

Improving our Capability to Investigate for Organizational and Management Factors

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Abstract

It is widely accepted that, to improve safety, organizations should focus their efforts on improving the system rather than the individual, that regulators should examine process and performance in addition to compliance and that effective organizational safety cultures are critical to ensuring these efforts are successful.

This presents a number of challenges for safety investigators. How do we decide when to investigate for these factors, balancing comprehensiveness and timeliness in investigations? How do we document and analyse the role of these factors in an occurrence? What standard of evidence do we use to prove the existence and influence of factors involving safety management and safety culture? How do we present a compelling argument for change?

In order to address these challenges, the Transportation Safety Board (TSB) of Canada has developed a number of tools for use by investigators. These include a safety analysis methodology, workshops on investigating for human and organizational factors and a Guide to Investigating for Organizational and Management Factors which was first produced in 2002. Based on learning in the intervening 11 years, developments in safety science and examination of feedback from our Board, the TSB has developed a second edition of our “Guide to Investigating for Organizational and Management Factors” .

This paper describes the approach taken in revising the guide, the challenges identified and the tools which are being provided to TSB investigators to help address these challenges.

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Background

It is well established that, to improve safety, we need to look at the system rather than the individual. Studies of how accidents happen in complex systems have convincingly documented that, although human performance is implicated in most occurrences, the key to improving the safety of the system and preventing future occurrences lies in improving the conditions in the system which influence human performance. These studies have led to such influential models that our lexicon has adapted – safety professionals will forever be associated with Swiss cheese!

Given our current understanding of the importance of the system in determining human behaviour and the advent of Safety Management Systems being recognized as the way forward in improving safety, we will define Organizational and Management (O&M) factors as: Latent unsafe conditions (hazards) within the organization that increase probability of further unsafe conditions or unsafe acts, or that reduce the effectiveness of the organization's ability to manage safety .

Our challenge as investigators lies in ensuring occurrence investigations are sufficiently comprehensive to examine the aspects of the system that will likely have the greatest safety pay-off and sufficiently robust to make a compelling argument for change while balancing the need to ensure timeliness and deliver investigations within our available resources.

To address this challenge, TSB has undertaken to provide an updated version of our *Guide to Investigating for Organizational and Management Factors* to our investigators. The purpose of the guide is to help structure inquiries into organizational and management factors which influence human performance in investigations. The 2nd edition of the guide builds on the first version which was published in February of 2002 and takes into account the significant advances in the implementation of SMS which have occurred throughout the industries we serve and the significant experience gained by TSB investigators in the eleven years since the original guide was produced.

The first edition of the guide included two lists that provided high level guidance in terms of the types of O&M factors that should be considered during an investigation. The first list was based upon the "4 P's" and provided starting points for understanding the organization's safety philosophy, policies and procedures and how these translated into actual work practices. The second list identified potential unsafe conditions which should be considered for their potential to impact human performance and reduce safety. While the first edition of the guide was most helpful in the data collection phase of the investigation, the second edition aims to provide greater structure for the analysis of O&M factors.

How TSB Investigates (ISIM)

Before discussing the tools the TSB is providing its investigators to investigate for O&M factors, it is helpful to have a fundamental understanding of the approach the TSB takes to investigating in general. All TSB investigators are taught to employ TSB's Integrated Safety Investigation Methodology (ISIM),

ISIM analysis begins with **depicting what** happened in the occurrence as a sequence of events, then progresses to **explaining why** it happened with the addition of underlying conditions for those events deemed safety significant. This information is represented in a sequence of events, unsafe conditions and underlying factors diagram (figure 1). The methodology progresses to **developing an argument for change** through the application of risk and defence analysis processes. The purpose of structuring the data collection and analysis in this systematic way is to ensure the argument for change is compelling.

