones is a well-structured, coherent, nation-wide system which works closely with the Institute of Meteorology's National Forecast Center and the National Staff of the Civil Defense. These two organizations exchange and analyze information, allowing authorities to take the necessary measures and establish the relevant phases.

The exchange of information between the National Forecast Center of the Institute of Meteorology and the National Staff of the Civil Defense at the national level allows establishing the phase of the response for the threatened territories, which presupposes a certain time for the adoption of measures in those places. As the Early Warning System works with more effectiveness, it would be greater opportunity that provinces and municipalities react and so be able to protect the lives of people and the resources of the economy exposed to different risk levels.

Whenever a province receives an Early Warning Message or the establishment of one of the phases of the response, they begin immediately to complete the measures stated in the plan for disaster reduction for that phase, in correspondence with the characteristics of the threatening event and the level of people's risk and the exposed economic resources. In this decision-making process, a similar exchange, like that of the national level, takes place in the province between the authorities and the meteorological service of that province, to determine the magnitude of the impact of winds, rains and the level of the sea in the territory, starting from the appreciations that are received from the National Meteorological Service. Carried out this assessment, the planned measures for protection for each situation of those that were designed in the preparations for each possible scenario begin implemented, making this a fast and efficient process.

Starting from the information of the Forecast Center of the Institute of Meteorology, the National Staff of the Civil Defense analyzes the initial situation and a note of the Civil Defense can be sent giving an early warning to the governments of the threatened territories. This exchange of information between the Center of Forecast and the National Staff of the Civil Defense continues while the hazard threat is maintained over the country or some portion of the country. The response action is staggered in Cuba with three phases or stages: Informative, Alert and the Alarms phases. In each phase, and for each event, protection measures are planned, with the early warning system working according to the phase set, because as the hurricane comes closer to the territory, the ways to disseminate the messages also varies. The establishment of each one of the phases is approved by the Central Government, being proposed by the National Staff of the Civil Defense, which takes into account, among other factors, the recommendations given out by the National Meteorological Service.

Likewise, the meteorological and hydrological services in each province interact with the authorities and are responsible for keeping them and the general population informed through all available communication means in each area.

There are three levels of local government in Cuba, namely, province, municipality and People's Council. These three instances of government have a President and a structure that allows organizing the government's administration. The National Center of Forecast (Meteorological Service) interacts with the Government at National level, while the Meteorological Provincial Centers interacts with the Government at provincial, municipal and People's Council levels, offering information and advice during the different Civil Defense phases.

The Institute of Meteorology (Meteorological Service of Cuba), through the National Forecast Center, interfaces directly with the Central Government, the National Civil Defense, the National Media, the Provincial Meteorological Centers and the National Institute of Hydraulic Resources.

The Provincial Meteorological Centers offer information on their territory to the Provincial and Municipal Governments, to the Civil Defense at that level, to the Provincial and Municipal Media, as well as to the

Provincial Delegations of the National Institute of Hydraulic Resources.

The system is a two-way system, for the National Forecast Center also receives information from those entities

### **Assessment of vulnerabilities and exposure**

A group of specialists at the national level, starting from the studies carried out on the hazard of rains, the state of the sea and winds in hydro-meteorological events that threaten the country, elaborated a methodology for each one, to determine the associated risk of these events. This methodology establishes indicators for vulnerability, such as the technical state of the housings, situation of the drainage, level of people's exposure in flood areas, etc. This allows multidisciplinary groups that have been created in each municipality with the participation of all the involved organisms, to estimate the reduction of risk that constitutes the basis for the upgrade of the plans of disaster reduction in each stance annually. All the information related with the upgrade of the databases for each indicator of vulnerability and the determination of the risk for each area are properly stored at the risk management centers of each municipality, supported by Geographic Information System (GIS). The results of the upgrade of the risk levels in each people's council of the municipality are informed to the provincial and national levels.

This annual analysis allows determining the weakest aspects of the risk assessment, which are then corrected for next period.

The communities with more exposure to the hazards generally coincide with those of more risk, because they also concentrate the main vulnerabilities. Therefore these places need a more detailed planning of the response actions and therefore they are prioritized with the available resources in the territory, being generally the first ones to be protected.

The Environment Agency creates those groups of specialists that elaborate the methodology for risk assessment in each municipality and prepares specialists in each territory.

At the local level, groups of specialists from municipal organizations such as Physical Planning, Statistics, Water Resources, Public Health, Agriculture, Construction, Housing, Project Enterprises and others are created under the supervision of the local office of the Ministry of Science, Technology and the Environment. The risk assessment program is undertaken in coordination with the National Staff of the Civil Defense.

The Environment Agency put together a methodology for risk assessment that considers the impact of the rain, the wind and the sea. This methodology has already been applied in the municipalities exposed to greater hazard.

The methodology allows for the local governments to periodically determine the risk so that its reduction is monitored. This requires for the specialists from each organization to update the information related to each indicator of vulnerability.

The vulnerabilities associated to the impact of the destructive effects are assessed (winds, storm surge, coastal flooding, rains, etc.) of hurricanes and other hydro-meteorological events, which, according to historical data, are the most recurrent events. Vulnerability indicators associated to drought, forest fires and earthquakes have also been determined. The Environment Agency has the mandate of producing the hazard, vulnerability and risk mapping of each municipality.

The social achievements of the Cuban Revolution—which wiped out illiteracy and promoted education, provided free health care, built roads connecting the most remote places, guaranteed electricity to more than the 95 percent of the homes, and facilitated women's involvement and participation—progressively led to a reduction of the population's vulnerability vis-à-vis the striking of hurricanes and other weather events.

The main elements of vulnerability associated to hurricanes these days have to do with the technical state and the construction typology of houses, mainly in the eastern region, where there still exist more than 240 coastal settlements and a large number of houses next to rivers or the course of spillways.

The Cuban Meteorological Service also participates in vulnerability and risk assessment studies with data, its

processing, their analysis, the projection of local hazards and also by means of the advice for these studies as well as to local authorities.

### **Warning dissemination mechanisms**

The Early Warning messages begin to be issued by the National Forecast Center with 120 hours in advance of a possible impact, repeating them every 24 hours. When the Hurricane penetrates inside the area of surveillance of the Caribbean Sea, warnings are issued every 12 hours, and when the Hurricane ends up being a potential threat to Cuban territory in 72 hours or less, warnings begin to be issued every 6 hours. When the hurricane is very near the territory of the country, warnings are issued continually every 3 hours or less.

Radio, and very especially television, is a very important tool for warnings. The country counts with more than a television set for home and the TV signal arrives to 98% of the national territory, and almost to all of the population. This results in building a great awareness and interest among everybody, with frequent live direct broadcasts by meteorologists from the National Forecast Center, which explain, with simple and plain language, the whole meteorological situation, including the analysis of uncertainties and different probabilities that could be possible at that time.

In the issuance and distribution process of the Early Warning messages, participate several entities:

- The National Forecast Center of the Institute of Meteorology issues Early Warning and Warnings on the tropical cyclone for the National Staff of the Civil Defense, the Central Government and the public as well, and meteorologists give the meteorological information through national radio and TV, both national and local.
- The National Staff of the Civil Defense issues informative notes with guidance and recommendations from an approach on the protection of lives and material goods, which are sent to all levels of government as well as to the radio and TV, both national and local.
- Television channels and radio stations, both national and local, transmit in a special way 24 hours round with reports, interviews to specialists and authorities and also reports related with the evolution of the hurricane, the protective measures being adopted in each place and guidance on measures to be completed. National radio and TV install a remote unit facility at the National Forecast Center from 48 hours before a forecasted hit of any hurricane, and a TV set is activated at the National Staff of the Civil Defense for the same purpose.
- The International Press Center disseminates information for the foreign press agencies and coordinates interviews with forecasters and specialists.

All information is public and is delivered to end-users by the Meteorological Service, except some very technical and detailed information on rain intensity, winds or storm surge, based on models, that is delivered to the National Civil Defense.

### **Public awareness and education**

Citizen preparedness for disaster situations in Cuba extends from the top authorities to the people in their work places, in schools and communities, aimed at making each capable of organizing or carrying out the actions planned, according to their responsibility, and aware of the risk they may be exposed to and the measures they must take to protect their lives and their property.

The Civil Defense preparedness is done through exercises, drills, training, practical activities and demonstrations, workshops, courses, lectures, and events. A separate mention should be made of the yearly, two-day long METEORO National Exercise for Disaster Case Actions. Usually conducted during a weekend in May, it helps authorities and the population at large to prepare for disaster situations. It is also used to test

the warning, communication and information systems, check the logistics needed for the different protection measures such as the evacuation of people, goods, and economic resources, the vulnerability mitigation actions, and it receives ample coverage by all communication media (television, radio, newspapers, etc.) regarding aspects that the population ought to know for every territory.

A subject dealing with Meteorology and Civil Defense topics is taught in the national school system during 3rd and 5th grades of elementary education and 8th grade in junior high school, which is complemented with extracurricular activities. Theoretical-practical classes are taught in senior high schools in the same curricular way and with extracurricular lessons. In higher education, all careers include a subject on Civil Defense in addition to other subjects also dealing with related issues.

In short, the preparation system for disaster reduction in Cuba is comprehensive, systematic and planned and it is constantly perfected through systematic analysis of its advances and deficiencies, with a view to creating a disaster reduction culture that results in less and less human lives getting lost and less damage to the national economy.

A Communication Program for Disaster Situations was designed for use by the media that contains general guidelines seeking to make the messages and reports more preparedness effective. Every year, mass media staff attends update training courses on disaster reduction, which contributes to improve their work. Media managers and journalists from different television and radio stations, and the newspapers attend this national workshop. The same course is later taught at the provinces with the participation of provincial and municipal media.

During the response and recovery phases, all the resources in the territory are used to keep the people informed and oriented. TV and radio units are set up and connected to power plants or solar panels; mobile and fix public address systems are installed; the radio ham network is activated, and radios with multiple sources of power supply are distributed. And people to people information also assists, with the participation or grassroots organizations, social workers and local leaders.

All this is possible because there is television and radio stations at the municipal and community levels, there is one TV set in each school classroom, and there are also VCR players and computers in all the schools of the country, as well as public television halls in remote communities.

All this contributes to the effectiveness of Cuba's Early Warning System as it allows for the spreading of information to the people in a fast, understandable and reliable way.

The Cuban Meteorological Service plays an important role in the public's awareness and in educational activities. Hundreds of conferences and chats are offered every year in working places, factories, as well as in social organizations of different types.

Meteorologists present several times daily weather information through radio and national, provincial and municipal television stations in the whole national territory. In these presentations they frequently explain different meteorological phenomena that happen in Cuba or any other part of the world, so that the population acquires more and more culture and awareness about weather.

Short Courses of 30 lessons each have also been given by meteorologists on themes such as General Meteorology and another one on Hurricanes through the educational channels of Cuban TV.

During Hurricane Season, meteorologists have also participated in brief spots, of only some seconds long, transmitted between regular programs changes of television and radio, calling to raise awareness on hazardous weather elements, mainly hurricanes.

### **Some examples of previous events where the operational EWS has led to improvements in emergency preparedness and prevention**

A new active period of Tropical Cyclones began in 1995 over the Atlantic, Caribbean and Gulf of Mexico

area. In these 14 years, Cuba has experienced the hit of 17 Tropical Cyclones of different intensities, namely, 6 Tropical Storms and 11 Hurricanes, of which 5 were minor Hurricanes and 6 were major Hurricanes. In 14 years Cuba had 41 casualties in Tropical Cyclones (direct and indirect), namely, an average of 3 casualties per year.

The 2008 Hurricane season was of great activity for Cuba. Two Tropical Storms and three Hurricanes, two of the major Hurricanes, hit Cuba. The strongest one in 2008, and also since 1995, was Category 4 Major Hurricane "Gustav" that badly hit the Isle of Youth and the province of Pinar del Rio with nearly Category 5 winds. The highest wind was the gust of 340 km/h recorded at the weather station of Paso Real de San Diego (WMO 78317). The National Forecast Center issued Early Warnings from several days before the hurricane arrival, and watches and warnings from 72 hours prior to the hurricane landfall. The increase in intensity was well forecasted, because of the high heat content in the Caribbean Sea (Rubiera, Ballester, 2009).

Meteorologist explained the main features of this deadly hurricane along with the track and intensity forecasts. People were well prepared and the Civil Defense made a superb job. The amount of material losses was great; however, not a single life was lost.

A few days later came Category 4 Major Hurricane "Ike". The difference was that this hurricane affected the whole country. The Early Warning and the Watch and Warning process was a very good one. Everything was done to warn people to be prepared for another deadly hurricane. However, this was the first category 4 hurricane to make landfall in the provinces of Holguin and Las Tunas, continuing to the west to affect the whole country, making landfall again in the area previously hit by hurricane "Gustav" a few days before. However, there were 7 deaths with "Ike", the majority of them provoked by negligence of the victims, sometimes without anything to do directly with the hurricane. The lesson is that we have to warn even more not to do things that people in the affected area or areas under some type of warning are not supposed to do.

Tropical Storm "Noel" had nothing in its center, except light winds (Rubiera, Ballester, 2008). However, some 300 kilometers to the East, huge bands of rain were forming. But the warnings this time was against the intense rains that were forecast to hit Eastern Cuba. Meteorologist explained with great detail that the danger was the rain and that it should be forgotten where the center of the Tropical Storm was, because it was not important; the important feature were the intense heavy rain that was going to come well after the center of the Tropical Storm crossed Eastern Cuba. Rainfall totals in 24 hours were between 200 and 300 mm over that area. The soil was already saturated because of heavy rainfall during the previous month. Large areas were completely flooded and a massive evacuation took place well before that it happened. There were big losses to agriculture and economy, but nobody was dead during the event.

## Conclusions.

1. Cuba has built an Early Warning System that covers all the legal, structural, institutional and public aspects.
2. The strong partnership and interaction among the National Forecast Center, the Civil Defense, the Media and the action of the people is a cornerstone of this system.
3. As a result of it, the amount of casualties in tropical storms and hurricanes is minimum and the smallest recorded in the Americas, despite the intense tropical cyclone activity in the area since 1995.

## Bibliography:

Rubiera,J., Ballester, M. (2008) Review of the Hurricane Season 2007, INSMET, ([www.insmet.cu](http://www.insmet.cu))

Rubiera,J., Ballester, M. (2009) Review of the Hurricane Season 2008, INSMET, ([www.insmet.cu](http://www.insmet.cu))

Rubiera, J; Puig, M, (2010) Early Warning System for Tropical Cyclones in the Republic of Cuba (in press, WMO paper to be published in 2010)



## 灾难中的食品管理——一个来自意大利的案例

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意大利马尔凯理工大学环境可持续性与管理研究生项目

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**【摘要】** 及时提供粮食对于灾民的生存和快速回复是至关重要的。本文以意大利应急管理组织为例，研究了食品管理和大规模粮食救助的策略问题。巧合的是，巧合的是，初步调查几个月后，也就是2009年4月6日的意大利拉奎拉地震，为这些策略的实地实施和评估提供了可能。结果显示，意大利在紧急时期的食品管理和大规模粮食救助主要是由志愿组织（食品管理单位）来实施，这些组织是事先选定、并承诺与应急管理机构共同应对紧急情况。选定的研究对象（食品管理单位）拥有开设野地厨房的装备和技能，能够妥善准备和分发食物，但还没有成文的预案或指南。更进一步地，志愿者通常并未拥有食品安全和营养的专业背景或教育背景，但基本都参加了食品安全基础课程。在拉奎拉地震的后续行动中，尽管有许多难以逾越的障碍，从被援助者和援助者两方面所反映的情况来看，总体来说食品管理和分发工作的开展是有效的。然而，不同的研究对象之间，在组织结构、人力资源、装备和服务质量等方面均存在着巨大的差异。为提高在灾难中进行食品管理的能力，意大利国家和地方应急管理部门正在讨论建立（灾难现场食品管理和服务组织）人力和装备方面的最低标准。然而，要标准化食品管理单位所提供的服务，还有许多工作要做。从拉奎拉地震中得到的一个重要教训就是，紧急救援阶段过后，越来越多的注意力将集中到所提供食品的文化适应性方面（比如，准备并分发符合当地饮食传统和习惯的饮食），以及在加速灾民情感恢复过程中的作用。

**【关键词】** 食品管理；紧急粮食救助；野地厨房；志愿者组织；意大利

## FOOD MANAGEMENT IN DISASTERS AN ITALIAN CASE STUDY

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## Keywords

Food management, emergency feeding, field kitchen, volunteer organizations, Italy

## Abstract

Timely delivery of food to populations hit by a sudden onset disaster is of primary importance to guarantee their survival and fast recovery. This paper investigated food management and mass feeding strategies in a sample of Italian emergency management organizations. Coincidentally, few months after the initial survey, the 6 April 2009 L'Aquila (Italy) earthquake, offered the possibility to assess the field implementation of such strategies. Findings highlighted that in Italy food management and mass feeding during an emergency is prevalently handled by volunteer groups (food management units) previously selected by the emergency management institutions. The studied units appeared to have suitable instrumentation and technical knowledge to set up field kitchens and properly prepare and distribute food, yet did not have written plans or guidelines. Furthermore, the volunteers, who generally did not have a food safety-nutrition professional or educational background, had in the most cases attended basic classes on food safety. In the aftermath of the L'Aquila disaster, and in spite of the inevitable hindrances, food management and distribution was overall carried out effectively (as perceived from both the rescued population and rescuers). However, large disparity was found among the studied units, both in terms of organizational models, people and instrumentation deployed, and quality of services provided. To enhance food management in disasters the Italian national and local emergency management departments are discussing a national plan setting the minimum personnel and equipment standards. Still, more efforts appear necessary to standardize the services offered by the food management units. An important lesson learned from the L'Aquila disaster was that passed the critical emergency phases, increasing attention must be paid also to the cultural aspects of food (e.g. delivering traditional and familiar flavours and texture) and its role in expediting the emotional recovery.

