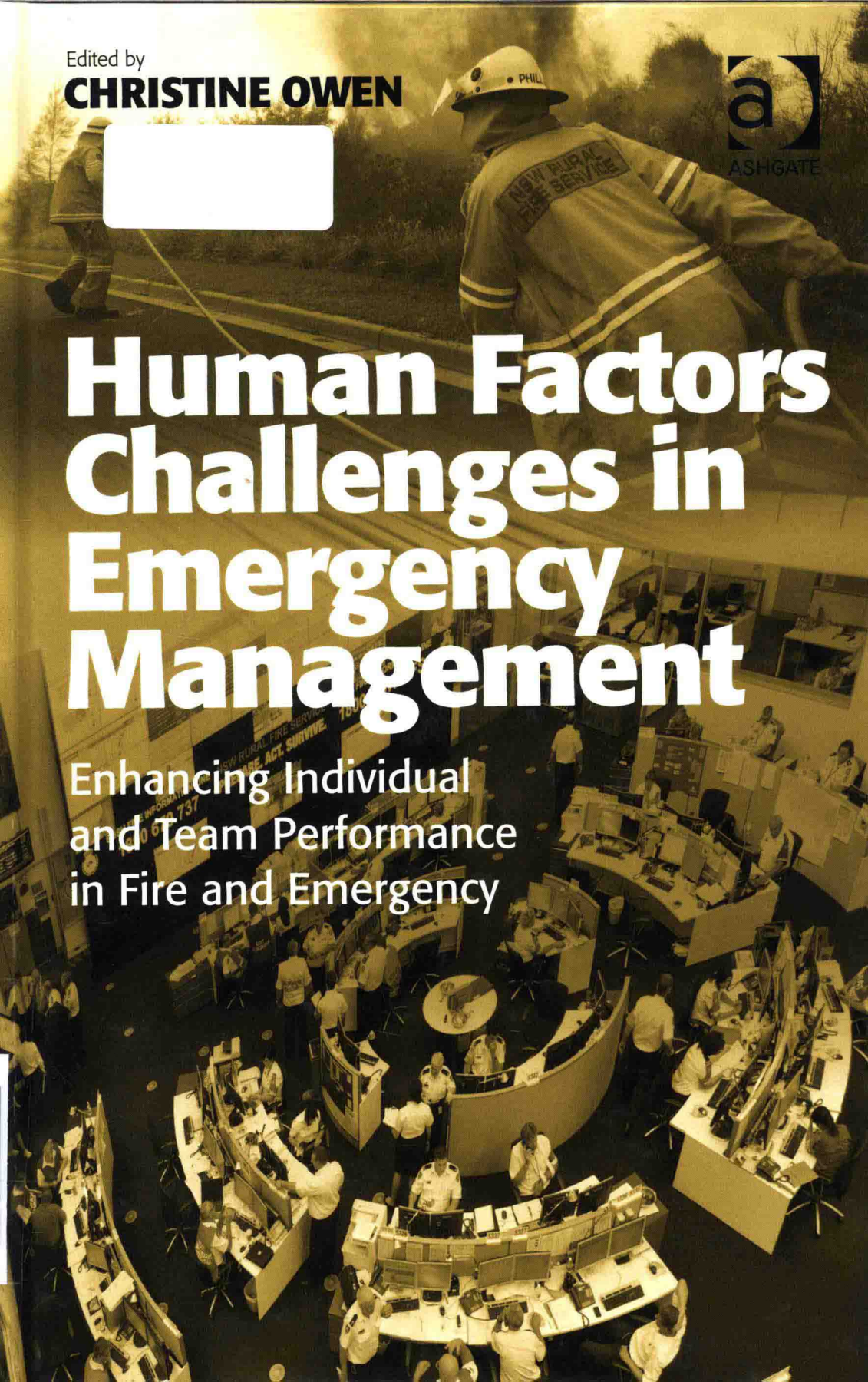
Edited by
CHRISTINE OWEN
ASHGATE
Human Factors Challenges in Emergency Management
Enhancing Individual and Team Performance in Fire and Emergency

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ASHGATE

Published by
Ashgate Publishing Limited
Wey Court East
Union Road
Farnham
Surrey, GU9 7PT
England

Ashgate Publishing Company
110 Cherry Street
Suite 3-1
Burlington, VT 05401-3818
USA

www.ashgate.com

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library.