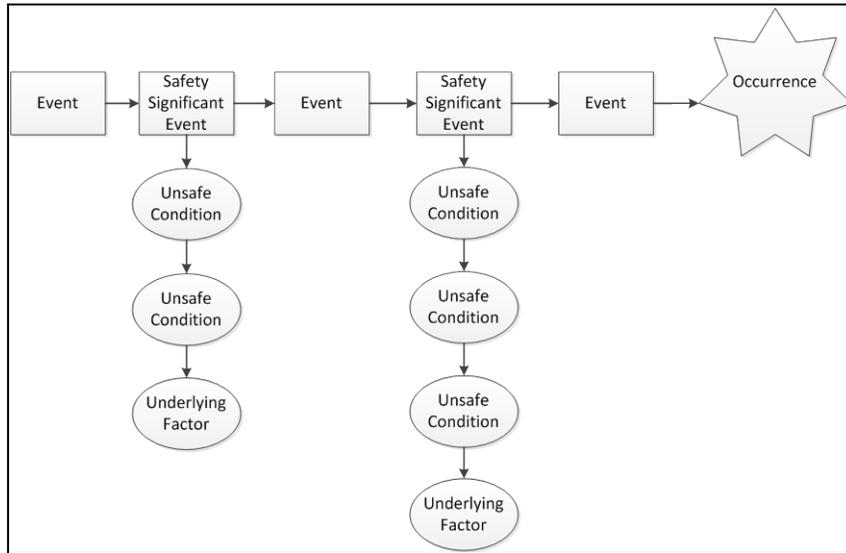


Figure 1: ISIM sequence of events, unsafe conditions and underlying factors diagram

TSB has had this investigation methodology in place for many years. The intent of the current work is to enhance the process already in place and provide a framework for using it to investigate O&M factors.

Method – Consultation and Development

TSB is well known internationally for the high quality of its investigations and is committed to continual improvement. In preparing to develop the updated guide, we wanted to understand what was working well and where there was opportunity for improvement in handling O&M factors in our investigations. Consultations were undertaken with TSB Board Members, managers and investigators in all of our modal groups to better understand what has gone well in these investigations, what challenges were faced and to better understand what tools and approaches were needed to improve the TSB’s capability to systematically investigate these issues.

In addition to these discussions, Board comments on draft reports were reviewed, a review of the literature was undertaken and discussions were held with investigators in other Boards.

The following is a brief summary of the challenges identified that we are intending to address through application of the new guide:

- **Scope:** Investigations vary significantly in scope and it may not always be evident that the decision to include or exclude issues was made explicitly. Given the data collection and analysis required to substantiate O&M issues, pursuing these factors in the investigation will impact the resources required for an investigation.
- **Completeness:** O&M issues may be identified too late in the investigation process such that the data to support analysis is not collected.
- **Weak or missing links:** The link between an O&M issue and the safety impact must be clearly demonstrated. Weaknesses in the analysis including leaps of logic, over-use of labels and lack of corroboration for opinion or third party statements will weaken the argument for change.
- **Potential for hindsight bias:** Given that O&M investigations often revolve around an organization's response to a given hazard, it is understandable how the risk associated with this hazard would be over-estimated post-occurrence with knowledge of the outcome. It is easy to overestimate what a decision maker "should have" known in the lead up to the occurrence.
- **Interviewing challenges:** With respect to O&M, it can be challenging to ask questions related to the organization without appearing to be 'fishing', to ask difficult questions of individuals in positions of authority and to press the interviewee for specifics.
- **Experience with management issues:** Investigators have excellent technical knowledge in their area of specialization, but few have management experience, particularly at the senior levels, and as a result O&M issues may be outside their comfort zone.

These challenges were targeted during the development of the guide and its associated tools.

The guide and the toolkit were piloted on various groups within the TSB. Participants were asked to use occurrence investigations with which they were familiar to test the tools and to provide feedback. Ideas and suggestions were incorporated into subsequent drafts of the guide.

At the time of writing this paper, the guide was in draft form but nearing completion. Following some additional testing of the tools, the guide will be published and rolled out to all TSB investigators.

