Rail Industry Standard
RIS-3119-TOM
Issue: 2.2
Date: March 2019

Rail Industry Standard for Accident and Incident Investigation

Synopsis
This document sets out requirements and guidance for the investigation of adverse events involving more than one duty holder so that system improvements necessary to prevent or reduce the likelihood of recurrence, or mitigate the consequences, are identified and implemented.

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Issue record

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Revisions have been marked by a vertical black line in this issue. Definitions and References may also have been updated but these are not marked by a vertical black line.

Superseded documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

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Supply

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Part 1 Purpose and Introduction

1.1 Purpose

1.1.1 This document is a rail industry standard on investigations. It also provides guidance to help transport operators:

a) Develop and apply effective policies on conducting investigations.
b) Carry out effective and proportionate investigations.
c) Learn lessons from investigations.

1.1.2 It is aimed at transport operators who have a legal responsibility to conduct investigations and those providing direct support to investigators. However, the content is likely to be of interest to others, whose responsibilities include the management of health, safety and wellbeing.

1.1.3 Effective investigations identify immediate and underlying causes. This RIS supports thorough analysis of evidence and informs objective and appropriate recommendations. This can lead to improved safety management. These should then be evaluated and, if appropriate, implemented. Learning lessons from operational experience should lead to fewer adverse events and continuous improvement.

1.1.4 This document promotes the understanding of risk management with the aim of continuous improvement in the application and performance of safety management and the integration of both human factors principles and a fair culture. It emphasises the need for cooperation to achieve an effective investigation.

1.1.5 RSSB has produced a training programme in support of this guidance for use by trainers in a classroom environment or for individual use. Use of this programme across the industry should assist in raising the standard of investigations. It is available via the RSSB website.

1.2 Background

1.2.1 The Health and Safety at Work, etc. Act (HASAW) places legal responsibilities on organisations regarding the management of safety. HASAW states ‘It shall be the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees.’ Investigating adverse events and reviewing risk control measures form a part of this process. The Health and Safety Executive (HSE) provides further information in the form of guidance documents.

1.2.2 The Management of Health and Safety at Work regulations reinforce HASAW, placing duties on employers and employees to manage health and safety.

1.2.3 The Railways and Other Guided Transport Systems (Safety) Regulations (ROGS) require transport operators to maintain a safety management system. This includes investigating accidents. The Office of Rail and Road (ORR) provides guidance in their guide to ROGS.

1.3 Scope

1.3.1 This document applies to the Great Britain (GB) mainline railway.
1.3.2 This document complements the guidance issued by the HSE and by the ORR in respect of investigations. It defines a procedural framework, common processes and objectives for the investigation of adverse events to enable:

a) Transport operators and other interested parties to cooperate to investigate immediate and underlying causes, identify measures and make recommendations to eliminate or prevent recurrence and to mitigate consequences of adverse events.

b) The results of investigations and recommendations to be reported in a structured way.

c) Investigations to be completed and the findings made known in a timely way so that lessons are learned (including the need to review risk controls) at the earliest opportunity.

d) Learning of safety lessons relevant to infrastructure managers’ and railway undertakings’ operations and the recommended actions that apply to them.

e) Information necessary to support the development of the industry’s safety strategies and safety risk models to be produced and reported.

f) Proposals for change to standards, processes, procedures or working instructions to be progressed.

1.3.3 This document covers the key aspects of investigation, including the provision of systems and resources, response management, reporting, recommendation management and the learning of lessons, leading to continuous improvement.

1.3.4 The risk-based proportional approach set out in this document can also be applied to adverse events related to trespass and suicide.

1.4 Principles

1.4.1 The requirements of this document are based on the following principles:

a) Investigations determine the circumstances of an adverse event, its immediate and underlying causes, and make recommendations to eliminate or minimise the risk from such events by addressing the frequency of occurrence and the consequences of the event with the capacity to share this learning through the industry.

b) The investigation processes in this document are not intended to be a process for allocating blame or liability.

c) The information included in a report of an investigation carried out in compliance with this document is not intended to create any presumption of blame or liability.

1.5 Application of this document

1.5.1 Compliance requirements and dates have not been specified because these are the subject of internal procedures or contract conditions.

1.5.2 If you plan to do something that does not comply with a requirement in this RIS, you can ask a Standards Committee to comment on your proposed alternative. If you want a Standards Committee to do this, please submit your deviation application form to RSSB. You can find further advice in the ‘Guidance to applicants and
members of Standards Committee on using alternative requirements’, available from RSSB’s website www.rssb.co.uk.

1.6 Health and safety responsibilities

1.6.1 Users of documents published by RSSB are reminded of the need to consider their own responsibilities to ensure health and safety at work and their own duties under health and safety legislation. RSSB does not warrant that compliance with all or any documents published by RSSB is sufficient in itself to ensure safe systems of work or operation or to satisfy such responsibilities or duties.

1.7 Structure of this document

1.7.1 This document sets out a series of requirements that are sequentially numbered. This document also sets out the rationale for the requirement, explaining why the requirement is needed and its purpose and, where relevant, guidance to support the requirement. The rationale and the guidance are prefixed by the letter ‘G’.

1.7.2 Some subjects do not have specific requirements but the subject is addressed through guidance only and, where this is the case, it is distinguished under a heading of ‘Guidance’ and is prefixed by the letter ‘G’.

1.8 Approval and authorisation of this document

1.8.1 The content of this document was approved by Traffic Operation and Management (TOM) Standards Committee on 03 July 2018.

1.8.2 This document was authorised by RSSB on 01 February 2019.
Part 2  Introductory Guidance

2.1 Investigations and risk management

Guidance
G 2.1.1 The process of carrying out investigations forms part of the management of risk on the GB mainline railway and is an inherent part of every duty holder’s safety management system.

Guidance: Overview
G 2.1.2 This RIS is set out in a logical sequence, as outlined in the investigation process flowchart. Each requirement corresponds to a stage in this chart, as do the appendices.

![Investigation flowchart]

**Figure 1:** Investigation process flowchart

2.2 Terminology

Guidance
G 2.2.1 The terms ‘Accident’, ‘Incident’, ‘Near Miss’ and ‘Close Call’ are all well known throughout the rail industry. The definition of these terms can be found in the definitions section. This document also uses the term ‘Adverse Event’ as an all-encompassing term which includes all of these. This is illustrated in Figure 2.
2.3 Guiding principles - Proportionality

Guidance

G 2.3.1 The application of proportionality is the process for ensuring that the amount of time, effort and resource allocated to the investigation process is commensurate with the potential risk and consequence of the adverse event. This allocation could change as the investigation progresses.

G 2.3.2 The principle of proportionality can be applied throughout the investigation process, starting from the initial response to the adverse event, through the evidence gathering and report writing stages, on to the recommendations and the response to the learning from operational experience which comes from it.

G 2.3.3 The Proportionate Response Model, which can be found in Appendix N, incorporates a three-stage filtering process. It provides a systematic methodology, which takes into account several influencing factors, and is designed to bring consistent and appropriate levels of response.

2.4 Guiding principles - Cooperation

Guidance

G 2.4.1 Good investigations are reliant on cooperation between those involved: transport operators, contractors, emergency services, public bodies and other relevant agencies.
Responsibilities for such liaison should be allocated and understood before adverse events occur. This guidance supports the need for cooperation in undertaking investigations.

G 2.4.2 The following is a non-exhaustive list of the stages of investigation where cooperation is essential:
- Coordination at the scene, including making the site safe.
- Sharing of data, for example, on personnel and vehicles.
- Coordination of witness interviews.
- Discussion on proposed recommendations.
- Reporting of data.
- Dissemination of lessons learnt.

G 2.4.3 Organisations should have in place arrangements for knowing with whom they need to cooperate and, where possible, build a good relationship, with clear roles and responsibilities to enable effective communication and cooperation.

G 2.4.4 In the case of security related incidents the principles of this document apply, such as in the gathering of evidence etc. However, such investigations are likely to be led by statutory authorities, for example, the British Transport Police (BTP), with reference to the National Railways Security Plan (NRSP).

G 2.4.5 The Rail Accident Investigation Branch (RAIB), BTP and Office of Rail and Road (ORR) have legally specified roles and are required to cooperate in relation to railway investigations, as described in a Memorandum of Understanding (MoU).

2.5 Guiding principles - Human Factors

Guidance

G 2.5.1 The integration of human factors principles is essential in good investigation practice. This includes, but is not limited to:

a) Promoting a fair culture throughout the investigation.
b) During evidence gathering through interviewing techniques.
c) During evidence analysis by identifying human performance-based immediate and underlying causes, based on the 10 incident factors in Appendix H.
d) Writing of the report.
e) The creation of effective recommendations and Competence Development Plans (or similar).

G 2.5.2 When investigating an adverse event, considering the different influences from the three levels of the human factors model shown in Figure 3 can help investigators build the investigation report. This integrated approach leads to the individuals involved being treated fairly, results in better recommendations and promotes improved safety management. The consideration of human factors is integral to the investigation, not just treated as a standalone topic.
G 2.5.3 RSSB’s Understanding Human Factors: a guide for the railway industry, contains more in-depth material on human factors, with examples of good practice relating to the railway industry.

G 2.5.4 Network Rail also produces guidance for investigating managers on commensurate levels of individual responsibility, and suggested management actions to help promote a fair culture. This can help the industry to develop a fair culture towards the management of front line staff and can also have a positive impact on other safety-critical processes.

2.6 Safety Management Systems

Guidance

G 2.6.1 Investigations form a key element of the monitoring, audit and review processes of a Safety Management System (SMS). They are part of the feedback loop within an SMS and are an essential part of achieving continuous improvement. The investigation process provides an opportunity to review the performance of the SMS and the effectiveness of risk control measures following an adverse event.

G 2.6.2 SMSs aim for continuous improvement through learning from operational experience. The ‘Taking Safe Decisions’ model can be used to support this process when:

- Monitoring – Adverse event reporting, investigation and analysis.
- Decision Making – Business case acceptance criteria of recommendations.
- Implementing Change – Improvement plans (lessons learnt).

G 2.6.3 Further information may be found under ‘Taking Safe Decisions’ on RSSB website.
G 2.6.4 Policy, resources, training and other issues related to investigation are specified within a company’s SMS and its own procedures and processes. These are in place to meet legal requirements and Railway Group Standards (RGSs). Where appropriate, these should complement the Network Rail National Emergency Plan and its supporting documents.

G 2.6.5 Transport operators have, where the risk indicates it to be appropriate, joint arrangements for response management and investigation in place with other transport operators and contractors.

G 2.6.6 This RIS supports the industry’s progress towards achieving the criteria set out in the Risk Management Maturity Model (RM3) to assess excellence in incident investigation. See RM3 section ‘MRA3: incident investigation’ on the ORR website. This sets out evidence criteria against each of the 5 maturity levels of achievement.

2.7 Data Protection

Guidance

G 2.7.1 The General Data Protection Regulation (GDPR) places a responsibility on organisations collecting and handling personal data. This regulation has an impact on the investigation process, for example in respect of data collection and storage.

G 2.7.2 Most of the problems can be avoided by not including names of individuals. But also consider any identifiers that could help someone guess the identity of a person involved, such as work location, job title, staff number, gender.
Part 3 Requirements for Adverse Event Investigation

3.1 Requirement to investigate

3.1.1 Transport operators shall apply a proportionate investigative process to adverse events.

Rationale

G 3.1.2 The HSE guidance Investigating accidents and incidents (HSG245) page 8 states: ‘...having been notified of an adverse event [...], you must decide whether it should be investigated and if so, in what depth.’

G 3.1.3 The Management of Health and Safety at Work Regulations 1999, regulation 5, requires employers to plan, organise, control, monitor and review their health and safety arrangements. Health and safety investigations form a part of this process.

G 3.1.4 The investigation process is part of the management of risk on the GB mainline railway and is an inherent part of every duty holder’s SMS.

G 3.1.5 The lessons learnt from a well-executed investigation provide benefits in terms of safety, people and business.

Guidance

G 3.1.6 Investigations establish:
- a) The events leading up to the adverse event.
- b) The detailed breakdown of the event.
- c) The causes of the adverse event.
- d) Any recommendations that address risk control measures to mitigate future reoccurrences.

G 3.1.7 Guidance on applying a proportionate approach to investigations can be found in Appendix N and throughout other appendices relating to specific stages of the investigation process.

3.2 Reporting requirements

3.2.1 Transport operators shall report adverse events.

Rationale

G 3.2.2 Legal requirements to report to statutory bodies, within prescribed timescales, are laid down in the following:
- a) The Health and Safety at Work etc Act 1974 (HASAW).
- b) Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR).
- c) The Railways (Accident, Investigation and Reporting) Regulations 2005 (RAIR).
- d) The Regulations concerning the International Carriage of Dangerous Goods by Rail (RID).
G 3.2.3 Industry members who have signed up to SMIS inputting (known as SMIS organisations) report into the industry safety management intelligence system (SMIS) for recording and for improvement processes, in accordance with RIS-8047-TOM Reporting of Safety Related Information.

G 3.2.4 The sharing of information helps promote learning throughout the industry.

Guidance

G 3.2.5 Guidance on good practice in adverse event reporting is in Appendix B:
   a) In respect of reporting to statutory bodies.
   b) In respect of passing urgent safety advice to other transport operators.
   c) In respect of reporting to rail industry systems.

G 3.2.6 Guidance relating to the sharing of investigation report information, and in relation to learning from operational experience, is given in Appendix L.

3.3 Requirement to have arrangements for investigations

3.3.1 Each transport operator shall have arrangements in place to be used in the event of an adverse event.

Rationale

G 3.3.2 Preparation and planning are vital to make the process of investigating run smoothly.

G 3.3.3 Cooperation and clear lines of responsibility are needed to produce an efficient and meaningful investigation where more than one transport operator is involved.

G 3.3.4 Liaison between different transport operators, and any other parties involved, is necessary to ensure meaningful outputs from the investigation.

Guidance

G 3.3.5 RIS-3118-TOM Incident Response Planning & Management identifies interface requirements for enabling a consistent, comprehensive and structured process for rail incident response planning and management. This includes interfaces with other transport operators, emergency services, and outside agencies.

G 3.3.6 Guidance relating to the process of gathering evidence during the early stages after an adverse event has occurred is given in Appendix D.

3.4 Capturing initial evidence

3.4.1 The relevant transport operators shall capture initial evidence on site, in a timely manner.

Rationale

G 3.4.2 Early capture of evidence can be vital to the subsequent investigation. Having arrangements that ensure staff and equipment are ready will help in recovering initial evidence at the earliest opportunity.
Some types of evidence such as physical and cognitive evidence can be perishable and deteriorate over time, so early and careful retrieval, and during initial interviews, is essential.

**Guidance**

'Relevant' transport operators are those who are involved in the adverse event, and the causal chain leading to it.

The immediate care of staff is considered both from a duty of care and to improve the quality of information in the initial interviews. Factors to be considered when arriving on site can be found in Appendix D.2.

Human memory of events can easily be contaminated and manipulated by initial questions asked after the adverse event; therefore, investigators are expected to take care in the way in which questions are phrased to enhance memory retrieval. Guidance on techniques to achieve this can be found in Appendix H.

### 3.5 The decision to investigate

The relevant transport operators shall decide whether the adverse event is to be investigated further.

**Rationale**

Adverse events of different severity or potential for harm or recurrence require different depths of investigation.

The HSE guidance (HSG245, page 8) states: ‘having been notified of an adverse event […], you must decide whether it should be investigated and if so, in what depth.’

**Guidance**

'Relevant' transport operators are those who are involved in the adverse event, and the causal chain leading to it.

Guidance on the decision relating to types and levels of investigations, including the application of proportionality, may be found in Appendix F.

Low-level events, such as some close calls, are recorded but might not warrant being investigated beyond the initial reporting and recording of the event.

### 3.6 Applying proportionality to investigations

The relevant transport operators shall apply proportionality to the process of planning an investigation.

**Rationale**

Planning the process of carrying out the investigation in the early stages will lead to an effective investigation report.
G 3.6.3 A proportionate response can inform more effective information and resource management in the early stage of the investigation and throughout.

Guidance

G 3.6.4 Guidance on the application of proportionality, including decisions relating to designating the lead organisation and level of investigation, may be found in Appendix N.

G 3.6.5 Proportionality includes considering the scope and content of the remit for the investigation. Further guidance may be found in Appendix F, which gives an indication of the content of a remit.

3.7 Gathering evidence

3.7.1 The relevant transport operators shall gather evidence to inform the investigation.

Rationale

G 3.7.2 An investigation needs to be well informed of the relevant facts to help the process and produce an effective investigation report.

G 3.7.3 Different sources of evidence are used in gaining a rounded view of the adverse event and its causes.

Guidance

G 3.7.4 An investigation considers multiple sources of evidence to verify and compare statements.

G 3.7.5 ‘Relevant’ transport operators are those who are involved in the adverse event, and the causal chain leading to it.

G 3.7.6 Evidence comes from a variety of sources, both physical and cognitive. Physical evidence includes anything that can be seen (for example, position of vehicles and equipment, damage sustained, records such as train register entries or OTMR downloads, photographs etc). Cognitive evidence is the term used in relation to human memory, and which can be collected through interviewing.

G 3.7.7 Guidance relating to the different types of physical evidence which can be collected, and on carrying out interviews to collect cognitive evidence, can be found in Appendix D and Appendix H.

G 3.7.8 Guidance relating to collecting evidence, including following an alleged signal passed at danger (SPAD) can be found in Appendix P.

G 3.7.9 Transport operators may wish to consider which individuals in their organisation are trained and competent to collect evidence, particularly in respect of technical evidence or utilising interviewing techniques.

3.8 Analysing evidence

3.8.1 The relevant transport operators shall assess, analyse and evaluate the evidence.
Rationale

G 3.8.2 This is necessary to ascertain and understand what happened, and to achieve an accurate and meaningful conclusion as to the immediate and underlying causes.

Guidance

G 3.8.3 ‘Relevant’ transport operators are those who are involved in the adverse event, and the causal chain leading to it.

G 3.8.4 Using visual representation techniques can help create a shared understanding, particularly where more than one person is undertaking the analysis and evaluation of a complex adverse event.

G 3.8.5 The majority of people can understand, interpret and recall information better when shown visually rather than solely through discussion, so having a visual representation of the sequence of events can aid understanding, analysis and evaluation of information. The minority who process information better auditorily or kinaesthetically will find other investigation techniques useful.

G 3.8.6 Techniques such as using an AcciMap or Sequentially Timed Events Plotting (STEP) diagram (see Appendix J) can help represent events, people involved, system feedback etc. It links to the evidence (both physical evidence and cognitive evidence), and the decisions made by the persons involved in the lead-up to the adverse event. These can also be used to help visualise the event to an interviewee if they are being asked about what other people did / made decisions on, before or after the event.

G 3.8.7 The 10 incident factors are useful in determining the human factors related causes of an adverse event.

3.9 Writing the investigation report

3.9.1 The relevant transport operator shall record the output from the investigation in a structured manner in the report.

Rationale

G 3.9.2 The report provides the vehicle for establishing causes, formulating recommendations, and for sharing safety lessons with others. This leads to improved risk mitigation measures, fewer adverse events and improved safety performance in the future.

Guidance

G 3.9.3 Guidance on how to structure a report, including the various sections and how they are related to each other, can be found in Appendix K.

G 3.9.4 Guidance relating to finalising investigation reports, against the remit and using a consultative process, can be found in Appendix K.

G 3.9.5 Guidance on inputting the investigation findings into SMIS can be found in RIS-8047-TOM Reporting of Safety Related Information, which requires the causes of all
adverse events to be entered in SMIS, and provides transport operators with guidance on how this obligation can be satisfied.

3.10 Learning from investigations

3.10.1 Transport operators shall share the findings from investigations.

Rationale

G 3.10.2 Learning lessons from investigation can lead to safety improvements. These lessons can be transferrable to other transport operators, so need to be shared.

Guidance

G 3.10.3 Appendix L provides guidance relating to learning from investigations, including those relating to events outside the rail industry.

G 3.10.4 Circulating relevant learning points to other organisations is a useful way of spreading learning from operational experience. This is facilitated by industry-reporting systems, such as SMIS and safety publications.

G 3.10.5 RSSB produces regular digests for industry consumption, relating to adverse events in other industries, as well as the rail industry.

G 3.10.6 RAIB issues urgent operating advices as deemed necessary, in addition to its accident reports, for transport operators to consider taking appropriate action to reduce risk.

3.11 Recommendations management

3.11.1 Transport operators shall monitor and report on the implementation of recommendations which are applicable to their operations.

Rationale

G 3.11.2 There are statutory duties under The Railways (Accident Investigation and Reporting) Regulations 2005 for transport operators to report on the progress of some recommendations; however, it is good practice for the progress of all accepted recommendations to be tracked through to implementation.

Guidance

G 3.11.3 Appendix M gives guidance relating to recommendations management.

G 3.11.4 SMIS provides an industry-wide mechanism for tracking the progress of implementing recommendations from investigations.
Appendices

Appendix A  Requirement to Investigate

A.1  Introduction
A.1.1  The content of this appendix is provided for guidance only.
A.1.2  This appendix deals with reasons for investigating adverse events and why it is important to investigate them. It details the roles of those involved in investigations, as well as the authorities and the relationships between them. It also explores the reasons why accidents happen, and the control measures that are intended to prevent them occurring.

A.2  Legal obligations

Overview of legal requirements to investigate

A.2.1  There are legal requirements relating to investigations. The most relevant for the railway industry are set out here, but this list is not exhaustive:

a)  The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended) (ROGS), Schedule 1 requires of a Safety Management System: ‘procedures to ensure that accidents, incidents, near misses and other dangerous occurrences are reported, investigated and analysed and that necessary preventative measures are taken’.


c)  Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR).


e)  Health and Safety at Work etc Act 1974.

f)  The Management of Health and Safety at Work Regulations 1999, regulation 5, requires employers to plan, organise, control, monitor and review their health and safety arrangements. Health and safety investigations form an essential part of this process.