The Library of Congress has cataloged the printed edition as follows:
Human factors challenges in emergency management : enhancing individual and team performance in fire and emergency services / [edited] by Christine Owen.
pages cm
Includes bibliographical references and index.
ISBN 978-1-4094-5305-5 (hardback) -- ISBN 978-1-4094-5306-2 (ebook) -- ISBN 978-1-4724-0523-4 (epub) 1. Emergency management--Australia. 2. Fire management--Australia. 3. First responders--Job stress--Australia. 4. Fire fighters--Job stress--Australia. 5. Human engineering. I. Owen, Christine, editor of compilation.
HV551.5.A8H86 2014
363.34'80683--dc23

2014003397

ISBN: 9781409453055 (hbk)
ISBN: 9781409453062 (ebk – PDF)
ISBN: 9781472405234 (ebk – ePUB)

Printed in the United Kingdom by Henry Ling Limited,
at the Dorset Press, Dorchester, DT1 1HD

HUMAN FACTORS CHALLENGES IN EMERGENCY MANAGEMENT

List of Contributors

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Chris is a Senior Research Fellow and Program Director for the Masters in Safety Science at the Appleton Institute of Central Queensland University. Chris conducts industry-focused research in the areas of occupational health and safety, human factors and applied cognitive psychology. Chris has worked closely with industry partners and government organisations around the world to produce research that has both a strong theoretical underpinning and a robust application to industry. Some highlights of his research are working with small commercial aviation operators to determine the pressures that lead to sub-optimal flight-related decisions, identifying high risk tasks and mitigating strategies in the volunteer incident commander role, helping rail operators to develop an evidence-based approach to evaluating new technology, and working with the National Aeronautics and Space Administration on projects that sought to redesign the US airspace system. Recently, Chris has investigated breakdowns in coordination at the incident management team and above during emergency management.

Dr Karyn Bosomworth
Karyn is a Post-Doctoral Research Fellow in RMIT University's Centre for Risk & Community Safety, and its Climate Change Adaptation Program (CCAP). With over a decade of conducting policy-relevant research and analysis within government, her academic research interests are policy-orientated and interdisciplinary, including climate change adaptation; adaptive governance; disaster risk management; institutional and frame analyses; and the research-policy interface. She enjoys involvement in a range of collaborations across these arenas.

Peter Bremner
Peter is a part-time PhD candidate at CQU whose research includes pressures on decision making and mitigating strategies used by bushfire incident controllers both on the fireground and at higher incident management levels. Peter is also an experienced systems engineer and a volunteer firefighter.

Dr Benjamin Brooks
Ben is a human factors researcher and Senior Research Fellow in the National Centre for Ports and Shipping at the Australian Maritime College. Ben has been a researcher and safety management system consultant for 15 years. He currently works on research in areas such as advanced training and safety systems and safety information systems, and builds tools for the evaluation of safety management systems and safety culture to support individual and team cognition. He works

with a range of stakeholders, including regulators, private companies, pilotage organisations and port authorities.

Steven Curnin
Steve is a PhD candidate at the University of Tasmania and his interest is investigating how stakeholders in emergency management use boundary spanning activities in temporary supra organisations to facilitate multi-agency coordination.

Dr Jan Douglas
Jan has recently completed her PhD exploring the role of individual and collective affect in fire incident management. Her study took a sociocultural perspective based on the belief that people and their work contexts cannot be separated. Jan has worked in a range of high-reliability industries, including aviation, emergency medicine and fire and emergency services.

Dr Lisa M. Frye
Lisa is a human factors researcher. Her PhD studies explored how people make decisions during large-scale bushfires; in particular, how bushfire fighters and residents regulate their thinking while they are under pressure. Lisa's current role is to develop the leadership and decision making skills of bushfire fighters and incident management teams who respond to emergencies in Victoria.

Dr Peter Hayes
Peter has just completed his PhD. His research used specially created bushfire simulations to investigate the human factors underlying differences in teamwork and decision making between pre-formed and ad hoc incident management teams. Prior to undertaking his studies Peter worked for 15 years in forest management, including fire management.

