Preface

Within safety science, it is widely accepted that a systems thinking approach is required to understand, and ultimately prevent, incidents in contemporary workplaces. The basic premise of this approach is that safety in organizations is influenced by the decisions and actions of people at all levels of the work system (e.g. supervisors, managers, chief executives, safety officers, regulators, and government), not just workers directly involved in the incident. Incidents are therefore a product of multiple, interacting, factors across a work system (Rasmussen 1997, Leveson 2004).

This philosophy is by no means new, and several methods* have been developed to understand and analyze incidents from this perspective. Studies have demonstrated the advantages of these methods, over other more reductionist methods, in many domains. The core conclusion from this large body of work is that human errors, procedural violations, and technology failures typically result from poorly designed and managed work systems. Incident prevention strategies, or countermeasures, therefore need to focus on changing the conditions of work, rather than just reiterating the importance of compliance with existing procedures, or introducing new equipment, procedures, or training.

This approach is firmly embedded in incident reporting and investigation practices in commercial and military aviation. This continual cycle of feedback and systems improvement over many years has resulted in exceptionally safe operations in these settings.

In many other industries, there remains a significant gap between state-of-the-art research on incident analysis and prevention, and practice. This is particularly so in the context of incident reporting systems. Most incident reporting systems are designed on an ad hoc basis, without any reference to the research on accident causation models or analysis methods. Consequently, most incident reporting systems are only capable of capturing data about the injured person or the immediate context of the event, rather than the broader contributory factors across the work system. As a result, little is typically learnt from reports of incidents, and in many organizations, the costs of administering the incident reporting system outweigh any real safety benefits.

This book attempts to address this gap by describing a program of research in which we designed and implemented an incident reporting system that was (1) directly underpinned by the systems thinking approach; and (2) uses

---

* An accident analysis method is a systematic or established procedure for analyzing the data collected about an incident. Many methods also include a way of graphically representing the findings from the analysis in a diagram.

systems thinking analysis methods. In doing so, the book provides guidance on designing a practical, usable incident reporting system underpinned by a systems thinking approach. This guidance is based on state-of-the-art systems thinking theories and methods, the literature on good practice for incident and injury data collection, and the lessons learnt from developing, testing, and implementing an incident reporting system for the outdoor sector in Australia. The resulting system became known as the Understanding and Preventing Led Outdoor Accidents Data System (UPLOADS, at www .uploadsproject.org).

UPLOADS has been highly successful during its first three years of operation. Thirty-five organizations have contributed data to a national incident dataset, which is regularly analyzed by the research team and reported back to the sector. This demonstrates the strength of the approach that we have used to develop UPLOADS, and the sector's commitment to preventing incidents and injuries during outdoor programs.

The commitment and leadership of our industry partners has been central to the success of this work (see Acknowledgements). In the following section, one of our industry partners, Clare Dallat, who has more than 15 years of experience in risk management, describes how the need for a new approach to incident reporting was identified by the outdoor sector, and the factors motivating the ongoing commitment to the UPLOADS project.

Why Did We Need a New Approach to Incident Reporting?

Every year in Australia, thousands of LOA programs are conducted that all share one common goal – the provision of an enriching, outdoor experience where the risk of harm to our participants is minimized.

Over 2008 and 2009, a small group of Australian LOA practitioners met to discuss the injuries and fatal incidents that had occurred in our respective organizations. We realized we were experiencing similar events, and that the strategies adopted to prevent incidents were not always successful. We also realized that most incident reports, and indeed the resulting strategies, focused solely on the behavior of the staff and participants involved in the activity (e.g. retraining, reprisals, review of procedures).

After many conversations, we realized we needed a more in-depth understanding of the types, frequency, and magnitude of incidents experienced during LOA programs, and the factors contributing to them. This led to the sector committing to a new program of research, involving what is now a highly successful collaboration with researchers from the University of the Sunshine Coast, Federation University of Australia, Monash University, and Edith Cowan University.

The intention at the time (2009) was to review what was known about the contributory factors involved in LOA incidents. This initial piece of work revealed that little was known, in part, because there were few incident reporting systems. Critically, the incident reporting systems that did exist were unable to provide us with an in-depth understanding of what was causing LOA incidents. The outcome was a proposal to the Australian Research Council to develop and implement a new sector-wide incident reporting system that was aligned with the systems thinking approach.