A.2.2  The HSE publication Investigating Accidents and Incidents HSG245 contains the following text which aligns with the approach taken within this guidance document: ‘Carrying out your own health and safety investigations will provide you with a deeper understanding of the risks associated with your work activities. Blaming individuals is ultimately fruitless and sustains the myth that accidents and cases of ill health are unavoidable when the opposite is true. Well thought-out risk control measures, combined with adequate supervision, monitoring and effective management (that is, your risk management system) will ensure that your work activities are safe. Health and safety investigations are an important tool in developing and refining your risk management system.’

A.2.3  Organisations have an obligation to assess their control measures, which includes the failure modes, and to reduce the risk from adverse events to as low as is reasonably practicable (ALARP).
Section 2 of the Health and Safety at Work, etc Act 1974 states: ‘It shall be the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees’.

The term ‘Reasonably Practicable’ is defined in case law (Edwards v National Coal Board 1949) ‘…, ‘Reasonably practicable’ is a narrower term than ‘physically possible’ and seems to me to imply that a computation must be made by the owner in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) is placed in the other, and that, if it be shown that there is a gross disproportion between them - the risk being insignificant in relation to the sacrifice - the defendants discharge the onus on them.’

Notifying authorities about adverse events

Companies have procedures in place for reporting to the RAIB, ORR and BTP and to meet the requirements of RIDDOR. The legal requirements for adverse event reporting are summarised in Table 1, along with the requirements for reporting to rail industry systems, in Table 2.

RIS-8047-TOM Reporting of Safety Related Information, sets out requirements for adverse event reporting by transport operators. For adverse events involving non-duty holders, reporting is via the contracting transport operator.

SMIS provides a mechanism for discharging the duty to notify certain types of adverse events.

Roles of the various investigation bodies

Various bodies, the main ones being the RAIB, BTP and ORR, have legally specified roles relating to railway investigations. These are described in a Memorandum of Understanding (MoU), dated April 2006. The most relevant content is summarised below.

The MoU sets out the principles for effective liaison, communication and cooperation between these parties so that rail accidents, and related criminal incidents and deaths, can be independently investigated, as necessary, by each party, in a thorough and professional manner, considering their respective roles and responsibilities, while also ensuring that legitimate public expectations are met.

The MoU recognises that all parties have duties to perform in relation to investigating rail adverse events and that each party in fulfilling these duties should appropriately consider the respective roles and responsibilities of the other parties.

The MoU provides a framework within which each party can carry out their respective roles and responsibilities, and, where necessary, carry out parallel independent investigations in cooperation with one another, in a way which achieves the best outcome for all concerned.

The RAIB was established by the Railways and Transport Safety Act 2003 (RTSA) following a recommendation by Lord Cullen’s inquiry into the accident at Ladbroke Grove. It is the independent railway accident investigation body for the United Kingdom, as required by the European Railway Safety Directive, 2004/49/ EC.
Railways (Accident Investigation and Reporting) Regulations 2005 (RAIR) implement that part of the Safety Directive dealing with rail accident investigation which was not implemented already by the Railways and Transport Safety Act 2003.

A.2.14 RAIB conducts ‘no blame’ investigations into railway adverse events to identify the causes and make recommendations to improve safety. The purpose behind their investigation is to ensure that safety lessons are learned.

A.2.15 RAIB is administratively part of the Department for Transport (DfT), but is functionally independent in its conduct of investigations, and submits its investigation reports directly to the Secretary of State.

A.2.16 RAIB is required by the Directive to investigate serious accidents, as defined by the Directive, and has discretion to investigate other adverse events. Its remit covers all railways, except for those in some industrial premises, museums and funfairs. The remit also includes tramways in England and Wales, and the UK side of the Channel Tunnel Fixed Link up to the mid-point. Railway industry bodies are required to notify RAIB of certain fatalities, specified major injuries, derailments, collisions and other specified dangerous occurrences (see regulation 4 of Guidance on the Railways (Accident Investigation and Reporting) Regulations 2005 for more information).

A.2.17 The MoU sets out the circumstances in which an RAIB investigation takes precedence and in which a police investigation takes precedence. It would normally require firm indications of serious criminality to justify a criminal investigation taking precedence over an RAIB investigation whose results will be made public, so in most cases RAIB will be the lead party.


A.2.19 The BTP and Home Office police forces’ primary duty is to protect life and property, and to prevent and detect crime. In relation to accidents involving fatalities, the police have a duty to investigate and determine whether there is evidence of criminal culpability on the part of any person or corporation. The police also have a duty to investigate any death on behalf of HM Coroner.

A.2.20 The BTP is the national police force for the main line railways throughout England, Wales and Scotland. In addition to the main national railway network, it is also responsible for policing the London Underground System, the Docklands Light Railway, the Midland Metro Tram system and Croydon Tramlink.

A.2.21 The BTP works closely with the local Home Office police force, in accordance with procedures approved by the National Police Chiefs’ Council.

A.2.22 The ORR is the safety authority and the safety regulator for the railway industry. This safety regulator function was transferred to the ORR from the HSE on 01 April 2006 when the Health and Safety (Enforcing Authority for Railways and Other Guided Transport Systems) Regulations 2006 came into force. The ORR works to maintain and improve railway safety by operating a system of safety certification and authorisation, by actively monitoring compliance, and by developing the regulatory framework. Its jurisdiction covers all GB’s railways and associated infrastructure, including light railways, underground systems and tramways.
A.2.23 As part of its statutory functions the ORR investigates potential breaches of health and safety legislation in relation to the operation of the railways, including those arising from rail adverse events. Following an investigation, the ORR will take action as appropriate and in accordance with its Health and Safety Enforcement Policy. Although the RAIR Regulations make significant changes to the way railway adverse events are investigated, they do not alter the duties and functions of the rail safety regulator as they have been transferred to the ORR in 2006.

Cooperation between parties

A.2.24 The lead party takes into account the other parties’ needs in the way it handles issues of common interest. The parties are committed to fully cooperating and liaising with each other. In relation to environmental damage, the Environmental Agency and Scottish Environmental Protection Agency may become involved.

A.3 The importance of effective investigations

Adverse event reduction

A.3.1 Good investigation is designed to lead to thorough analysis, with identification of the underlying causes, and the proposal of appropriate recommendations which, if implemented and monitored effectively, can result in fewer adverse events. This can produce a potential economic benefit with less damage and fewer injuries to employees, passengers and the public.

Why do adverse events happen?

A.3.2 Adverse events happen when something goes wrong. This could be an unsafe act (such as climbing on a structure without a secure harness) or an unsafe condition (such as a broken ladder). Usually, it is a result of a combination of decisions, acts and/or unsafe conditions. It is likely that there are failures both in an individual’s perception or decision making and in organisational factors, such as training and supervision.

A.3.3 This model of causation is represented in the Swiss Cheese model (see Figure 4), which is based on James Reason’s theory (Human error: models and management. 2000) and is the root of many modern applications of investigation processes.
A.3.4 Every hole represents a weakness in the control measure (the slice of cheese). The fewer or smaller the holes in each slice, the smaller the opportunity for an adverse event to occur.

A.3.5 The Swiss cheese model can be used to represent the proximity of causes to the adverse event. The person involved is closest to the adverse event, tracing back through other human performance issues, job or equipment issues and the 10 incident factors.

A.3.6 The following rail industry example shown in Figure 5 further illustrates the lining up of system failures:
The investigation focusses on understanding why each of these immediate and underlying factors occurred. This is intended to identify what the organisation can do to systemically prevent recurrence in terms of linking these failures to the recommendations.

**Figure 5: Clapham Junction collision (1988) Barriers and failures in signal installation**

**What are the benefits of good investigations? - It is good for safety**

**A.3.7**
The effective implementation of recommendations, and the learning of lessons, can result in continuous safety improvement, both within individual transport operator’s activities and across the industry, and lead to fewer adverse events. To achieve this, organisations need to have in place well-designed, risk-based investigation processes and adequate resources, underpinned by strong and visible commitment and support from senior managers.

**A.3.11**
The principles of good investigation apply to all adverse events, whether the event resulted in injury, or damage or neither of these. It is important to recognise that the investigation of near misses and close calls can bring the benefits of investigation, with little or no costs in terms of harm.
A positive work culture, or safety culture is reflected in employee attitudes (frontline and management) towards safety, their day-to-day safety behaviours and the quality and effectiveness of the underlying safety management system.

The HSE’s HSG245 states: ‘As well as being a legal duty, it has been found that where there is full cooperation and consultation with union representatives and employees, the number of adverse events is half that of workplaces where there is no such employee involvement.’

What are the benefits of good investigations? - It is good for business

Accidents are expensive, with many factors contributing to this. In addition to the more obvious costs are reputational risks and the cost of the investigation. For major accidents these costs can be extreme, to the level of business collapse. Costs of legal fees can be significant, sometimes several times the more obvious costs.

Much has been written about the cost of accidents, particularly by the HSE, both in the rail industry and the wider UK economy. When it comes to drafting recommendations, it is useful that investigators have an appreciation of the full costs of accidents and some are set out below:

a) Robust application of the SMS and its components (such as risk assessment and control, adverse event management, competence systems, outcome and activity indicators, acting on recommendations, high-level review and learning lessons) can lead to a reduction in adverse events and therefore costs.

b) Claims are sometimes an element of the total cost and those that are made constitute a larger percentage of costs for the lower level occupational health and safety (for example, slips, trips and falls) or passenger accidents, compared with the higher consequence adverse events. Again, good investigation, coupled with recommendations, leads to fewer adverse events and fewer claims.

c) The HSE website publishes an overview of the costs of workforce injuries and new cases of work-related ill health in GB. Latest estimates show that annually between 2014/15 and 2016/17 an average of 614,000 workers were injured in workplace accidents and a further 521,000 workers suffered a new case of ill health which they believe to be caused or made worse by their work. The economic cost of workplace injury and illness is estimated to be £14.9bn: split between injuries (£5.3bn) and illness (£9.7bn).

d) The HSE website provides basic tools to assist in identifying approximate annual accident costs and those for specific accidents. The Annual Accident Calculator includes insurance premiums and uninsured costs such as lost time, production delays, extra wages, legal costs and loss of contracts. HSE studies have shown the ratio of insurance premium paid to uninsured losses to be between 1:8 and 1:36.

RSSB’s Taking Safe Decisions describes the industry consensus view on how decisions that affect safety are made, and sets out the different costs that are to be taken into account both when assessing compliance with the legal duty to ensure safety so far as is reasonably practicable, and whether a decision makes sense from the wider business perspective.
A.4 The roles in investigations

The role of the senior manager

A.4.1 When senior managers are visibly and positively engaged in the investigation process, they encourage lessons to be learnt and improvements to be made. This can promote learning and continuous improvement in investigations. The following areas of visible commitment are key:

- Leadership. The engagement and interest of senior managers at appropriate stages of the investigation process, and especially in understanding and applying the lessons learnt, can facilitate its chances of leading to continuous improvement.
- Policies and arrangements. An effective SMS will, in addition to containing the relevant policies, as required by law and by the company’s business needs, include arrangements for applying these policies effectively.
- Providing resources. A key role for senior management is to provide the necessary, competent resources to assist with investigations and the wider aspects of adverse event management. Appendix N.1 gives guidance on the best use of resources, through the use of tools to achieve a proportionate response throughout the investigation process.

A.4.2 In order to systematically learn lessons, senior managers will need to actively participate in a review process, involving a thorough scrutiny of risks. This could include:

- Reports on activity (leading) and outcome (lagging) indicators, noting trends and understanding the reasons for them.
- Analysis of any relevant major accident, noting underlying causes.
- Implementation and effectiveness of previous recommendations.
- Agreeing actions from lessons learned and review of previous actions from high-level reviews.
- Agreeing how to apply this learning to the company, for example, via team meetings.

A.4.3 Once learning points have been identified, then senior management support is necessary in order to gain the benefits through improvements. These may include updating procedures and SM5s, training and briefing of staff, introducing new equipment, improving safety culture and making changes to monitoring and review processes.

A.4.4 The pace of change in the industry can impact on the level of staff turnover and the consequent risk of a loss of corporate knowledge so that lessons, once learned, might be forgotten. Effective systems for safety validation of change can assist with the retention of corporate knowledge.

The role of the person managing the investigation process

A.4.5 Each transport operator has at least one person responsible for managing the investigation process and contributing to investigations. This person is usually referred to as the Designated Competent Person (DCP).
A.4.6 This person covers the overall management of the investigation process and specifically the management of recording and signalling data, management of the interface with other parties and the establishment of a remit.

A.4.7 This person has a role in reviewing the final report to ascertain whether the investigation has been carried out effectively and has met the remit.

The role of the investigator

A.4.8 The lead investigator plans the investigation. The plan is prepared to manage the delivery of the investigation and the report.

A.4.9 It is logical for the amount of time and effort engaged in carrying out an investigation to be in proportion to the risk associated with the adverse event.

A.4.10 Transport operators take into consideration the following factors when planning an investigation:

a) The potential severity of the event.
b) The likelihood of reoccurrence (including somewhere else on the railway).
c) The need to demonstrate transparency of the investigation process.
d) Any requests made by parties to hold a particular category of investigation.
e) Any previous investigations into similar adverse events.
f) The timescales involved in carrying out the investigation and writing the report, taking into account any factors affecting the urgency of the investigation.

A.4.11 Guidance on applying proportionality can be found in Appendix N.1.

The role of Safety Representatives

A.4.12 The Safety Representatives and Safety Committees Regulations 1977 give safety representatives the right of access to safety records and to carry out inspections and examinations of reportable accidents.

A.4.13 The HSE suggests that it is good practice to involve the representative as ‘an investigation involving the health and safety representative can give employees more confidence to cooperate.’ The HSE also advises that there should be an agreed system for informing the relevant representative if an accident occurs and that they should then be involved as soon as possible.

A.4.14 The involvement of designated Health and Safety representatives in the improvement of safety is an aspect of a positive safety culture. Safety representatives can assist directly with investigations and support a constructive response from the workforce. Benefits to the company can be gained if safety representatives are:

a) Invited to visit the site.
b) Consulted on the investigation.
c) Invited to accompany witnesses in interviews.
d) Consulted on the formulation of recommendations.

A.4.15 Network Rail’s Health & Safety Handbook points to the importance of a joint approach to the investigation, an element of which could be a site inspection, with the line manager arranging that the safety representative be accompanied by somebody from the management team.
Appendix B  Reporting Arrangements

B.1  Introduction

B.1.1  The content of this appendix is provided for guidance only.

B.1.2  This appendix deals with the arrangements for reporting adverse events to statutory bodies, other transport operators and rail industry systems. It also covers arrangements for reporting urgent safety issues which have the potential to occur elsewhere.

B.2  Statutory responsibilities for reporting

B.2.1  Companies have procedures in place for reporting to the RAIB, ORR, HSE and BTP. Rail industry adverse event information is sent to a number of bodies and systems. This is summarised in Table 1. Cooperation is required between transport operators when reporting adverse events to statutory bodies.

<table>
<thead>
<tr>
<th>Statutory body</th>
<th>Reason for reporting and investigation. Relevant reference document.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAIB</td>
<td>The RAIB leads the technical investigation into the causes and consequences and makes recommendations to improve safety. Guidance on the Railways (Accident Investigation and Reporting) Regulations 2005.</td>
</tr>
<tr>
<td>ORR</td>
<td>The ORR investigates potential breaches of health and safety legislation in relation to operation of the railways. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR).</td>
</tr>
<tr>
<td>HSE</td>
<td>For accidents away from the operational railway report to HSE/local enforcing authority.</td>
</tr>
<tr>
<td>Competent authority of the RID contracting state</td>
<td>The Carriage of Dangerous goods and Use of Transportable Pressure Equipment Regulations 2009 (CDG) (as amended) and the Regulations concerning the International Carriage of Dangerous Goods by Rail (RID) require that any serious accident or incident during the loading, filling, carriage or unloading of dangerous goods be reported to the competent authority of the RID contracting state concerned within one month of the occurrence. The competent authority of the RID contracting state is defined in the CDG.</td>
</tr>
<tr>
<td>Environment agencies</td>
<td>To alert environmental agencies and other authorities with environmental responsibilities. For potential damage to the water environment and to protected species and habitats.</td>
</tr>
</tbody>
</table>
BTP and civil police

The police investigate to find out if there has been a breach of law and any deaths on behalf of HM Coroner.

Table 1: Statutory responsibilities for reporting

B.3 Urgent safety reporting

B.3.1 Transport operators have arrangements in place to communicate the cause(s) of ‘dangerous occurrences’ to other transport operators, where there is evidence to suggest a similar occurrence could reoccur elsewhere in the railway system.

B.3.2 The Guide to ROGS (ORR, 2014) states: ‘transport operators are now equally responsible for co-operating to keep the railway system safe’. Therefore, if a transport operator has evidence to suggest that a ‘dangerous occurrence’ could reoccur elsewhere in the railway system, they have a legal obligation under the general duty of cooperation (ROGS, regulation 22) to share such intelligence with other transport operators.

B.3.3 It may be necessary to communicate lessons learnt that are relevant to other transport operators, and to communicate these efficiently, prior to the investigation concluding.

B.3.4 The following methods are used to inform transport operators of safety-critical issues:

a) An Urgent Operating Advice in accordance with the details and process outlined in RIS-3350-TOM Communication of Urgent Operating Advice.

b) An urgent safety related notice in accordance with the details and process outlined in RIS-8250-RST Reporting High Risk Defects, in respect of train / rail vehicle defects.

c) A workforce safety alert (WSA) in respect of issues affecting the safety of the workforce. Further details are available at www.railnotices.net.

B.4 Internal industry reporting

B.4.1 Rail industry adverse event information is sent to a number of bodies and systems. Table 2 contains a summary of internal reporting requirements.

<table>
<thead>
<tr>
<th>Report to</th>
<th>Reason for reporting and investigation/relevant reference document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Rail’s National Operations Centre (NOC)</td>
<td>Records details of events occurring on the national rail network (as reported by Network Rail’s route operations controls) – mainly on Network Rail managed infrastructure. NOC issues National Incident Reporting (NIR) (see below) on behalf of the rail industry. Allows Network Rail’s contractors to report adverse events to a Network Rail control centre. Details of safety related events submitted to SMIS.</td>
</tr>
</tbody>
</table>
Table 2: Internal industry reporting

<table>
<thead>
<tr>
<th>Report to</th>
<th>Reason for reporting and investigation/relevant reference document</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Incident Reporting</td>
<td>Alerts the industry to vehicle-related safety defects. RIS-8250-RST</td>
</tr>
<tr>
<td>(NIR)</td>
<td>Reporting High Risk Defects alerts the industry to operations</td>
</tr>
<tr>
<td></td>
<td>irregularities. RIS-3350-TOM Communication of Urgent Operating</td>
</tr>
<tr>
<td></td>
<td>Advice alerts the industry to safety issues. Workforce Safety Alerts</td>
</tr>
<tr>
<td></td>
<td>are issued via Rail Notices <a href="http://www.railnotices.net">www.railnotices.net</a> (registration is</td>
</tr>
<tr>
<td></td>
<td>required for this site).</td>
</tr>
<tr>
<td>SMIS</td>
<td>RIS-8047-TOM, Reporting of Safety Related Information requires</td>
</tr>
<tr>
<td></td>
<td>reliable safety data to be collected, analysed and made available</td>
</tr>
<tr>
<td></td>
<td>for use by the rail industry parties in the management of risk.</td>
</tr>
</tbody>
</table>

B.5 Confidential reporting

B.5.1 The Confidential Incident Reporting & Analysis Service Ltd. (CIRAS) provides employees of any company in the railway industry with a confidential and independent way to report safety-related concerns without fear of recrimination, or where they feel unable to report through normal company channels. CIRAS supplements internal reporting systems rather than seeking to replace them.

B.5.2 CIRAS takes calls from all staff, from front line to managers, in the strictest of confidence and is independent of all subscribing member organisations.
Appendix C Incident Response Planning and Management

C.1 Introduction

C.1.1 The content of this appendix is provided for guidance only.

C.1.2 This appendix deals with the arrangements for planning for investigations, including at the stage of the initial response to the adverse event, to facilitate a timely commencement of the investigation process.

C.2 Response planning

C.2.1 ROGS requires the inclusion of the following amongst the basic elements of an SMS: ‘provision of plans for action, alerts and information in the case of an emergency which are to be agreed with any public body, including the emergency services, that may be involved in such an emergency.’

C.2.2 ROGS place a statutory duty on transport operators (as defined in those regulations) to ensure that accidents, incidents, near misses and other dangerous occurrences are reported, investigated and analysed, and that necessary preventative measures are taken. The same regulations also require the production of plans for such events and for duty holders to cooperate, as basic elements of their respective safety management systems.

C.2.3 RIS-3118-TOM Incident Response Planning & Management identifies interface requirements for enabling a consistent, comprehensive and structured process for rail incident response planning and management, including arrangements with other transport operators and emergency services. It contains requirements for interface issues concerning the planning and management of coordinated responses to incidents. This includes using the current edition of the Network Rail National Emergency Plan as an overview to aid the creation of all coordinated incident response plans.

C.2.4 The Network Rail National Emergency Plan is the primary industry document for emergency planning. It describes the arrangements in place to provide an effective response to accidents, incidents and emergencies on the Network Rail controlled infrastructure, and is intended to implement the requirements of RGSs. All relevant stakeholders are consulted on the content of this plan and it outlines the responsibilities of railway undertakings and other interfacing organisations. It includes a section (S) on investigation.

C.2.5 Rail Delivery Group guidance note RDG-GN011 Emergency Planning – Knowledge, Understanding and Responsibilities provides advice to passenger operators on requirements with regard to knowledge, understanding and responsibilities for those accountable for emergency planning.

C.2.6 Each company has its own procedures and processes to meet the legal and RGS requirements and to complement the Network Rail National Emergency Plan and its supporting documents.
C.3 Response management resources

C.3.1 The Rule Book (GERT8000) mandates requirements for managing the site of the accident, including early aspects of the investigation such as the protection of evidence (see also Appendix D).

C.3.2 In addition to the procedures, other resources are required. This includes trained and competent investigators. Specialist support for investigation teams (see Appendix F) might also be needed.