Dr Claire Johnson
Claire completed her PhD examining the consideration of possible worst case scenarios in fire incident planning. This work has introduced the pre-mortem technique as a method for overcoming planning inertia and has generated a set of wide ranging recommendations for fire and emergency services agencies. She has also developed human factors interviewing and debriefing protocols suitable for use by staff.

Andrew Lawson
Andrew holds the position of Deputy Chief Officer at the Country Fire Service (CFS) of South Australia. He has extensive experience in all areas of fire and emergency services, including operational firefighting, fire planning and mapping, administration, management and the development of policy. Andrew was selected by the Australasian Fire and Emergency Service Authorities Council (AFAC) as a

member of the national steering group that developed the new Australasian Inter-service Incident Management System (AIIMS) 4th edition manual.

Professor Jim McLennan
Jim is an industrial/organisational psychologist. He is interested in safety-related decision making. He has worked with the Melbourne Metropolitan Fire Brigade investigating decision making by on-scene Incident Controllers. This has led to various research studies concerning decision making with the Defence Science and Technology Organisation—Air Operations, and Marine Operations, the Office of Corrections and CFA. Since the 2009 Black Saturday Victorian bushfires he has been working as a member of the Bushfire CRC Task Force undertaking research in the aftermath. His current research activities include the role of anticipation in managing complex tasks, emotional and cognitive self-control in survival-related decision making, and effective community alerting and warning.

Dr Mary Omodei
Mary is a cognitive psychologist whose overall research program focuses on the human factors underlying decision making in complex systems, including military command and control and emergency management. She has developed the Networked Fire Chief simulation software and the helmet-mounted video debriefing technique. Mary led the Bushfire CRC 'Safe Behaviour and Decision Making' and 'Volunteerism' projects.

Dr Christine Owen
Christine's research investigates communication, coordination and collaborative practices in high-technology, high-intensity and high-reliability environments. She has conducted research in aviation, emergency medicine and emergency management environments. She has a particular interest in sociocultural theories of work activity and how learningful and developmental work environments may be enabled.

Dr Sue Stack
Sue is an experienced educator and facilitator in a variety of learning formats, including face to face, group-work and online learning. Sue also has extensive experience in designing online learning communities and curriculum development in fire and emergency services.

Roger Strickland
Roger holds the substantive position of Senior Instructor Wildfire in the Country Fire Authority Victoria (CFA), is a Wildfire Investigator, the CFA State Planned Burn Co-ordinator and a member of the CFA Serious Incident Investigation Team. He has 33 years of fire experience, qualified at level 3 in Operations and Planning, and is actively involved in pioneering techniques in incident debriefing,

investigation and wildfire training incorporating current human factors research with a focus on improved learning outcomes.

Dr Joel Suss
Joel has conducted research on performance in dynamic and complex environments, including wildfire fighting and law enforcement. He has employed a variety of cognitive task analysis techniques to examine expertise in these domains. Joel has recently completed his PhD using a prediction and option-generation paradigm to understand and improve decision making in law enforcement.

Professor Alexander J. Wearing
Alexander has taught and undertaken research in complex psychological processes. His recent work has involved collaboration with Lisa Frye as her PhD supervisor at the University of Melbourne, Australia.

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Chapter 1
Human Factors in Emergency Management

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Introduction

People who manage emergency events face many challenges. This book focuses on the human factors challenges that are experienced by managers who deal with emergency events. Such events arise from hazards in the environment. Hazards can be natural, for example, earthquakes, wildfires, storms and tsunamis; they can be created by human activities, for example, oil spills and chemical explosions; or they can be intentional, for example, terrorism. Emergencies are actual or imminent events that pose a threat to life, property or the environment, and require a significant and coordinated response (EMA 1988). Some emergencies can be small in scale, like road accidents, while others can impact on thousands of people. A disaster has been defined as a crisis arising from significant damage, where agencies and the services they provide are overwhelmed by the damage and where the communities they work with are limited in their capacity to recover (Turner 1976). Although definitions of scale and complexity may be used to differentiate between emergencies and disasters, there are also some important qualitative differences. Quarantelli (2000) noted that compared with emergencies, disasters tend to require responding organisations:

- to work with more groups, many of which will be unfamiliar to those responding
- to have reduced autonomy
- to operate to different performance standards
- and to develop closer working arrangements between the public and private sectors.

Clearly these conditions present many challenges for those involved.