## Introduction

Among the various issue to address in disaster response there is also food management and mass feeding. If the impact displaces a large number of people, thus preventing them to access and properly prepare food by themselves, the emergency management organizations must provide necessary nutrition to ensure wellbeing of survivors and rescuers. Indeed the approaches to food management and mass feeding in an emergency situation varies greatly according to the contingencies created by the impacting event, location and surrounding context, number of people involved, and available resource and infrastructure.

Each phase of a disaster emergency requires different food support. For example, in the immediate aftermath disaster victims needs liquids (water) and simple snacks (Bovee, 1958). If not injured, an individual can go few days without food, but water shortage would create dehydration problems. In this phase the focus is guaranteeing survival and health, thus shelf-stable pre-packaged food items may be a quick and effective solution. This types of food is widely used for immediate handling of humanitarian crises to save as many lives as possible. To the affected populations is distributed the Humanitarian Daily Rations (HDR), which consists of pre-packaged ready-to-eat thermo-stabilized vegetarian entrées and complementary components (e.g. peanut butter, jelly). The HDR are designed to provide no less than 2200 kilocalories and to meet the daily nutritional requirements of an adult (US Department of Defense, 2008).

However, while the pre-packaged food could be an effective solution for a short-term feeding emergency (the

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HDR has become an integral part of initial international emergency response plans), it cannot be sustained in the long term. These nutritionally balanced packages are costly and most of all, lack freshness and have unfamiliar flavours and textures (Slavker, 2003). Thus, passed the critical phases of the search and rescue and the survivors moved to temporary shelters, food should be prepared fresh on, or nearby, the campground premises. Assuming abundant supplies from local and international donation, during this phase it becomes important to provide the affected population with staple food and other comfort dishes part of the region's traditional diet. Some guidelines for campground set up and food preparation have been developed (see for example the Sphere Project, Oxfam, 2004).

With the normalization of the emergency situation, and survivors' acceptance of the disaster and its consequences, food becomes an important element for reestablishing old routines in the new circumstance, and expedite the psychological recovery. To help people forced to a long permanence in the campgrounds, the groups in charge of food management should attempt to recreate the local culinary traditions and flavors. Moreover, when food ingredients becomes accessible again at the local market, those among the tended population who can prepare and cook food on their own should be encouraged to do so.

Indeed, paramount differences exist in the handling and recovering of emergencies in developed and developing countries (Alexander, 1993), yet the cultural dimension of food, and its psychological effects in helping disaster survivors to go back to normal, it is most likely a common attribute of all humankind. The focus of this study is about the planning of food management and emergency mass feeding in case of a sudden disaster in Italy, a western developed country. The country's roads and communication infrastructures, along with well stocked and equipped emergency management services, make any community inside the Italian national territory readily accessible within few hours. Consequently, the challenge of mass feeding after a disaster in Italy is not expected to be about rapidly getting enough food to the disaster area to avoid starvation, but rather to organize adequate food services capable to give relief and comfort to survivors.

#### The Italian emergency management system and its approach to food management in disasters.

The current emergency management model in Italy was set by Public Law 225/1992 which instituted the "*Servizio Nazionale di Protezione Civile*," the governmental department in-charge of disaster prevention and management. Such law envisions emergency management as a shared responsibility among the various components of society. All levels of government (national and local), the private sector, the volunteer organizations, and the population at large must contribute their resources and expertise in case of disaster. Emergency management in Italy is based on the principle of subsidiarity, namely an emergency should be handled by the smallest, and least centralized competent authority (e.g. the city Mayor). The higher authority has a subsidiary function performing only those tasks which cannot be performed effectively by the lower level. In this system the local volunteer organizations become pivotal operative structures of emergency management. As of January 2010 the Italian emergency management system has selected and trained about 2500 volunteers groups, for a total of 1,300.000 individuals; 57% men and 43% women, ready to help during emergencies (Dipartimento Nazionale Protezione Civile, 2010). These groups are called to provide a variety of tasks ranging from logistics to medical support, including food management and mass feeding services.

### **Theory and Method**

Preliminary data showed that in Italy, both the national and local emergency management departments outsource food management and mass feeding to selected volunteer organizations (food management units). In the aftermath of a disaster several food management units are sent to the disaster area with the aim to provide food support to the victims and rescuers. Within a couple of days from the impact the pre-selected units are expected to be able to get to the affected areas and start feeding the involved population. The basic assumption of this study is that the majority of these units, especially the small ones, although capable to perform mass feeding services, do not have written plans clearly and unambiguously defining emergency procedures, roles and responsibilities. Very likely they operate with an ad hoc approach, making decisions about the present contingencies according to direct past experience. To verify such assumption a sample of 10 Italian volunteer organizations providing food management and mass feeding services have been visited.

These units were all selected by the national or local emergency management department, and deemed qualified to provide food services in emergency situations. A questionnaire and open interviews were administered to the units' leader and the available volunteers, to clarify their organization and assess their available equipment. The study was conducted during the summer and fall of 2008 and a total of 68 people participated in the survey. The questionnaire consisted of 23 queries organized in three main sections: (1) human resources, questions 1 through 9, inquiring about the number of volunteers registered with the units, their professional background and training, units' organization, chain of command, etc., (2) equipment and supplies, questions 8 through 15, examining the available technical resources and shelved food ingredients, and (3) *modus operandi*, questions 16 through 23, probing into the units' operational strategies and emergency planning procedures.

Coincidentally, the 6 April 2009 L'Aquila earthquake offered a possibility to actually see at work various food management units, including 3 of the earlier visited volunteer organizations. The effectiveness of food management operations during such disaster was also investigated by the authors and the detailed results can be found elsewhere (Marincioni and Vittadini, submitted).

## Results

### Human resources.

Table 1 summarizes the most significant results of the described survey. The size of the 10 studied food management units ranged from 6 to 70 individuals, each one with very different professional background. Only in 7 units there were volunteers who had previous experience as cook (ranging from 7 to 23% of the personnel). In 2 units there were individuals who had attended technical schools for hotel and restaurant management. The great majority of the volunteers had developed their food management and mass feeding experience while participating in previous disasters recovery activities, planned crowd management events (concerts, visit of authorities), and practical drills. It is noteworthy that none of the volunteers had a university degree on subjects related to food, either from a technological (food safety, food handling and food transformation) or a nutritional perspective.

The organizational level and subdivision of roles and duties among the units' personnel was found to be quite different across the studied sample, with some units highly organized and others relying on impromptu strategies developed during the activities. The units with a high level of technical training (high number of volunteers who had already attended training on food management), showed a greater interchangeability of roles, with a higher number of volunteers able to perform the various activities required in the kitchen, such as ingredient preparation, cooking, storing, managing and coordinating distribution activities, etc. Conversely, the units who paid less attention to training, had fewer people able to perform the various activities necessary to operate the field kitchen. Each volunteer had a specific role and the unit appeared more hierarchically organized, and the presence of a leader was necessary and noticeable. The leader often acted concurrently as cook, storage manager and coordinator. In this type of units the majority of the volunteers acted as the leader's handymen. Remarkably, none of the 10 studied units designate a person to specifically carry out the tasks expected by a nutritionist (i.e. definition of nutritionally correct menus), and this in spite of having trained volunteers on proper human nutrition. Similarly, nobody was entrusted as a food technologist (i.e. oversee of proper food handling/storage/distribution).

### Equipment and supplies.

The studied volunteer organizations were equipped with mobile kitchens supplied with the essential gears necessary for cooking, transforming, storing and distributing meals. Figure 1 shows a few examples of these mobile units, often made out of trucks and trailers specially furnished with kitchen appliances. These mobile kitchens significantly differed one another in size and features, and some were standalone units, while others were modules of a larger compound. All the visited mobile kitchens were furnished with stainless steel equipment (Figure 1) such as stoves, ovens, boilers (pasta cookers), deep fryers, sinks, refrigerators and freezers, hoods, and basic kitchen utensils (e.g. pots, pans, bowls, etc.). The floors were also made of

stainless steel (corrugated anti-slippery shields) to facilitate proper cleaning of the kitchen. All units were equipped with water tank and an electric generator. This equipment is the minimum standard required by the Italian national and local emergency management departments. Additional equipment was also available in some units. For example, 7 out of the 10 mobile kitchens had a simmer, 6 had a multifunction food processor, 3 had a dish washer, and 2 had a blast chiller. In regard to the initial basic ingredients carried to the affected areas, they generally consist of extended shelf-life items, including bottled water, pasta, canned tomatoes, legumes, tuna, preserved meats, spices, cookies, bread, coffee, tea, oil, vinegar, salt, sugar and sterilized milk. These are the very basic ingredient of the Italian diet.

### Modus operandi.

From an operational perspective, the essential modules of these mobile kitchens are sent immediately to the disaster area and are expected to be self sufficient for the first 48 hours, both in terms of energy and supplies. They are usually loaded with basic ingredient to feed between 40 and 100 individuals. Later on, when the remaining kitchen modules arrive to the affected areas, the full field kitchen gets installed inside the temporary campgrounds raised to shelter the disaster survivors, and begins the massive production and distribution of food. To avert the risk of food poisoning the Italian emergency management institutions requires the mobile kitchens to be set up and operated according to the Italian health and safety code. Periodic controls are performed by campgrounds' health and safety officers.

As the field kitchen begins its full production, the energy and the water necessary for its operation is expected to be available through the temporary utility network set up by the camp facility management groups. Similarly, the staple ingredients necessary for cooking is expected to be available through the central food warehouse and storage facilities set up by the emergency command center. Each food management unit stores only a relatively small quantity of ingredients within the premises of its mobile kitchen (in ambient temperature or refrigerated trailers). The studied units could produce between 500 and 1000 meals at the time. Indeed, this production size requires large preparation areas (peeling, washing, cutting, mixing, seasoning, etc.) generally set up outdoor, with tables and portable sinks covered by tents. Only two food management units performed preparation indoor, inside trailers specifically devoted to these operations. Conversely, all surveyed units carried out cooking inside the mobile kitchen units, a confined and more controlled environment.

Food distribution is usually performed in a tent set up next to the kitchen. Only in one of the studied food management units, distribution was performed inside a specially crafted trailer (Figure 2). The distribution methods varied greatly from one unit to the next. Some served meals directly from the pot to the plate, others transited the food into thermally controlled food storage containers (Figure 2). For hygienic reasons, food portioning and distribution is a task allowed only to the personnel of the food management unit; the tended population is generally allowed to autonomously pick up single portion pre-packed items (e.g. bread, fruit, drinks, ice creams, etc.). Disposable plastic cutlery is the standard for food consumption. At the end of the distribution line, the entrance to the dining halls is usually located, namely large tents with foldable tables and chairs.

The majority of the surveyed food management units, 9 out of 10, did not have written procedures and emergency plans guiding the activation and operation of the unit. As written above, these are volunteers organizations selected by the national and local emergency management agencies, and are not required to have an internal written plan defining roles, responsibilities, operations and scope. Procedures, roles and chain of command are often defined impromptu and based on past experience. Furthermore, because of the voluntary nature of the units, the teams sent to the disaster areas, are not pre-set groups, with a defined chain of command. Hence, the team's organization and modus operandi varies according to the mission leaders' style. Thus, procedural changes may be expected with the rotation of the team members and leader. Individual experience, sensibility and skills of the person in charge, often the cook, becomes pivotal for the effectiveness and success of the food management unit. An important example may be found in the definition of menus, which selection is usually performed by the cook according to the available ingredients and his or her personal preferences and common sense. Indeed, it would be far more appropriate to leave the selection of the menus to personnel trained in nutrition and dietary matters. Moreover, none of the surveyed food

management units offered menu containing dishes for special dietary requirements (needed for specific pathologies, cultural or religious precepts). They claimed, however, to provide customized food items upon request.

### Food management in the aftermath of the 6 April 2010 L'Aquila earthquake.

On Monday 6 April 2009, the district of L'Aquila, located in central Italy, experienced a 6.3 Mw earthquake (USGS, 2009), which killed 308 people and injured another 1500. The widespread structural damages temporarily displaced some 65,000 people, of which 22,000 were left permanently homeless. Survivors were housed in campgrounds, provisional trailer homes, hotel complexes and private houses made available outside the impacted areas. 107 campgrounds were set up to host the rescued population, providing for the basic human needs. Most of the campgrounds were equipped with a field kitchen run by a food management unit similar to those described above.

The specific study on food management and mass feeding in the aftermath of the L'Aquila earthquake (Marincioni and Vittadini, submitted) highlighted a fast and adequate response of the food management units. Many of the surveyed field kitchens were up and operating within 2 days from the impact, and were found properly equipped and organized for food production, storage and distribution. Consequently, the earthquake survivors did not experience food or water deprivation. Yet, despite this overall ability of the food management units to provide the required services, they were found to operate quite heterogeneously one another, with very different levels of organization and efficiency. They could be classified in 4 different types: (a) highly organized and highly standardized, e.g. the Red Cross, with long and broad international experience. These units showed high efficiency, reliability, and professionalism, (b) well organized and somewhat standardized, e.g. Italian National Association of Public Assistance, with a long tradition of volunteer services. These units were dependable and well organized, and operated according to general guidelines; (c) ad hoc and not standardized, e.g. small independent volunteer organizations. These units were organized enough to operate and provide mass feeding services, but did not follow standardized procedures. They were resolute and task driven. Their line of production was not always effective or dependable. Within these units one could find superlative as well as borderline situations that were kept together by the volunteers' sense of sacrifice and humanitarian inspiration; and (d) community run kitchens. There were also instances of small and remote mountainous communities that refused the external help of a food management unit, and opted for a self-run field kitchen assembled in temporary shelters. These groups were generally smaller and consisted of about 40-50 individuals. The emergency command center supplied these communities with the necessary ingredients and whatever missing equipments they requested.

The feeding experience, as described by a sample of 147 interviewed survivors, was overall satisfactory. 39% defined the food served excellent, 52% good, and only 9% average. No one reported bad or unacceptable food. The only consistent complain was about the lack of continuity from one team shift to the next. Namely, every time a new team of volunteers took over the field kitchen (within the same food management unit), new procedures, timing, attitude and menus were imposed. This was particularly true with the small independent volunteers organizations. Although apparently negligible in the aftermath of a disaster, in the long run this may become a stressful experience for the survivors, who craved for routine and normalcy. Some comments also referred to the type of food the missed the most, which was local or family traditional recipes. Italians' cultural approach to food is very conservative and unadventurous, leaving very little space for different flavors and textures. Noteworthy was the recurring longing of "the savor of home," which was missing from the field kitchen food.