C.3.3 The RAIB uses accredited agents, who are employees of transport operators, to assist with RAIB investigations, usually in remote locations, before an RAIB inspector gets to the site. They have three essential tasks:

a) Identify and record perishable and vulnerable evidence for RAIB use. This includes photographs, where photographic equipment is available.

b) Provide an assessment of the adverse event to the RAIB duty coordinator.

c) Ensure as far as reasonably practical that technical evidence is preserved for RAIB, pending the arrival of an inspector on site.

C.3.4 Accredited agents receive training from the RAIB and such training is recorded in competence records.

C.4 Training and competence

C.4.1 Investigations are led by investigators with the necessary competence to conduct the level of investigations they are asked to undertake.

C.4.2 A lead investigator is expected to:

a) Understand the requirements of this RIS and its application.

b) Have experience in investigations (or be provided with the necessary training and other support to develop the necessary skills).

c) Lead a panel (if required).

d) Have technical competence to:

   i) Conduct the investigation or have access to competent technical advice on those aspects outside their own technical competence.

   ii) Identify safety matters which justify urgent action before the final report is completed.

   iii) Identify the need for, and to make, recommendations.

C.4.3 A good competence management system brings benefits in the form of better investigations and reports, and consequently fewer adverse events.

C.4.4 Competence for investigators should include:

a) Basic training to suit the level and type of investigations. RSSB’s Accident Investigation Training, a digital training programme, is a good starting point.

b) Training in human factors awareness for investigators.

c) Participation in table-top exercises and live simulations.

d) Useful qualifications include the NEBOSH certificate.
C.4.5 Transport operators are likely to require specific content variations in their training and competence systems for different levels of investigators. For the higher levels of investigation, training and competence regimes are more formal because:

a) The risks to be addressed and the costs are likely to be higher.
b) The breadth of experience required is likely to be greater.
c) They may involve managing a team. Competence for investigators above the basic level could additionally include:

   i) Independent review of reports.
   ii) Involvement in table-top exercises and assessment during these.
   iii) A programme of training and refresher training to suit the level and type of investigations, based on training needs analysis.
   iv) Useful qualifications, including investigator course certification and NEBOSH diploma.

C.4.6 Good Practice – Competence for investigators above the basic level could additionally include:

a) Independent review of reports.
b) Involvement in table-top exercises and assessment during these.
c) A programme of training and refresher training to suit the level and type of investigations, based on training needs analysis.
d) Useful qualifications, including investigator course certification and NEBOSH diploma.

Training – courses and providers

C.4.7 The guidance in this document is intended to support training design and delivery.

C.4.8 Transport operators can use external training suppliers who have a knowledge of the railway industry and its interfaces. Training is best pitched at an appropriate level and covers the essentials of investigating, as outlined in this guidance; for example, investigation techniques, report and recommendation writing and managing recommendations to implementation.

C.4.9 The training that is provided will have a more lasting impact if it is integrated into the competence system and its effectiveness is measured and monitored.

Human factors training

C.4.10 RSSB provides a human factors awareness course for investigators, which is designed to:

a) Raise awareness of the range of human factors issues that can contribute to the likelihood of adverse events.
b) Provide investigators with practical skills in understanding and correctly classifying human error and intentional rule breaking.
c) Raise awareness of the issues that can influence safety performance at the three levels of human factors (see Figure 3).
d) Enable investigators to identify underlying system weaknesses and to make effective recommendations in investigation reports to reduce the likelihood of future adverse events.

C.4.11 Network Rail has an e-learning programme on incident and human factors investigation.

C.4.12 RSSB also provides a non-technical skills (NTS) course and resources which can help investigators better understand how NTS affects a part of the investigation.

C.5 Investigative equipment

C.5.1 Investigators require correct equipment to be readily available to undertake a timely investigation. Such resources and equipment might include the following (this is not an exhaustive list):

a) Local/route maps.

b) Cameras.

c) Torch.

d) Voice recorder.

e) Laptop computer.

f) Measuring equipment (including non-metallic).

g) Secure containers/locations for perishable evidence.

C.5.2 A more extensive list might be appropriate in case of major accident response and investigation.
Appendix D  Capturing Initial Evidence

D.1  Introduction

D.1.1  The content of this appendix is provided for guidance only.

D.1.2  This appendix deals with the arrangements for initial evidence gathering, both at the scene of an adverse event and in the wider context. It covers why this initial stage is key to the rest of the investigation, what sort of evidence is collected, including gathering perishable evidence such as that on site and people’s recollection of events.

D.2  Responding

D.2.1  The immediate actions taken in the event of an emergency on the railway are contained in the Rule Book.

D.2.2  The protocols for site management are laid down in RIS-3118-TOM Incident Response Planning and Management, and for anyone attending the site of an adverse event, including liaising with the appropriate persons in charge to establish whether it is permissible to enter the site.

D.2.3  At locations where a command structure is in place, involving the designation of strategic, tactical and operational commanders, as referred to in RIS-3118-TOM and the Network Rail National Emergency Plan (NRNEP), then the protocols of this structure provide a useful point of contact for the investigator.

D.2.4  RIS-3118-TOM and the NRNEP specify requirements for operational adverse events, as do individual company procedures. The gathering of initial evidence is crucial to the investigation, and it is important that it should be preserved and protected.

D.2.5  The acronym ‘METHANE’ (see Figure 6) is used nationally, by transport operators and the emergency services to focus attention on critical information at the site.

Figure 6: METHANE Acronym
D.3 Health and safety considerations

D.3.1 Everybody has a responsibility for their own health and safety, as well as for anybody who could be affected by their activities.

D.3.2 The railway environment is one which has its own specific hazards, and this is even more pertinent at the site of any adverse event. Personnel who are attending such have to be aware of the hazardous conditions which are normally present, as well as any which have been created as a result of the adverse event itself, or by the recovery operations. Not all hazards can be foreseen, hence the continuous assessment of risk in the rapidly changing circumstance of an operational incident in order to implement control measures to achieve an acceptable level of safety.

D.4 Management of dangerous substances and health hazards

D.4.1 In the event of an occupational health exposure such as fumes or disturbance of asbestos, an early accurate record of the exposure is important for the management of possible future liabilities.

D.4.2 Early contact may need to be made with the relevant environmental agency and, in the case of water and land pollution, the respective water and local authority. Early actions may also be required to stop or limit release especially when substances are dangerous and where water courses may be polluted.

D.5 Early reporting of an adverse event

D.5.1 It is important that the early reports of adverse events contain information that is as accurate as possible. An investigation needs to draw on a variety of sources of information to create a more rounded view of the adverse event. This is likely to include but not limited to initial interviews, physical evidence, technical, operational, engineering and human factors evidence.

D.5.2 Investigators, who may have access to such early information, liaise closely with those who are responsible for reporting to the various bodies and systems to ensure that the industry benefits from good data. Arrangements for reporting to statutory bodies and to railway industry systems are set out in B.1.

D.6 Gathering evidence

D.6.1 Once the individual’s safety and that of the site are managed, the key event in the immediate aftermath of an accident is the collection of evidence. This is where crucial evidence can be collected before it can become lost or distorted. It includes the gathering of perishable evidence including witness statements. How well this is done will impact on the investigation, setting the tone for the interviews and the rest of the investigation.

D.6.2 When attending the scene, it is important that the process of evidence gathering begins early, especially in respect of perishable evidence. The RAIB sometimes uses accredited agents for this purpose, as set out in Appendix C.

D.6.3 The aim of collecting physical and witness evidence is to determine:

a) The events leading up to the adverse event.
b) The immediate cause(s) of the adverse event.
c) The consequences of the adverse event.
d) The immediate response to the adverse event.
e) The underlying causes of the adverse event.
f) Any other relevant factors.

D.6.4 RIS-3118-TOM Incident Response Planning & Management identifies interface requirements for enabling a consistent, comprehensive and structured process for rail incident response planning and management. This includes arrangements relating to the gathering of evidence.

D.6.5 The following is a checklist of key activities for those who are earliest at the scene of the accident:

a) Ensure own safety and safety of others.
b) Consider the physical and mental well-being of those involved.
c) Record what has happened (possibly involving a walk through the area of the undesired event).
d) Gather physical and witness evidence to determine:
   i) The events leading up to the adverse event.
   ii) The immediate cause(s) of the adverse event.
   iii) The consequences of the adverse event.
   iv) The immediate response to the adverse event.
   v) Any identifiable underlying causes of the adverse event.
   vi) A draft timeline or log of actions and who is on site, including timings.
   vii) Any other relevant factors.

D.6.6 Priority is given to gathering perishable evidence, because it might become altered by time, weather or movement. Such evidence includes:

a) Brake and wheel temperatures.
b) Positions of driving controls, switches etc.
c) Brake pressure and other instrument and gauge readings.
d) Signalling equipment positions and indications.
e) Photographs of the site and equipment, including any pollution.
f) Condition of location prior to rescue and recovery operations.
g) Weather conditions.
h) Results of alcohol and drugs tests.
i) Eye-witness accounts.
j) Verbal or written recollection and testimony of the events from the person(s) involved in the adverse event.
k) Details of any personal injuries and treatment afforded.
l) Names, addresses and statements from witnesses.

D.7 Human memory and collection of evidence

D.7.1 Human memory, both the encoding (putting it into memory) and recall (remembering and recalling those memories), as illustrated in Figure 7, is complex and prone to
error. Memories around events or information associated with events is notoriously perishable and can be affected by a number of factors. These can include where the person’s attention was at the time of the event, if they were distracted, the level and type of emotion associated with the event, any assumptions or inferences made, anxiety, and the use of leading questions etc.

D.7.2 When gathering initial statements it is important that uncorrupted evidence is gained at the scene as quickly as possible. Due to the possibility of witnesses experiencing some negative emotions around the event, that is, fear of blame, upset at harm caused to others, physical harm to themselves, fear of authority etc; care has to be taken in the way in which questions are asked, and how they are asked, to optimise the person’s recall of events.

D.7.3 Investigators can use a range of interview techniques to gather reliable witness statements (see Appendix H). This evidence includes both the individual’s actions and decisions about what happened and why, their motivations for these and other systemic management factors (that is, tools or equipment use, planning used on the night, environmental factors, supervisor’s/manager’s instructions etc. Fair and unbiased evidence gathering can help the witness to make sense of what has happened. Providing or leaving them with a sense of being able to tell their version of events can help them to feel calmer after and could enable them to recall better at the interview stage.

(adapted from Milne and Bull, 2003 by Network Rail)

**Figure 7:** The process of encoding and recalling memory

D.7.4 During the recall of events, it is possible to create false memories or cause witnesses to wrongly interpret memories which can then go on to impact on the person’s longer-term recollection of the event. Where possible it is desirable to minimise the number of occasions that an individual is interviewed about the same event. This may be achieved by combining interviews where possible.
D.7.5 Incorrect recall can be caused by the use of emotive words or by the use of emotive questions.

D.7.6 To help retrieve good quality witness statements, the Enhanced Cognitive Interviewing (ECI) technique in Appendix H can be used.
Appendix E — Assessment of Adverse Effects

E.1 Introduction

E.1.1 The content of this appendix is provided for guidance only.

E.1.2 This appendix deals with the initial assessment of adverse events, and the decision on whether any further investigation is needed.

E.2 The decision whether to investigate further

E.2.1 In applying the principles of proportionality (Appendix N), transport operators assess the severity and the potential severity of the adverse event to inform the decision on the level of the investigation required. For the most minor events, this might simply be to report the event via an entry into industry reporting systems (for example, SMIS). For more serious events, an appropriately structured approach is required, as set out in Appendix F.

E.3 Obligatory investigations

E.3.1 Companies have a statutory duty to report and investigate certain adverse events (see Appendix A).

E.4 Proportionality

E.4.1 The type and severity of the event has an influence on the type and detail of the whole investigation process, from the initial response through to the implementation of the recommendations. Some adverse event types may have an associated form (for example, SPAD form, wrong routing form etc) which indicate what information is required. The type of interviewing used and the gathering of other evidence such as photographs etc is considered in terms of Table 3.

<table>
<thead>
<tr>
<th>Level</th>
<th>Investigation actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record the adverse event</td>
<td>Complete forms.</td>
</tr>
<tr>
<td></td>
<td>Input into SMIS.</td>
</tr>
<tr>
<td>Low level of investigation</td>
<td>Complete forms.</td>
</tr>
<tr>
<td></td>
<td>Input into SMIS – 10 Incident Factors and Human performance.</td>
</tr>
<tr>
<td>Medium level of investigation</td>
<td>Complete forms.</td>
</tr>
<tr>
<td></td>
<td>Input into SMIS – 10 Incident Factors and Human performance.</td>
</tr>
<tr>
<td></td>
<td>Use of accident mapping technique.</td>
</tr>
<tr>
<td>Local investigation</td>
<td>Use of Enhanced Cognitive Interviewing and detailed consideration of human factors, including 10 Incident Factors and Human performance.</td>
</tr>
</tbody>
</table>
### Level Investigation actions

<table>
<thead>
<tr>
<th>Level</th>
<th>Investigation actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>High level of investigation</td>
<td>Complete forms.</td>
</tr>
<tr>
<td></td>
<td>Input into SMIS.</td>
</tr>
<tr>
<td>Formal investigation</td>
<td>Use of accident mapping technique.</td>
</tr>
<tr>
<td></td>
<td>Use of Enhanced Cognitive Interviewing and detailed consideration</td>
</tr>
<tr>
<td></td>
<td>of human factors, including 10 Incident Factors and Human</td>
</tr>
<tr>
<td></td>
<td>performance.</td>
</tr>
<tr>
<td></td>
<td>Use of multi-disciplinary interview panel.</td>
</tr>
</tbody>
</table>

**Table 3:** Level of investigation and investigation requirements
Appendix F  Planning an Investigation

F.1  Introduction

F.1.1 The content of this appendix is provided for guidance only.

F.1.2 This appendix deals with the planning stage of an investigation, determining the level of the investigation, the lead organisation and the lead investigator. It also considers the contents of the remit.

F.1.3 Planning is crucial to a good investigation. An early review of an adverse event provides a useful forum to capture what is already known and to decide the resources required for the investigation.

F.2  Conducting an initial assessment

F.2.1 An early review of the event can be held to assess the need for an investigation. The review involves representatives from different organisations and some early joint understandings, arrangements and decisions may need to be made. The selection of the reviewer(s) takes into account the principle of proportionality in relation to the adverse event as well as the organisations' policies and resources. This review could take place by way of a telephone conference call, to maximise the opportunity for representatives to be involved.

F.2.2 The timing of this review may depend on the scale of the adverse event and on the ease of gathering the information necessary to make an early decision on the appropriate level of investigation. A rough guide may be that for a low-level event the decision on the content of the remit could be made immediately the circumstances of the event are known. Whereas, for a high-level event (for example, train movement accident) 24-72 hours may be reasonable; these timescales are existing, common targets in the industry.

F.2.3 The decision on the level of investigation (see Appendix N regarding proportionality) is based on consideration of the information available at the time. If new information is made available at a later stage, then it might be deemed appropriate to revisit the decision.

F.2.4 Guidance regarding early action to collect perishable and other physical and witness evidence in a timely fashion, and the preservation and collection of evidence immediately following the adverse event, can be found in Appendix D. A checklist for the initial review is useful and could be used to encourage an open-minded approach to the identification of immediate and underlying causes. This might include items such as:

a) Description of the event, based on known information.
b) Assimilation of evidence.
c) Timelining the event.
d) Assessment of any known sub-standard acts and conditions.
e) Potential causes – immediate and underlying.
f) Review of related risk assessments.
g) Action already taken and planned to be taken.
h) Comparison of time of day between event and visit and any differences.
F.2.5 The early review of the event can be used to complete the details of the remit. A clear and comprehensive remit provides for a better investigation process, and in turn, a more effective report. Further guidance regarding remits can be found in F.4.

F.3 Determination of lead organisation and level of investigation

Lead organisation

F.3.1 Investigations are more effective when they are carried out by the organisation best placed to investigate the adverse event.

F.3.2 Transport operators involved in an adverse event decide which organisation will lead the investigation. The decision on which organisation is to lead the investigation is a cooperative one, including input from each of the transport operators involved in the adverse event. Transport operators might wish to specify who within their own organisation is responsible for making these decisions, such as a senior member of the safety team for higher-level investigations.

F.3.3 The transport operator with direct control of the control measure(s) which failed and led to an adverse event is usually the organisation best placed to lead the investigation. Where more than one transport operators’ risk control measures have failed, then the organisation which takes the role of lead organisation will normally be the owner of the greater part of the relevant control measures.

F.3.4 ROGS places a duty of cooperation on transport operators, who have an obligation to collaborate in order to achieve their responsibility of ensuring the railway system is safe and in doing so agree who is best placed to undertake the investigation.

Level of investigation

F.3.5 HSG245 provides useful assistance in deciding on an appropriate level of investigation.

F.3.6 Appendix N contains guidance relating to deciding on the lead organisation and level of investigation.

F.3.7 Appendix P contains guidance relating to deciding on the lead organisation and level of investigation for SPADs.

F.4 The remit

F.4.1 The remit is the document which contains the parameters for the investigation. It is used by the lead investigator in carrying out the investigation. The remit is best written soon after the adverse event has occurred and in consultation with affected parties.

F.4.2 It is good practice to involve the lead investigator in the development of the remit.

F.4.3 The lead organisation is responsible for writing the remit that guides the investigation in terms of breadth and depth of enquiry. Applying the principles of proportionality will lead the writer towards writing an appropriate remit.

F.4.4 If other transport operators are involved in the adverse event, then they are consulted on the remit prior to being finalised and issued to the investigator. This provides an
opportunity for other transport operators to influence the course of the investigation and to identify specific areas of interest that may be relevant to mitigating the likelihood of reoccurrence.

F.4.5 Network Rail’s Investigators’ Handbook has some detailed requirements and guidance regarding writing a remit.

F.4.6 It is good practice for the remit to define the scope of the investigation and any specifics that have been identified through the initial assessment of the circumstances. Key topics may include:

a) Identification of the lead organisation.
b) Brief details of the adverse event to be investigated (type of adverse event, date, location).
c) Identification of the person appointed as lead investigator.
d) The objectives of the investigation, such as:
   i) Determination of events leading up to the adverse event.
   ii) Identification of the immediate and underlying cause(s) as well as any contributory factors.
   iii) Identification of recommendations that could mitigate or eliminate the risk from such adverse events in future.
   iv) In the case of a SPAD, specific and final confirmation, as agreed with the infrastructure manager, of the SPAD type as specified in Table P.3, or the alternative conclusion (together with the reasons for such a change).
   v) Any objectives which are specific to the adverse event.
   vi) Reporting of safety-critical issues found during the investigation by the lead organisation and which justify remedial action before the investigation report is completed.
   vii) A well-structured written report of the investigation containing any recommendations signed off by the investigation panel members.
   viii) Completion of the investigation within a defined time limit. The principle of proportionality is useful in setting the timescale.

F.4.7 Liaison between the person(s) writing the remit and the investigator during the development of the remit can help improve understanding of what is required and help make the objectives more realistic.

F.4.8 Transport operators may wish to have a process in place for the checking and approving of draft remits, including the option of amending them.

F.4.9 It is important that the remit encourages the identification of underlying causes and that it does not pre-empt any conclusions regarding the adverse event.

F.5 Appointing the lead investigator

F.5.1 The lead organisation appoints a person to lead the investigation.

F.5.2 The investigator is responsible for delivering the investigation process to meet the objectives of the remit. They are the single point of contact for interfacing organisations. It is good practice to have designated persons with the required
competencies within an organisation who can be called upon to carry out this function as required.

F.5.3 It is good practice to have a lead investigator whose safety responsibilities are independent of the adverse event. If neither infrastructure manager nor railway undertaking can provide such a person to lead a formal investigation, then an external lead investigator can be sought. A person, who is independent of the organisations involved in the adverse event, can be appointed to lead the investigation, if it is jointly decided by all affected parties that this is the most appropriate action.

F.5.4 An agreement to appoint an independent person to lead an investigation might arise if:

a) The lead organisation is unable to supply a competent person to lead the investigation, for example, because of the company’s small size.

b) The subject matter or scale of the adverse event is particularly complex, and the investigation is likely to demand the full-time attention of the person appointed to lead it.

c) The transport operators involved jointly decide that the investigation would be best led by someone independent of those parties to avoid perception of bias in the investigation’s findings.

F.5.5 Where a conflict of interest exists, the lead organisation may decide, following consultation with other affected organisations, to appoint a lead investigator who is independent of the organisations involved. A conflict of interest could be where:

a) Current or previous employment with any party involved in the adverse event and whether the activities performed in connection with such employment are likely to be significant matters for the investigation in relation to the cause(s) of the event.

b) Any substantial financial interest (excluding occupational pensions), in any party involved in the adverse event, the value of which could be significantly affected as a result of the findings and recommendations of the investigation.

c) Close personal or commercial relationships with any witnesses likely to be called before the investigation or with persons holding senior office within any commercial corporation involved in the adverse event.

F.5.6 The lead investigator might require support with technical expertise, either from inside or outside the organisation, for example, fire/explosion expert or engineering specialists in traction and rolling stock, human factors or structures. How independent these experts actually are is a factor for consideration in deciding on who to appoint to fulfil these roles.

F.5.7 It is good practice for the lead investigator to take an active role in appointing the investigation team and any technical experts. If the lead investigator is appointed before the early review it can be of benefit if that person is able to visit the scene and liaise with the personnel on site.
Appendix H  Gathering Evidence

H.1  Introduction

H.1.1  The content of this appendix is provided for guidance only.

H.1.2  This appendix gives guidance on collecting evidence from various sources, including getting the most from interviews. The quality of the information gathered will greatly influence the accuracy and the value of the report, its usefulness, and therefore the learning which can be gained from it.

H.2  Why gather evidence?

H.2.1  Gathering robust evidence is crucial to a good investigation. Early action and planning will be required to ensure perishable and other physical and witness evidence can be obtained.

H.2.2  RIS-3118-TOM Incident Response Planning & Management identifies interface requirements for enabling a consistent, comprehensive and structured process for rail incident response planning and management. This includes arrangements relating to the gathering of evidence.