Emergency services are made up of people and technology-based systems for coping with adverse events, and the discipline of *human factors* can offer valuable insights into how these emergency services meet the challenges faced and how they can be continually improved. As a discipline human factors is concerned

with 'understanding the interactions among humans and other elements of a system...[and] applies theory, principles, data and methods to design, in order to optimize human well-being and overall system performance' (Karwowski 2012, p. 3).

Most of the research discussed in this book has been undertaken with emergency services agencies responsible for either wildfire, and/or flood and storm management in Australia and New Zealand. Although personnel working within the fire and emergency management domain face a unique set of human factors challenges, the insights provided in this book will be of interest to researchers, scholars and practitioners involved in managing hazards of all kinds, such as technology and terrorism-based emergencies; emergencies in safety-critical industries like nuclear power, oil and energy production; and emergencies in health and transportation. This is because many of the challenges to be discussed in this book also can be found in these domains.

This book contributes to a growing body of knowledge about emergency services work and about the role of human factors involved in building capability in the sector. At the heart of this book are the following questions: how do personnel responding to emergency events manage these events, and what can be learned to enhance their capabilities?

The Growing Importance of Emergency Management

The emergency management sector performs a critical role in attempting to mitigate the harmful effects of a hazard that may develop into an emergency or even a disaster. Its activities therefore aim to protect individuals, communities, businesses, the economy and the environment from harm. In so doing, their purpose is to provide confidence to communities, governments and other stakeholder groups in the face of adversity.

In this respect the emergency services sector helps support the maintenance and development of stable and resilient communities. In many jurisdictions the part-funding of fire and rescue services by insurance companies is recognition of the loss minimisation role these emergency services agencies play in the economy. These agencies play a role in reducing the likely costs of emergency and disaster events, and, importantly, support resilient communities and businesses, so that they are able to recover more quickly from emergency events.

The emergency management sector comprises a variety of agencies, including fire and rescue, ambulance, police, coastguard, search and rescue, civil defence and state emergency services, as well as members of self-responding community groups. Emergencies often require several agencies to coordinate their response activities, e.g., fire, ambulance and police. Complex or large-scale events require multiple emergency services: various federal and state government departments;

local government and their municipalities; Red Cross and other non-government organisations; and logistical support from the military.

A core challenge for the emergency management sector is the fact that the number and intensity of adverse events is increasing and there is a growing vulnerability in our communities. This includes our social and ecological vulnerabilities, as illustrated by some of the major events that have happened globally in the past decade. These are outlined below:

- The 2004 Indian Ocean earthquake and tsunami had an impact on 14 countries where an estimated 275,000 people died. More than 600,000 people lost their livelihoods and 1.7 million were displaced.
- In 2010 a number of overwhelming disasters affected many populations. These included:
  - the earthquake in Haiti that affected an estimated 10 million people, creating one of the most complex urban disasters in decades (World Vision 2010); and
  - the record-breaking floods in Pakistan, which had an impact on almost all of the country. An estimated 20 million people were affected, and 1.89 million homes were damaged or destroyed (Red Cross 2010).
- In 2011 the Japanese earthquake, subsequent tsunami and nuclear power plant meltdown was reported as the toughest and most difficult crisis for Japan since the end of World War II (CNN 2011).
- The hurricanes and tornadoes now occurring across the Atlantic each year continue to cause considerable damage to countries such as Bermuda, Haiti, Jamaica, the Dominican Republic, the USA and sometimes Canada.

Australia and New Zealand have also had a series of significant emergency events and disasters that have tested and challenged governments and communities. The summer of 2010–2011 saw every State and Territory in Australia – except for the Australian Capital Territory – impacted by emergency events unprecedented in intensity and geographic spread. These occurred within two years of other exceptional events. The evidence gathered during the empirical research carried out for this book, and listed below, supports this claim:

1. **In 2009** Australia experienced its hottest month on record in January. In the state of Victoria, this heatwave was linked to 374 deaths (DHS 2009). In February of the same year, following a decade of drought, Victoria also experienced catastrophic bushfires where 173 people died and thousands of others remain displaced and multiple communities continue to recover.
2. **The 2010–2011 floods in Queensland and Victoria** were reported as Australia's wettest two-year period on record (BOM 2012). In terms of extent, impact and severity, the flooding along Australia's east coast was amongst the most significant in the country's recorded history.