### **Discussion**

This study revealed that in Italy food management and mass feeding in the aftermath of disasters is largely performed by pre-selected volunteer organizations which operates quite independently. Beyond the general public health and safety codes, no strict guidelines or plans were required by the emergency management institutions to carry out such tasks. Yet, despite the overt lack of standardization, the services provided by these food management units have been generally satisfactory. Nonetheless, the intention to reach

standardization in emergency food services can be detected in both the national and regional emergency management departments, who have been discussing the subject. For example, it has been proposed to include a food management unit in each one of the 20 regional mobile emergency response columns (*colonne mobile regionale di protezione civile*); these columns are emergency response contingents kept on stand-by and ready to be deployed within 6 hours from an impact. This first food management unit, should be equipped with a cooking trailer, a 6x6m dining-hall tent with folding tables and chairs. Later on this food outpost will be supplemented by the full mobile kitchen, which should leave for the disaster area within 12 hours from the impact, and should be manned with 15 people, of which 1 coordinator, 3 cooks, 5 cook-helpers, 4 people for food distribution and 2 people in-charge of food storage (Dipartimento Nazionale Protezione Civile. (2010).

Certainly these guidelines will contribute to set explicit standards in terms of human resources and equipment required to the volunteer food management units in Italy. However, beside the definition of a minimum configuration of these units, more efforts are necessary for achieving standardization of their services. Following are some recommended measures:

- Standardization of menus to provide continuity of service within and among food management units,
- Creation of a field kitchen manual providing nutritional information about the different types of food, the best way to handle, transform and preserve them, recipes to cook them, and their possible health benefits and drawbacks (allergies, intolerances, ...),
- Development of a nutritional software for emergency mass feeding helping the calculation of a menu's nutritional properties,
- Creation of a database about special diets related to pathologies, cultural and religious practices (especially for the rescue teams expected to operate also internationally),
- Timeline definition of the different kinds of food needed in the different phases of the emergency to expedite victims' emotional recovery. Namely, passing from essential to comfort food by recreating (taking into consideration also the cultural aspects of food) traditional and familiar flavours and texture,
- Develop mandatory training organized at the national level about food management (e.g. safety, handling, nutrition, regional recipes, etc) for all personnel employed in the field kitchen

Standardization of food services does not mean developing few menus that could be used everywhere and during any phase of the emergency, but rather develop effective and controlled procedures that could dynamically be adapted to the various contingencies of the disaster aftermath.

## References

- Alexander, D. (1993). *Natural Disasters*, UCL Press, London, United Kingdom
- Bovee, D.L. (1958). Emergency feeding in disaster. *The American Journal of Clinical Nutrition*, Vol. 6, No. 1, pp. 77-83.
- CRED. (2010). EM-DAT:OFDA/CRED International Database. Centre for Research and Epidemiology of Disasters, Brussels, Belgium. <http://www.cred.be.emdat>. Last Accessed 15 February 2010.
- Dipartimento Nazionale Protezione Civile. (2010). Italian National Department of Civil Protection. Rome, Italy. <http://www.protezionecivile.it>. Last Accessed 15 February 2010.
- USGS. (2010). United States Geological Survey. Reston, USA. <http://www.usgs.gov>. Last Accessed 15 February 2010.
- Italian Public Law 24 February 1992, n. 225. Istituzione del Servizio nazionale della protezione civile. *Gazzetta Ufficiale della Repubblica Italiana*. 1992(41). SO64.

Marincioni, F., Vittadini, E. (submitted). Food Management and Mass Feeding in the Aftermath of the April 6<sup>th</sup>, 2009, L'Aquila, Italy, Earthquake. *Disasters*.

Oxfam. (2004). The Sphere Project: Humanitarian Charter and Minimum Standards in Disaster Response. Oxfam Publishing. <http://www.sphereproject.org>. Last Accessed 15 February 2010.

Sklaver, B. (2003) Humanitarian Daily Rations: The Need for Evaluation and Guidelines. *Disasters*, Vol. 27, No. 3, pp. 259–271.

US Department of Defense. (2008). Operational rations of the department of defence, Natick PAM 30-25, 8<sup>th</sup> edition.

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Table 1: Size of the food management groups, background, role in the group, and training received by the volunteers.

Group	1	2	3	4	5	6	7	8	9	10
<b>Number of volunteers</b>	20	30	6	25	20	20	70	55	26	25
<b>Background (%)</b>										
Cook	-	7	17	15	-	-	21	7	23	8
Technical degree in hotel and restaurant management	25	-	-	8	-	-	-	-	-	-
Food technologist (University degree)	-	-	-	-	-	-	-	-	-	-
Nutritionist/dietician/medical doctor	-	-	-	-	-	-	-	-	-	-
Practical experience during emergency	60	-	83	100	100	100	50	100	77	80
Other	15	93	-	-	-	-	29	-	-	16
<b>Role in group (%)</b>										
Cook	90	7	67	87	20	5	98	70	23	73
Storage manager	51	-	47	70	-	5	98	45	-	11



Coordinator	20	-	16	39	-	5	10	8	77	30
Nutritionist/dietician	-	-	-	-	-	-	-	-	-	-
Food technologist	-	-	-	-	-	-	-	-	-	-
Handyman	20	93	16	16	90	95	30	26	42	40
<b>Training (%)</b>										
Food safety/food handling/HACCP	70	3	100	100	100	5	100	100	8	90
Nutrition	70	-	-	100	-	-	100	100	-	-
Recipes/cooking	60	-	100	100	-	-	100	100	23	-

Figure 1: Examples of mobile kitchen



Figure 2: Examples of preparation, storage, distribution areas and dining halls



## JEDDAH 洪灾中的天灾人祸: SAUDI 市的经验教训

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**【摘要】** 本文对沙特阿拉伯王国 Jeddah 市 2009 年 11 月 25 日发生的洪灾进行了详细的调查和分析, 这次发生于最近的洪灾造成了至少 121 人死亡、数十亿美元经济损失、约 2 万户家庭失去固定住所。精确的损失数字现在还在调查、统计和估算中, Mecca 地区首领 Khalid al-Faisal 王子领导这一工作。作者对此次洪灾的全程进行了跟踪, 从开始下雨到恢复阶段, 并注意记录、建档、总结经验教训, 因此, 此次洪灾的时间线得以构建。进一步地, 本文按照以下分类对灾害的可能成因进行了研究: 自然原因(如引发闪洪的海平面上升、地形特征等); 技术原因(如缺乏早期预警系统等); 人为因素(如协调不力、城市建设规划混乱等)。最后, 为防止、减少未来在自然、人为灾难中的人员和经济损失, 本文提出了相关建议。

**【关键词】** 洪灾; 灾难时间线; Jeddah 洪灾

## NATURAL OR MAN-MADE DISASTER IN SAUDI CITY OF JEDDAH FLOOD DISASTER: LESSONS LEARNED

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### Keywords

Flood Disaster, Disaster Timeline, Jeddah Flood Disaster

### Abstract

In this paper we examined the last flood disaster which occurred in Jeddah City- Kingdom of Saudi Arabia in 25<sup>th</sup> of November 2009 which caused more than 121 fatalities and billions of dollars in losses in addition to around 20,000 sheltered families. Exact numbers are not clear yet due to ongoing disaster loss estimation and investigation activities which are led by Prince Khalid al-Faisal, the governor of Mecca region. We followed the flood disaster events starting from rain fall to the recovery stage. Then, timeline for the event is constructed with the intention to document and draw lessons for quick response in future disasters. Moreover, this paper

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investigates the potential causes for the and finally, this paper gives recommendations to prevent or reduce future human and monetary losses due to future natural and man-made disasters.

## About The City Of Jeddah

The city of Jeddah on the west coast of the Kingdom of Saudi Arabia in the middle of the Red Sea, a total area of 748 square kilometers one of the most important cities in Saudi Arabia, and the gateway to trade, which has gained great importance the movement of international trade with foreign markets. Jeddah is characterized as a main gate of the Two Holy Mosques and the first stop for the pilgrims and pilgrims coming to the leading of the Holy Land (Mecca and Medina) enters through the year to Jeddah's King Abdul Aziz International large numbers, up to 5 million people annually with the purpose of Hajj or Umrah or work or tourism and entertainment.

## Climate

Jeddah is directly affected by the climate of their geographical location, with high temperature and humidity during the summer, and temperatures of up to early forties centegrades, where the percentage under the influence of seasonal low over a warm air mass, solid and up to the higher humidity in the summer due to rising sea temperatures and lower in winter.

## Topography Of The City Of Jeddah

Jeddah is bounded to the south of the mountains from the east and the Red Sea to the west as shown in Figure (1), we see that most of the development zones are located within the Tihama plain stretches in the area between the Red Sea coast in the east, and mountains and mountains of the Hijaz Sarawat along the length of the western province , and most of these areas is land and plains by a slight decline from east to west vary from zero to 12,5 m, on the other hand, the rainfall in the province of Jeddah, a rare and highly variable rates between the spray and light flash floods and help the nature of the ground exacerbate the problem due to limited land surface to absorb this water.

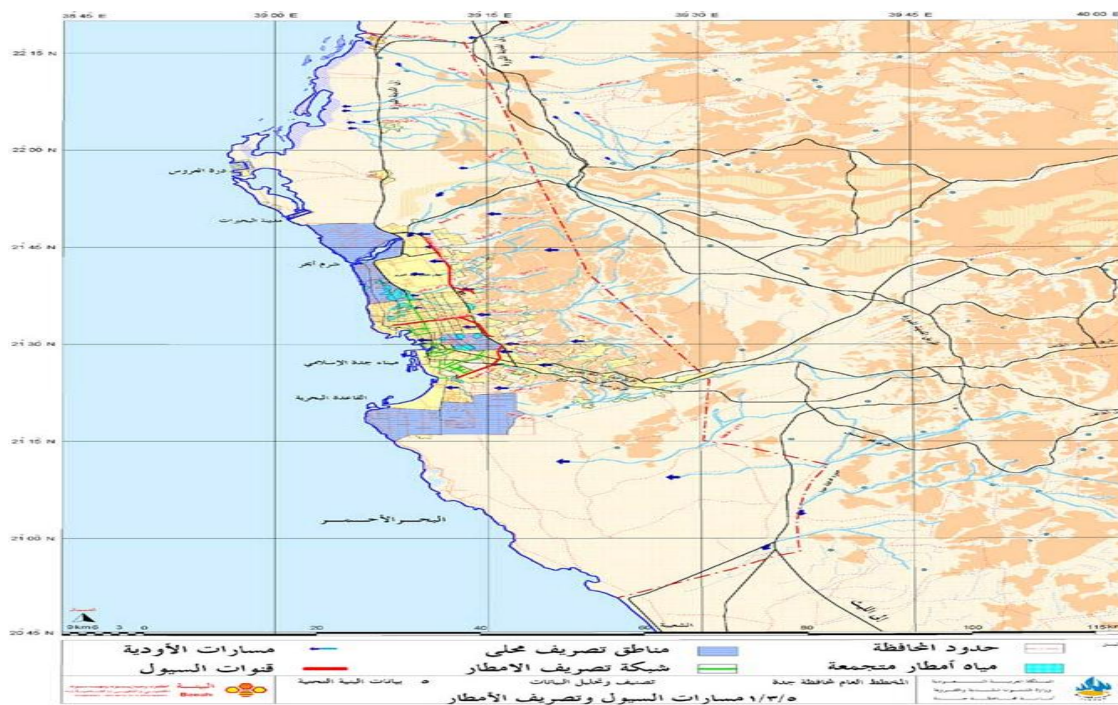


Figure (1) Flood plain area for Jeddah City, redlines: flood tunnels; blue lines: stream lines

## Chronology Of Events

1. Wednesday 25/11/2009, at 8 am: rain lashing the coastal city of Jeddah and lasted for several hours without interruption and the outcome of initial reports the death of 10 citizens and save more than 100 people.
2. Thursday 26/11/2009: Saudi civil defense announces high death toll in the heavy rains and floods to 48 people, and save 900 others trapped in rain, and declares its use of rubber boats in the rescue operations.
3. Friday 27/11/2009: Director of Health Affairs in Jeddah invite parents to stay away from gatherings of water and torrential rains for fear of diseases that may cause, and the announcement of the high death toll to 83 people, civil defense aircraft continues in its attempts to rescue caught up in the water.
4. Saturday 28/11/2009: Declaration of the high death toll to 106, the Saudi lawyer Waleed Abu Al Khair says he will sue Jeddah Municipality, stressing that the families of victims of the floods to support these endeavors and that he intended to condemn the failure of the sewerage system in the city.
5. Sunday 29/11/2009: Rescue attempts continued in the stricken city, and media attention is unprecedented floods, and the legacy of large numbers of victims, and a book critical of Saudi Jeddah municipality, negligence and lack of appreciation of things well.
6. Monday 30/11/2009: Jeddah disaster cast a shadow on the travel of the traveling and the return of pilgrims to their countries because of delays in flights due to a breakdown in the building automation system inquiries, thus forcing the officials to end the proceedings traveler manually, while continuing the search for the missing.
7. Monday 30/11/2009: King Abdullah bin Abdul Aziz to form a commission to investigate the disaster, Jeddah and give the power to call any of the official inquiry, headed by the Prince Khalid bin Faisal, governor of Mecca, and instructs the competent authorities for the payment of compensation of one million riyals for each victim's family, and provide assistance and shelter all those affected by the floods.
8. Tuesday 1/12/2009: Start a commission of inquiry of its work, and a tribute to wide attention the king and decided to form the Committee and provide emergency assistance for families of the victims, while authorities continue their efforts and the implementation of the precautionary plans are broad indicators of the stability of the Lake "musk." Which could cause a cascade threat to the city of Jeddah if flooded by rain.
9. Thursday 3/12/2009: the search for the missing continues, and the announcement of the names of 108 dead by the floods, and civil defense established attribution to the emergency center to monitor developments in flood and trapping Lake musk.
10. Saturday 5/12/2009: Committee formed by the king to investigate the disaster Jeddah hold its first meeting under the chairmanship of Prince Khalid Al Faisal, according to the outcome of the meeting it was decided to form several sub-committees have been entrusted with the tasks initially, at the top limit the damage and begin to arrange payment of subsidy governmental organizations for the families of the victims of \$ million riyals for each prisoner is dead.
11. Sunday 6/12/2009: Saudi Shura Council reaffirms its support for the work of the Commission of Inquiry in the catastrophe of Jeddah, and pays tribute to the issuance of a royal order in this regard, and suggests that he will work on his part up the impacts of catastrophic floods across Jeddah as guaranteed by the rules

and powers of a regulatory source said the floods destroy the nano-devices and lost experience and research of 30 years at King Abdul-Aziz University.

12. Monday 7/12/2009: Seek citizens and residents involvement to provide information according to the investigation, and begin to call people from inside and outside the secretariat of the Jeddah and prevention of vacation and traveling outside the Kingdom for engineers and experts to help in investigation.

13. Wednesday 9/12/2009: Media spokesman for the secretariat of the Jeddah talks to Ahmed al-Ghamdi Elaf "We are accused of ... and the investigation will not stop at al-Faqih". (al-Faqih is mayor of Jeddah City).

14. Thursday 10/12/2009: Death toll rises to 116 dead and diminishing the chances of finding survivors.

15. Saturday 12/12/2009: Civil Defense declared finding 5 victims from the same family in raising the death toll to 120 dead and reduced the number of missing to 32.

16. Thursday 17/12/2009: dwindling chances of finding survivors after the disaster and the death toll to 121 and the Investigation Commission continue its work without notice to the investigation.

17. Sunday 20-12 2009: The number of deaths is 122 deaths, and the number of missing dropped to 39 missing, and the number who have been accommodated in the apartments amounted to 7167 the number of Saudi families 26131 persons, of whom 664 young bachelor, while the number of households that 221 families were sheltering 784 individuals.