H.2.3  Piecing together what happened can take time and it is necessary to be persistent and accurate. A detailed description or timeline (Appendix J.2) of the activities leading to the event, noting anything different from the usual or expected can help. When evidence is conflicting, it is useful to seek additional evidence with a view to clarifying the events. HSG245 includes principles for the gathering of information.

H.2.4  HSG245 suggests the following areas for attention in respect of information gathering:

a)  Time and effort spent on information gathering should be proportionate to the scale of the investigation.

b)  Explore all reasonable lines of enquiry.

c)  Information gathering should be as soon as possible.

d)  Recording of information gathered should be well structured, setting out the investigation process and what is known and what is not known.

H.3  Sources of evidence - perishable evidence

H.3.1  Perishable evidence, that is, things that might change or be moved over time, are best collected quickly following an adverse event (this list is not exhaustive):

a)  Brake pressure readings.

b)  Wheel and tyre temperatures.

c)  Positions of driving controls.

d)  Positions of signalling equipment controls.

e)  Weather conditions.

f)  Rail head conditions.

g)  Alcohol and drugs tests.

h)  Initial witness accounts, details of what happened and statements.

i)  Details of any personal injuries and treatment afforded.
j) Condition of adverse event location prior to rescue and recovery operations.

k) Photographs of the site and equipment involved. Where a digital camera is used, it is useful to set the date and time stamp facility, if provided, and to include scales and measurements where appropriate. A statement confirming that the photos are not edited may be added.

l) Views or video of the site to show full layout and from different viewpoints.

m) Equipment damage and details such as model numbers.

n) Pictures related to possible causes.

o) Spillages.

p) CCTV footage (note activity before, during and after the adverse event).

q) Voice tape/recordings, including telephone and radio recordings, where available, for the signal box and the relevant traffic control room for an appropriate period prior to the adverse event.

r) Train running details on the Total Operations Processing System (TOPS) and Train Running Under System TOPS (TRUST) for the trains involved.

s) Data from data recorders, including On Board Driving Data Recording Systems (ODDRS) and Solid State Interlocking or Integrated Electronic Control Centre (SSI / IECC) event recorder data, for an appropriate period before the adverse event.

t) Anything unusual or out of place.

H.4 Other sources of non-perishable evidence

H.4.1 Other evidence to be considered for collection to inform the investigation process, includes:

a) Training records and competence development plans (or similar) of employees involved in the adverse event.

b) Maintenance histories and technical tests of equipment involved in adverse events.

c) Testimonies from expert witnesses who could include local management, technical experts etc.

d) Reports from investigations undertaken at the site of adverse events.

e) Technical investigation reports.

f) Diagrams and sketches.

g) Description of work activities, such as materials used, actions taken, safety equipment and processes.

h) Anything unusual or out of place.

i) Communications and work arrangements records.

j) Safe systems of work.

k) Permits to work.

l) Minutes of appropriate planning/safety meetings.

m) Signal box registers.

n) Training records for those whose training needs to be considered.

o) Competence records.

p) Content and timing of training.

q) Refresher training and toolbox talks.
r) Briefings on specific tasks and risks on the day.
s) Rosters, rotas, work schedules, hours worked related to fatigue.
t) Vehicle and component maintenance records.
u) Infrastructure maintenance records.
v) Data on precursor events.
w) Fault records.
x) Records of similar events or involving similar elements, for example, same people, location, rolling stock.
y) Related risk assessments.
z) Assurance records, such as audit reports, monitoring of systems that are designed to detect faults, and relevant risk assessments.

aa) Work or management incentives.
ab) Targets and piecework.
ac) Bonus priorities.
ad) Relevant procedures and instructions, ranging from SMSs to local instructions.
ae) Records of previous adverse events related to this location, type of equipment or method of operation.
af) Signalling and level crossing data records.
ag) TOPS train lists for the trains immediately involved (or the equivalent for passenger trains).
ah) TOPS train consists for preceding train(s).
ai) TRUST reports for preceding train(s).
aj) The results of any technical investigation into any on-board equipment and data associated with the train(s) which were provided by the railway undertaking following the adverse event, including:

i) The train braking system.
ii) Trainborne CCTV and visual recording media (interior and exterior).
iii) In-cab signalling (including European Rail Traffic Management System (ERTMS) equipment).
iv) Automatic Warning System (AWS).
v) Train Protection and Warning System (TPWS).
vi) Automatic Train Protection (ATP) equipment.
vii) Radio Electronic Token Block (RETB) equipment.
viii) GSM-R system equipment.

H.5 Collecting evidence by interviewing witnesses

Setting the scene for an interview

H.5.1 Adopting a fair culture approach to investigations means starting the investigation with an open mind, understanding that people, even with the best intentions can make mistakes, and that the reasons behind the error need to be understood and the follow-up action with the individual managed accordingly. Individuals who make an error in the course of trying to undertake their role, within the constraints of their organisation, can be investigated and managed differently to someone who knowingly decides to not follow a rule or procedure, as this intentional rule-breaking is
sometimes referred to as a ‘violation’. RSSB has produced guidance Supporting a Fair Culture: Creating Appropriate Plans After Incidents.

H.5.2 The guidance provided by the RSSB fair culture work (T1068) and the Network Rail Fair Culture Flowchart are available for use when interviewing, when deciding on the individual’s responsibility and what a suitable and ‘fair’ management response is, related to the error or intentional rule breaking type which occurred.

H.5.3 Key skills in interviewing include the use of different techniques to enhance recall, as well as in consideration of the different human factors issues and human performance factors in the questioning, and in the types of questions which are used. This is all couched in the context of promoting a fair culture, at all stages of the process.

Planning and structuring an interview

H.5.4 Planning ahead can assist in the management of interviews. This could include:

a) A timeline of events.
b) Witnesses to be interviewed.
c) Which panel members will be involved.
d) Who will lead which parts.
e) How to resolve any conflicts.
f) Management of interviewees’ reactions.
g) The attendance of observers.

H.5.5 The following persons should not be permitted to attend, other than in the capacity of witnesses to the adverse event being investigated:

a) BTP Officers.
b) Inspectors of the ORR.
c) Legal representatives, including those of any witnesses or other party to the proceedings.

H.5.6 Transport operators might wish to invite trade union representatives as observers.

H.5.7 Interviews with witnesses inform the investigation and offer the investigator an opportunity to cross-check information, gain new information, confirm existing evidence and to test hypotheses. Time is important in the planning of each interview so that they are adequately resourced, well structured and targeted for the individual, while remaining flexible enough to respond to the situation.

H.5.8 When considering multiple sources of evidence, it is important that investigators remain open minded and avoid making early assumptions about why events happened. Testimonies may not correspond, and using a variety of sources can help the investigator to resolve conflict.

H.5.9 Planning a structure for the interview can help evidence gathering. A seven-phase structure for interviewing is set out below as good practice:

a) Phase 1: Greet and Personalise - Establishing a rapport and helping the interviewee to feel comfortable, at ease, confident and secure. This phase is
importance as a better rapport will mean the witness is more likely to recall and want to report what happened.

b) Phase 2: Explain the Interview Aims - It is important that the interviewee knows what is expected of them during the interview because they may not have been interviewed in this way before. The aims include:

i) How long it is likely to take.

ii) What sorts of questions (Enhanced Cognitive Interviewing) and resource will be used.

iii) Blame versus responsibility.

iv) The option to speak with their trade union representative (if relevant) etc.

c) Phase 3: Initiate a Free Report - Ask the interviewee to describe what happened and to report everything that comes to mind (similar to the first stage in Enhanced Cognitive Interviewing). The interviewee is encouraged to run through at their own pace, with the investigator(s) not interrupting other than to clarify, if necessary, and not to question them. This ‘free recall’ method is proven to provide more information, as there is no perception that the interviewee’s testimony is faulty. As an investigator, while actively listening, be aware of your own assumptions at this point and listen with an open mind.

d) Phase 4: Questioning - This phase of the interview will involve questions about the information they have just given in phase 3. Start with open questions (who, what, where, when, why, how?) and structure the questions in a logical sequence following the flow that the information provided in phase 3. Follow up these open questions with closed questions to probe the information provided (for example, starting questions with did, is, was, does?).

e) Phase 5: Extensive Retrieval - This is the phase for different retrieval techniques, such as ECI. When using these (and if not done in phase 3), explain the concept of the questioning technique to the interviewee, to ensure they feel comfortable with it. If they feel uncomfortable or unsure as to the intention or reason for this technique, this may make them more reticent to respond. Be clear that this technique helps them to retrieve more information, not because their testimony is perceived as faulty. As the majority of interviewees will understand information better displayed visually, you may also want to use techniques such as the STEP technique (see J.2). Again, explain their use to the interviewee to help them sort information, timelines or review what happened and when etc.

f) Phase 6: Summary - Summarise the information provided by the interviewee and encourage them to add or question anything they think does not sound correct. This gives the interviewee a chance to clarify whether their contribution is correct, and that the interviewer has all the information required.

g) Phase 7: Close - Leave the interviewee in a positive frame of mind at the end of the interview. Explain what will happen next, the likely timescales, who to contact if they think of anything else that they remember at a later date and thank the interviewee for their time and effort.

Types of interview questions and when to use them

H.5.10 Investigators can get better quality information from witnesses through the use of good interviewing techniques or can shut them down and potentially distort their
A good investigator is aware of the power of language and how to be flexible in the way an interview is run. For example, they know how to use different types of questions for different purposes. Table 4 sets out types of questions with examples of how the same question about the location of detonator protection can be asked in different ways.

<table>
<thead>
<tr>
<th>Type</th>
<th>Good for...</th>
<th>Not good for...</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>Invites a yes/no answer. Useful for checking understanding, probing single facts and clarifying points.</td>
<td>They usually close down discussion so are not useful for areas needing further exploration.</td>
<td>‘Did you place the detonator on the up line?’</td>
</tr>
<tr>
<td>Open</td>
<td>Open up dialogue and the subject you want to discuss. Useful for most openings, gathering information, to direct thinking and checking information.</td>
<td>Less useful for exploring sensitive or emotionally charged areas.</td>
<td>‘Tell me about where you placed the protection?’</td>
</tr>
<tr>
<td>Probing</td>
<td>Questions that promote discussion, for example, starting with ‘who’, ‘what’, ‘why’, ‘where’, ‘when’, ‘how’, ‘could’, and ‘would’.</td>
<td>Not good for those who are reticent to reveal information if badly used as they can make some people feel defensive.</td>
<td>‘What line did you place the detonator on?’ ‘What did you consider when placing the detonator?’</td>
</tr>
<tr>
<td>Leading</td>
<td>Avoid leading questions, for example, ‘I assume that this would happen if…’</td>
<td></td>
<td>‘I assume you put it in the right place?’</td>
</tr>
</tbody>
</table>
Table 4: Types of interview questions.

<table>
<thead>
<tr>
<th>Type</th>
<th>Good for...</th>
<th>Not good for...</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encouraging</td>
<td>Questions/phrases to promote discussion, for example: ‘That’s interesting, tell me more...’, ‘Can you expand on that’.</td>
<td></td>
<td>‘Tell me more about your knowledge of the area and other times you’ve put protection out’.</td>
</tr>
<tr>
<td>Use of silence</td>
<td>A considered use of silence provides a strong incentive to speak.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H.5.12 The quality of information gained will depend on the skill and questioning of the investigator. An investigator who develops a good rapport and remains flexible in their style of questioning is more able to obtain accurate information from interviewees. Investigators who are aware of the influence that their questioning could have on the detail and quality of witness’s responses will elicit a more favourable outcome from the interviews. It is prudent that an interviewer considers their:

a) Capability and allocation of sufficient time to build a rapport with the individual.
b) Tone of voice and body language.
c) Assumptions already made about what happened.
d) Assumptions made about why people did what they did (or did not do).
e) Attitude or motivation to investigate, that is, to assign blame or to find out what went wrong throughout the organisation.
f) Biases they might have (that is, towards certain people, groups, roles etc); be aware of this and moderate your language and tone accordingly.
g) Position within the company and how this can impact people’s perceptions and their willingness to respond.
h) Previous experience (negative or positive) with the individual or with the group and how this might affect their interviewing.
i) Position in terms of power and social dynamic with the person they are interviewing.

H.6 Enhanced Cognitive Interviewing (ECI) technique

H.6.1 Investigators have different interview techniques available for use, depending on the scale and complexity of an investigation. Depending on their background, personality and training they may feel more comfortable with some than others. It is important to consider the range of techniques available to maximise the quality of the information gained at the initial evidence gathering and in interviews.
The Enhanced Cognitive Interview (ECI) technique was developed to improve the quantity and quality of memory recall from witnesses. Human memory is fragile and can be easily contaminated and this technique can help with the recall and recollection of memories. The key stages of the ECI technique are shown in Table 5.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask them to recall EVERY detail</td>
<td>Ask the witness to recall every detail in their own words from a start point removed from the event. The witness is encouraged to use their own words, their own level of detail, their own pace and is not interrupted, other than for encouragement to continue. This stage allows the witness to walk themselves through the event and for you to listen and create a picture of the event and to record details which can be clarified at a later stage. Consider your body language at this stage and make sure you look engaged and encouraging.</td>
</tr>
<tr>
<td>Reinstate the context where the memory was made</td>
<td>If the event is recalled (remembered) in a similar way to how it was encoded (stored into memory) then this increases the level of details that can be recalled. This ‘cognitive reinstatement’ may include asking the witness to run through what happened, what they felt, saw, smelt etc to both use all senses to trigger recall and to simulate the event in their minds. Listen for new information or watch for new memories or triggers which are unearthed at this stage.</td>
</tr>
<tr>
<td>Change order and change perspective</td>
<td>Using the information given in the free recall stage, encourage them to retell the sequence of events from the adverse event backwards, or from the perspective of someone else. This change can help trigger new memories or information.</td>
</tr>
</tbody>
</table>

Table 5: The key stages in the ECI technique

Interviewees may face significant pressures after an adverse event and this may affect their ability to easily recall information. Table 6 sets out issues and possible mitigations.
<table>
<thead>
<tr>
<th>Issue</th>
<th>Possible mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>They cannot recall the exact details and are feeling under pressure to give an answer</td>
<td>This is not uncommon if they were in ‘autopilot’ when it happened and they were not consciously aware. Use ECI techniques to help retrieve the detail they can remember. Resist the temptation to think they are ‘hiding’ something as this may bias your questions.</td>
</tr>
<tr>
<td>Feeling under pressure to give the ‘right’ answer</td>
<td>Setting the right tone at the outset of the interview will mean they understand that there is not a ‘right’ answer.</td>
</tr>
<tr>
<td>Giving very short answers with no details</td>
<td>Think about your questions and if you are asking closed questions. If so, try more open questions. Think about whether you built rapport with the witness at the start. A lack of rapport can lead to a lack of cooperation or less than optimal recall from a witness.</td>
</tr>
<tr>
<td>Worry about being blamed, threats to their employment or prosecution</td>
<td>Setting the right tone at the outset of the interview will clearly and overtly establish what the aim of the interview is. If it is clear that the interview is about finding out what happened, then this will reduce the fear of blame.</td>
</tr>
<tr>
<td>Worry about ‘telling on’ others</td>
<td>Being open at the start of the interview about the anonymity of reports or how information will be used in the final report may help to manage this.</td>
</tr>
<tr>
<td>Not giving much information away</td>
<td>Think about your questions and if you are asking closed questions. If so, try more open questions. Think about whether you built rapport with the witness at the start. A lack of rapport can lead to a lack of cooperation or less than optimal recall from a witness.</td>
</tr>
</tbody>
</table>
Fear of senior managers

Many witnesses will have no experience of interviews and are likely to be fearful or sceptical. To get good interview data, it is important to acknowledge this in the opening, to build rapport with the witness and to select the ‘right’ senior manager to be the lead for the interviews.

They may be traumatised or shocked

Witnesses who are displaying these signs need to be interviewed with care. The use of ECI techniques or interviewing them in a different location / format could be considered.

They may face several interviews, some of which may have been challenging

As memory is fragile, interviewing by multiple parties, with the use of different methodologies and for different aims or purposes, can affect an individual’s recall of events and could create false memories. The use of ECI techniques could help to identify and iron out any anomalies.

Table 6: Memory issues and possible mitigations

Understanding the difference between errors and intentional rule breaking, and their analysis and investigation.

H.6.4

When analysing testimonies, it is important to not only understand what the person did but also why they did it. Understanding this will help the investigator to better identify causes and relevant management interventions in the recommendations. The difference between errors and intentional rule breaking can be established at this point.

a) Errors are defined as ‘an action or decision which was not intended, which involved a deviation from an accepted standard, and which led to an undesirable outcome.’ and are unintended events. As this was an unintentional action or deviation from the right course of action, you will need to establish why this made sense to them at the time, by asking what they saw/thought/felt which made it seem like the right action to take, why this seemed to them like the right thing to do at that time, with the information they had to hand. This will identify what type of error was made and agree the most appropriate management activities and recommendations. The different types of errors can be identified using the Human Performance Factors in conjunction with the 10 Incident Factors.

b) Intentional rule breaking (sometimes referred to as ‘violations’) is defined as ‘a deliberate deviation from a rule or procedure’, so someone is aware of and
understands the rules but consciously chooses not to follow them. It is tempting to suggest that, in a rules-based industry, all rule-breaking is wrong. During the investigation, it is important to seek to understand the reasons for non-adherence. This will help an investigator to better describe the background to intentional rule breaking and to make more productive recommendations.

H.6.5 HSG48 Reducing error and influencing behaviour gives practical advice on how to develop systems designed to take account of human capabilities and fallibilities. It also describes some of the other influences on human performance which can contribute to failures, and could be considered as part of analysing how a person’s actions or decisions have failed or not been optimal. These include fatigue and shift work, communications, risk perceptions and the impact of safety culture of an organisation which are also covered by the 10 Incident Factors (10 IF).

H.7 Using the 10 Incident Factors and Human Performance Factors in the interviewing and analysis

H.7.1 The consideration of human factors helps in understanding why things go wrong, from individual human performance at the time of the adverse event back to the underlying causes. Identifying the organisational, systemic, underlying causes in the organisation’s processes or adverse event causation chain, such as competence management, supervision, fatigue, or equipment design is, when addressed, likely to have the biggest impact on preventing future recurrence. This can be done by adopting the principles of the ‘Swiss cheese model’ shown in Figure 4 as part of the analysis. To do this, it is useful to work backwards from the moment of the adverse event, through the steps of the causes, or potential causes that led to the adverse event, understanding not only WHAT happened, but also WHY each step in the chain happened.

H.7.2 The rail industry uses 10 Incident Factors (10 IF’s) and Human Performance Factors (HPFs), as shown in Figure 8 to provide guidance to investigators on human factors and underlying causes. This gives an investigator a structure to consider the potential human factors influences, the collection and analysis of evidence, to inform questions in an interview and help understand the underlying causes, in terms of the different slices of ‘Swiss cheese’.
It is important to be able to recognise the difference between the 10 IFs and the HPFs when investigating and classifying the causes of adverse events. Differentiating them and correctly understanding the causes will lead to more effective learning and will help to focus recommendations or the Competence Development Plan (CDP) detailed in RSSB’s Supporting a fair culture - creating appropriate plans after incidents (T1068). The human performance categories are described in Table 7.

When investigating, the first consideration is whether it is a human performance issue, which can be either an error or intentional rule breaking, and can be categorised using the HPF list set out in Table 7, in order to differentiate it from a 10 IFs issue and to align with categories in SMIS. Otherwise, the 10 IFs are used as prompts to consider other organisational and human factor issues.

When gathering initial statements, it is important that uncorrupted evidence is gained at the scene as quickly as possible. Due to the possibility of witnesses experiencing some negative emotions around the event, that is, fear of blame, upset at harm caused to others, physical harm to themselves, fear of authority etc, care has to be taken in the way in which questions are asked, and how they are asked to optimise the person’s recall of events.

The human performance factors have four categories covering errors and intentional rule breaking, in addition to a ‘Don’t know’ response option. The ‘Don’t know’ category can be important because there will be cases where the witness’s recollection and available evidence do not allow the error type to be determined.

If the answer is ‘yes’, that means that you have a human performance factor about something that someone has done, which is ‘wrong’ or not optimal. The start is to investigate and understand the human performance factors.
The person was familiar with what they were doing and knew how to correctly respond to the situation but did something wrong without realising (that is, slip/lapse)

These are errors that tend to happen in routine tasks that people are doing without much conscious thought (for example, on autopilot). Slips and lapses happen when people know what to do in that situation but do something wrong because they have mis-seen or misheard something, forgotten information (not long-term knowledge or skills), accidentally spoken too loudly, too quietly or vaguely, or unintentionally carried out the wrong physical action.

A tester was testing points but forgot to complete the testing of the track circuit over the points. The signaller inadvertently put reminder appliances on the set of points on the up line, rather than the down line, even though they knew which was which. They look very similar and are located next to each other in the signal box, which is why the signaller confused the two.

The person understood the situation and realised what they were expected to do, but deliberately did something else (that is, intentional rule breaking)

These are human failures where people realise what they are expected to do in that situation, but deliberately do something different. They break the rules on purpose.