Response to Challenges – O&M Factor Investigation Toolkit

In the TSB's ISIM framework, analysis is defined as: "The process of organizing facts, by using methods, tools, techniques to: a) assist in deciding what additional facts are needed; b) establish consistency, validity and logic; c) establish sufficient and necessary causal and contributory factors; and d) guide and support inference and judgements (conclusions)."

The tools and frameworks presented in the guide are aimed at addressing the challenges described in the previous section by assisting with all of the aspects of analysis. Specifically, using the tools will:

- Provide a framework for making explicit decisions about the scope of investigations with respect to O&M factors;
- Ensure adequate data is collected to support the safety issues;

- Guide the analysis to ensure a clear link between the factual information and safety management or safety culture;
- Serve to document the analysis, making the thinking accessible for the purposes of review and approval; and,
- Provide a “standard of evidence” for demonstrating organizational and management factors and a means for self-assessment against this standard.

Five tools were developed. The questions addressed and the links between the tools and the existing ISIM process are depicted in figure 2. The tools are briefly described in the section that follows.

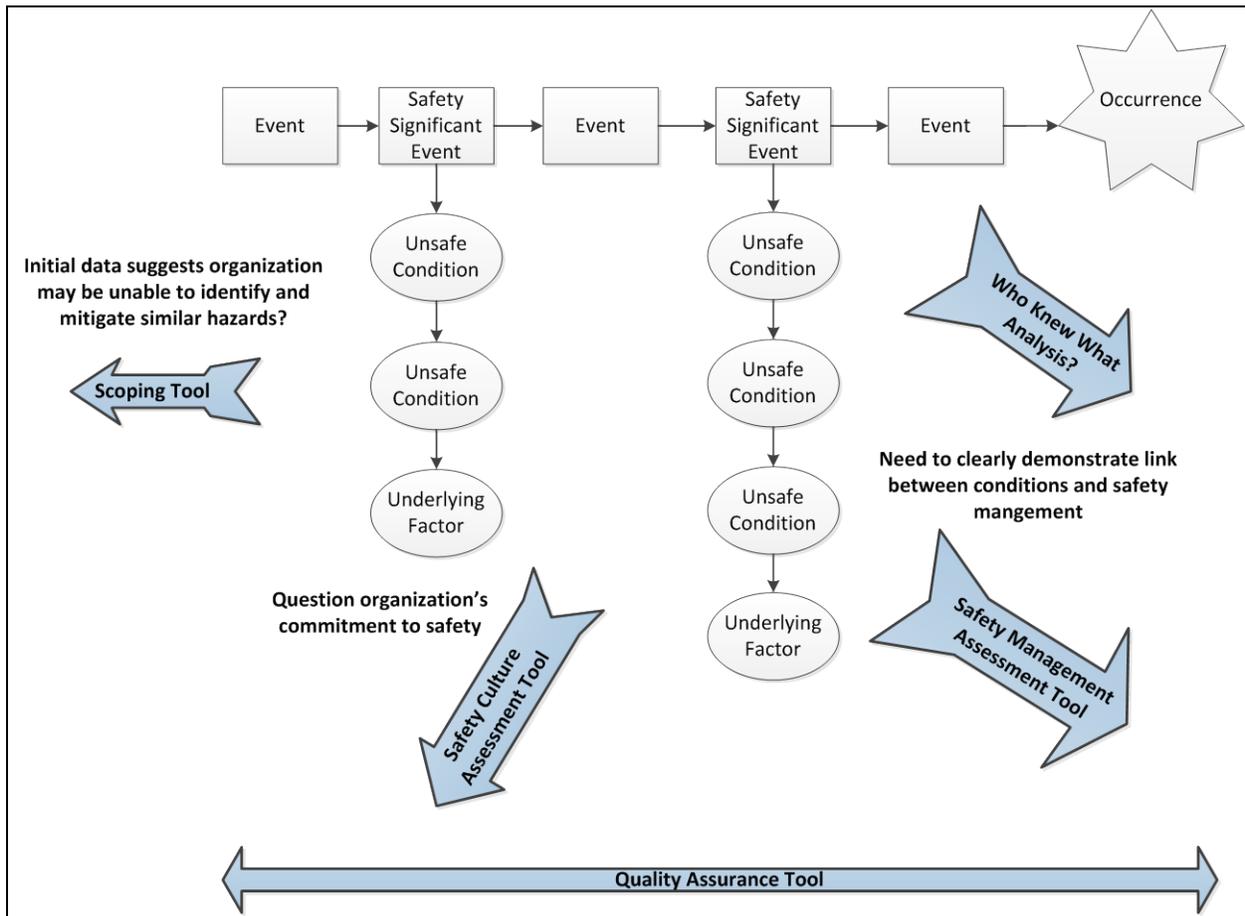


Figure 2: How O&M Tools build upon ISIM

A Brief Overview of the Tools

While a complete overview of the tools presented in the guide is beyond the scope of this paper, the following provides a brief overview of their purpose and approach.

Tool 1: *Scoping Tool*

Purpose: To determine the level of effort in investigating for O&M factors, document the decision and assist in planning the investigation.

Approach: Presents a series of questions to identify situations where the scope of the investigation should include organizational issues and documents decisions about scope. Issues to be pursued are identified and a plan for the next steps in the investigation documented.

Tool 2: *“Who Knew What?” Analysis*

Purpose: To document the flow of information with respect to a specific hazard in the organization.

Approach: Hazards (unsafe conditions) identified in the investigation are followed to identify who had information prior to the occurrence, what was done with this information, whether appropriate mitigations were put in place and if the action taken was reasonable and consistent with established procedures.

Tool 3: *O&M Factor Assessment Tool*

Purpose: To explicitly demonstrate the link between hazards which were unmitigated or unaddressed and the unsafe conditions/underlying factors identified.