18. Monday 21/12/2009: Death toll rises to 122, according to the statement of defense and civilian volunteer efforts accounted scene in Jeddah. (<http://65.17.227.80/Web/ElaphGulf/2009/12/516106.htm> Elaph daily e-2009)

19. Tuesday 22-12 2009: Citizens in a speech calling for people to «bring the perpetrators» in the «Jeddah disaster» (<http://al-madina.com/node/209675>)

20. Wednesday 23/12/2009: Manager falling on electric wires due to rainfall and civil defense without cranes, rain Tuesday cut the current in Yanbu City, Jeddah citizens fears from flood return, 90% the proportion of students are absent and the cancellation of the afternoon shift ([www.alyaum.com](http://www.alyaum.com), 2009)

21. Friday 25/12/2009: Unveiling the civil national defense will be within a week the announcement of results of the examination of DNA that was collected from about 30 families to identify some 25 unidentified bodies. (<http://aawsat.com/details.asp?section=43&article=549978&issueno=11350>, 2009)

22. The Custodian of the Two Holy Mosques King Abdullah bin Abdulaziz stressed the importance of identifying responsibilities for «Jeddah disaster» and hold accountable, and said «will not compromise with any remiss in this respect» (<http://al-madina.com/node/209675>, 2009)

23. Monday 28/12/2009: A number of the Shura Council members said that the stop of 32 officials of Jeddah on Tuesday on the back of flood disaster strongly devoted to directives of the Custodian of the Two Holy Mosques King Abdullah bin Abdul Aziz to fight corruption and to prosecute any official careless in the performance of its mission. (Sharif, 2009)

24. Wednesday 30/12/2009: Committee on «Truth» custody of the 25 employees of «Jeddah Municipality». (<http://al-madina.com/node/210185>, 2009)



25. Friday 20/02/2010: Investigation with contractors who did not support disaster relief efforts in Jeddah. The Ministry of Transport investigate the failures and shortcomings that have emerged from some contactors during the flood disaster which limit the ministry capabilities in implementing the provisions in the disaster management plan for Jeddah area to address potential risks in the future, such as floods, landslides and earthquakes. (Wahib, 2010)

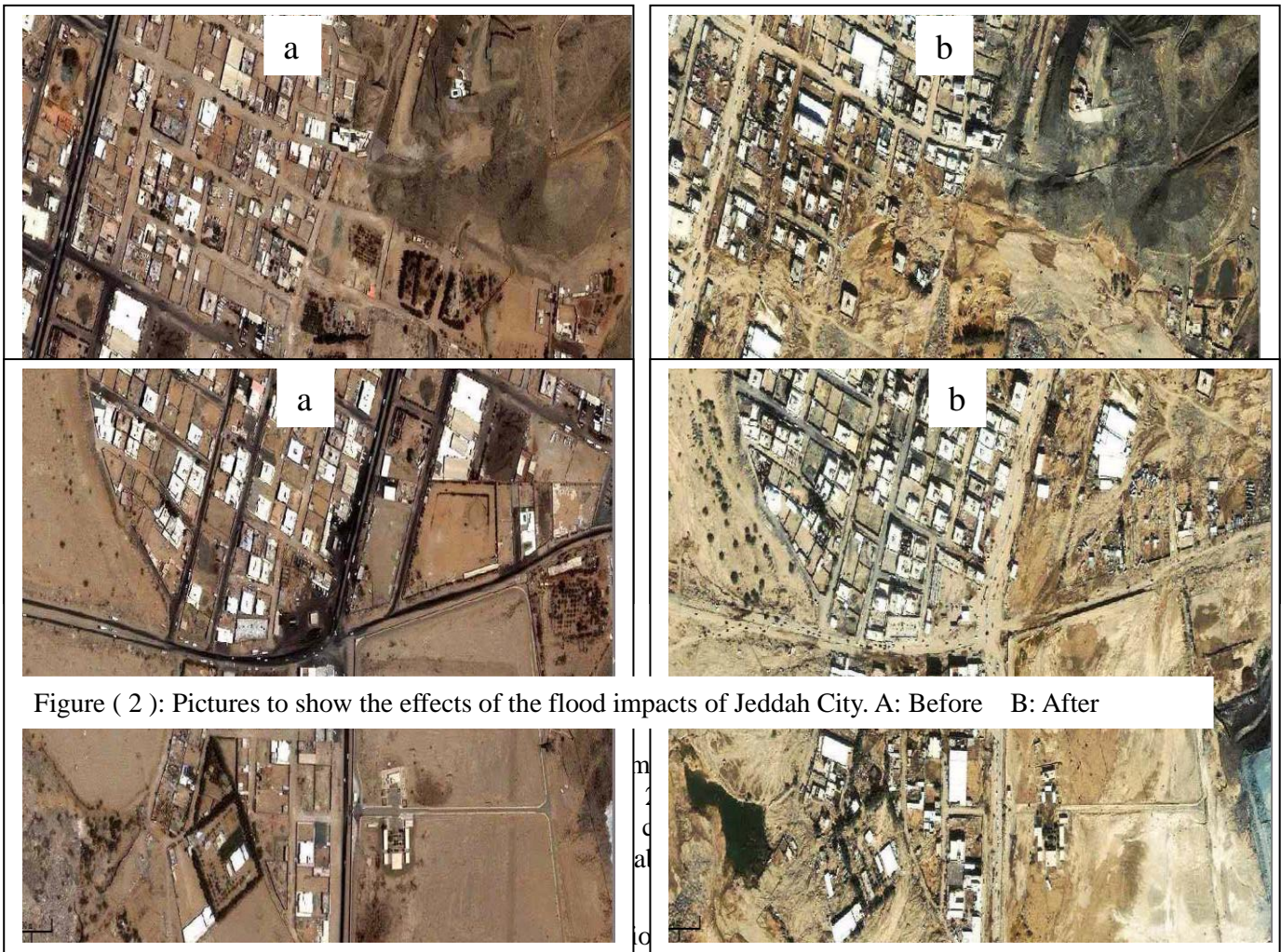


Figure ( 2 ): Pictures to show the effects of the flood impacts of Jeddah City. A: Before B: After

compensation for those affected is estimated at 5.1 billion riyals. As for the number of deaths it has reached 121, and other sources, 122 cases with number of missing of 30 people. The number of sheltered was included 26,711 people in furnished apartments and also pay subsistence for the families of 7821 people. An estimated of 11849 damaged properties and 10913 damaged cars (Mani, 2010). Commercial traffic was paralyzed and sales fell to about 60% in some shops and the fear of the spread of epidemics and diseases (dengue fever). What is more, it led to the destruction of farms along the road in length of about 100 kilometers. Some buildings get cracks such as residential buildings, shops, which led to the collapse of some houses. In addition, some main and branch roads had washed away a number of cars and high water levels in residential neighborhoods. Floods also led to the displacement of hundreds of families during the crisis and the evacuation of homes in the affected districts and neighborhoods close to them during the crisis and then to avoid the rain later. As for the side effects of the disaster mental disorders have emerged, especially among children who lived through the suffering and frequent theft because thieves are waiting for what will be drawn by them as floods increased theft of equipment and cars and many more.

## Jeddah Flood Disaster

The city is located on the coast surrounded by sea and from the east and the plains of the Tihama are low to the Hijaz highlands to the west of the Red Sea, it is imperative that the city extends north and south at the expense of the sea due to a rapid increase of population density. This cause two problems:

- 1- Reclamation areas from sea, which formed two-thirds of the current city
- 2- There is no solid infrastructure to contain the growth of population

Most of the rainfall that falls in Jeddah is accompanied by thunderstorms, the rains usually during the winter, as well as in the spring, and autumn, as a result of the passage of depressions air from west to east and concur with Sudan over low heat on the region, and the world dealing with this kind of devastating rain which is usually accompanied with sever and devastating winds.

Since the Tihama mountains surrounded by sea from the east and the west it is natural to move torrents from the east to the west and create these torrents a number of valleys, estuaries end to the Red Sea. Moreover, rising groundwater due to leakage of sewage and storm-water irrigation and rising sea level due to global climate change (Habib, 2009) and the rapid onset of the rain were the main reasons for the flood (Sahli, 2009)

There was a lack of disaster warning devices and systems both fixed and mobile ones in Jeddah which delay informing stakeholders and the population of heavy rainfall by the meteorological services which could use the Saudi Telecom to deliver messages to mobile customers of the population, as well as to inform the Saudi state television.

The search for missing bodies in Jeddah City took longer than expected since the Civil Defense did not use modern technologies to detect the missing bodies which delay the declaration of recovery stage in addition to the lack of cranes and some important necessities in such crises. This shortcoming could be due to lack of emergency management body to take over the task of knowing the needs of the city of Jeddah to deal with future disasters.

Consulting engineer Nizar Abdullah said that the real reason behind the Jeddah disaster was failure to maintain the floodplain and drainage channels which are established to protect the city of Jeddah. He said: "In addition, there is another reason was the echo of water flowing from the valley in an easterly direction and turned to the south-east and its convergence with water from other valley which composed momentum high water, which led to the transformation towards the neighborhoods." Moreover, he added that "Echo is due to the closure of areas along the northern drainage channel yet fully allow the establishment of a residential district primarily to direct flood water to the channel established for the North to protect dangers of flooding for the city of Jeddah."

The flood disaster proved that failure to take precautions and preparation for natural disasters is a big mistake, especially if it came from government agencies that bear the responsibility to address all risks, including that resulting from natural disasters since they bear the responsibility for implementing and organizing rescue operations, evacuation, and providing assistance in the event of any disaster and they should be able to take actions and policies that limit or reduce the risk of natural and man-made disasters. That is why the government agencies should identify ways to address these risks and develop programs ready for rescue if the event takes place. In the case of Jeddah Disaster, the growing governmental bureaucracy slowdown propose solutions despite prior knowledge of the dangers of floods that overwhelmed the city of Jeddah.

The recent event of Jeddah made an urgent need to develop mechanisms for reporting of natural hazards (and others) and take appropriate decisions to prevent, taking action and appropriate precautions to deal with before disaster strikes. With so many accusations of corruption after the floods Jeddah, there is a need to establish effective mechanisms to fight corruption and to address the abuse of power which many people blamed for the disabled storm water drainage projects and sewage since there was construction on land

which is known for officials to be in the valleys or seas buried planned and sold to the people. Moreover, there was only 8 per cent of the city covered with sewer system according to the Saudi Consulting Engineer Zaki Mohamed Farsi.

Lack of police and civil defense during the event of a disaster, where it encountered the disaster pilgrimage season increased the human and monetary losses. In this season, the Kingdom mobilize its security in the service of pilgrims and uniqueness of this season there are many threats that were causing concern to the State, including the war on Houthis (Yemen borders) and the threats of Iran and the swine flu and therefore has been to consolidate positions in Mecca and reduce the number of elements the security in Jeddah, which led to delays in rescue operations.

### Conclusion And Recommendations

It is important to establishing early warning system for disasters. This system must be linked with traffic and the Civil Defense and the National Guard and the Jeddah Municipality and the Department of Meteorology, government and private hospitals, etc. Such system if implemented could warn affected communities and institutions of impending disasters. Large losses were due to corruption, therefore, there is a need to establish effective mechanisms to fight corruption and to address the abuse of power which many people blamed for the disabled storm water drainage and sewage projects as long as emphasizing on the relevant authorities to implement the ordinance that prevents the property and construction in valleys. In addition we recommend the following:

- Activating the role of maintenance of equipment and streams of rainfall in the rainy seasons and the use of meteorological and environmental protection in periods of rainfall in the province of Jeddah.
- The Association of Meteorology and Environmental Protection must pursue a new approach in the process of notification and warning of rain and floods, so that affected communities could be warned before a disaster strike.
- Preparation of hydrological studies to address the tendencies surface when creating new roads and maintenance of the old ones.
- Develop awareness programs for preventing the dangers of rain and floods and activating the role of the community.
- Review all regulations and plans related to the natural and man-made disasters management in the Kingdom.
- Review and study all of the issued regulations related to urban planning, particularly with regard to identifying the urban boundaries of each city to identify shortcomings both in the regulations or the application.
- Establishment of a national anti-corruption institutions which does not interfere with government ministries and non-governmental organizations in its work where it will completely independent financially and administratively to monitor projects and the budget of these institutions and government ministries.

### References

- <http://www.aawsat.com/details.asp%3Fsection%3D43%26article%3D547404%26issueno%3D11332> . (2009). Al Shaq Al Awsat Newspaper.
- <http://65.17.227.80/Web/ElaphGulf/2009/12/516106.htm> Elaph Electronic News. (2009, 12).
- <http://aawsat.com/details.asp?section=43&article=549978&issueno=11350>. (2009, Dec. 25<sup>th</sup>).
- <http://al-madina.com/node/209675>. (2009, Dec. 26<sup>th</sup>).



<http://al-madina.com/node/210185> . (2009, Dec.)

[www.alyaum.com](http://www.alyaum.com). (2009, Dec. 26<sup>th</sup>).

Sahli, 2009, (2009, Dec. 8<sup>th</sup>). “We informed the authorities one month ahead”.

<http://www.okaz.com.sa/new/Issues/20091208/Con20091208319314.htm>.

Sherif, S. (2009, Dec. 28<sup>th</sup>). <http://al-madina.com/node/210185>. Al Madina Newspaper.

Habib, S. (2009, November 28<sup>th</sup>). Our cities between weather fluctuation and rainfall drainage.

<http://www.al-madina.com/node/202155>.

Mani, S. (2010, February 12<sup>th</sup>). Housing extension for Flood victims.

Wahib, W. (2010, February 12<sup>th</sup>). The didn't take their role through ministry of transportation. Al-Madina newspaper.

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## 文物建筑的洪灾准备策略

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**【摘要】**在保护生命、健康、财物和环境方面, 应急计划的问题是受到关注的主要问题之一。无论实际状况如何, 保护措施总是每一社会的第一选择, 而文化、历史和道德传统同样具有价值、值得保护; 历史性建筑及其内部物件是世界上每个国家所特有的文化遗产。博物馆、展览馆及陈列馆里有大量的无价文物需要保护。相对于处理灾难造成的后果来说, 高效备灾是更容易实现的。大部分灾难与水相关, 例如, 洪灾常常是由过高的水位、暴风雨、水管爆裂泄露等引起的。文化遗产总体上来说是在暴露于污染物、自然天气过程以及意料之外的水灾(如洪灾、海啸、滑坡、极端天气等)之中的。不幸的是, 在灾难性袭击中, 没人能够等到所有的数据、风险分析、信息和结论都完成。当灾难发生时, 时间通常非常紧迫; 面对抉择必须快速决策, 因此对于受过良好训练的救援队伍来说, 优先度排序和措施一直是不可或缺的工作指南。决策时必须考虑文物的价值、必要时进行更换的可行性、或是之后再修复和保护所需花费的努力。在时间允许的情况下, 可移动的文化遗产可被转移, 然而不可移动的文化遗产则会面临严重损失。

**【关键词】**洪灾准备; 文化遗产; 文物; 及时响应

## FLOOD-PREPAREDNESS STRATEGY FOR CULTURAL HERITAGE BUILDINGS AND THEIR CONTENTS

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### Keywords

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Flood-preparedness, cultural heritage, artefact, in-time response

## Abstract

Problems of emergency planning are predominantly focused on protection of lives, health, material and property values and environment. Regardless of this fact, these protected interests are number-one priorities for every society, there are also values related to culture, history, ethic; historical buildings and their contents are specific case, it is a part of cultural heritage, which belongs to every nation of this planet. Museums, galleries or archives house amount of priceless artifacts, which have to be secured. Efficient preparedness is easier to carry out comparing to dealing with consequences of disasters, anthropogenic incidents and other emergencies. Most disasters are water related, i.e. the result of flooding caused by high water, storms, leaks of water used to extinguish the fire, etc. Cultural heritage as a whole is exposed to attack from pollutants, natural weathering processes as well as unexpected water-origin disasters, such as floods, tsunamis, landslides or extreme weather events. Unfortunately, no one can afford to wait for all the data, risks, information and conclusions to be entirely completed having survived a disastrous attack. When a disaster occurs, time is of the essence; decisions must be made quickly about which items to sacrifice and which to save, therefore priority lists and measures are always inevitable working guides for trained salvage teams. Decisions must consider the cost of artifacts, availability if replacement is necessary, or demanding conservation-restoration efforts afterwards. Movable cultural heritage can be relocated from a site if the time allows, however immovable means are subject to severe changes in climatic environment.

## Introduction

Cultural heritage of every advanced sophisticated country becomes its inseparable component, whose keeping and preservation is in public interest; therefore cultural heritage protection has to be paid extremely careful attention to. It must follow the latest scientific knowledge and result from international agreements in the field of European and World cultural heritage.

Various destructive natural disasters frequently strike populated areas in addition to calamities caused by human beings, such as terrorism attacks, war, arson, etc. Hardly a month goes without a report detailing loss of property or lives or the facts that cultural institutions and valuable heritage sites are damaged, destroyed or affected. Risk of fires, floods, mud slides avalanches, rain or snowstorms, tsunamis and other water-related emergencies are taken very seriously; therefore in-time prepared plans and strategies have to be developed, tested and implemented as well as regularly trained staff in case an emergency strikes.

It is impossible to avoid neither unexpected natural disasters nor the damage caused afterwards; however we are able to reduce the risk of loss or damage to property if a response plan is ready being tailored to the specific needs of most frequently repeated cases, e.g. floods, which happened a couple of times in a particular region in the last decades. Its aim is to be better prepared and respond more appropriately to coming high water resulting in threat to inhabitants and cultural values.