The Controller of Site Safety (COSS) knew that they should have rejected the Safe System of Work Pack when they discovered the errors in it, but they did not, because they felt under pressure to get the job done.
### Classification Description Example

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>The person misunderstood the situation or did not know how to correctly respond, so they made the wrong decision or had the wrong strategy for that situation (that is, decision error, which includes when the person’s strategy has become incorrect over time or through experience)</td>
<td>These are errors in conscious judgements, decisions or strategies. They happen when people are aware that they are making a decision, a choice or adopting a strategy, but they are not aware that it is somehow ‘wrong’. Modern science has shown that a lot of human behaviour is automatic and not based on conscious decisions. Only conscious decisions, where people are aware that they are making a choice or decision, go into this category. If a person misinterprets a situation because they mis-saw, misheard or forgot something, then it is a slip/lapse (see below), not a decision error.</td>
<td>The driver decided they did not need to advise the signaller that the train stood beyond the signal. The driver believed that the signaller knew where they were and that it would be indicated with an occupied track circuit. The ground frame operator did not check the points were in the correct position before setting the train back because they incorrectly believed that the ground frame position guaranteed the position of the points. Prior to the incident, the driver did not go through the correct procedure for setting up the GSM-R, as they did not ring the signaller for a new number (wild card) to set up the GSM-R radio. This was because the driver did not understand the correct set-up procedure.</td>
</tr>
<tr>
<td>The person was asleep or unable to respond</td>
<td>These are human failures where people are asleep or unable to respond to the situation.</td>
<td>The driver fell asleep in the cab for approximately six minutes and the train then passed the signal at danger.</td>
</tr>
</tbody>
</table>

#### Table 7: Human performance factors

H.7.8 Where there has been intentional rule breaking, it is important to understand why the person chose not to follow the rules as this will identify their motivation and the external factors which influences them, and can be addressed in the recommendations. There are four different types of intentional rule breaking, as described in Table 8
**Table 8:** The four different intentional rule breaking types

<table>
<thead>
<tr>
<th>Type</th>
<th>Description of intentional rule breaking</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The person was breaking the rules because they thought it was the right thing to do to prevent an incident from happening or getting worse.</td>
<td>The person in charge of possession (PICOP) ran across an open line to tell a group of track workers that they were not working under the protection of a line blockage and a train was approaching. The PICOP recognised that he should not have crossed the line, but did it anyway in order to protect his team.</td>
</tr>
<tr>
<td>B</td>
<td>The person was breaking the rules because of pressures from their workload, managers or their peers (for example, taking short cuts or going ahead without the right resources for the task because they think the company prioritises task performance, or due to high workload).</td>
<td>The shunter knew that he/she should walk ahead of train, but he/she also knew that by staying where he/she was, by the points, he/she would be able to quickly pull the points once the train had passed, and save valuable time. Conscious that he/she needed to make up time, he/she stayed by the points.</td>
</tr>
<tr>
<td>C</td>
<td>The person was breaking the rules because they personally gained from it (for example, earning themselves more money, more time outside of work etc).</td>
<td>The driver knew that he/she should have walked through the train to check that it was empty before moving it to the sidings, but he/she wanted to get home quickly, so he/she skipped this check.</td>
</tr>
<tr>
<td>D</td>
<td>The person was intending to do harm to themselves, another person or an object.</td>
<td></td>
</tr>
</tbody>
</table>

The Incident Factors are described in Figure 9 and Table 9 alongside considerations of when to use them, with examples. This table provides guidance for use when deciding which category to choose.
Figure 9: The 10 Incident Factors

- Verbal Communication
- Fatigue, health and wellbeing
- Processes and procedure documents
- Written information on the day
- Competence management
- Infrastructure, vehicles, equipment and clothing
- The person's environment
- Workload (real or perceived) and resourcing
- Teamworking and leadership
- Risk management
### H.7.10 10 Incident Factors

<table>
<thead>
<tr>
<th>Verbal communication</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal communication is about the exchange of spoken information only and is concerned with how safety-critical information is communicated between staff. Information conveyed in a written format is covered by the ‘written information’ incident factor. Issues with the exchange of visual information (such as indicators, hand signals etc) will be captured within other factors if there is a weakness in the system, such as: ‘infrastructure, vehicles, equipment and materials’ which may present visual feedback; ‘information’ which is presented non-optimally or the ‘processes and procedure documents’ which lead to visual information (for example, hand signals) being presented or used in a way which is difficult to interpret. Look for the underlying causes of the communication issues. For example, lack of application of communication protocols is often stated in reports but it is unclear what has led to this issue.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communications within and between the following job roles: driver, signaller, engineering supervisor, shunter, PICOP and route conductor. For example, ‘The PICOP did not repeat back the signaller’s message to check that they had understood it correctly.’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Incident Factors</td>
<td>Definition</td>
<td>Example</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Fatigue, health and wellbeing</td>
<td>This factor concerns the individual’s fatigue, health and well-being, which is the joint responsibility of the company and member of staff. The fatigue, health and wellbeing can affect the individual’s ability to maintain focus and attention whilst at work. Consider the broader fatigue risk management and health management processes and avoid a tick box approach where, for example, fatigue is only considered as adherence to the fatigue risk index.</td>
<td>Fatigue risk management (including rostering and rest breaks), managing for attendance processes, health monitoring. For example, ‘The working hours of the track worker were in excess of industry guidelines and he/she was tired. In the two weeks prior to the adverse event the signaller had worked over 12 hours in a shift on three occasions and had less than 12 hours’ rest on three occasions.’</td>
</tr>
</tbody>
</table>
| Processes and procedure documents | This refers to laws, rules, policies, procedures, standards, guidelines etc, which are long-term documents guiding the actions of staff, passengers and the public on or around the railway. This includes the operational rules which dictate how activities must be undertaken such as: train driving, signalling, maintenance, fault identification/reporting and setting up safe systems of work for train or track maintenance. It also includes management or office processes (such as filing, preparing documents) and processes to co-ordinate activities between companies. Critically evaluate established policies, standards and guidelines to look for improvements which could reduce error likelihood. | Rule Book, risk-triggered commentary procedure, maintenance procedures. For example, ‘The method of working for the freight yard left trains blocking the level crossing for up to an hour at a time, increasing road user frustration and risk’.

### 10 Incident Factors

<p>| Written information on the day | This is data and documentation which can be renewed from day to day, or week to week, and supports people in carrying out a task/applying a process in specific situations, for example, schedule cards, notices, timetables, Safe System of Work packs. Written information must be relevant, timely and well designed. There are often challenges for staff to identify key critical information from a large amount of more routine information. Investigate whether the written information has been presented in a usable format and made available on time. | Train running information, timetable simplifiers, late notices, special train notices, weekly/periodic operating notices, pre-job information, electrification/isolation diagrams. For example, ‘The driver diagram showed incorrect station stopping points.’ |
| Competence management | This factor covers the company competence management systems and has to do with the selection, training and assessment process a person has (or has not) gone through. Challenge and investigate how competence management processes support the individual for all tasks which contribute to an adverse event. Consider technical skills and also non-technical skills, adverse event reporting etc. | Route knowledge or local knowledge, traction knowledge, non-technical skills competence. For example, ‘The person had not been given practical training to deal with the particular type of emergency.’ |</p>
<table>
<thead>
<tr>
<th>10 Incident Factors</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure, vehicles, equipment and clothing</td>
<td>This refers to any infrastructure, vehicles, equipment and clothing that are used to undertake or support an activity. Always aim to identify the underlying causes of equipment issues. Ask ‘why’, rather than concluding that the infrastructure, equipment or materials failed or was badly maintained. Evaluate systems which cannot easily be changed but have contributed to adverse events (for example, contribution of AWS to driver performance, impacts of gantry signals on drivers misreading signals).</td>
<td>Railway signals, train brakes, DRA, AWS, ERTMS, TPWS, controls and displays in cabs, signal boxes or control centres, traction handling characteristics, control route drivability, windscreen and view from cab, PPE. For example, ‘The passenger’s high-heeled shoes broke as she was getting off the train, which contributed to her fall.’ ‘The signal was poorly located, with inadequate siting, and the signalling design contributed to the adverse event.’</td>
</tr>
<tr>
<td>The person’s environment</td>
<td>The person’s environment refers to the environmental stressors which can affect the decisions and/or performance of the person. Identify the environment as an influencing factor, even when it is not directly causal, because it may become important if it is identified as an influence in a number of adverse events.</td>
<td>Hot/cold environments, wet, draughty or noisy environments, sunlight, fog and snow. For example, ‘The sun was shining directly in the lookout’s eyes and they had difficulty seeing.’</td>
</tr>
</tbody>
</table>
### 10 Incident Factors

<table>
<thead>
<tr>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workload (real or perceived) and resourcing is about the demand on a person. Workload can be influenced by resourcing, which is about the number of people or amount of equipment available to do the task. If the workload is higher than acceptable limits it will be stressful, fatiguing and demotivating for the individual and this could make their performance slower and less accurate. If workload is low, staff may have reduced attention and be slower to react to non-routine situations. Workload can be perceived differently by different people, so it can be useful to collect information on both the views of those involved and others who experience the task. For example, if signaller workload is identified as a factor for a workstation it may be useful to discuss the route with a group of signallers.</td>
<td>High workload created by complex tasks or locations, or when non-routine tasks need attention at the same time as routine tasks. Low workload when the system largely takes care of itself. For example, ‘The driver of the stranded train was faced with the conflicting demands of communicating with the signaller, fault finding, spurious passcom activations and passenger complaints and queries.’</td>
</tr>
<tr>
<td>10 Incident Factors</td>
<td>Definition</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Teamworking and leadership</td>
<td>Teamworking and leadership is concerned with how people are organised to work together, how they relate to each other and influence each other in order to carry out their work safely. Team members may not necessarily work in the same location or even for the same organisation as each other. It can be challenging but valuable to capture the more subjective type of information related to team dynamics, such as relationships between signallers, mobile operations managers and control.</td>
</tr>
<tr>
<td>Risk management</td>
<td>This factor is about the processes used to identify, assess, reduce and monitor safety problems. Risk management processes can be an underlying reason for an adverse event, if the organisation is not mitigating risk effectively. This could be because of an ineffective risk assessment, because the organisation’s monitoring and feedback systems have not detected safety problems (such as non-compliances by staff, defective equipment etc), or because management chose not to act to correct safety problems which were picked up through reporting, monitoring etc.</td>
</tr>
</tbody>
</table>

Table 9: The 10 Incident Factors.
H.8 How do non-technical skills link the 10 IFs and the HPFs?

H.8.1 Non-technical skills (NTSs) are social, cognitive and personal skills that impact on human performance. They form an important part of competence, as shown in Figure 10, and enhance awareness of human performance capabilities and limitations, and identify possible threats and errors to performance.

Figure 10: Competence

H.8.2 Non-technical skills are divided into seven categories, involving 26 skills. This is set out in Table 10.

<table>
<thead>
<tr>
<th>NTS Category</th>
<th>NTS Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situational awareness</td>
<td>Attention to detail</td>
</tr>
<tr>
<td></td>
<td>Overall awareness</td>
</tr>
<tr>
<td></td>
<td>Maintain concentration</td>
</tr>
<tr>
<td></td>
<td>Retain information (during shift)</td>
</tr>
<tr>
<td></td>
<td>Anticipation of risk</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>Systematic and thorough approach</td>
</tr>
<tr>
<td></td>
<td>Checking</td>
</tr>
<tr>
<td></td>
<td>Positive attitude towards rules and procedures</td>
</tr>
<tr>
<td>Communication</td>
<td>Listening (people not stimuli)</td>
</tr>
<tr>
<td></td>
<td>Clarity</td>
</tr>
<tr>
<td></td>
<td>Assertiveness</td>
</tr>
<tr>
<td></td>
<td>Sharing information</td>
</tr>
</tbody>
</table>
### Table 10: The seven NTS categories and their 26 skills

<table>
<thead>
<tr>
<th>NTS Category</th>
<th>NTS Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision making and action</td>
<td>Effective decisions</td>
</tr>
<tr>
<td></td>
<td>Timely decisions</td>
</tr>
<tr>
<td></td>
<td>Diagnosing and solving problems</td>
</tr>
<tr>
<td>Cooperation and working with others</td>
<td>Considering others’ needs</td>
</tr>
<tr>
<td></td>
<td>Supporting others</td>
</tr>
<tr>
<td></td>
<td>Treating others with respect</td>
</tr>
<tr>
<td></td>
<td>Dealing with conflict / aggressive behaviour</td>
</tr>
<tr>
<td>Workload management</td>
<td>Multi-tasking and selective attention</td>
</tr>
<tr>
<td></td>
<td>Prioritising</td>
</tr>
<tr>
<td></td>
<td>Calm under pressure</td>
</tr>
<tr>
<td>Self-management</td>
<td>Motivation</td>
</tr>
<tr>
<td></td>
<td>Confidence and initiative</td>
</tr>
<tr>
<td></td>
<td>Maintain and develop skills and knowledge</td>
</tr>
<tr>
<td></td>
<td>Prepared and organised</td>
</tr>
</tbody>
</table>

**H.8.3**  
In an investigation, NTS can be used to understand the causes or influences of how and why a person’s performance failed. However, NTS categories are not used to classify human performance issues as part of an investigation, as they do not map directly to the 10 IFs. Human Performance Factors (HPFs) are the categorisations used to input human factors information into SMIS.

**H.8.4**  
For example, if ‘verbal communications’ is identified as a cause, then the ‘verbal communications’ category from the 10 Incident Factors is used in the analysis. The NTS skills list could be used to guide interview questions on the individual’s performance and possible causes or types of failure. Investigators may also find some of the behavioural indicators and descriptions of NTS as useful prompts for an interview.

**H.8.5**  
NTS and strategies for their future use may be linked to recommendations or competence development plans. Where human performance contributed to the adverse event, the NTS categories are reviewed to identify any NTS based competence development requirements. For example, if a driver has passed a signal at danger due to failure to manage their attention (NTS skill 1.3 Maintain concentration) properly, then the related NTS categories (Situational awareness) could direct the investigator to strategies such as risk-triggered commentary driving, the use of distraction plans etc as part of a CDP.
H.9 Investigating the effect of fatigue

H.9.1 Fatigue can cause impairment, which can lead to errors and adverse events. Rail industry staff are exposed to a range of factors which increase the potential for fatigue, that is, the 24/7 nature of rail operations, travelling times etc and this means that fatigue can be a consideration in investigations.

H.9.2 It is difficult to conclusively identify fatigue as a cause of an adverse event because fatigue can be individual and subtle and there is no ‘blood test’ to provide a positive or negative indicator. This can mean there is an element of subjectivity when considering the role of fatigue. Investigators need to become comfortable with this and be able to use the three-step fatigue investigation process shown below to guide their questions.

H.9.3 To understand if fatigue was a cause in an adverse event an investigator can:

a) Access specialists who understand alertness and fatigue, what causes fatigue and what its effects are on people.

b) Ask themselves whether fatigue could have been a factor.

c) Use RSSB’s guidance to identify whether people involved in the adverse event were fatigued and whether this was a factor.

d) Form an understanding of why a person is reporting that they are fatigued. It is critical that an investigator considers work-related fatigue management factors and considers personal factors such as family issues that may have impacted on effective management of fatigue.

e) Examine the company’s management arrangements for managing fatigue risk to assess whether they are working correctly.

f) Link causes to recommendations that address the problems identified.

g) Promote a culture where fatigue can be openly discussed and staff understand the expectations and are confident that they can report fatigue concerns without fear.
The way in which investigators behave can have a positive or negative impact on the likelihood of interviewees honestly reporting on fatigue risk. If witnesses expect to be dealt with fairly on fatigue and that positive changes are likely to be recommended to improve how fatigue is managed, they are more likely to be open and honest. If they feel like they are judged, accused or punished when fatigue is discussed, then they are less likely to open up about information on fatigue related issues. This can damage the investigation of fatigue, which often relies on open discussions with people involved in the adverse event. Some good practice for investigators includes:

a) Think about what you can do to create an open and honest interview to gather information about fatigue, following an adverse event. Consider what questions will be asked, how they will be phrased, and how you may respond.

b) Make yourself easily available for those who need to talk about fatigue.

c) Encourage people to talk about fatigue; show them respect and listen to what they have to say.
Appendix J  Analysing Evidence

J.1  Introduction

J.1.1 The content of this appendix is provided for guidance only.

J.1.2 This appendix describes two different techniques of accident mapping and visualisation. These techniques can aid understanding and analysis if working as an individual or as a group, as they can help better describe the events that occurred, the links between them, and the causal and underlying contributory factors. Recommendations can then be developed based on the outcomes of these techniques.

J.2  Accident mapping

J.2.1 The volume and complexity of information gathered from an adverse event can be vast and complex. Understanding how the events at each stage of the ‘Swiss cheese’ fit together, what the sequence of events were and how they directly contributed to the adverse event can help an investigator or panel to analyse and process the evidence.

J.2.2 There are several techniques that can be used to analyse and visualise evidence. Two are described here, AcciMap and STEP. Choosing an appropriate technique is a key investigation decision; therefore, it is useful to consider the conceptual differences between them, and how they may be used either separately or as complementary tools. AcciMap is based on a sequence of events, which is then developed into a visual representation of the causes and systemic failures. The STEP technique involves the identification of front-line actors, the interactions between them and the sequence of events; this information is then analysed to identify the underlying safety problems. The STEP technique therefore is useful for examining individual behaviours and the interactions between people. The AcciMap, on the other hand, can aid holistic understanding of how the organisational system as a whole, and not just individual actions, contributes to adverse events.

ACCI MAP technique

J.2.3 The AcciMap technique is a systems-based accident analysis method developed by Svedung and Rasmussen (2002). It is based on a risk management framework. The technique involves arranging the various causes of an accident into a tree diagram, with the sequence of events at the bottom and the causes branching upwards. It visualises and links both the failures of the front-line staff and the underlying systemic failures involved. The technique has been applied to a range of accidents in the oil and gas, maritime, rail and aviation industries.

J.2.4 The AcciMap is useful for:

a) Identifying the broad range of factors that can contribute to an adverse event.
b) Illustrating how those factors combined to result in an adverse event.
c) Identifying the key problem areas that should be addressed to prevent further adverse events.
J.2.5 The AcciMap technique presented here identifies the individual, job and organisational factors, as described by the human factors model, that led to the adverse event. These can then be classified into individual Human Performance Factors and the 10 Incident Factors, as described in Appendix H. The technique also incorporates an external level of influence, which includes causes that are beyond the control of the organisation(s), such as Government cost-cutting and privatisation.

J.2.6 The AcciMap consists of 5 steps:

**Step 1: Create your AcciMap template**

J.2.7 Use a large piece of paper or whiteboard and write the headings of the five levels down the left-hand side of the page:

a) External factors.
b) Organisational factors.
c) Job and workplace factors.
d) Individual factors.
e) Outcomes.

**Step 2: Identify the outcomes**

J.2.8 Identify the sequence of events and write each individual event on a Post-it® note. These events can be identified by data collection and analysis of interviews, observations or documentation. Stick them in the Outcomes section of the AcciMap, in the order that the sequence of events occurred.

![Figure 12: AcciMap Step 2: Identify the outcomes](image)
Step 3: Identify the causes

J.2.9 Determine the causes of each event. These are the factors which, if corrected, could have prevented the incident from occurring. Each cause will correspond to Human Performance Factors, the 10 Incident Factors (Appendix H), or external causes. Some causes may be linked with more than one outcome; equally, several causes may be linked to one outcome. The focus should not be solely on the immediate causes, but also the underlying contributory factors, that is, systemic failures that prevailed over longer periods of time before the adverse event. Write each causal factor on a Post-it® note.

Step 4: Identify the appropriate AcciMap level

J.2.10 Classify the causal and contributory factors identified according to the AcciMap levels created in step one. The following tables detail each level of the AcciMap model and some examples of how they may correspond with Human Performance Factors and the 10 Incident Factors (a full description can be found in Appendix H), as well as some examples of external influences. This is not a definitive list, however, and some incident factors may be present in more than one level of the system.

<table>
<thead>
<tr>
<th>AcciMap level</th>
<th>Classification examples</th>
</tr>
</thead>
</table>
| The external causes level includes causes that are beyond the control of the organisation(s). | Government:  
  - Government and cost-cutting  
  - Inadequate legislation  
  - Privatisation, outsourcing  
  - Inadequate provision of services  
  Regulatory issues:  
  - Inadequate regulations  
  - Inadequate communication of regulations  
  - Inadequate safety standards  
  Society and the public:  
  - Trespass/vandalism  
  - Public perceptions  
  - Market forces |

Table 11: External factors
The organisational level incorporates causes relating to organisational processes. Factors are placed within this level if they are within the control of the organisation(s).

<table>
<thead>
<tr>
<th>AcciMap level</th>
</tr>
</thead>
<tbody>
<tr>
<td>The organisational level incorporates causes relating to organisational processes. Factors are placed within this level if they are within the control of the organisation(s).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10 incident factors classification examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workload (real or perceived) and resourcing:</td>
</tr>
<tr>
<td>• Organisational budgeting/cost-cutting</td>
</tr>
<tr>
<td>• Inadequate resourcing</td>
</tr>
<tr>
<td>Competence management:</td>
</tr>
<tr>
<td>• Competence Management Systems</td>
</tr>
<tr>
<td>• Assessments and training</td>
</tr>
<tr>
<td>Processes and procedure documents:</td>
</tr>
<tr>
<td>• Inadequate policies, standards and guidelines</td>
</tr>
<tr>
<td>Risk management:</td>
</tr>
<tr>
<td>• Inadequate risk assessment</td>
</tr>
<tr>
<td>• Inadequate reporting systems</td>
</tr>
</tbody>
</table>

**Table 12:** Organisational factors
AcciMap level | 10 incident factors classification examples
---|---
The job/workplace level incorporates causes relating to the job, tasks, workplace and factors associated with these that are within the control of the organisation(s) involved. | Verbal communication:
- Communication, omission, misinformation, wrong person, misunderstanding
Fatigue, health and wellbeing:
- Rostering and shift scheduling
- Provision of adequate rest breaks
Written information on the day:
- Periodic operating notices
- Late notices
- Train running information
Infrastructure, vehicles, equipment and clothing:
- Design problems (poor layout, poor alarms)
- Missing or poorly maintained equipment
- Misuse of equipment
The person’s environment:
- Environmental stressors, for example, noise, heat, sunlight
Workload (real or perceived) and resourcing:
- Task overload/underload
- Context/situational demands
- Individual perceptions of workload
Teamworking and leadership:
- Inadequate supervision
- Inadequate information provision
- Failure to correct front-line problems
Processes and procedure documents:
- Inadequate, ambiguous, conflicting, outdated, absent or difficult to follow procedures.