The ensuing program of research has completely transformed the LOA sector's understanding of incident causation. UPLOADS has helped us, as leaders within the outdoor sector, grasp that multiple factors, actors, and decisions and interactions across the LOA system contribute to minor injury incidents and fatal events. Another major benefit from UPLOADS has been the real and factual insight into the types of activities associated with the most incidents. It was surprising to us that it is not the high risk, high adventure, high equipment intensive activities that experience the greatest number of injuries. Rather, it is less overtly risky activities such as free time, cooking, and bushwalking that have the most frequent incidents and injuries. With its rich descriptions of incident causation, UPLOADS has enabled the sector to consider, and implement, incident prevention strategies based on real data. This is a huge advancement for us, and will ensure that we are able to provide safe LOAs for generations to come.

As a safety practitioner, I would highly recommend this book to anyone interested in developing a practical and theoretically sound approach to incident reporting. It is my personal view that this program of research, and its practical translation has, and continues to prevent, real harm, whilst also enabling participants to continue to achieve the significant and meaningful outcomes associated with participation in LOA programs across Australia.

Who Should Read This Book?

This book is intended to provide a guide for practitioners and researchers wishing to develop new incident reporting systems, as well as those wishing to evaluate and improve their existing systems. Students studying safety management will also find the book useful.

The book encompasses the development of both internal incident reporting systems established within a specific organization, and sector- or industry-wide systems established to collect and analyze incident reports from multiple organizations. The processes required to develop and evaluate both types of systems are largely the same; the additional factors to consider in the design of sector-wide systems are highlighted throughout the book.

Finally, the reader interested in general principles, methods, and philosophies for safety management will find sections of the book interesting. These include overviews of systems thinking, accident analysis methods, and testing the reliability and validity of accident analysis methods.

Why Should You Read This Book?

Designing, testing, and implementing an incident reporting system is a massive undertaking. Many organizations are concerned that their existing incident reporting systems do not enable them to understand and prevent incidents, even after much time and effort has been spent on developing the incident reporting software and training staff to use it. The guidance in this book is intended to help readers to work more collaboratively with software developers to get a better outcome.

This book breaks incident reporting systems down into their most basic elements, and describes how to design these elements to ensure the resulting system is practical for users, produces good quality data and analyses, and reflects the principles of systems thinking. The book also describes how to formally evaluate incident reporting systems to determine whether they meet these requirements.

How to Read This Book

The chapters are designed so that they may be read independently of one another based on the goals of the reader (so there is some repetition of key concepts across chapters). Together, the chapters provide a comprehensive theoretical and practical framework for developing and evaluating an incident reporting system.

The chapters are divided into four main parts:

I. Theoretical framework for designing incident reporting systems

- Chapters 1 and 2 introduce the systems thinking approach, and provide an overview of systems thinking accident causation models and analysis methods. Chapter 1 concludes by highlighting four important principles of the systems thinking approach for the design of incident reporting systems. Chapter 2 presents a case study incident analysis to illustrate the strengths and weaknesses of different systems thinking methods when used as part of an incident reporting system.

- Chapter 3 presents a process model for developing incident reporting systems that is underpinned by the principles of systems thinking, and good practice for injury and incident data collection. The chapter concludes with criteria for designing and evaluating incident reporting systems.

II. Developing and testing incident reporting systems

Chapters 4 to 11 then provide guidance on developing and testing incident reporting systems, using examples from the development of UPLOADS.

- Chapters 4 and 5 describe how to evaluate the state of knowledge on incident causation and data collection in a domain, and identify the priorities of end users prior to designing a new incident reporting system.
- Chapters 6 and 7 describe how to adapt Accimap for use within an incident reporting system, and develop, test, and refine a contributory factor classification scheme.
- Chapters 8, 9, and 10 describe how to develop a prototype incident reporting system, and then test its usability and data quality.
- As an example of the outputs from the previous stages of development, Chapter 11 presents an overview of UPLOADS as implemented in multiple organizations in 2014.

III. Analyzing and using the data from an incident reporting system

Chapters 12 and 13 then provide guidance on analyzing and utilizing the data collected via incident reporting systems underpinned by systems thinking, using examples from the implementation of UPLOADS.

- Chapter 12 describes how to analyze and interpret the data from multiple incident reports.
- Chapter 13 describes how to translate incident data into appropriate, systems thinking–based, incident prevention strategies.

IV. Conclusions and future applications

- The final chapter reflects upon the lessons learned through the development and implementation of UPLOADS, along with some critical future research directions for incident reporting generally.

References

Leveson, N. 2004. A new accident model for engineering safer systems. *Safety Science* 42 (4):237–270. doi: http://dx.doi.org/10.1016/S0925-7535(03)00047-X.

Rasmussen, J. 1997. Risk management in a dynamic society: A modelling problem. *Safety Science* 27 (2/3):183–213. doi: https://doi.org/10.1016/s0925-7535(97)00052-0.