The United Nations General Assembly designated the 1990s the International Decade for Natural Disasters Reduction. At that time the global awareness was raised about the need for preventing the destruction of natural disasters caused to cultural heritage. The initiatives strengthened existing frameworks for preparedness, response and recovery and put in place a number of useful mechanisms for practical assistance at site level, including logistic support in case of cultural heritage property evacuation.

## Cultural heritage protection

Cultural heritage is irrecoverable treasure of every country and its population. It indicates the development of community, philosophy, religion, science, technology and arts; it demonstrates education and culture level of every nation. This treasure has to be protected against its damage or devastation.

Historic buildings as well as collections, furniture and other cultural heritage is always at risk; risk from, the daily forces of slow decay, neglect and attrition, risk in the face of natural disasters, technological accidents and even from the hand of over-jealous conservators. There must be made bridges between those responsible for planning for disasters and ordinary people whose own vigilance must be stimulated, courage should be supported. We are able to deal with a catastrophe and its consequences without having to set human life against the value of cultural heritage. The life and heritage are linked and interrelated, they are parts of indivisible whole; the efforts to secure one should serve to strengthen the other and we are able to find one common language.

Vast numbers of artefacts are preserved in archives, libraries, historic houses and museums. In the course of time, every country is confronted with damage to their cultural heritage a wilful or accidental destruction. In both groups of disasters, natural and those caused by a man, we can notice the same causes and consequences. Even if we are powerless facing the outburst of celestial or terrestrial forces, we have a chance to take all known and possible measures to minimize the consequences. We need to set up a disaster plan including preventive measures to take long before the disaster strikes considering the building, the equipment, the infrastructure, road system, the staff training, the emergency response, etc.

When a disaster strikes, the evacuation of people is often made immediately and when the staff is allowed to re-enter the site, it is couple of hours later and often for a limited time. However, it is essential that a building is secured and entry is allowed for a limited period of time, particularly at the beginning. Everybody knows that especially in case of a flood, it is necessary to act as soon as possible because two or three days are enough to ruin water-damaged documents. This is why we have to carry out emergency response very urgently. Nevertheless, there should always be realized that it is better to spend a few minutes to decide on the best emergency strategy than hurrying around chaotically which can only lead to mistakes. Using common sense prevents making mistakes. Disaster plan is a document but there is always a long way from theory to practice. The staff should be trained: time devoted to theoretical training has to be complemented by disaster workshops. Topics should include handling of damaged documents which needs time and money. Workshops should be dedicated to specific problems, starting from discussing equipment and response measures to the handling documents necessary to get in touch with emergency services which might be called for help on case of disaster. Organized teams of volunteers should be arranged; we should make lists of human resources, equipment and service off-site.

### **Floods – the most urgent calamities in the Czech Republic**

Most disasters are water related, i.e. the result of flooding caused by high water, storms, and leaks of water used to extinguish the fire. However, floods are one of the most common hazards in the Czech Republic. Flood effects are local, impacting a neighbourhood or community, or very large, affecting entire river basins and multiple regions as happened in 1991. However, all floods are not alike: some floods develop slowly, sometimes over a period of days. Flash floods can develop quickly, sometimes in just a few minutes and without any visible signs of rain. They have a dangerous wall of roaring water carrying rocks, mud and other debris and can sweep away most things in its path. Overland flooding occurs outside a defined river or stream, such as when levee is breached, but still can be destructive. Flooding can also occur when a dam breaks, producing effects similar to flash floods. We should be aware of flood hazards no matter where we live, but especially if we live in a low-lying area, near water or downstream from a dam. Even very small streams, gullies, creeks, culverts, dry streambeds or low-lying areas, which appear harmless in dry weather, can flood.

Moisture damage also results from leaking joints or broken pipes in water and water transport system within old buildings. As pipes are generally enclosed within walls and floors, leak may only be noticed long after hidden moisture may have increased wood rot or weakened plaster walls and ceilings. Water and humidity can cause particular damage to objects, fittings, furnishings, collections, libraries and archival records. Damage can include loss, separating or removal from original setting

or context; rusting or corrosion of metals; dissolution of finishes, paints and surfaces; erosion of masonry mortars and deposition of waterborne impurities in the pores of masonry units; warping, splitting and cracking of wood and organic materials and increased susceptibility to rot; deposition or contamination from waterborne chemicals and microorganisms.

A flood preparedness strategy reduces the potential for damage to cultural heritage. It requires well-integrated efforts on the part of those responsible for cultural heritage. Together there are developed balanced strategies to improve care for human life, property and heritage. Cultural heritage monuments protection problems in the Czech Republic date back to the 50ies of the 19<sup>th</sup> century; it is related to the so called Vienna cultural heritage school. At the time of the so called first Czechoslovak Republic the protection of the cultural heritage monuments was solved via Governmental Commissariat of cultural heritage protection. After WWII its activities were continued by the Department of Cultural Heritage Protection of the Ministry of Education and National Edification. In 1951 the Ancient Monuments Department was established. Later decades can be characterized as years when the most significant changes regarding cultural heritage monuments occurred; specialized authorities dealing with cultural heritage pool protection was established: it consisted of the Ministry of Culture as a central state administration authority, Ancient Monuments Authority and regional cultural heritage authorities.

Cultural heritage protection is included into the Constitution of the Czech Republic as well as into further legislative standards (Act on museums and galleries and on protection of objects classified as valuable for museums and galleries, act on libraries, act on cultural heritage pool, etc.). These above mentioned standards rigidly result from international agreements, negotiations, resolutions and charters within the European and World cultural heritage (UNESCO and Council of Europe agreements, documents issued by ICOM and other international organizations).

Considering broad experience from repeated floods in 1990s (damaged archives and libraries in Prague, Olomouc and other cities), further flood disaster plans include detailed lists of emergency procedures and recommendations, as well as updated lists of resource people to contact when the crises arises, lists of suppliers and service providers. In case of movable heritage evacuation from buildings, there are lists of types and number of vehicles including passable roads available. The flood disaster plan also include the list of people who might be able to help in case of disaster and the extent of their intervention, kind of responsibility, they are given, external staff working in other neighboring cultural institutions, packaging material, cardboards, freezer companies, decontamination centers, etc. Finally, the plan also includes location of collections, rescue priorities, handling of damaged collections according to various types of water damage. Placing rescue kits or carts with essential response equipment in strategic sensitive points of the building also helps to avoid losing time later on. Such a disaster plan is intended for entire staff of the institution; different members of the staff are provided with specific responsibilities according to their abilities not to their status. That is why a storage area employee who has been working at the building, e.g. an archive, library, gallery, museum, etc., let us say for 15 years, is more qualified than a recently appointed boss to select water-damaged items to be evacuated from the shelves. The senior manager's job consists in coordinating operations within the emergency services and keeping in touch with the local services.

### **Care, handling and removal of library and archival materials**

Books should always be shelved upright, resting square on their bases. They should not be placed on their fore edges, allowed to lean, or packed tightly or too loosely. When a book is shelved fore edge down, gravity will eventually and inevitably pull the text block from the case to the hinge. Oversized books frequently have bindings that are weak in proportion to their size and weight and cannot be stored on ordinary vertical shelving. Sometimes double-width shelves can be used for this purpose. There should be no protrusion of books into the aisle.

Book trucks should be used to move books to the stacks from processing, circulation or in any case of emergency. Regardless the situation, materials on book trucks should be shelved upright resting square on their bases with their spines parallel to each other and perpendicular to the shelf bottom – as they are on shelves.

A salvage team must concern itself with the issues involving those materials to salvage and those to replace. These triage-based decisions must take into account the cost of material, its value to the library, its availability if replacement is necessary and the labor involved in acquiring and processing it. If only a small amount of material is affected, it is possible to review each item for salvage or discard. Usually there is not enough time for careful packing. Once the material is frozen, it can be reviewed at a more leisurely place. That is why it is better to have some idea ahead of time as to which collections should be recovered first. Many libraries as well as archives give priorities for package and salvage (it was the case of Karlin archive in Prague) to records and collections containing information needed to establish or continue operation after a disaster and aid recovery operations. All the materials are grouped into four or five priority categories in the event of a disaster in advance.

First priority is given to the bibliographic records of the collection or some types of magnetic or electronic storage devices. High priority is always given to special collections, rare or restricted materials or materials which would be too costly to be replaced or are not available at any price. There are included materials and items which should not be frozen and further air-dried. Next are materials, which are replaceable but to get them is time and money consuming. When the disaster strikes, the time is the essence. Decisions must be made quickly about which materials to sacrifice and which to save.

Materials must be physically removed from the damaged area. This operation is sometime complicated by lack of electricity. Wet items must be removed in order to lower the humidity in the affected area and space and to facilitate drying and decisions for disposition. Stairways are not safe therefore there are formed human chains and people pass single books or boxes with books from one person to another. Wherever books are slippery, paper-based media fragile and become distorted. Whatever containers are used for transport, they must be uniform in size for stacking; otherwise, they may tilt or tip over being transported on lorries and further handling, storage, cleaning and processing techniques.

## Conclusion

For historic properties, the response plan should include an inventory and documentation of fragile and significant building elements, objects and fittings which may require special attention and possibly salvage removal and conservation prior to and in the aftermath of, flooding. Further, there should be ensured providing secure centers for emergency storage of e-located objects, and conservation treatment of waterlogged materials. The plan must always include the fact that emergency teams of trained and experienced conservation professionals, i.e. historians, craftspeople and responsible members of the local community are available for assessment and planning repair interventions during emergency-response operations. Emergency-response officials must be trained in measures to care for significant cultural heritage in the course of carrying out their duties. Such training includes increasing consciousness of the value of the cultural heritage and appropriate measures to ensure its conservation and care.

Evacuation of movable cultural heritage is one of way of its protection. Successful solution how cultural heritage can be saved consists, among other, in professional preparation and training of individuals involved as well as in competent and complex logistic support for every evacuation activity.

Rescue activities create situation causing physical, physiological and mental load and strain. Unfavorable factors affecting psychic activities of a human being have to be fully or partially

excluded or minimized. Therefore physical preparation process has to help create, develop and improve control mechanisms finally resulting in optimum behavior and activity control of rescuers.

Considering logistic support, movable cultural heritage evacuation is ready to solve the possible problems as follows: to determine in advance the place for further location; to select appropriate trucks; vehicles and handling equipment considering the specificities of load bearing capacities of historic yards, bridges and gate widths; to work and keep instructions how to manage and handle safely particular cultural heritage items; methods, how evacuated items are removed out of the buildings and loaded on and into prepared means of transport; methods and routes of transport (routes to relocation places).

Cultural heritage, its keeping and preservation become an inseparable component of public interest. Archival documents, manuscripts, monuments, fine arts, paintings, etc. are threatened at various emergencies and crisis situations and these priceless and irrecoverable historic items can be seriously damaged and destroyed. Evacuation of movable cultural items can significantly effect how fast and safe historic masterpieces and items are salvaged in case any emergency occurs. Promptness and effectiveness of evacuation procedure requires from involved responsible individuals using every available means in order to save and salvage maximum cultural heritage items with minimum strength and means.

## References

- DePew, J. (1991). Library, Media and Archival Preservation, ABC-CLIO , Inc., Santa Barbara, California, USA.
- Rosicka, Z. (2008). Emergency Preparedness Related to Cultural Heritage, Institut Jana Pernera, Pardubice, Czech Republic.
- Rosicka, Z. et all (2008). Vita In Societate Secura. Univerzita Pardubice, Pardubice, Czech Republic.
- Torraca, G. (1991). The Application of Science and Technology to Conservation Practice. Science Technology and European Cultural Heritage. Butterworth Heinemann Ltd., pp. 221-232. United Kingdom.

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Zdena Rosicka graduated from the Faculty of Arts of the Jan Evangelista Purkyně University in Brno in 1979, specialization Russian and English studies. She works as a university teacher at the Faculty of Regional Development and International Studies, Mendel University Brno. She is dealing with and focuses on problems related to interpersonal and cross-cultural communication, emergency preparedness and cultural heritage protection at emergencies.

Jiri Stodola is a professor of University of Defence in Brno, Faculty of Military Technology. He deals with theory, practice and application of technical systems risk management. He was the head, author and co-author of 60 scientific assignments that were focused on problem solution. He is the author of 60 expert publications and about 215 papers published in the Czech Republic and abroad (USA, GB, Germany, Italy, Korea, etc.). He represents Czech Republic in AVT (Applied Vehicle Technology) RTO (Research Technology Organization) NATO as a principal panel member.

## 2009 年维多利亚灌木林火的经验性分析：问题，挑战，经验与策略

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**【摘要】** 本文阐述了导致 2009 年 2 月 7 日黑色星期六多人死亡的关键问题；并强调了那些在文档分析、公众资讯内容分析、并与事故管理与控制小组 15 位成员进行讨论的基础上发现的事实和关键性问题。通过本文的研究发现，天气、纵火犯、灌木林火早期预警通信和疏散问题、以及目前的土地及森林管理问题是造成这场灾难的核心问题，但火势的凶猛是难以想象的，要预测到并为之制定预案更是困难。以基于证据的改进为目标，对于早期预警、疏散和生态政策决策进行进一步的研究，将会拯救生命。本文强调了灾难管理者和地方当局在备灾和有效响应灌木林火中所必须考虑的事项，无论是在发达国家还是发展中国家。

**【关键词】** 黑色星期六；灌木林火；维多利亚灌木林火；澳大利亚灌木林火；野火

## AN EMPIRICAL ANALYSIS OF THE 2009 VICTORIAN BUSHFIRES: ISSUES, CHALLENGES, LESSONS AND STRATEGIES

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### **Keywords**

black Saturday, bushfires, Victorian bushfires, Australian bushfires, wildfires

### **Abstract**

The paper identifies and describes the key issues that contributed to the magnitude of loss of life on ‘black Saturday’ 7 February 2009; and highlights the implications and key issues arising from the disaster using document analysis and content analysis of publicly available information as well as discussions with 15 members of the incident management and control team. The study found that the climate; arsonists; bushfire early warning communication and evacuation issues; as well as current land and forestry management issues were at the core of the disaster, however it is difficult to imagine, anticipate or plan for the ferocity of the fires. Further research into early warning, evacuation and ecological policy decision-making with a view to evidence-based improvements that may save lives. The study highlights factors that disaster managers and local authorities must consider in preparing for, and responding effectively to a large bushfire disaster in developed and developing countries.



## Introduction

High Mortality from the effects of natural disasters is usually associated with poor, developing countries and the recent Haitian earthquake and the 2008 Cyclone Nargis in Burma comes to mind (EM-DAT, 2008; Benson et al. 2001). However, the Australian bushfire disaster of 7th February, 2009 now popularly referred to by many as ‘Black Saturday’ shocked the world by its magnitude of loss of life (The Age, 2009). 173 lives were lost and over 500 people suffered fire-related injuries (ABC, 2009; Telegraph, 2009). During the fires and its aftermath, more than 200 people were admitted to hospitals across Victoria with severe burns. (ABC, 2009; Telegraph, 2009). A number of the dead victims come from foreign countries such as the Phillipines, New Zealand and the United Kingdom (ABS-CBN, 2009).

The ‘black Saturday’ disaster destroyed at least 1,834 homes and damaged thousands more (Sydney Morning Herald, 2009; ABC, 2009). Several towns north-east of Melbourne, the state capital of Victoria were damaged, or almost completely destroyed. These include Marysville, Strathewen, Kinglake, Narbethong, and Flowerdale (ABC, 2009). ‘Black Saturday’ left an estimated 7,500 people homeless

(ABC, 2009). It is the most serious bushfire disaster in Australian history (Bushfire Cooperative Research Centre, 2009). Sometimes, this type of fire is referred to as an ‘extreme’ or a ‘mega’ fire, i.e. fires that exhibit behaviour outside known fire fighting experience (James, 2009). No Australian disaster since the 2002 terrorist attacks in Bali has attracted so much international attention and assistance. For example, the United States sent more than 30 US Department of the Interior and US Forest Service wild-land fire-fighters and specialists in emergency land rehabilitation to the Australian government to assist; Canada sent nine wildfire specialists from British Colombia to help fight the fires; Papua New Guinea donated \$A2 million (USD 1.5 million) to the Australian government to assist Australian disaster victims; Singapore offered the use of a fleet of Super Puma Helicopters; New Zealand sent scores of firefighters; Indonesia sent dozens of disaster victim identification (DVI) and forensic experts as well as contributed US\$1 million for the reconstruction of schools that were burnt; Russia offered large fire-fighting aircrafts which were declined by the Australian government while France offered the use of unspecified logistics resources based in the near-by island of New Caledonia. In addition, governmental condolence messages poured in from as far as Norway, Russia, Portugal, Turkey, Bulgaria, East Timor, Germany, India, Iran, Japan, South-Africa, Israel, Lithuania, United Kingdom and the Vatican, as well as hundreds of thousands of private phone calls emanating from outside Australia to confirm the welfare of friends and relatives in Australia. Bushfire appeals for relief funds and goods-in-kind were undertaken in the United Kingdom, Canada, United States, and New Zealand (The British Monarch website, 2009).