Table 13: Job and workplace factors
AcciMap level | Human performance factors
---|---
Individual factors are the immediate precursors to the outcome(s). | • Slips and lapses
• Intentional rule-breaking
• Decision errors
• Unable to respond (asleep, incapacitated)

**Table 14: Individual factors**

J.2.11 Once the AcciMap level of each cause is established, the Post-it® notes detailing each causal factor can be arranged on the AcciMap template. The next task is to draw arrows indicating causal links between each factor and each level. Factors should only be linked if the higher-level factor was necessary for the lower-level factor or outcome to occur. The sequence of arrows will then illustrate the causal factors that led to the outcomes. The resulting structure enables the causes and contributions to be visualised as interactive levels within a complex sociotechnical system.

**Figure 13: AcciMap Step 4: Identify the appropriate AcciMap level**

### Develop recommendations

J.2.12 The final step is to develop recommendations for each causal factor identified, the aim of which is to establish what could be changed, controlled or mitigated to prevent future adverse events occurring. Good practice on writing safety recommendations is set out in Appendix K. Completing the following table can assist the investigator in ensuring each of the human performance factors, incident factors and external factors has an appropriate assigned recommendation.
The STEP methodology (Hendrick K. & Benner L. (1986). Investigating accidents with STEP.) helps an investigator to plot, in a time-bound sequence, the different events and people (called actors) in the adverse event. It also helps to differentiate between issues which were a direct influence on the event and those which are subsidiary.

The STEP technique has four key stages and can be developed on a white board or paper, using post-it® notes to represent the key events, placed to represent the correct sequence of events. Lines are drawn between the events to denote the causal links.

**Step 1**

Step 1 (see Figure 14) is to identify the people involved in the adverse event. The names and roles of the ‘actors’ who were actively involved in the adverse event down the left side. The actors are those present at the time of the event as well as those actively involved in the events leading up to the adverse event through their decisions, actions, or omissions. This list does not include anyone present who was not directly involved in the event.

**Step 2**

Step 2 (see Figure 15) is to identify the events and their causal links. First, identify the events that influenced the adverse event. These are placed sequentially into the timeline, parallel to the ‘actor’ they were related to, one event per post-it® note. The sequence of events is important, even if the exact time of the event is not known.
Cognitive processes (that is, perception of information, decisions made on a course of action) which impacted on the adverse event should be included in the diagram against the person. Some investigations may be particularly complex and involve events some time prior to the adverse event, for example, a failure in the planning of engineering work.

**Figure 15:** Step 2: Identify events (and their causal links)

**Step 3**

J.2.17 Step 3 (see Figure 16) is to identify the safety problems. These are defined as weak points in the system and could be a Human Performance Factor for the individuals involved, that is, a failure to use correct communication protocols. Or a 10 Incident Factor, that is, management failing to identify the risks involved in a particular situation as part of the risk assessment. The safety problems or failures are identified on the diagram using red triangles. The safety issue can be further analysed to better understand why the contributory event occurred, for example, was there a weakness in the process? Was there a failure to identify a risk? If individuals failed to follow correct procedure, why did this happen?
Step 4

J.2.18 Step 4 is to develop recommendations for each human factors failure (see Figure 16.) The safety problems are used to identify appropriate recommendations and actions. The recommendations and actions focus on identifying measures which are designed to prevent recurrence. This technique can assist the investigator in making sure each of the issues have been covered in the recommendations.

<table>
<thead>
<tr>
<th>Issue no.</th>
<th>Human factors failure</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 16: Identifying HF failures and recommendations

The ‘Five Whys’

J.2.19 The safety issue can be further analysed to better understand why the contributory event occurred, for example, was there a weakness in the process? Was there a failure to identify a risk? If individuals failed to follow correct procedure, why did this happen? In order to identify the root cause of the problem, a tool called the 5 Whys (Ohno, 1988) can be applied. The primary technique is to repeat the question ‘Why?’ in a sequence of steps:

a) Identify the problem
b) Ask ‘why’ that problem is occurring. The answer should be supported by the evidence collected.
c) Once you have formulated an answer, ask ‘why’ again.
d) Continue asking ‘why’ until you establish the root cause of the problem. According to this technique, five iterations of the question should be sufficient.
e) Once the route cause has been identified you can then move on to developing recommendations.

J.2.20 An example of the 5 Whys technique is detailed below: Problem: The car will not start

a) Why? The battery is dead.
b) Why? The alternator is not working.
c) Why? The alternator belt is broken.
d) Why? The alternator belt is old, worn and has not been replaced.
e) Why? The vehicle has not been regularly maintained according to the recommended service schedule. This final answer represents the root cause.
Appendix K  Writing the Investigation Report

K.1  Introduction

K.1.1 The content of this appendix is provided for guidance only.

K.1.2 This appendix deals with writing the report of an investigation. It gives guidance on each section of the report, and how the sections of the report relate to each other to produce a comprehensive, logical sequence which leads to appropriate conclusions and recommendations. The quality and thoroughness of investigation reports provide an indication as to the efficacy of an organisation’s SMS and of its safety culture.

K.2  Proportionality

K.2.1 The principles of proportionately are applicable to the report writing phase. The amount of time, effort, and resource devoted to writing the report should be in proportion to the potential outcome of the adverse event. Therefore, the information in this appendix may be of more use to some levels of reports than others.

K.2.2 This appendix contains guidance which can be tailored to suit the level of investigation being undertaken, commensurate with the principles of proportionality.

K.3  Constructing a report

K.3.1 The lead investigator compiles an investigation report which:

a) Satisfies the remit. The remit is the reference document for the lead investigator’s guidance in carrying out the investigation. Appendix D gives an example structure of an investigation report. An investigation cannot be considered to have been completed successfully unless it meets the parameters of the remit.

b) Follows a clear and logical structure, an example of which is shown below.

c) Identifies whether system improvements are necessary to eliminate or mitigate the risk from adverse events by addressing the likelihood of recurrence and/or their consequences. It is the aim of all transport operators to improve safety. By mitigating or removing the risk from adverse events, improvements in safety will be achieved. Transport operators are responsible for considering and implementing recommendations concerning those issues within the scope of their safety certificates and those involving their contractors and suppliers.

d) Specifically directs each recommendation to the appropriate transport operator(s). It is important to recognise which organisation is the subject of each recommendation. This adds clarity to the process of implementing control measures.

K.3.2 The objective of an investigation report is to not only report accurately the mechanism of the adverse event, its causes and to formulate recommendations to improve safety, but also to demonstrate that the investigation has been professionally conducted.

K.3.3 A good investigation report is clear, easy to read, factually correct and addresses the requirements of the remit. The investigation is likely to have more impact if it is completed quickly and thoroughly, and the report is published within the timescale set in the remit.
K.3.4 A report may be structured with its key sections as follows:

a) Introduction.
b) Executive summary.
c) Summary of evidence: Leading to
d) Summary of events: Leading to
e) Factors for consideration: Leading to
f) Conclusions, including causes: Leading to
g) Recommendations.
h) Appendices (if needed).

K.3.5 There should be a logical flow of threads running through the report. For example, ‘factors for consideration’ is based on the ‘summary of events’ which in turn is based on the evidence described in the ‘summary of evidence’ before it. The conclusions, including the immediate and underlying causes, are based on the issues discussed in the ‘factors for consideration’ and, finally, the ‘recommendations’ are linked back to the preceding items and specifically to the conclusions and the relevant immediate and underlying causes.

**Report section - Introduction**

K.3.6 This section contains details of the adverse event which has been investigated, along with a copy of the remit. It is useful to include:

a) Date, time and location of the event.
b) Brief description of the nature of the event.
c) A statement on the purpose of the investigation (relating to the remit).
d) A description of the environment and geographic features, for example, track configuration and weather (diagrams, plans, maps and photographs are useful methods).
e) A brief summary of the evidence.
f) Names of the investigator(s).

**Report section - Executive summary**

K.3.7 This section is a succinct, accurate reflection of the contents of the full report. It forms a stand-alone synopsis regarding the adverse event, the investigation and the immediate and root causes identified, enabling the reader to gain an overview, without reading the full details in the report. It acts as a ‘taster’ for the full report, so that the reader can make a quick decision on how pertinent it is to them.

K.3.8 There is as much detail as necessary to tell the reader what happened and what the investigation found, in sufficient detail to communicate a good understanding of the salient points, but without giving too much detail. It can be a matter of a fine balancing act to achieve an optimal summary, especially in complex investigations with a large number of technical elements.

**Report section – Summary of evidence**

K.3.9 This section is the assimilation of the facts, data, and any other evidence. The use of evidence, and the recognition that some of it might be inconclusive, conflicting or less
accurate, and resolving these conflicts objectively and collaboratively is key in putting together the summary of events, and the subsequent parts of the report.

**Report section - Summary of events**

K.3.10 This is usually a chronological narrative, describing the events, decisions and actions leading up to the adverse event, and can include the events immediately after, relating to the response to it.

K.3.11 The use of a time-line of events is a useful tool which can be used to form the structure of this section. Laying out what happened in a chronological order provides an easily comprehended context for the report.

K.3.12 A timeline indicates when each event in the sequence of events occurred, both in the lead-up to the adverse event and, where relevant, during the time following it. It is a useful tool, not only in presenting the chronology of events to the reader of the report, but also in examining and analysing the evidence.

**Report section - Factors for consideration**

K.3.13 This section draws on the previous section, and is a structured presentation, identifying why the investigation has come to its conclusions. It can describe the thought processes, as well as the weighing-up of evidence, especially where conflicting evidence, such as witness accounts, has been presented to the investigation.

K.3.14 The factors for consideration can be structured around the headings of the 10 Incident Factors and the Human Performance Factors (see Appendix H for further information and definitions). Structuring factors for consideration around those headings which are relevant to the adverse event, provides a consistent format that links back to the evidence gathering process presented in Appendix H. It also provides a demonstration of the range of human performance and organisational factors which have been considered during evidence gathering.

K.3.15 The ‘factors for consideration’ section is where any confliction in the evidence is explored, including ways of resolving these conflicts. Sometimes, it is not possible to resolve such conflicts, and if this is the case, then the report reflects this. Any opinions and conjecture as to the considered view regarding which evidence is likely to represent the correct version are clearly identified as being the considered opinion of the investigator or the panel.

K.3.16 The words ‘probable’ and ‘possible’ are useful in quantifying any uncertainty regarding the factors, as well as their links to the conclusions. The RAIB uses these words in its reports, as explained in the preface: ‘Use of the word “probable” means that, although it is considered highly likely that the factor applied, some small element of uncertainty remains. Use of the word “possible” means that, although there is some evidence that supports this factor, there remains a more significant degree of uncertainty’.

**Report section - Conclusion**

K.3.17 This section draws on the previous section. It is the outcome of the deliberations and evaluation of the evidence by the investigation panel. The conclusions relate directly
to the investigation panel’s discussions regarding the sequence of events and the evidence discussed.

K.3.18 In determining causes and linking to evidence, it is necessary to consider all immediate and underlying causes leading up to the adverse event. It can be useful to work backwards from the moment of the adverse event through the history of the events that led up to it.

K.3.19 Where the available evidence is contradictory and where an agreement cannot be reached by the investigator, it is possible to record an ‘inconclusive’ conclusion, although this is not often used.

Report section - Recommendations

K.3.20 This section contains any improvements (for example to infrastructure, vehicles, procedures etc.) which the investigation proposes, to address the causes and to prevent a recurrence or to mitigate the risk from a recurrence. An effective investigation is productive to the extent that causes are accurately identified and linked to the recommendations.

K.3.21 The quality, relevance and practicability of the recommendations are of importance rather than the number of recommendations. In terms of the Swiss Cheese Model linking recommendations to causes and framing them to prevent the recurrence means the recommendations either add another slice of cheese (an additional layer of defence) or eliminate or make the hole in an existing slice smaller.

K.3.22 In terms of good practice, recommendations:

a) Are clearly and succinctly worded.
b) Are designed to address one or more of the issues identified in the conclusions section.
c) Are achievable and realistic.
d) Are clear in their objectives.
e) Indicate the intended outcome of implementation.
f) Indicate a suggested timescale for implementation.
g) Acknowledge any changes which have already been made, or are planned to be made, following the adverse event.
h) Are directed at an organisation, or group of organisations.

K.3.23 Care is required to make sure that a recommendation is directed to the correct organisation. For example, a recommendation relating to the use of ladders by a painting and decorating company is not directed at the company itself, but instead at the transport operator which contracted them to carry out the work.

K.3.24 Local Investigations may specify who in their organisation is responsible for undertaking each recommendation. This should be by specific role rather than by name. It is good practice for the lead investigator to consult the intended recipient(s) prior to making the recommendation.

K.3.25 In choosing to which transport operator(s) a recommendation is to be addressed, the investigation team may wish to consider the following:
a) Which transport operator(s) owns the issue or directly controls the risk at which the recommendation is directed, for example, railway undertakings directly control the risk associated with traction and rolling stock.

b) Whether to address the recommendation to a particular transport operator that has participated in the investigation and has responsibility for applying the measures that are recommended to be changed.

c) Whether the recommendation may initiate a submission to RSSB for a proposal to change a standard.

d) In addition to transport operators, it may be appropriate to direct recommendations to other parties (for example Rolling Stock owners, or contractors) that would have a significant role in implementing those recommendations. This is because the transport operator needs their cooperation in accordance with Regulation 22 of the Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS). In these situations, it is the transport operator who is responsible for the risk and for gaining support of those parties.

K.3.26 Recommendations might also propose further work to be carried out, such as more in-depth or wider investigation, or research.

K.3.27 Not all investigations will result in recommendations being made. It is not necessary to write recommendations for the sake of it. If the investigation does not make any recommendations, then this can be stated in this section, along with reasons.

K.3.28 HSG 245 refers to the need to review related risk assessments and, where the investigation reveals weaknesses in these and competence assessments, then recommendations relating to altering and improving these may be appropriate, for example, reassessment of risk of slipping on a platform after several such adverse events. Hence, the investigation might result in a recommendation to revisit a risk assessment.

K.3.29 When considering human performance in the writing of recommendations, it is important that the recommendations link to both the immediate and underlying causes, including any failures in human performance or the 10 IFs, where relevant. To reinforce the principles of a fair culture, Table 17 gives guidance on the sort of mitigations, actions and possible basis for recommendations that could be used.

<table>
<thead>
<tr>
<th>Type of error</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slip, lapse</td>
<td>Use of job aids such as reminders (for example, scripts, checklists, aides memoires) to prevent a slip or lapse error.</td>
</tr>
<tr>
<td></td>
<td>Suggest system changes such as integration of alarms or warnings to maintain alertness.</td>
</tr>
<tr>
<td></td>
<td>Suggest Non-Technical Skills awareness and strategies if the error was related to situational awareness, communication slip etc.</td>
</tr>
<tr>
<td></td>
<td>Consider shift pattern design if the error was related to fatigue.</td>
</tr>
<tr>
<td></td>
<td>Consider changes to design of the workplace, if this was a factor.</td>
</tr>
<tr>
<td>Type of error</td>
<td>Mitigation</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Rule-based mistake</td>
<td>Review the procedures or rules around the task. Provide enhance training and assessment, specifically in regard to situations that are not experienced very often. Consider the role that supervision played and whether this needs to be improved.</td>
</tr>
<tr>
<td>Knowledge-based mistake</td>
<td>Consider the role that the quality of applicability of the individual’s training played. This could be initial or refresher training.</td>
</tr>
<tr>
<td>Intentional rule breaking</td>
<td>Consider the selection processes into the role and how selection could be improved going forward. If it was routine rule breaking, how could the rules or procedures be amended to reduce the perceived need to break them? Consider available resources (planning, equipment, time, people) and if this impacted on the perceived need to break them. Could this be improved in the future? What training or on-going assessment could be used to reduce the possibility of intentional rule breaking? Did supervision play a role or could this be improved to reduce the opportunity to intentionally break rules? What can management do to reduce the opportunity or perceived need to intentionally break rules?</td>
</tr>
</tbody>
</table>

Table 17: Mitigations for errors and intentional rule breaking

K.3.30 Recommendations can also target individual competence issues. As part of a duty holder’s Competence Management System, duty holders are required to ‘identify sub-standard performance and restore competence’. Investigations might determine that sub-standard performance played a part in the causal chain to the adverse event, in which case the recommendations can be part of ‘restoring competence’.

K.3.31 As the recommendations may then be integrated into a Competence Development Plan (CDP) the RSSB guidance on this can be considered. This guidance was written to help the industry learn lessons and to minimise the impact of drivers’ availability; however, the principles of the document can be applied to any safety-critical role, and some guidance on the application of this to train dispatchers (as an example) is included. It is based on fair culture principles, including:

a) A competence requirement may be identified in the investigation findings, through performance monitoring/assessments, or by the member of staff or others identifying a particular development objective.

b) The CDP process is followed in an open and fair manner. All parties are treated with respect as colleagues and professionals.
c) The development of the CDP should be led by the member of staff, with a manager providing advice and coaching. They and other supporting staff are expected to recognise the commitment required to deliver the CDP.

d) The development of the CDP is most effective when it is holistic, and considers the person’s broad performance and experience over a period (at least five years) to identify areas in which the person has strong competence as well as the areas that may require development.

e) The competence objective and the resulting CDP forms a commitment between the member of staff and the company, involving:

i) Development actions to address the specific competence objective.

ii) Monitoring actions to measure improvement in that competence.

iii) Setting clear timescales. The plan is more effective if it is scheduled for the shortest period that delivers the required support, while being workable within the commitments of the member of staff and their manager. The scheduling of CDP activities can work best if they complement activities required under the competence management system.

f) The CDP can work best if it is tailored to the member of staff’s individual competence objectives and includes consideration of their learning style.

g) The CDP should be proportional to the person’s competence objective, and any related risk. This is not necessarily related to the consequences of any event. Involvement in an adverse event does not always mean that there is a competence weakness. Actions of little direct consequence may reveal a serious failing, especially if they are part of a pattern.

h) The progress against CDP objectives should be monitored with regular review meetings to discuss achievement. It should be adaptive to reflect their progress, and be revised if it is not proving effective. The CDP is closed once the objectives are accomplished.

i) The competence developed in the CDP should contribute to a long-term performance improvement for the person. Where particular behaviours or actions have formed part of the CDP, they should continue their use beyond the end of the plan.

j) The activities, observations and outcomes of a CDP should be recorded in the CMS.

Report section - Appendices

K.3.32 The appendices are used for additional information that is required to fully understand the report. Other evidence can be held in the investigation file. The appendices and their significance to the main body of the report are referred to at the appropriate point in the report.

K.3.33 Particular care is taken when reproducing documents in appendices, as some documents (such as witness statements, training records, competence development plans) are likely to contain personal details which will need to be redacted.

K.4 Finalising the report

K.4.1 It is important that the completed report be measured against the initial remit to determine whether it has been met. This is ideally by the author of the remit.
K.4.2 In respect of investigations involving more than one investigator, under the leadership of a lead investigator, the agreement of each panel member can be obtained using a sign-off sheet, or via email.

K.4.3 It is considered good practice to circulate the report amongst all of the transport operators who were involved in the adverse event by way of a formal consultation, prior to its being finalised and published.
Appendix L Learning from Investigations

L.1 Introduction

L.1.1 The content of this appendix is provided for guidance only.

L.1.2 This appendix deals with the process for learning the lessons from adverse events, and how to mitigate against their reoccurrence. The learning which can be obtained is not limited to adverse events on the railway. Other industries’ reports can contain valuable lessons for the rail industry.

L.2 Learning from adverse events

L.2.1 The history of accidents is full of commitments to make sure that they will not be repeated. However, despite this, failures to learn important lessons are common.

L.2.2 To systematically learn lessons, organisations need to review investigation reports. Once lessons have been learned, the benefits will be gained through, for example, updated and improved procedures and SMSs, better training and briefing of staff and changes to monitoring and review processes.

L.2.3 Over the last 30 years, investigations of several major accidents have identified common failures of SMSs. A selection of prominent accidents, and the failings which were identified, are set out in Table 18. One significant element of these failures is the lack of learning from previous experience of accidents and/or failure to act on the lessons learned.

<table>
<thead>
<tr>
<th>Accident report</th>
<th>The report identified that:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deepwater Horizon Marine Casualty Investigation Report. Office of the Maritime Administrator, Republic of the Marshall Islands (2011)</td>
<td>The accident demonstrated that lessons had not been learnt and how an absence of major incidents can foster a culture of complacency. A failure to share learning across the entire oil industry was also highlighted.</td>
</tr>
<tr>
<td>An independent review into the broader issues surrounding the loss of the RAF Nimrod MR2 Aircraft XV230 in Afghanistan in 2006 Haddon-Cave, C (2009)</td>
<td>Lessons were not learned from previous incidents, in particular the rupture of the SCP duct in Nimrod XV227 (p10 para 7). The report states that ‘many of the lessons to be learned are not new’ and that the organisational causes were similar to those for other major accidents, including Columbia and BP Texas City (p13 para 26).</td>
</tr>
<tr>
<td>Accident report</td>
<td>The report identified that:</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>The lessons from Challenger in 1986 were not learned, in particular those relating to budget restraints (Cpt 5).</td>
</tr>
<tr>
<td></td>
<td>There was no process to ensure problems from one flight were addressed before the next, and this in the situation where the system was being stretched by the rapid succession of flights (p139 Findings F 6.2-3 and -5).</td>
</tr>
<tr>
<td></td>
<td>NASA’s own Lessons Learned Information System was not used when making decisions (p193 Finding F 7.4-10). History of ignoring external recommendations (p13).</td>
</tr>
<tr>
<td></td>
<td>NASA does not fully understand the mechanisms that cause foam loss on almost all flights from larger areas of foam coverage and from areas that are sculpted by hand. (Findings p55, 121).</td>
</tr>
<tr>
<td>Train Derailment at Hatfield: A Final Report by the independent Investigation Board. Office of Rail and Road (2006)</td>
<td>The knowledge of the track asset had not been improved in line with earlier audit finding (13.2.5 and 5.13.1.1).</td>
</tr>
<tr>
<td></td>
<td>Track renewals deferred for maintenance – ‘sweating the asset’ from McKinsey report – at a time when contractor safety management was considered a top risk (6.11 and 12.7).</td>
</tr>
<tr>
<td>The Ladbroke Grove Rail Inquiry. Health and Safety Executive (2001)</td>
<td>Railtrack senior management waited for proposals rather than lead in seeking solutions and they failed to implement previous inquiry recommendations from serious incidents (1.11/12).</td>
</tr>
<tr>
<td></td>
<td>There was no Zone recommendations tracking procedure (7.99).</td>
</tr>
<tr>
<td>Investigation into the Clapham Junction Railway Accident. A Hidden QC (1989)</td>
<td>Many examples of wrong side failures and very similar previous incidents were known of, but learning from these and actions to prevent recurrence were very poorly managed (9.48-53, 9.59, 13.20 &gt;).</td>
</tr>
</tbody>
</table>

**Table 18:** Failures to learn from accidents
L.2.4 These major accident failures are often referenced in safety literature but more frequent, lower consequence failures can occur at a company level and may be reviewed.