Approach: Links made in ISIM analysis are explicitly examined to ensure there is a clear relationship. Having arrived at the unsafe conditions and underlying factors using “why?”, the examination involves working back up the causal chain asking “how?”.

Tool 4: *Safety Culture Assessment Tool*

Purpose: To develop a clear picture of the organization’s safety culture (the organization’s capability to foster safe work and effective safety management practices).

Approach: Examples indicating where an organization falls on the safety culture continuum are compiled using information gathered during the occurrence investigation. A picture is developed and the extent to which the organization is able to support effective safety management is described. The implications of this conclusion for regulatory oversight are identified.

Tool 5: *Quality Assurance Tool*

Purpose: To ensure a compelling argument for change has been developed and presented in the analysis.

Approach: A series of questions are presented to review the analysis for clarity of links, reasonableness, sufficiency and generalizability.

Conclusions and Additional Information

Investigating for O&M factors increases the scope and complexity of an investigation. However, an investment in this area will lead to greater safety payoff through safety action that addresses the systemic issues that shape human performance.

TSB's approach to improving our ability to investigate for these issues is one of continual development. The tools briefly described here and documented in the 2nd Edition of *The Guide to Investigating for Organizational and Management Factors* were developed in order to capture and systematise the learning which has taken place in the 11 years since the first edition of the guide was produced. The tools will help guide data collection and analysis and make the thinking related to these issues explicit and accessible to the investigation team.

Aviation Safety Management Systems (SMS) are one of the items on TSB's Watchlist. Implemented properly, safety management systems (SMS) allow aviation companies to identify hazards, manage risks, and develop and follow effective safety processes. Canada's large commercial carriers have been required to have an SMS since 2005. However, the Board has included this item on the Watchlist since: "Transport Canada does not always provide effective oversight of aviation companies transitioning to safety management systems, while some companies are not even required to have one."ⁱ The tools developed for this guide will help the TSB to monitor this important Watchlist issue.

Copies of the guide may be freely shared for the purposes of advancing safety. To obtain a copy, contact the lead author at joel.morley@bst-tsb.gc.ca.

ⁱ http://www.tsb.gc.ca/eng/surveillance-watchlist/aviation/2012/air_4.pdf