As at the time of writing, insurance companies indicated that it was too early to tell what the costs of the fires to insurers would be. However, preliminary estimates suggested that the total insurance costs for the fires could amount to over \$1.5 billion (USD 1 billion) (Business Spectator, 2009; Investor Daily, 2009). At the close of trading on 9 February, shares of major insurance companies with some exposure to the fires had dropped by more than a quarter (Investor Daily, 2009).

The study is justified because of the unusually large number of deaths in a country with a long experience of fighting bushfires, the inability of residents to clearly see the enormity of the danger and the need for early self-evacuation despite warnings, and the inability of the authorities to consider the need for mandatory evacuation in spite of the early warning of the risk of high intensity fires. In addition, the study is justified because of the unusually large scale of the fire — for example with over 50% of the Murrindindi Shire area in Victoria was under fire despite Australia’s huge financial, human, scientific, and technological resources.

## Objectives

The study:

1. identifies and analyses the key issues and challenges that may have combined to contribute to the unusually high rate of mortality on ‘black Saturday’; and
2. identifies and discusses the key lessons and implications arising from the disaster for practitioners and researchers, while suggesting future strategies.

Towards achieving these goals, the paper provides an analytical reflection on key issues and challenges in the

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disaster as reported by various media with an emphasis on the process of early warning, the communication of that warning and evacuation

policy. The study concludes by identifying lessons and implications while proffering potential strategies for effective bush fire disaster preparedness, response and management in this disaster and beyond.

The rest of the paper is structured as follows: a brief historical overview of bushfires in Victoria is provided in the following section; then the data collection techniques utilised in the study are discussed with attendant limitations. The penultimate section highlights and analyses the key issues and challenges that may have combined to contribute to the unusually high rate of mortality on 'black Saturday', while the following section identifies some lessons, strategies and implications arising from 'black Saturday' while making recommendations and suggestions for further research.

## **Historical overview of bushfires in Victoria**

Australia is the most fire-prone continent and country on Earth (Bushfire Cooperative Research Council, 2008). There has been several large bushfires on the Australian continent over the centuries and this has been significant in shaping much of the Australian landscape before the arrival of European settlers (Yibarbuk et al. 2001). Bushfires are usually started by lightning, however, indigenous Australians, for long have used deliberately started bushfires for the clearing of tracks through dense vegetation for the encouragement of grasslands for hunting purposes, and for cultural and land management reasons (Yibarbuk et al. 2001).

Significant bushfire events that have resulted in loss of human life and property since 1851 in Victoria are: The 'Black Thursday' bushfires of February 6th 1851 that covered 25% of what is now Victoria (5 million hectares) (see fig 1 below). The bushfires affected Portland, Plenty Ranges, Westernport, and the Wimmera and Dandenong districts resulting in the loss of 12 lives, a million sheep and tens of thousands of cattle. On the 1st of February, 1898 'Red Tuesday', bush fires burnt 260,000 hectares in South Gippsland resulting in the loss of 12 lives and more than 2,000 buildings. Between 1905, 1906, 1912 and 1914, fires burnt more than 100,000 hectares. In February and March 1926, forest fires burnt across large areas of Gippsland killing 60 people and damaging several farms, homes and forests. On February 14, 1926, 31 deaths were recorded at Warburton. Affected areas were Noojee, Kinglake, Erica, and the Dandenong Ranges. In 1932, large bushfires occurred in several areas across Victoria throughout the summer. Forests in Gippsland were burnt and 9 lives were lost.

On Friday, January 13, 1939, 'Black Friday', fires killed 71 people and destroyed more than 650 buildings including the township of Narbethong. Areas affected included Noojee, Woods Point, Omeo, Warrandyte, Yarra Glen and others. The fires started in December 1938 and burned till January 1939. Almost 2 million hectares were destroyed — 800,000 hectares of protected forest, 600,000 hectares of reserved forest and 4,000 hectares of plantations. The findings of the Royal Commission that was held following the 1939 fires were highly significant in increasing fire awareness and prevention throughout Australia. Hence, fatalities reduced significantly in the 3rd/4th March, 1942 fires that killed 1 person and destroyed more than 20 homes and 2 farms in South Gippsland. Although in the following year, on 22 December, near Wangaratta, 10 people were killed. Between 14th January and 14th February, 1944, 20 people died, 500 homes lost and 440,000 hectares of land destroyed as a result of bushfires in Hamilton, Dunkeld, Skipton and Lake Bolac.

### **Fig 1. Political map of Victoria showing towns**



More recently, between 14<sup>th</sup> and 16<sup>th</sup> January, 1962 in the Dandenong Ranges and on the outskirts of Melbourne 32 people died and 450 homes destroyed in bushfires. Similarly, on 17<sup>th</sup> January, 1965, a bushfire near Longwood in Northern Victoria caused 7 deaths and burnt 6 houses. On the 8<sup>th</sup> of January 1969, 280 fires broke out in Lara, Daylesford, Dulgana, Yea, Darraweit, Kangaroo Flat and Korongvale, resulting in the loss of 23 persons, 251 houses and buildings, 12,000 assorted livestock and 250,000 hectares. On February 12, 1977, bushfires in Western Victoria caused the deaths of 4 people and resulted in the loss of roughly 103,000 hectares, 198,500 assorted livestock, 116 houses and 340 buildings.

Australia's most well-known bushfire event 'Ash Wednesday', occurred on 16 February 1982 — over 100 fires in Monivae, Bransholme, East Trentham, Mt Macedon, the Otway Ranges, Warburton, Belgrave Heights, Cockatoo, Beaconsfield Upper and Framlingham areas of Victoria burnt 210,000 hectares and caused 47 deaths. It also resulted in the loss of over 27,000 livestock and 2,000 houses. Another major fire on 14 January 1985, in Avoca, Maryborough, and Little River, Central Victoria, killed 3 persons, burnt 50,800 hectares of land, 180 houses, 500 farms and 46,000 livestock. Finally, the last major fire that resulted in loss of life was the 21 January 1997 fire — five major fires broke out in the Dandenong Ranges, including

Arthurs Seat, Eildon State Park, Gippsland and Creswick, that caused 3 fatalities, destroyed 41 houses and burnt 400 hectares. There have been several major fires in Victoria since with no loss of life until the 7<sup>th</sup> February 2009 fires that claimed 173 lives. Other major Australia-wide bushfires include the Tasmanian fires that killed 62 people and burnt through 265,000 hectares within 5 hours, in February, 1967, the Sydney fires of January 1994 that killed 4 persons and destroyed a million hectares of bushland; the Dandenong Ranges fires in Victoria in January 1997 that killed 3 persons, and the Canberra firestorms of January 2003 that killed 4, as well as the Eyre Peninsula fires of South Australia that killed 9 who were found in or near vehicles they were trying to flee and destroyed several homes. Having provided a summary overview of the history of bushfires in Victoria, in the following section I describe data collection sources and techniques.

## Method

Data for this study was collected from several secondary sources, such as published disaster records, web sites and web documents of various Australian disaster management organizations, TV news reports, newspapers, communiqués, press releases, written reports, of sample organizations. Additionally, government and emergency management situation reports were used as well as the 2009 Victorian Bushfires Royal Commission interim report. Also, bulletins and updates from the web were subscribed to and utilized, as well as reports from charities, non-profits and community organisations (e.g. St Vincent de Paul, Lions club and Salvation Army); and various other agencies and institutions (e.g. Police, libraries, Geoscience, Bureau of Meteorology Australia). Thus, through a detailed content analysis, a large quantity of qualitative and quantitative data and information about the background issues and challenges in “black Saturday” was obtained. The author also obtained a large quantity of qualitative and quantitative data and information about the on-going disaster relief, recovery and management operation.

In the period 7th February to 7th March 2009, a total of 180 hours was spent undertaking document and content analysis of the secondary data sources mentioned above with a view to determining the tilt of the stories being published about the disaster and its attendant response. Content and document analysis was adopted for pragmatic reason. For example, it was difficult to get access to the fire areas and to disaster managers as the fire was on-going at the time of the study with the affected areas cordoned off. In addition, some of the fire disaster sites have been declared crime scenes as forensic investigators did their work. Apart from some television footage, many activities and processes of responding to and managing the disaster were undertaken out of sight by the various agencies involved. However, shortly after the fires were put under control, the author was able to gain access to the devastated areas of Marysville, Flowerdale, Kinglake, and Kinglake West and to discuss with 15 senior members of the incident management and control team.

**Table 1 Sites visited and sample organisations of the discussants**

Sites visited	Marysville	Flowerdale	Kinglake	Kinglake West
Target organisations	Victoria Police Dept of Human Services	Country Fire Authority	Victoria State Emergency Services	Dept of Sustainability and Environment

and Environment (DSE) and the Department of Human Services (DHS). The author also held discussions with local council officials and at the state level with senior bureaucrats of the Victoria bushfire reconstruction and recovery authority as shown in table 1 above.

### Limitations of the study

Some data from the secondary sources may be questionable to some extent with the exception of scientific journals, as there may be reporting bias that reflects the unknown bias of the authors of these (web) documents (Pettigrew, 1990; Yin, 2003). However, the literature review, document and content analysis process was used in a complimentary fashion to verify, validate and triangulate evidence in order to reduce bias and increase validity in the study (Yin, 2003; Pettigrew, 1990; Siggelkow, 2007; Eisenhardt and Graebner, 2007).

In addition, the empirical data collected was not taken as literal recordings of events that have taken place. Their validity was cross-checked with other responders that the author discussed with, as well as with other sources such as TV reports and official government websites (Yin, 2003: p.87). Therefore, a multiplicity of sources of data conferred various perspectives and a holistic view on the disaster. Also, the various sources are highly complimentary and the government sources authoritative (Yin, 2003). It is however noteworthy that the information in this paper may evolve as more facts come to light. For example, the official Victorian Bushfire Royal Commission of Inquiry — a major Australian Commonwealth government public inquiry constituted to investigate the direct and indirect causes of the black Saturday disaster is still undertaking its investigations and a final report is expected soon. Likewise the disaster relief and longer term community recovery and rebuilding effort are unfolding while incident controllers are still being debriefed. In the following section, the results of the content analysis undertaken, and the discussions held with key actors in

the incident are broadly classified into 2 broad themes (controllable and uncontrollable issues) and several sub-themes for ease of presentation. Each is then discussed serially.

## Results and discussion

### Issues and challenges in the Black Saturday bushfire disaster

After content and document analysis of the aforementioned secondary sources was undertaken and informal discussions held with 15 members of the incident management and control team, five themes emerged that may be broadly categorized into two main groups:

- a) The uncontrollable issues and challenges; and
- b) The controllable background issues.

### Uncontrollable issues and challenges

The uncontrollable issues include for example the extremely dry and hot climate of the disaster area in the preceding 12 years before ‘black Saturday’, while the controllable background issues included: (1) bushfire early warning communication and evacuation; (2) the role of arsonists in the disaster; (3) building regulations for bush fire prone areas; (4) current land and forestry management practices.

In the following section, each factor will be serially discussed starting with the uncontrollable issue of the heat wave. Afterwards, the controllable background issues will be discussed in turn and lessons and strategies identified will be argued concurrently.

#### (1) The heat wave

For almost 12 years south-east Australia including Victoria had been experiencing a drought and forests had been dry for a long time (Victoria Bushfires Royal Commission, 2009). Consequently, there was very little rain in November-December of 2008 coupled with extreme high temperatures of over 40 degrees Centigrade (C) for several consecutive days at the end of January 2009. In deed, many locations through the region reached all-time high temperatures. Adelaide, for example reached its third-highest temperature ever, while Melbourne reached its highest temperature on record 46.4C with a relative humidity of less than 6 % (Adelaide Now, 2009). The highest temperature recorded during the heat wave was 48.2 °C (118.8 °F) in Kyancutta, South Australia (National Climate Centre, 2009).

The heat wave was caused by a slow moving high-pressure system that settled over the Tasman Sea with a combination of an intense tropical low located off the North West Australian coast, and a monsoon trough over Northern Australia. The combination of these factors produced ideal conditions for hot tropical air to be directed down over South-eastern Australia resulting in ambient temperatures exceeding 46.4 C in some places and dry north-west winds with speeds in excess of 75 km per hour (Adelaide Now, 2009). Near Melbourne in Victoria, winds of up to 100 km per hour were reported in places (Adelaide Now, 2009). In addition, forest, grasses and vegetation grew prolifically in the warm moist conditions of spring and dried out rapidly over summer into a tinderbox. The Bureau of Meteorology (BOM) in its Friday, 30 January 2009 media release (a week before black Saturday) indicated that:

“Melbournians have endured three successive days of temperatures above 43 degrees Celsius for the first time in recorded history. The mercury reached 44.2 degrees today at 2.27pm, 44.3 yesterday, and 43.4 on Wednesday”.

As a consequence of the heat wave, localized power outages occurred throughout Adelaide and Melbourne during the week preceding the 7th February 2009 bushfire disaster at varying times, for various lengths. For example, over 500,000 residents of Melbourne’s 3 million residents were without power on the evening of 30 January 2009 (Herald Sun, 2009; ABC News, 2009). The outages affected much of Melbourne, with over 1,300 individual train and tram services cancelled in metropolitan Melbourne alone due to buckling rail lines, air conditioning failures and power outages (Fairfax Media, 2009). The Police had to, for example order the evacuation of many public buildings. There were also: traffic light failures; people being rescued from stuck lifts; and entertainment shows being cancelled (ABC News, 2009). On the 30th of January, all public transport services in the city was declared free as the government admitted responsibility for failing to

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provide adequate infrastructure elements to cope with the heat, however, despite the government gesture over 40% of all rail services were cancelled even on that day (International Herald Tribune, 2009).

Several outdoor matches during the 2009 Australian Open Tennis tournament on the 29th and the 30th of January were also cancelled due to the heat (The Age, 2009).

The Victorian state coroner announced a tripling of corpses deposited in the state mortuary thereby filling up the morgue to capacity, with hospitals and funeral homes being relied upon to provide temporary storage of corpses even before the casualties of 'black Saturday' increased demand for mortuary space (The Age, 2009). Unconfirmed reports claim that over 350 persons lost their lives as a direct consequence of the heat wave.

### Fire danger

The fire danger in these weather conditions is the direct consequence of the combination of tinderbox dryness of vegetation and extremely high wind speeds of up to 100 kilometers per hour in some places. The winds often changed direction several times throughout the day (for example in the Horsham fire). Such high winds fanned existing fires and blew flaming embers to areas of forest, rural houses and communities that had not been on fire, and as a result starting secondary spot fires that themselves developed to become sources of new embers. This is the main mechanism through which the fires travelled fast (Bushfire Cooperative Research Centre, 2009). This was one of the most extraordinary and extreme weather conditions ever experienced in the history of Victoria and there was little that could have been done to ameliorate the condition, unless it rained.

Controllable issues:

#### (1) The bushfire early warning communication and evacuation

The Victoria State Government devoted efforts and resources to informing the community of the bushfire risks that Victoria faced with clear benefits as many people self-evacuated in many areas of the fire. However, on its own, this risk information appeared to be insufficient to translate levels of community awareness and preparedness into specific action, in other words to self-evacuate on time and en-masse. On-going education and information about bushfires should prepare and educate the community on the specific steps or actions to take if a warning is given. Indeed, early warning is a very specific advice about an imminent event that should move the community into action in response to the specific threat when equipped with the prior education and specific information that has prepared them to respond (Victoria Bushfire Royal Commission, 2009).

The early warning, on-day predictions and real-time advice given by the Bureau of Meteorology on Black Saturday was clear (Kininmonth, 2009). Likewise, the Premier of Victoria issued a warning on the eve of the fires about the extreme weather conditions expected on 7 February: 'It's just as bad a day as you can imagine and on top of that the state is just tinder-dry. People need to exercise real common sense tomorrow'. According to the Premier, it was expected to be the 'worst day of fire conditions in the history of the state'.