L.2.5 Rail adverse events which have similar precursors to previous ones could indicate that:
   a) Lessons have not been sufficiently learnt.
   b) One organisation has learned but that the lessons have not been effectively shared with, or applied by, other organisations.
   c) The recommendations did not identify the correct cause.

L.2.6 The effective learning of lessons is not simple and requires management commitment and resources. The output from the investigation, and the recommendations, are designed to lead to the learning of lessons and safety improvements. These improvements might include:
   a) New design or technologies, for example, modification to rolling stock.
   b) Improved processes, for example, training or maintenance regimes.
   c) Correction of systemic problems, for example, supervision levels.
   d) Improving competence and capabilities.

L.3 Industry-wide learning from operational experience

L.3.1 Learning from Operational Experience (LOE) is defined by RSSB as: The process by which knowledge from the operation of systems is gained, exchanged and used, leading to continuous improvement and the development of a positive safety culture.

L.3.2 The railway and its regulatory bodies have been learning lessons from adverse events since William Huskisson MP was struck and killed by Rocket at the opening of the Liverpool & Manchester Railway in 1830, and the improved safety performance for both rail staff and passengers is a testament to this.

L.3.3 Early accidents and incidents like this led to the first Railway Regulation Act (1840), which required all injurious accidents to be reported to the Board of Trade. Within 50 years, block signalling, interlocking and continuous braking on passenger trains had been made mandatory. The twentieth century saw further advancements, ranging from continuous welded rails and multi-aspect signalling, through to automatic train protection systems.

L.3.4 The cycle of safety planning and performance reporting is essential to continuing development. Much learning also comes from investigations into adverse events that have occurred, near miss data, reports to the industry’s Confidential Incident Reporting and Analysis System (CIRAS) and Close Call.

L.3.5 LOE is discharged through the rail industry’s national stakeholder groups, all of which have been established by the RSSB Board.

L.3.6 RSSB’s LOE annual report contains useful information relating to a wide range of adverse events, affecting the rail and other industries, both domestic and international.

L.3.7 There are many sources of learning from operational experience which transport operators may find useful. These include:
Learning from the investigation report

On completion of the investigation, the report is published by distributing to those involved. These include those organisations:

a) To which recommendations have been addressed.
b) Whose employees were involved in the undesired event and/or who gave evidence.
c) Responsible for managing safety.

The lead organisation for the investigation informs transport operators of the conclusions and recommendations from an investigation.

Investigation reports are likely to include issues which are relevant to other transport operators, who may wish to take action in respect of their own systems. Recommendations from investigation can only be effective if they are communicated to the organisation(s) to which they are directed.

For formal investigations, the lead organisation provides a written report of the investigation to all transport operators and other railway industry parties involved in the adverse event and RSSB.

RSSB uses this information to maintain adverse event data which are used to provide statistics and safety management information to the rail industry.

The conclusions and recommendations are made available to industry when the lead organisation inputs them into SMIS. RIS-8047-TOM Reporting of Safety Related Information details the arrangements in respect of SMIS reporting.

Management review of adverse events and trends

To systematically learn lessons organisations will need to review investigations. This review could include:

a) Reports on activity (leading) and outcome (lagging) indicators, noting trends and reasons for them (see Measuring Safety Performance on the RSSB website).
b) Analysis of a relevant major accident, noting underlying causes.
c) Implementation and effectiveness of previous report recommendations.

Measuring improvement in loss due to reduction in adverse events

ROGS (Schedule 1) requires demonstration of the continuous improvement of the SMS. The implementation of recommendations in response to investigations and reporting forms a significant element of this, and that the ‘necessary preventative measures are taken’ following investigation.
L.6.2 The continuous improvement of the SMS, with the objective of reducing the loss due to adverse events, can be measured. The following questions are suggested to help measure the effectiveness of implementing recommendations:

a) Were reports completed to meet the timescale in the remit?
b) Were the recommendations implemented on time?
c) Was the effectiveness of the implemented recommendations reviewed at a high level?
d) What is the overall adverse event trend?

L.6.3 It is considered good practice for cross-industry groups to undertake a proportionate review of adverse events and trends.
Appendix M  Recommendations Management

M.1  Introduction
M.1.1  The content of this appendix is provided for guidance only.
M.1.2  This appendix deals with the process for managing recommendations, including accepting or rejecting them, tracking the process of implementation and reporting on the progress.

M.2  Assessing and accepting/rejecting recommendations
M.2.1  Some aspects of the management of recommendations, from writing recommendations through to tracking their implementation, are required by legislation. This guidance may be useful where this is not the case.
M.2.2  All recommendations are thoroughly evaluated at the appropriate level and a decision made to either accept or reject them. If the decision is to reject a recommendation, then justification can be given in writing to the issuing organisation. Records of such actions are kept by the organisation to which the recommendation is directed. Every effort is made to agree on how to resolve differences over the acceptance or rejection of a recommendation.
M.2.3  While investigators would be expected to have an awareness of the costs versus benefits as they formulate recommendations, the organisation or manager responsible for implementing the recommendation would normally undertake a more detailed assessment of these and would possibly rank the benefits against other recommendations.
M.2.4  Organisations that have several recommendations to implement may wish to prioritise these actions or amalgamate where they are similar, in order to manage resources and timescales.

M.3  Managing the implementation of recommendations
M.3.1  Where appropriate, actions can be included within the organisation’s SMS improvement planning and implementation programmes. This will enable the actions to be monitored and subjected to the organisation’s management review processes.
M.3.2  Organisations are encouraged to utilise the Taking Safe Decisions model and approach as this can help bring about safety improvements through the monitoring of the effectiveness of their implementation. Taking Safe Decisions sets out the industry’s consensus view of how safety is taken into account when taking decisions. It describes the principles that companies apply to protect people’s safety, satisfy the law, respect the interests of stakeholders and meet wider commercial objectives.
M.3.3  Organisation’s safety communications are one way of highlighting the actions that are being taken, and the lessons being learned from adverse events. This could range from the supply of information, to gaining understanding and support, to briefing, training, supervision and competence regime changes.
M.4 Tracking and reporting progress on the implementation of recommendations

M.4.1 The tracking of recommendations is a vital part of the investigation output. The failure to implement recommendations can be a precursor to future adverse events.

M.4.2 SMIS is used to capture and report details of undesired events, the investigations into them, and to log and track recommendations for the range of inquiries and investigations. These include public inquiries, HSE inspectorate inquiries, RAIB investigations, as well as formal and local investigations.

M.4.3 The organisation’s SMS management review processes include the monitoring of the implementation of recommendations and commitment for appropriate resources to be made available commensurate with the risks involved. Records of adverse events, their causes and the recommendations are useful in monitoring performance and to detect trends.

M.4.4 Some organisations have introduced their own system for recommendation reporting and tracking, some of which are integrated business processes and include the logging of the progress of outputs from audits and risk assessments. SMIS includes a simple recommendation tracking system for transport operators so that they do not need to duplicate such a system, though some may opt for a more tailored system designed for their business or SMS.

M.4.5 The organisation’s SMS management review processes and procedures include the review of the effectiveness of recommendations and act on the results of such reviews to assist with continuous improvement.

M.4.6 Recommendations contained within RAIB investigation reports are addressed to transport operators and are monitored by the ORR.
Appendix N  Proportionality

N.1  Introduction
N.1.1  The content of this appendix is provided for guidance only.
N.1.2  This appendix deals with the principle of proportionality in investigating adverse events and how to apply it. It includes the Proportionate Response Model and cites examples of its application.

N.2  What is ‘proportionality’?
N.2.1  Proportionality is defined as the process for ensuring that the amount of time, effort and resource allocated to the investigation process, is commensurate with the potential risk and consequence of the adverse event.
N.2.2  The Proportional Response Model (PRM) provides a systematic method of balancing several influencing factors, to bring consistent levels of response and use of resources during an investigation. The text, tables and diagrams take the reviewer through the three stages of filtering. These include notes and additional explanation of the process to assist the user.

N.2.3  There are three stages to employing the PRM, as illustrated in Figure 17.

N.2.4  

Figure 17: Three-stage proportionate response model

N.3  Factors to be considered during stages 1, 2 and 3

Stage 1 - Consideration of credible worst outcome
N.3.1  The first stage involves consideration of what the credible worst outcome of the adverse event could have been. This is illustrated in Figure 18. Starting with the actual outcome, consider whether the outcome could have been more serious. For example, if the adverse event resulted in a minor injury or minor damage, then consider whether the event could have resulted, under slightly different circumstances, in a major injury(s) or moderate damage. For example, in the scenario of a person falling over on the flat section of a station footbridge, resulting in bruising: if the circumstances (the location) had been slightly different (the top of the footbridge steps), could the result have been a major injury (for example, a broken arm)?

N.3.2  For lower level adverse events, it may be appropriate for the reviewer (who may later be the investigator) to conduct the three-stage process. In such cases the reviewer is usually a manager who is familiar with investigations and understands the need for proportionality and the criteria used in stage three. Companies may wish to specify that for medium- and high-level investigations stage 3 will be undertaken, or at least checked, by a senior manager.
Proportionate Response Model

Stage 1 - Credible worst outcome

Soon after the undesired event, when enough information has been gathered, Stages 1 and 2 should be undertaken by competent staff.

Examples
This stage aims to determine the credible worst outcome, should the circumstances around the accident have been slightly different. The following are three examples of scenarios of different scales:

Stage 1 Determine the credible potential outcome

Examples of three accident scenarios:

- 1 Slip, trip and fall in an engineering depot, resulting in a broken leg and no other injuries.
- 2 Passenger fall after alighting from train, then trying to get on it again, resulting in minor cuts and bruises.
- 3 Near miss at a level crossing involving a car being struck in traffic, due to road works and moving off just in time.

The following are possible conclusions on Stage 1 for each of the three accidents:

- If the car had not moved off, the crossing multiple fatalities could have been expected.
- If the person had fallen towards the train, they could have fallen between train and platform resulting in a fatal accident.
- In the location where the accident happened a more serious injury such as a broken leg would have been unlikely.

Select credible potential outcome:

Note: Typical issues to consider when making decisions at Stage 1 and 2 are shown after Stage 3.
Typical issues to consider when making decisions in the example scenarios are set out in Table 19 using the 10 incident factors described in Table 7 as a starting point.

<table>
<thead>
<tr>
<th>Example Scenario 1</th>
<th>Example Scenario 2</th>
<th>Example Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental conditions - for example, lighting</td>
<td>Environmental conditions - for example, lighting</td>
<td>The barrier sequence and controls operating correctly</td>
</tr>
<tr>
<td>Current workplace and task related risk assessments</td>
<td>Current train dispatch risk assessment - right class and type of trains operating</td>
<td>All signage associated with this type of crossing is presented appropriately to road users and pedestrians</td>
</tr>
<tr>
<td>Footwear policy - and correct footwear worn</td>
<td>Train dispatch arrangements followed correctly</td>
<td>Environmental conditions - foliage obstruction of any part of the crossing and/or signage</td>
</tr>
<tr>
<td>Cleaning and housekeeping arrangements</td>
<td>Any recent building / refurbishment work which may impact on the driver’s view of the platform</td>
<td>Current level crossing risk assessment</td>
</tr>
<tr>
<td>State of the flooring</td>
<td>CCTV and monitors working correctly</td>
<td>Use of all the All Level Crossing Risk Model (ALCRM) for this level crossing?</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Correct train stop location and in the correct location and train length platform markers placed appropriately</td>
<td>Proper consultation and liaison between the highway authority (County Council) and Network Rail</td>
</tr>
<tr>
<td></td>
<td>Changed platform dwell times</td>
<td>Road works contractor compliance with any permits to work</td>
</tr>
</tbody>
</table>

Table 19: Example issues to consider during stages 1 and 2

Stage 2 - Evaluating the effectiveness of barriers

The second stage involves consideration of how effective the existing safety barriers are. This is illustrated in Figure 19. These safety barriers can be represented by the slices of cheese in the Swiss cheese model. Starting with the actual outcome, the user questions how effective the safety barriers (each slice of cheese) which are in place are in preventing the credible worst outcome, taking into account the possible failures in the defences (the holes). There may be more than one safety barrier, for the
example above, such as non-slip surfaces, regular checks for trip hazards, public announcements during wet weather. Guidance on the credible worst outcomes is given in Table 20.
### Proportionate Response Model

**Stage 2 - Effectiveness of Safety Barriers**

Stage 2 can be completed immediately following Stage 1 if the necessary information on barriers/controls, eg from CCTVs and OMTRs, is available.

**Question 2**

- What is the overall level of effectiveness of the safety barriers preventing the undesired event reaching the credible worst outcome?
  - (When considering the remaining barriers at this stage investigators should focus on those which are more immediate or local, rather than those at a higher management system level)

The level should not change to higher than that for the credible worst outcome. To use the matrix below first note the outcome from Stage 1 then answer Question 2 on the effectiveness of barriers. From the identified box then move down to get the initial level of investigation.

<table>
<thead>
<tr>
<th>Stage 2: Answer to Question 2</th>
<th>From Stage 1: The credible worst outcome</th>
<th>Level of Investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negligible risk</td>
<td>Low risk</td>
<td>Low</td>
</tr>
<tr>
<td>Negligible risk</td>
<td>Low risk</td>
<td>Low</td>
</tr>
<tr>
<td>Low risk</td>
<td>Low risk</td>
<td>Low</td>
</tr>
<tr>
<td>Low risk</td>
<td>Low risk</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Stage 1 Outcomes:**

<table>
<thead>
<tr>
<th>LOW</th>
<th>MAJOR</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Stage 2 Outcomes:**

1. The individual was not fatigued, was wearing safety shoes and helmet, lighting was OK and there was a spillage policy in place.
2. The driver checked the platform monitors, which were working, and did not see the fallen passenger probably because she fell behind the shelter.
3. Liaison with the highway authority over proposed road works, although undertaken, had resulted in weak control of potential traffic congestion.

**Stage 3 Outcomes:**

<table>
<thead>
<tr>
<th>LOW risk so LOW initial level of investigation</th>
<th>MAJOR risk so HIGH initial level of investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDIUM risk so MEDIUM initial level of investigation</td>
<td>MEDIUM effectiveness</td>
</tr>
</tbody>
</table>

**Notes:**

- Typical issues to consider when making decisions at Stage 1 and 2 are shown after Stage 3.
- Note: Negligible effectiveness of barriers would suggest that only pure chance or exceptional skill, which is not trained for, stopped the credible worst outcome.

---

**Figure 19:** Proportionate Response Model - Stage 2
### Table: Proportionate Response Model - Stage 2 (contd.)

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injury or damage (including financial loss)</td>
<td>There is no actual or potential for injury or damage; no real financial loss other than reporting and recording of the desired event.</td>
<td>Minor injuries and/or minor damage; financial loss up to £50k</td>
<td>Major injuries* (see RIDDOR below) and/or moderate damage; financial loss up to £50k</td>
<td>Single fatality; multiple major injuries* (see RIDDOR below); major damage; financial loss between £50k and £250k</td>
<td>Multiple fatalities; significant damage; financial loss over £250k</td>
</tr>
<tr>
<td>Reputation (societal concern/ public relations)</td>
<td>Issue is resolved promptly by day to day management process</td>
<td>Issue is resolved promptly by day to day management process</td>
<td>Stakeholder and community concerns; local media coverage</td>
<td>Major stakeholder and community concerns; major embarrassment for the company; adverse media coverage</td>
<td>Significant adverse impact on the reputation of the company nationally or internationally</td>
</tr>
<tr>
<td>Legal</td>
<td>No actual or potential regulatory or claims issue</td>
<td>No actual or potential regulatory or claims issue</td>
<td>Possible breach of legislation; fines or claims up to £50k</td>
<td>Possible breach of legislation; fines or claims between £50k and £250k</td>
<td>Breach of legislation; possible criminal convictions; fines or claims above £250k</td>
</tr>
<tr>
<td>Environmental</td>
<td>No actual or potential damage to the environment</td>
<td>No actual or potential damage to the environment</td>
<td>Minimal harm; clean up expenses up to £50k</td>
<td>Medium term harm; clean up expense between £50k and £250k</td>
<td>Long term harm; clean up expenses over £250k</td>
</tr>
</tbody>
</table>

**RIDDOR 'Specified Injuries' since RIDDOR 2013 ("previously there was a wider list of 'Major Injuries'") include:**

- A fracture, other than to fingers, thumbs and toes
- Amputation of an arm, hand, finger, thumb, leg, foot or toe
- Permanent loss of sight or reduction of sight
- Crush injuries leading to internal organ damage
- Serious burns (covering more than 10% of the body, or damaging the eyes, respiratory system or other vital organs)
- Scalpings (separation of skin from the head) which require hospital treatment
- Uncosconsousness caused by head injury or asphyxia
- Any other injury arising from working in an enclosed space, which leads to hypothermia, heat-induced illness or requires resuscitation or admittance to hospital for more than 24 hours

**Figure 20:** Proportionate Response Model - Stage 2 (contd.)
Stage 3 - Consideration of wider factors

N.3.5 The third stage involves consideration of the wider factors. This is illustrated in Figure 21. These include factors such as numbers and seriousness of previous similar events, the outcome of previous investigation, the likelihood of a failure of management systems etc.
Proportionate Response Model

Stage 1
Credible worst outcome

Stage 2
Effectiveness of barriers

Stage 3
Wider factors

Stage 3 - Consideration of Wider Factors

As soon as the relevant information is available after stage 2, possibly immediately, then stage 3 must be undertaken by competent staff. Such information may include, eg SMIS downloads on similar accidents. This stage should be checked by a more senior manager, and in the case of medium or high level investigations, this should be by the DCP or similar. The time spent on this stage should be roughly proportionate to the scale of the accident.

Question 3
Should the initial level of investigation be confirmed, escalated or downgraded after consideration of the following criteria?
- Any likely systematic management failures
- Existing company policies
- Potential loss via claims and insurance premiums
- The level of investigation for similar previous events
- Other related undesired events forming a series (eg common location, equipment, behaviours, personnel or underlying causes)
- Gaining the optimum safety benefit for the company and the industry
- Other investigations into the same event by, eg, DRR, BPT and RAIB
- A sense check including consideration of public, passenger and stakeholder interests
- Issues relating to other involved Transport Operators

Examples
This stage uses transparent criteria to ensure consistency in response to other similar events and to check against important factors that could influence the decision on the level of the investigation. It provides the chance to look at the undesired event as part of a bigger picture. It must be applied by competent staff and should then be checked by a more senior manager, and in the case of medium or high level investigations, this should be the DCP (or similar).

Stage 2 Initial level of investigation:

Stage 3 Apply the criteria (Question 3) to confirm, downgrade or escalate level of investigation:

1. Further enquiries revealed that the cleaning company had not been meeting requirements at several depots and two claims were pending ESCALATE
2. There have been no similar incidents at this station or on the route, which has an effective ban of alcohol on trains CONFIRM
3. Over the last 2 years the introduction of new or modified road routes has led to some level crossing incidents. Roadside incidents account for nearly half the catastrophic train accident risk on Britain's railways CONFIRM

Select final level of investigation:

Final: Record the event
Final: Low level of investigation
Final: Medium level of investigation
Final: High level of investigation

The level of investigation should be kept open to review throughout the investigation process.

Figure 21: Proportionate Response Model - Stage 3
N.3.6 Wider factors for consideration during stage 3 when making decisions on the example scenarios are set out in Table 20.

<table>
<thead>
<tr>
<th>Example Scenario 1</th>
<th>Example Scenario 2</th>
<th>Example Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar investigations at this location</td>
<td>Similar adverse events at this location, with this class of train or on this route involving this company or other operators</td>
<td>Similar adverse events at this location or with this type of level crossing</td>
</tr>
<tr>
<td>Previous investigations and immediate and underlying causes</td>
<td>Previous investigations and immediate and underlying causes</td>
<td>Previous investigations and immediate and underlying causes</td>
</tr>
<tr>
<td>Relevant outstanding corrective action reports or recommendations</td>
<td>Relevant outstanding corrective action reports or recommendations</td>
<td>Relevant outstanding corrective action reports or recommendations</td>
</tr>
<tr>
<td>Involvement of those connected with the adverse event in similar events</td>
<td>Involvement of those connected with the adverse event in similar events</td>
<td>Involvement of those connected with the adverse event in similar events</td>
</tr>
<tr>
<td>Apportionment of blame by injured person</td>
<td>Apportionment of blame by person in the car</td>
<td></td>
</tr>
</tbody>
</table>

Table 20: Example issues to consider when making decisions

N.3.7 The three-stage filtering process is designed to assist in assessing the importance of the many variables and in steering towards the suggested scale of investigation in the examples set out in Table 21.