Although, the warning appeared to be clear thereby highlighting the importance of modern infrastructure and technology that supports weather forecasting and early warning, there is evidence that the warnings either were not heeded for some reasons, or were heeded too late. Some analysts felt the warnings were too general and ambiguous with no explicit and specific advice to communities on what should be done. For example, the Victorian Premier has admitted 'communications systems did not work as well as they should have during the devastating Victorian bushfires' (Live News website, 2009). According to the Victoria Bushfire Royal Commission (2009),

warnings were often delayed resulting in some people not being warned at all. The amount of time some people had to respond and take action in view of the warnings was far less than it should have been and often the warnings issued did not transmit a clear understanding of the ferocity and severity of the fire and how the people should respond.

Secondly, significant loss of lives and property appeared to have occurred despite the provision of bushfire risk information and early warning of fire to the communities and local authorities in the region, and this has

been attributed to the inadequate method of delivery of the warnings. For example, emergency warning signals on TV, local sirens and commercial radio and TV were not even used at all.

Thirdly, a desperate lack of bushfire information by a significant section of the community resulted in a sudden spike in demand for (warning) information from the usual sources of emergency information and warnings (e.g. at Police websites, emergency services websites, triple zero emergency phone numbers like Ambulance and Fire Brigade and the bushfire information lines). This sudden search for information by a large number of residents resulted in the information and warning delivery systems being overwhelmed. This resulted in system collapse with over 80% of phone calls seeking crucial information going unanswered and therefore calls being abandoned by callers after several attempts and websites ‘crashing’ as servers were unable to cope with the demand (Victoria Bushfire Royal Commission, 2009) This scenario agrees with Godschalk (1991, p. 142) who argued that civil hazards are usually characterized by limited or lack of warning, and may result in catastrophic outcomes. Perhaps a vulnerability analysis might have been conducted on this occasion and precise and specific directives given but that was not the case on this occasion.

The theory on warnings indicate that early warnings allow people to take steps to protect themselves, their property and allow them to prepare for impending danger or allow them to flee from danger (Constanzo, 1992). The most disturbing feature of this disaster is that the risk had been known well beforehand, however knowing the risk is not enough. Those at risk must understand the immediacy and severity of the threat in order to be able to take appropriate action. It appears that there were difficulties and failures in getting the warning message across effectively and getting people to remove themselves from the threat and in a timely fashion too. For example, local authorities might have warned that the fires in Marysville and Kinglake were, in reality out of control and everyone should get out in order to prevent the loss of lives, after all, the effective communication of risk is first and foremost a local responsibility (Toft, 1992).

Finally, there have been reports that the government warnings were unclear, unspecific and unreliable (Kininmouth, 2009). For instance, a contributory factor to the high death toll was the failure to predict specific areas at greatest risk and give very specific directives that residents in the outer fringes of Melbourne, for example, should leave the area for a couple of days before any fires even start. The deaths in Kinglake specifically may be predictable and avoidable, with currently available meteorological technology (Kininmouth, 2009). In the following section, I now discuss the ‘stay or go’ evacuation policy of the Victorian government.

#### Victorian evacuation policy

The current evacuation policy in the state of Victoria directs residents to ‘prepare, stay and defend’ or to ‘leave early’. This policy appears to promote the individualist ‘fight or flight’ policy which leaves fire-fighting up to the non-professionals — the working people and homeowners to protect their property themselves. The genesis of the policy may be traced to research on past fires that showed that with proper planning and preparation most buildings can be successfully defended from a bushfire. The other option, although understated is to leave early. In addition, there have been speculations that the cuts to government funding resulted in many fire fighters in the rural areas of Victoria becoming (part-time) volunteers.

Nevertheless, the current evacuation policy gives residents the option of self-evacuating ‘early’, or staying on to ‘defend’ their homes. In this particular case the policy has proven to be a failure as it appears to focus on saving property rather than saving lives. This situation has sometimes led to untrained or poorly trained individuals and homeowners fighting fires with garden hoses, rather than trained or professional fire fighters fighting fires. Analysis of the policy appears to indicate that the risk of staying to defend a property has been under-emphasized. Some fires are not severe and may justify staying to defend, however others are just too severe and dangerous and buildings cannot be safely protected. In addition, protecting a building is not a task for one person and will require prior preparation of the building with fire fighting equipment and ample supply of water that is immune to loss of electricity in order to make it defensible, as well as able-bodied, fit young people that can withstand the physical and emotional stress of fighting a bushfire for hours or days at a time. It is not a situation for the disabled, the old or for children.

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It is now known that most of those who survived the fires self-evacuated early based on a combination of personal judgement of the situation and the warnings, others self-evacuated based on previous fire experience while most of those that perished either did not evacuate, or left it too late and became surrounded by fire in their homes, in their cars, or while trying to escape on foot after their vehicles were surrounded by fire. Others that evacuated late were trapped in their cars by burning trees falling across the highways thus preventing escape. The high speed winds showered flaming embers on houses, roads and cars which resulted in their prompt combustion. Thick black smoke hundreds of meters high meant that there was little visibility for those fleeing in cars on highways and many also ended up being trapped.

#### Staying or leaving?

A potential strategy in dealing with this issue is to undertake research into the behaviour and decision making processes of residents before and during the fire disaster as well as community responses to bushfire warnings, while taking note of resultant implications on current evacuation policy. This policy is currently premised on the notion of a 'defendable space in a burning space' in which those planning to stay and defend their properties must be prepared to be self-sufficient and without support for a long period. In addition, the 'stayers' must be made fully aware of the risks of staying including the risk of death.

The alternative in the policy is to 'leave early' in advance of the arrival of the bushfire. This approach proved to be life-saving in this case. Nevertheless, the notion of a 'well-prepared' property as described above sounds ambiguous as it depends on the availability of time and money to prepare and how much time was given to prepare, as well as whether residents were trained on how to be 'well-prepared'. Perhaps this involves evacuating children and the infirm early. Similarly, to 'leave early' may be ambiguous — when is early enough? Immediately after the warning? When one sights the smoke, or the fires? When others are leaving? A corollary issue is when people do decide to leave or relocate, where do they leave to? A place of refuge in the surrounds or another city nearby which immediately raises questions about routes and road safety — the planning, preparation and logistics of evacuation (and return). For example, it has been reported that many self-evacuees forgot medications, prescriptions, reading glasses, mobile phone battery chargers and had no access to mobile phone charges once their credits ran out. Hence they could not communicate with any one.

#### Mandatory evacuations?

Authorities may need to consider the necessity of the use of early and orderly mandatory evacuations in light of the above ambiguities despite its undemocratic nature and people's aversion to mandatory evacuations, mainly borne out of the fear of their houses being looted while they were away, and out of the democratic freedom to make decisions for themselves. However, it is debatable that it is better to mandatorily evacuate residents to save lives and find out the evacuation was unnecessary (as was done during Cyclone Larry in the expectation of a storm surge in neighbouring Queensland March 2006 when a state of disaster was declared that legally empowered the Police to move people on), rather than to assume it is unnecessary to evacuate and find out much later that it was actually necessary as seen for example in the Marysville fires of Black Saturday in which the whole town was destroyed moments after an official and risky Police decision was taken to evacuate the town's residents relatively late. Although this decision saved many lives in this instance, many also elected to stay and died (CFA, 2009). This last minute evacuation worked for those who allowed themselves to be evacuated, however if the wind had changed direction or a tree had blocked the single road in and out of Marysville it would have been even more disastrous for all (CFA, 2009).

Although, unpopular, expensive and inconvenient if the fire is suppressed quickly, mandatory evacuations of communities in fire-prone areas would surely prevent morbidity. Local authorities may need to shift the emphasis from post-disaster relief to pre-disaster risk reduction, for example, by developing the ability to rapidly evacuate hazardous areas through designated collection centres as well as having designated and prepared 'safe' places of refuge. In this case, many of these forest communities are in rural, sparsely populated areas. Therefore, it should be logistically and operationally easier to evacuate people to safer areas for a few days or to designated and prepared places of refuge while trained fire fighters fight the fires. Although, often the terrain is mountainous with the windy, undulating, and heavily forested and foliage canopied roads which will make evacuation by buses slow and painstaking, however, it is worth the trouble.



A prompt review of the current warning and evacuation policy needs to be undertaken, with a view to removing people successfully from harm's way, or warned

to remove themselves from the highest fire risk areas well in advance whenever extreme fire conditions are anticipated. It is the opinion of this author, that saving lives is more important than saving property. In addition, in order to avoid burning trees falling across roads and blocking highway exit routes, local authorities may need to clear trees and vegetation on both sides of roads. At least 25 meters either side of the road should ensure that fires cannot burn any further. A collective warning and evacuation system may need to be seriously considered, with the centralised provision and dissemination of risk information to everyone perhaps through mobile phone SMS messages, automated phone calls to all mobile phones and all fixed line home phones in the threatened area. No one, with or without home and property insurance should have to risk their physical safety to 'stay and defend' their homes out of fear of losing everything they owned. In the following section, we discuss the issue of population movements and building regulations in bushfire prone areas.

### (2) Arsonists and arson

Arson is the crime of deliberately and maliciously setting fire to structures or wild land areas (Bryant, 2008). Arson costs the Australian community an estimated \$A1.6 billion in damage each year (Australian Institute of Criminology, 2009). According to the Australian Institute of Criminology (2009), around 50 percent of bushfires is deliberately lit or suspicious. There are also economic, environmental and social costs to bushfires, including injuries and death, as well as the physical and emotional welfare of people who lose property to fire. On top of these losses come the costs of resources involved in managing and responding to fire incidents (Willis, 2004; Bushfire Cooperative Research Centre, 2009). The socio-psychological motives for arsonists may include recognition, fame and attention, making insurance claims, revenge, anger and/or frustration, creation of excitement or simply to relieve boredom and pyro-terrorism — a form of psychiatric illness (Bryant, 2008; Willis, 2004) Bushfires may also be lit without motive (Bushfire Cooperative Research Centre, 2009).

A significant number of the 'black Saturday' fires were believed by the Police and others to have been deliberately lit by arsonists, although this is unconfirmed (Herald Sun, 2009). For example, the Delburn/Boolarra fires were believed to have been deliberately lit and the Police offered a \$100,000 reward for information leading to the arrest and prosecution of suspected arsonists (Herald Sun, 2009). Lightning strikes and severed high-power electricity cables were responsible for igniting other fires. After the Gippsland fires, the Victorian Minister for Emergency Services announced that the Victorian government was looking at ways to tackle social problems such as arsonists, including the potential for developing a state-wide register of arsonists that is accessible to police (Herald Sun, 2009). Some citizens who made submissions to the on-going Royal Commission inquiry proposed tougher penalties for arsonists and litterbugs, while others called for the implementation of a monitoring system for known arsonists to be used on total fire ban days as a deterrent (Victoria Bushfire Royal Commission, 2009). Indeed, many including senior commonwealth government officials denounced the activities of arsonists as 'mass murder' on national TV and there were insinuations that arsonists may be tried for murder (ABC News, 2009).

A potential strategy of dealing with arson is to have fire/arson scouts and patrols in and around forests. These scouts may be equipped with radio-communications to

patrol the forests and woodlands frequently, by foot and by aircraft and on watch towers to promptly spot any would-be arsonists before they light a fire or spot a fire as soon as it is lit. Also, communities living in and around forests and woodlands must be educated and trained to report suspicious behavior and suspicious persons. Community partnerships with for example bush walkers and campers in keeping vigil over forest areas may pay-off dividends in preventing and managing arson attacks. Another factor is the issue of high-powered overhead electricity cables on wooden poles in fire-risk areas, it may be useful to increase the level of maintenance and inspections to prevent cables snapping and starting fires as well as swapping wooden poles to steel as there were reports that aluminium pinions melted in the heat of the fires.

### (3) Population and building regulations in bushfire prone areas

The rising population of rural towns and hamlets is one of the factors suspected of contributing to the high death toll in this disaster (The Australia, 2009). Many retirees have moved to the bush, and a considerable number of working people who are unable to afford a home in Melbourne or bigger urban towns now live in semi-rural towns just outside the state capital and commute to their workplaces in the city. By and large, the expansion of semi-rural dwellings has been largely unplanned and unregulated in some areas, and this is driven by property developers rather than the health and safety of residents (The Australia, 2009). In addition, Victorian building laws are relatively lax compared to other states (The Australia, 2009). The Australian of 10th February 2009 reported that unlike New South Wales and some other states, in Victoria there are few restrictions on the use of flammable housing materials such as cedar wood. NSW is also alone in prohibiting the building of homes on ridge tops partly because of accessibility issues and in imposing strict rules for water supplies (The Australian, 2009). Therefore, a review of the Victorian building regulations especially in rural fire prone areas may be warranted as the frequency and severity of bushfires increase.

Forest communities may need to re-consider where they build dwellings i.e. vegetation type and what type of materials they should be using to build (e.g. the wall and roof materials adopted) with the aim of achieving more fire resistant dwellings. For example, fire shutters may be installed on windows of buildings at high risk of bushfires, and improved fire resistance for windows, walls, roofs, and doors to protect them from direct flame and radiant heat. Consideration must also be given to the distance of the building to the vegetation (fire source), as well as the protection of sub-floor area, windows and door openings in building design. In addition to the direct burning effect of flames and the effect of smoke inhalation, radiant heat is another major killer in bushfires, therefore, placing a solid object like a concrete wall in between the double walls of the house, prevents heat transfer from the heat source. This would greatly improve the survivability of homes in bushfire prone areas.

In addition, building houses with concrete underground bunkers (with necessary relief goods) may serve as a shelter of last resort from raging fires overhead, especially when people are trapped in their houses. Although, it is the opinion of this author that no person should become trapped in the first instance. Despite, the goal of saving lives and property, the extra costs of 'fireproofing' new houses and retrofitting old ones would add to the cost of building a new home and may deter people from relocating and investing in rural, fire prone areas. Nevertheless, the authors believe

the extra cost is worthwhile. Finally we shall discuss the issue of current land management practices in the following section.

#### (4)Current land management practices

There is much difficulty in reaching consensus on how to appropriately manage ecosystems in Australia (Czeck and Krausman, 1997; Yibarbuk et al., 2001). There are competing interest groups that vary in their view of how many social and economic goals should be permitted to shape ecological and land management policy in Australia (Czeck and Krausman, 1997; Yibarbuk et al., 2001). For example, some commentators have criticized environmental groups for over-protecting rural forests and parks and (their public owned status) despite the inherent fire danger from inadequate controlled burnings and clearings (Rockwell, 2007).

Some influential environmentalists by and large have not been supportive of land clearing, land burning or deforestation for the sake of protecting flora and fauna that may be lost, perhaps forever in the clearing or burning process (Anderson, 2007). Moreover, the argument that climate change may have contributed to the extreme heat-wave in south-eastern Australia in the lead to the bushfire disaster is being used by some to buttress the environmental standpoint (ABC News, 2009b; Ryan, 2009; Packham, 2009). They argue that clearing the forest may further increase the rate of climate change that may result in further warming (ABC News, 2009b; Ryan, 2009; Packham, 2009).

Nevertheless, land must be cleared and used for construction, residential, farming and fuel control purposes. When there is a prolonged rainless spell, the organic layers in the forest trees dry up to a completely tinder dry state that is very prone to fire and ignition by lightning strikes (Bushfire Cooperative Research Council, 2009). These forest fires create much more smoke per hectare than other types of forest fires and are difficult to extinguish. Some of the forests when dry contain highly inflammable oils that further act as incendiaries.

Therefore, clearing and burning must be undertaken in a long term sustainable manner. For example, benefits of a timely, prescribed and controlled burning for land management reduces the fuel available in the forest trees (e.g. the Eucalyptus tree in Victoria). Controlled burning may also be used for silviculture treatments and habitat regeneration for biodiversity objectives (O'Connor, 2009). Overall, controlled burning can reduce the impacts of large, uncontrollable wildfires. In spite of this, there are reports that controlled burning has not been done in an adequate fashion because of a lack of funding and cut-backs in 'slash and burn' staff, and perhaps in order not to anger the environmentalists (O'Connor, 2009). This is despite the fact that the McLeod Panel of Inquiry that investigated the 2003 bushfires in Canberra, Australia, found that management of fuel loads in public forests was inadequate. This finding was again repeated in the subsequent coroner's report on the fires in 2006, which found that recommendations for a rigorous back-burning process were not followed, thus resulting in heavy fuel loads that fuelled the fires (Doogan, 2006).

Unplanned and uncontrolled bush fires, on the other hand, can result in destruction of property and loss of life, as we have seen. Uncontrolled fires may also create fire regimes based on seasons and intervals and intensities with negative impact on flora and fauna. Consequently, controlled, prescribed burning can be used to reduce

unplanned burning (bush fires) and the areas that they burn, while a reduction in fuel quantities may reduce ignitions from cloud-to-ground lightning strikes (Bushfire Cooperative Research Council, 2009). Like bush fires, also called wildfires, grassland fires are important issues in Australia and New Zealand and the degree of current and predicted grass curing (curing is the dying off grasses during the dry season) may need to be assessed through field research as part of the input into fire behaviour modeling and fire danger rating systems, resulting in more accurate predictions of fire behaviour and danger levels, hence better decision-making by authorities. Grass curing is the percentage of grass fuel that is dead. By addressing fire as a land management issue all year round, there is a better chance of surviving a bushfire disaster.

## Summary, implications and future research

Bushfires accounted for around 400 deaths in Australia between the 1920s and the 1980s. After the Ash Wednesday fires in 1983, and the 2005 fire, procedures and education, progressed rapidly. Now, it is less common for people to die in bushfires, though, this has not been the case in this bushfire event. Fire authority personnel and volunteers accounted for most of the recent fatalities in recent years as the majority of residents in affected regions usually self-evacuated. Nevertheless, many of the conclusions and recommendations of this study are based on the analysis of empirical data gathered through discussions with major actors in the incident management and control team within months of 'black Saturday' and publicly available secondary data and information. Evidence suggests that warning and evacuation decision making and warning delivery systems in this case needs to be further researched and re-evaluated, as well as current land management practices. Specifically, early warning and evacuation policy may need evidence-based policy changes if necessary. The logistical ability to rapidly evacuate communities from bush fire prone areas is also worth investigating.

This paper suggests that despite the significant populations in the area and high costs, the authorities could have nevertheless gone ahead to compulsorily evacuate members of the affected communities. Alternatively, they could at least have issued a temporary mandatory evacuation order to be enforced by the police in view of the unprecedented circumstances. Although, given the current 'leave or stay' policy on evacuation, it might not have been possible to compulsorily evacuate people in the area legally. Nevertheless, despite the rigid evacuation policy, complex logistics and high cost of evacuating, housing and returning large scattered populations, in hindsight, these reasons may not be tenable for giving community members (with a minimal level of quality decision-making information) the option to 'stay and fight' fires or leave. Temporarily bending the law through a temporary mandatory evacuation may have attenuated the consequences of the fires at least with regard to the loss of life. The magnitude of loss of life in the overall fire disaster would have been reduced if people responded to warnings by self-evacuating early or being compulsorily evacuated early by authorities.

The bushfire (wild land fire) issue has assumed increased significance in fire prone parts of the world (e.g.

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New Zealand, Tasmania, Colorado, California) because of an apparent increase in the frequency and intensity of fires, termed 'mega fires'. The study has emphasized the issue of the appropriate balance between efforts to protect people in the event of a major fire, and efforts to minimize the likelihood of fire and to maintain biodiversity. That the issues discussed herein are important beyond

Australia and New Zealand adds emphasis to the international significance of research in this area especially, as it is multi-disciplinary including the physical, chemical (fire behavior and land management), biological (forestry and ecology management) and social sciences (human psychology and behavior) and engineering (technology and knowledge of buildings). This combination overlaid with broader issues of climate change places bushfire issues into a broader context of public policy and research.

Effective community education, awareness and engagement programs targeted to the needs of communities in bushfire prone areas are required to achieve this objective. Neighbors may be trained to help themselves and each other in the event of a disaster, using the skills of builders, doctors, first-aiders, plumbers, electricians, home removal experts and so forth. They could be trained to work together for the good of the affected community. There is only one certainty in disaster prevention and management and that is we will never be able to tame nature, especially, 'mega fires' that are 100 meters high, roaring on overhead at very high speeds. The fires in this case were simply unprecedented and are insuppressible by fire fighters and their equipment, unless rain falls on the fire. Indeed, many long-serving fire-fighters including fire-fighters from New-Zealand and the US that fought the fires had never experienced such fires, and many had been fighting fires for over 40 years — with flames leaping 100 meters into the skies. We can only respond to the type of fires on 'black Saturday' in a timely and appropriate manner by our preparedness, early warning and evacuation policies.

## References

Anderson, W. (2007). Fires of the Feds: How the Government has Destroyed Forests,

Discussion of global-warming claims during the 2007 California fires, see Mises Daily, October 25, 2007.

Australian Institute of Criminology (2009). Greater cooperation could help to reduce bushfire arson Media Release 1st, February 2009.

ABS CBN 5 (2009). Australia remembers victims of 'Black Saturday' International response to the 2009 bushfires in Victoria, Australia.

Benson, C., Twigg, J., and Myers, M (2001). NGO initiatives in risk reduction: an overview. *Disasters*, Vol 19, No 3, pp. 199-215.

Biswajeet, P., Mohd Dini Hairi, B., and Mohamad, A (2007). Forest fire susceptibility and risk mapping using remote sensing and geographical information systems (GIS), *Disaster Prevention and Management : an International Journal*, Vol.16, No.3, pp.344-352.

Bryant, C (2008). Deliberately lit vegetation fires in Australia. Trends and issues in crime and criminal justice, Australian Institute of Criminology (350). ISBN 978 1 921185 71 7. ISSN 0817-8542.

Bushfire CRC

(2006).[recrc.com/publications/downloads/Bushfire-CRC-Third-Year-Review-Response-Dec06-\\_Revised2\\_.pdf](http://recrc.com/publications/downloads/Bushfire-CRC-Third-Year-Review-Response-Dec06-_Revised2_.pdf) (Last accessed 10 Feb 2010).

Bushfire Cooperative Research Centre (2008). Trends in bushfire arson: A report on national trends in deliberate vegetation fires. April 2008.

CFA (2009). Informal discussions with a level 3 incident controller in the Country Fire Authority, Victoria.

Costanzo, S (1992). The role of public health services in disaster prevention, *Disaster Prevention and Management: an International Journal*, Vol. 1, No.1, pp.33-45.

Czech, B., and Krausman, P.R (1997). Implications of an ecosystem management literature review, *Wildlife*

Society Bulletin, No.25, pp.667-675.

Daily Telegraph (2009). <http://www.news.com.au/dailytelegraph/story/0,22049,25031406-5001021,00.html>  
(Last accessed 10 Feb 2009).

Doogan, M (2006). The Canberra Firestorm, Australian Capital Territory Coroner's Report, December 19, 2006, pp. 65–70.

Godschalk, D.R. (1991). Disaster mitigation and hazard management, in Drabek, T., Hoetmer, G. (Eds), Emergency Management: Principles and Practice for Local Government, International City Management Association, Washington, DC.

Ibrahim Mohamed Shaluf (2008). A flare incident at an oilfield, Disaster Prevention and Management: An International Journal, Vol 17, No 1, pp.6-15

James, C (2009). Mega-fires, mega-denial, Online Opinion- Australia's e-Journal of Social and Political debate.<http://www.onlineopinion.com.au/view.asp?article=8570> (Last accessed 10 March 2009).

Kininmouth, W (2009). Anatomy of a firestorm, The Age newspaper article 26 February 2009.

Live News (2009). Bushfire warnings not good enough, Brumby admits.  
[http://www.livenews.com.au/Articles/2009/02/10/Bushfire\\_warnings\\_not\\_good\\_enough\\_Brumby\\_admits](http://www.livenews.com.au/Articles/2009/02/10/Bushfire_warnings_not_good_enough_Brumby_admits)  
(Last accessed 13th March 2009).

National Climate Centre (2009). The exceptional January-February 2009 heatwave in south-eastern Australia, <http://www.bom.gov.au/climate/current/statements/scs17.pdf> (Last accessed February 14, 2009).

O'Connor, P (2009). As death toll rises: Evidence mounts of lack of planning prior to Australia's worst bushfire, World Socialist Website <http://www.wsws.org/articles/2009/feb2009/vic-f11.shtml> (Last accessed 11 February 2009).

Packham, D (2009). Victoria bushfires stoked by green vote, The Australian, February 10, 2009.

Rockwell Jr, L.H (2007). Land Socialism: Playing with Fire, Mises Daily, October 24, 2007

Ryan, S (2009). Burnoffs following Victoria bushfires a 'threat' to biodiversity, The Australian, February 12, 2009.

Sydney Morning Herald (2009). Horrific, but not the worst we've suffered'.  
<http://www.smh.com.au/national/horrific-but-not-the-worst-weve-suffered-200902183ib.html> (Last accessed 11 Feb 2009).

The British Monarch Website (2009). Royal events and messages following the Australian bushfires, <http://www.royal.gov.uk/LatestNewsandDiary/Pressreleases/2009/ThePrincessRoyalwillrepresentTheQueenattheVictoria.aspx> (Last accessed March 7, 2009).

Toft, B. (1992). The failure of hindsight, Disaster Prevention and Management: an International Journal Vol.1, No.3.

Willis, M (2004). Bushfire arson: a review of the literature. Australian Institute of Criminology, Canberra. ISBN 0 642 53851 4.

Yibarbuk, D., Whitehead, P.J., and Russell-Smith, D (2001). Aboriginal fire management and conservation of biological diversity, Journal of Biogeography, Vol.28 pp.325-343.

#### Websites

ABC News, (2009) b, "ABC News, (Accessed February 28, 2009)

Doctors treating bushfire burns victims around the clock. ABC News. 2009-02-09.  
<http://www.abc.net.au/news/stories/2009/02/09/2486698.htm>. Last accessed Feb 16, 2009

Marysville almost destroyed in Victorian bushfires. Sydney Morning Herald. 2009-02-08.

国际应急管理学会(TIEMS)

第 17 届年会, 2010 年 6 月 8-11 日

中国·北京

<http://www.smh.com.au/news/national/marysville-devastated/2009/02/08/1234027832317.html>. Retrieved on 2009-02-08.

Absolute devastation: Victoria gutted by deadly bushfires. ABC News (Australian Broadcasting Corporation). 2009-02-08. <http://www.abc.net.au/news/stories/2009/02/08/2485299.htm>. Last accessed Feb 8 2009.

Counting the terrible cost of a state burning. The Age. 2009-02-09.  
<http://www.theage.com.au/national/counting-the-terrible-cost-of-a-state-burning-20090208-811f.html?page=fullpage>. Last accessed Feb 9, 2009.

IAG says too early to estimate cost of fires, shares drop 9.5%. Business Spectator.  
[http://www.businessspectator.com.au/bs.nsf/Article/IAG-says-too-early-to-estimate-cost-of-fires-\\$pd20090209-P3W3J?OpenDocument](http://www.businessspectator.com.au/bs.nsf/Article/IAG-says-too-early-to-estimate-cost-of-fires-$pd20090209-P3W3J?OpenDocument). Last accessed Feb 9, 2009.

Nichols, Nick (2009-02-11). "Insurance bills set to rocket". goldcoast.com.au.  
[http://www.goldcoast.com.au/article/2009/02/10/47451\\_gold-coast-news.html](http://www.goldcoast.com.au/article/2009/02/10/47451_gold-coast-news.html). Last accessed Feb 11, 2009

May, Julie (2009-02-10). Bushfires could raise premiums. Investor Daily.  
<http://www.investordaily.com.au/cps/rde/xchg/id/style/5742.htm?rdeCOQ=SID-3F579BCE-3E651345>. Last accessed Feb 11, 2009.

Melbourne blackout causes chaos. Australian Broadcasting Corporation (ABC News).  
<http://www.abc.net.au/news/stories/2009/01/30/2478898.htm>. Last accessed Feb 1, 2009

<http://www.news.com.au/heraldsun/story/0,21985,24987389-2862,00.html>. Last accessed Jan 31, 2009.

Ashley Gardiner (2009). Victorian blackout causes commuter chaos. News Limited. Herald Sun.  
<http://www.news.com.au/heraldsun/story/0,21985,24986957-2862,00.html>. Last accessed Jan 31, 2009.

Fewster, Sean Coroner waiting for autopsies on heat wave deaths. News Limited (AdelaideNow).  
<http://www.news.com.au/adelaidenow/story/0,22606,25001958-2682,00.html>. Last accessed Feb 3, 2009.

Brad Crouch, Kate Kyriacou, Michael Owen (2009). "Sudden deaths rise across Adelaide amid 40C-plus heatwave". News Limited. Adelaide Now.  
<http://www.news.com.au/adelaidenow/story/0,22606,24984187-5006301,00.html>. Last accessed Jan 31, 2009.

Erdem Koch (2009). Heatwave puts morgue under pressure. Fairfax Digital. The Age.  
<http://www.theage.com.au/national/heatwave-puts-morgue-under-pressure-20090206-7zo9.html>.  
<http://www.theage.com.au/national/heatwave-left-hundreds-dead-20090221-8ea4.html>. Last accessed Feb 10, 2009.

Lucas, Clay (2009-01-27). Train system completely off the rails. Fairfax Media. The Age.  
<http://www.theage.com.au/national/train-system-completely-off-the-rails-20090130-7u1a.html>. Last accessed Jan 31, 2009.

Record-breaking heat scorches southern Australia. The Associated Press (International Herald Tribune). 2009-01-30. <http://www.iht.com/articles/ap/2009/01/30/asia/AS-Australia-Heat-Wave.php>. Last accessed Feb 1, 2009.

Lucas, Clay (2009-01-28). Not enough spent, says Kosky'. Fairfax Media. The Age.  
<http://www.theage.com.au/national/not-enough-spent-says-kosky-20090127-7qzq.html?page=-1>. Last accessed Feb 1, 2009.

Bushfires death toll. Victoria Police. 2009-02-18.  
[http://www.police.vic.gov.au/content.asp?Document\\_ID=19190](http://www.police.vic.gov.au/content.asp?Document_ID=19190). Last accessed Feb 9, 2009.

Reports of major casualties at Kinglake. Geelong Advertiser. 2009-02-08.  
[http://www.geelongadvertiser.com.au/article/2009/02/08/49445\\_news.html](http://www.geelongadvertiser.com.au/article/2009/02/08/49445_news.html). Last accessed Feb 9, 2009.

At a glance: where bushfires are burning. Australian Broadcasting Corporation. 2009-02-08.

<http://www.abc.net.au/news/stories/2009/02/08/2485609.htm?section=justin>. Last accessed Feb 9, 2009.

Victoria under siege as fires rage across state. Herald Sun. 7 February 2009.

<http://www.news.com.au/heraldsun/story/0,21985,25022560-2862,00.html>. Last accessed Feb 9, 2009.

Reports of major casualties at Kinglake. Geelong Advertiser. 2009-02-08.

[http://www.geelongadvertiser.com.au/article/2009/02/08/49445\\_news.html](http://www.geelongadvertiser.com.au/article/2009/02/08/49445_news.html). Last accessed Feb 9, 2009.

At a glance: where bushfires are burning. Australian Broadcasting Corporation.

2009-02-08.<http://www.abc.net.au/news/stories/2009/02/08/2485609.htm?section=> Last accessed Feb 9, 2009.

Death toll may reach more than 40: police. The Age. 7 February 2009.

<http://www.theage.com.au/national/death-toll-may-reach-more-than-40-police-20090207-80ao.html>. Last accessed Feb 9, 2009.

Barry, Evonne (2009-02-07). 30 homes burn near Kilmore Herald Sun.

<http://www.news.com.au/heraldsun/story/0,21985,25022931-661,00.html>. Last accessed Feb 9, 2009.

Houston, Cameron & Bachelard, Michael (2009-02-08). Huge Wandong blaze kills 14 people, rips through homes. The Age. 2009

<http://www.theage.com.au/national/huge-wandong-blaze-kills-14-people-rips-through-homes-20090207-80fv.html>. Last accessed Feb 9, 2009.

Australian Broadcasting Corporation. 2009-02-02.

<http://www.abc.net.au/news/stories/2009/02/02/2480272.htm>. Last accessed Feb 2, 2002

Hill paddock is pinpointed as area where fire started. Herald Sun. 12 February 2009.

<http://www.news.com.au/heraldsun/story/0,21985,25043261-662,00.html>. Last accessed Feb 9, 2009

Rudd angrily denounces 'mass murder' arsonists'. ABC News. 9 February 2009.

<http://www.abc.net.au/news/stories/2009/02/08/2485579.htm?section=australia>. Last accessed on Feb 9, 2009

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