<table>
<thead>
<tr>
<th>Event</th>
<th>Use 3-stage process</th>
<th>Suggestion on scale of action/level of investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut finger in office</td>
<td>No</td>
<td>First aid and entry in accident book</td>
</tr>
<tr>
<td>Asbestos exposure</td>
<td>Yes</td>
<td>Full record in internal files after appropriate level investigation</td>
</tr>
<tr>
<td>Hit by falling luggage with minor injury</td>
<td>Yes</td>
<td>SMIS report which includes minimal explanation</td>
</tr>
<tr>
<td>Event</td>
<td>Use 3-stage process</td>
<td>Suggestion on scale of action/level of investigation</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>Slips, trips and falls</td>
<td>Yes</td>
<td>Minor investigation unless significant trends and then possibly a review</td>
</tr>
<tr>
<td>Buffer stop collision with no injury</td>
<td>Yes</td>
<td>Medium level of investigation (Local)</td>
</tr>
<tr>
<td>Passenger fatality when boarding train</td>
<td>No</td>
<td>High level of investigation (Formal)</td>
</tr>
<tr>
<td>Event where causes are clearly unknown</td>
<td>Yes</td>
<td>Investigation which may be of a greater scale than the initially known risks would warrant</td>
</tr>
<tr>
<td>Event associated with new technology or new ways of working</td>
<td>Yes</td>
<td>Level of investigation based on risk and to include expertise on the new technology/work method</td>
</tr>
<tr>
<td>Near miss</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Derailment on a running line</td>
<td>No</td>
<td>High level of investigation (Formal)</td>
</tr>
</tbody>
</table>

Table 21: Examples of use of stage 3

N.4 Level of investigation and lead organisation

N.4.1 Applying the principles of proportionality helps to determine what level of investigation is appropriate and whether it will be a formal investigation, or a local investigation. A formal investigation normally involves a panel, under the chairmanship of the person leading the investigation and comprises one or more representatives of the organisations involved.

N.4.2 A transport operator can carry out a formal investigation, even if the criteria indicate that a local investigation would normally be sufficient. This is up to the company involved, in applying proportionality to the investigation.

Formal investigations

N.4.3 A formal investigation is normally held following an adverse event where there may have been a failure of control measures under the direct control of a transport operator, leading to a fatality, major injury or a potentially high-risk incident.
A formal investigation is normally led by the infrastructure manager (network) in the following circumstances:

a) Major injury or fatality to a member(s) of the public not at a station when struck by a train, including level crossing users (other than a deliberate, non-suspicious act).

b) A derailment on a running line.

c) A collision on a running line other than in a station, where no SPAD has occurred.

d) Major injury or fatality to a member(s) of the workforce employed by or contracted to the infrastructure manager (or the infrastructure manager responsible for the management and operation of the station concerned) when struck by a train.

A formal investigation is normally led by the infrastructure manager (stations) in the following circumstances:

a) Major injury to a passenger(s) or a member(s) of the public at a station (other than a deliberate, non-suspicious act).

b) Fatality to a passenger(s) or a member(s) of the public at a station, when boarding or alighting from a train (other than a deliberate, non-suspicious act).

A formal investigation is normally led by the railway undertaking in the following circumstances:

a) A collision between trains in a station.

b) A train fire where there is injury to, or requiring the evacuation of, passengers at a location other than a station.

c) A buffer stop collision at a station where there is injury to people or significant damage to infrastructure or train.

d) A runaway vehicle with, or with potential for, injury to people or significant damage to infrastructure or train.

e) Major injury or fatality to members of the workforce employed by or contracted to the railway undertaking when struck by a train not at a station.

Local investigations

A local investigation is normally led by the infrastructure manager when there may have been a failure of a control measure under their direct control that led to an adverse event that does not meet the criteria for a formal investigation.

A local investigation is normally led by the infrastructure manager (stations) in the following circumstances:

a) An operating irregularity (for example, dispatch against a red signal).

b) A passenger, member of public and workforce accident resulting in an injury that did not warrant a formal investigation.

A local investigation is normally led by the railway undertaking in the following circumstances:

a) A runaway vehicle where there is no actual, or potential for, injury to people or significant damage to infrastructure or train.
b) A buffer stop collision where there is no injury to people or significant damage to infrastructure or the train.

c) A traction or rolling stock defect on a running line likely to affect system safety or resulting in the evacuation of the train.

d) A train fire where there is no injury to passengers and no evacuation is required other than at a station.

e) A station overrun not involving a SPAD.

N.5 Using the PRM to investigate near misses or close calls

N.5.1 Using the PRM, a near miss investigation may warrant a significant resource depending on the related risks, and this is explained in the following extract from the ORR’s ROGS Guidance on Regulations, April 2006:

N.5.2 ‘For near misses the collection and analysis of data can provide real value in helping to prevent accidents and incidents’ and that ‘for the investigation arrangements to be adequate, it is essential that incidents, which have the potential to endanger people, be examined effectively and those that could lead to more serious consequences should be treated with a similar rigour to accidents that actually do cause harm’.

N.5.3 The near miss may be easier to investigate as there will be no injured people and both the threat of criminal proceedings and low workforce morale are less likely. Improving systems as a result of near miss investigation is to be seen as a cost-effective way to manage safety.
Appendix P     Investigating SPADs

P.1     Introduction

P.1.1 The content of this appendix is provided for guidance only.

P.1.2 This appendix deals with reporting and investigating of SPADs. Whereas SPADs constitute a small part of safety risk on the railway, they can be a low-frequency, high-consequence event.

P.1.3 The term ‘SPAD’ - Signal Passed at Danger - is one which is applied to a specific type of adverse event. The definition of a SPAD can be found in the definitions section. SPADs are divided into four different types, as set out below.

P.1.4 This appendix relates specifically to the investigation of SPADs. It provides guidance in conjunction with the rest of this document.

P.1.5 According to the industry’s Safety Risk Model, SPADs account for a low percentage of overall risk, though there is the potential for catastrophic harm. Different priorities are given to this risk by different sections of the industry in relation to the risks, as perceived by transport operators, the public and the ORR. Train operators have differing risk profiles and therefore attach differing weightings to the SPAD investigations and mitigations. Their use and calculation of proportionality may therefore differ and this section provides guidance on SPAD-specific considerations.

P.2     Initial designation

P.2.1 The designation of an adverse event, which has been reported and is being investigated as a SPAD, is treated as being a provisional designation and not confirmed as a SPAD until the investigation is concluded. The decision which is reached by the investigation will either confirm it as being a SPAD, or alternatively re-categorise it as a different type of operational event, based on the evidence.

P.3     SPAD types

P.3.1 There are four different types of SPADs and no degree of severity or importance is implied within or between these. They specify events that have, or might have, led to a signal being passed at danger without authority in the circumstances described. The distinct numbering of SPAD types is intended to enable more accurate analysis of SPADs and to help a better understanding of the circumstances, but not for the purposes of blame, liability or severity.

P.3.1 SPAD type A1

P.3.1.1 A SPAD type A1 is when a SPAD has occurred and, according to available evidence, a stop aspect, indication or end of in-cab signalled movement authority was displayed or given correctly and in sufficient time for the train to be stopped safely at it.

P.3.1.2 A type A1 SPAD is one where the train concerned is correctly signalled, running under normal signalling aspects (or a safety-related movement authority provided by an Automatic Train Control System (ATCS) or train protection system), which are correctly displayed. Hence, the driver had the opportunity to react to the signalling...
information displayed, and to bring the train to a stand at the signal at danger (or end of safety-related movement authority).

P.3.1.3 This SPAD type includes (but is not limited to) these scenarios:

a) A train is proceeding under green aspects, then encounters a cautionary sequence of aspects prior to approaching a signal at danger. The driver applies the brakes in reaction to the aspects displayed, but does not make a sufficient brake application, resulting in the train passing the signal at danger by a short distance.

b) A train is stationary at a platform and the platform starting signal is at danger (or a safety-related movement authority is not available). At departure time, when station duties are complete, the train starts away against the signal at danger (or without a safety-related movement authority) and goes past it.

c) A train is stationary at a platform. The last signal which the train had passed before stopping was displaying a single yellow aspect. When station duties are complete, the train starts away from the station, but when the next signal comes into view it is at danger, but the train is travelling too fast to stop at it and subsequently goes past it.

d) The driver applies the brakes on the approach to the end of safety related movement authority but does not make sufficient brake application (for example, when running under a release speed) resulting in the train exceeding the end of safety related movement authority.

e) A train is proceeding under written authority from a signaller or other authorised staff in circumstances which are authorised in the Rule Book, and the driver does not make sufficient brake application to stop at the required end of safety related movement authority.

P.3.2 SPAD type A2

P.3.2.1 When a SPAD has occurred and, according to available evidence, the stop aspect, indication or end of in-cab signalled movement authority concerned was not displayed or given correctly but was preceded by the correct aspects or indications.

P.3.2.2 A type A2 SPAD is one where the train concerned goes past a signal which should have been regarded as a stop signal because it was either not showing, or not showing correctly. Under these circumstances the driver is required by the Rule Book to regard the signal as being at its most restrictive state, which in the case of a stop signal, is at danger.

P.3.2.3 This SPAD type includes (but is not limited to) these scenarios:

a) A train is proceeding under green aspects, then encounters a cautionary sequence of aspects indicating that the train is approaching a signal at danger. However, the train goes past the signal which the driver was expecting to be at danger, which is either displaying no aspect at all (a ‘blank’ or ‘black’ signal), partially obscured by foliage or missing (for example, it has fallen over).

b) A train is standing at a position light signal, displaying a red and a white light. The red light extinguishes, leaving only the white (pivot) light illuminated. The driver moves off and goes past the signal.

c) Where safety-related movements authorities are provided by an Automatic Train Control System (ATCS) or train protection system: A train is proceeding under
written authority from a signaller or other authorised staff in circumstances which are authorised in the Rule Book. However, the train goes past the end of the safety related movement authority because the lineside sign denoting the stop location is missing or obscured by foliage.

P.3.3 SPAD type A3

P.3.3.1 When a SPAD has occurred and, according to available evidence, verbal and / or visual permission to pass a signal at danger (or an end of safety-related movements authority provided by an Automatic Train Control System (ATCS) or train protection system) was given to the driver by a handsignaller or other person, in circumstances other than those which are authorised in the Rule Book.

P.3.3.2 A type A3 SPAD is one where the train concerned goes past a signal (or an end of safety-related movements authority provided by an ATCS or train protection system) which the driver believes that they have been given authority to pass. However, the driver should not have taken the ‘authority’, because it was given by someone other than in accordance with the Rule Book, taking into account the circumstances.

P.3.3.3 This SPAD type includes (but is not limited to) these scenarios:

a) An engineering train is stood at a signal at danger, waiting to be authorised into a T3 possession. The signal is the protecting signal for a T3 possession. The PICOP instructs the driver to pass the signal at danger and to proceed as far as the detonators. The driver does so, but without speaking to the signaller.

b) A train is stationary at a platform and the platform starting signal is at danger (or a safety related movement authority to proceed has not been provided). A member of platform staff tells the driver that there is a problem with the signalling and that the driver will have to go past it. The driver takes this as being authority to pass the signal at danger (or safety related movement authority).

c) A green handsignal is displayed at an automatic half barrier level crossing which is on local control, but the handsignal is seen by the driver, who takes this as being authority to pass the protecting signal at danger.

P.3.4 SPAD type A4

P.3.4.1 When a SPAD has occurred and, according to available evidence, a stop aspect, indication or end of in-cab signalled movement authority was displayed or given correctly and in sufficient time for the train to be stopped safely at it, but the train driver was unable to stop the train owing to circumstances beyond their control (for example, poor rail head adhesion, train braking equipment failure or malfunction etc).

P.3.4.2 The difference between a type A4 SPAD and all other SPADs, is that when a type A4 SPAD occurs, the driver is not considered responsible for the SPAD. In the examples below, responsibility lies with the train braking systems/maintenance; environmental conditions; and the shunter respectively.

P.3.4.3 A type A4 SPAD includes one where the train concerned is correctly signalled, under normal signalling aspects (or a safety related movement authority), which are correctly displayed. However, when the driver applies the brakes in the correct manner, the train does not react as expected, owing to a failure of equipment or adverse conditions, and the train passes the signal at danger (or end of safety related movement authority).
This type A4 SPAD includes the scenario whereby the braking system on a train does not function correctly, thus extending the distance which the train requires to stop, and a SPAD results.

In the situation of poor rail head adhesion, there can be doubt as to whether the train reacted as expected to the brake application. If the driver took sufficient action in view of the environmental conditions when braking (such as by braking earlier and more gently), but was still unable to stop, then this could constitute type A4 SPAD. However, it could be that the driver did adjust the braking technique because of the conditions, but not sufficiently to account for the extended stopping distance which would be required, then this could constitute type A1 SPAD. It is a matter for the investigation to establish whether the action taken, and the knowledge on which this was based, was commensurate with the conditions prevailing at the time.

SPAD type A4 also includes a SPAD where responsibility for the SPAD lies completely with another person. For example, a shunter authorises a train to make a propelling movement in a yard which is under the shunter’s control, but fails to set the points correctly, resulting in the rear of the train passing a signal at danger.

Capturing evidence for SPAD investigations

In addition to the evidence sources set out in Appendix H, a SPAD investigation also collects:

a) Data regarding any previous SPADs at the signal (or end of safety related movement authority) in question.

b) The report from any signal sighting committee (SSC) which looked at the signal in question, both in respect of previous SPADs and the one being investigated.

c) Completed 3119A, B, C or D forms, as appropriate. SPAD Data Collection forms may be downloaded from www.rssb.co.uk, which are in four different versions as follows:

i) RT3119A is for the use of the infrastructure manager, in respect of SPADs on conventionally-signalled lines.

ii) RT3119B is for the use of the railway undertaking, in respect of SPADs on conventionally-signalled lines. (The SPAD error categories are of particular use in ascertaining causes.)

iii) RT3119C is for the use of the infrastructure manager, in respect of SPADs on ERTMS-signalled lines.

iv) RT3119D is for the use of the railway undertaking, in respect of SPADs on ERTMS-signalled lines. (The SPAD error categories are of particular use in ascertaining causes.)

d) The output from the SPAD Risk Ranking Tool (SRRT).

e) The result of the signal overrun assessment (SORA).

f) Report from a SSC, where relevant.

g) Results of any SPAD-specific testing which was carried out by the train operator following the SPAD. This includes train braking system tests which are initiated by the train operator immediately following the SPAD, particularly if there are any allegations made against the train braking performance.
h) Results of any SPAD-specific testing which was carried out by the infrastructure manager following the SPAD. This includes railhead examination, signal examination and testing, signal sighting assessment etc, which are initiated by the infrastructure manager immediately following the SPAD.

i) Records of relevant previous SPADs and other adverse events at the same signal, taking into account any renumbering of the signal or any minor changes in signal position as a result of a re-signalling scheme.

j) For safety related movement authorities provided in an ATCS or train protection system, it may be necessary to review the information contained within the safety related movement authority information and the configuration of the onboard ATCS or train protection system, where relevant. The safety related movement authority information presented in-cab to the driver may also be reviewed if available.

P.5 The SPAD Risk Ranking Tool

Using the tool

P.5.1 The infrastructure manager completes the SPAD risk ranking process before the investigation team meets and provides the results to them for their consideration.

P.5.2 The SPAD Risk Ranking Tool (SRRT) is designed to quantify the risk from SPADs, and to act as an aid to assessing the changes in SPAD risk over time.

P.5.3 An investigation needs to draw on as much evidence as is available to conduct a meaningful investigation.

P.5.4 Whereas the SRRT is not designed to give an absolute measure of risk in respect of an individual SPAD, the outcome of the SRRT is one of the factors which is taken into account in the process to determine the lead organisation as well as the level of investigation to be undertaken.

P.5.5 Further details regarding the SRRT can be found in the SPAD Risk Ranking Methodology Handbook, which is available at www.rssb.co.uk, via the ‘Rail Risk Portal’.

Informing others of SPAD risk ranking results

P.5.6 The organisation which is best placed to input the SPAD risk ranking result into SMIS is the lead organisation.

P.5.7 RIS-8047-TOM Reporting of Safety Related Information contains requirements for reporting safety related information by means of the SMIS, so that reliable safety data is collected, analysed and made available for use by rail industry parties in the management of risk.

P.6 Signal Sighting Committees (SSCs)

Convening an SSC

P.6.1 An SSC examines, and considers the visibility of, signals, taking into account all of the factors which have a bearing upon the driver’s perception of the signal. It is normally
convened as part of the evidence gathering process when investigating alleged SPADs, to provide evidence in relation to the visibility of the signal.

P.6.2 The SSC report usually includes recommendations relating to the visibility of the signal. It is used to inform the investigation into an alleged SPAD.

P.6.3 The infrastructure manager decides whether to convene an SSC. If the infrastructure manager decides not to convene an SSC, then the infrastructure manager documents that decision, along with the reason, and submits it to the lead organisation for inclusion with the SPAD report. If no SSC is convened, then this needs to be recognised in the investigation report, along with the reasons for that decision.

P.6.4 An SSC is not normally convened if:

a) The signal had been commissioned within the preceding 12 months and the SSC report is comprehensive and is available to the investigator.

b) The train was wrongly authorised to pass the signal at danger after coming to a stand at the signal.

c) An SSC had been convened within the preceding 12 months, following a previous SPAD at the signal and the organisation which is in the lead for the SPAD investigation is satisfied that both of the following apply: the SSC report is comprehensive and is available to the investigator, and the factors relevant to the alleged SPAD were considered and no change has taken place to the signal or at its location, which could affect these factors.

P.6.5 RIS-0737-CCS Signal Sighting Assessment Requirements sets out the signal sighting assessment process that is used to confirm compatibility of lineside signalling system assets with train operations (signal sighting).

P.6.6 If an SSC report is available, then it is evaluated to establish its relevance and adequacy for the investigation, and whether a further SSC is required.

P.6.7 Where signal sighting is a factor in the SPAD, the investigation remit will specifically require the investigation team to consider the findings of the SSC as part of the evidence for the investigation process.

Remit for SSCs

P.6.8 The infrastructure manager sets the remit for the SSC after consulting the railway undertakings involved in the alleged SPAD.

P.6.9 The infrastructure manager includes, for consideration in the remit, all risk factors that could contribute to, or result from, a SPAD.

P.6.10 The remit for the SSC is the document which the chair of the SSC works to in carrying out their sighting of the signal.

P.6.11 Examples of factors that could contribute to, or result from, a SPAD, and are considered when setting the remit for an SSC are:

a) The previous record of SPADs and close call reports at that signal, and at other signals in the vicinity.

b) Reports from train drivers about the approach view. Local conditions, including vegetation and light sources.
c) The sighting of signals, lineside signs, indicators and other features preceding the signal (or end of safety related movement authority) under investigation.

d) Signal spacing on the approach to the signal. Aspect sequences on approach to, and beyond, the signal.

e) Gradients.

f) Distances from which the signals become readable.

g) Stopping position of trains (in regard to starting against red or yellow aspects at platforms or in relation to the end of safety related movement authority.

h) Train dispatch methodology.

P.6.12 An SSC will benefit from having background information as to the SPAD, so that the SCC can consider the specific issues appertaining related to the SPAD itself.

P.6.13 It has become standard practice to undertake a detailed examination of all cautionary signals in the sequence leading to the signal at red, as well as the SPAD signal itself. Since it is important to understand the driver’s perspective of events, this means that the normal boundary of the committee’s investigation is the point at which the outermost cautionary aspect became visible. From this point onwards, all significant features of the infrastructure, as well as any significant features outside the infrastructure manager’s boundary that could have had a material effect on the driver’s actions, are examined.

Report of SSC

P.6.14 The lead investigator for a SPAD investigation includes the conclusions from the SSC report within the SPAD investigation report.

P.6.15 The report from the SSC (if one has been convened) forms a material part of the evidence for the investigation report and is used during the investigation process.

P.6.16 If the investigation report were to be concluded without considering the SSC report, then vital evidence could be overlooked, subsequently leading to ineffective or incorrect recommendations.

P.6.17 If the SSC has made any recommendations in relation to the visibility of the signal concerned, then these are likely to be relevant to the SPAD event being investigated, and thus add value to the identification of underlying causes and to the robustness of the investigation report.

P.6.18 The SPAD investigation team can include the recommendations from the SSC report in the SPAD investigation report, so that they are recorded for consideration by the transport operator(s) concerned.

P.6.19 If an SSC report has been completed as part of the investigation into a SPAD related adverse event, the SSC report is included as an appendix to the investigation report.

P.7 Applying proportionality to SPAD investigations

P.7.1 Depending on the complexity of the alleged SPAD being investigated, the length and depth of the investigation and the report is proportionate to the circumstances. This is the same as in any investigation, where the principles of proportionality in Appendix N are applied.
P.7.2 A railway undertaking normally leads the investigation into an alleged SPAD where:

a) The SPAD led to a collision or derailment (Part 2 of the SPAD risk ranking; SPAD accident vulnerability ranking A – accident occurred).

b) The SPAD did not lead to a collision or derailment, and: Part 2 of the SPAD risk ranking (accident vulnerability ranking) is B to G inclusive, or Part 3 of the SPAD risk ranking is greater than or equal to 18.

c) It is clear from early evidence that infrastructure may be a causal factor.

d) The signal is defined as a multi-SPAD signal or will be so defined because of the SPAD concerned.

e) The driver disputes that a SPAD has occurred, unless there is irrefutable evidence (such as SSI data, OTMR etc) which shows a SPAD did occur.

P.7.3 A local investigation is normally carried out by the railway undertaking into any other alleged SPAD.

P.7.4 The railway undertaking may decide, in the case of a low risk SPAD where the circumstances and causes can be easily determined, that the report will consist of little more than the completed provisional SPAD data collection forms, with suitable narrative added to record causation details and any recommendations.

P.7.5 If the causes and circumstances of a SPAD are so clear as to indicate a degree of certainty of cause and effect, then the duty holders concerned may decide, as part of their initial joint review (sometimes referred to as ‘table top meeting’), that a reduced and more proportionate type of investigation be held. In this case the parties concerned can justify and document their decision in a risk-based approach.

P.8 Consideration of multiple SPADs and consecutive SPADs

P.8.1 When considering the designation of an incidence of a train or movement which proceeded past more than one signal at danger, the infrastructure manager and railway undertaking involved decide whether to treat the event as one SPAD, or as multiple SPADs.

P.8.2 Depending upon the circumstances, some SPADs involving a movement which passes more than one signal are more logically treated as one SPAD, and some are more logically treated as individual SPADs. In the circumstances set out below, it is logical for the event to be treated as two separate SPADs:

a) A train passes a signal at danger, and subsequently passes the next signal, which is also at danger within the same movement. This can occur when a driver had not attempted to stop at the first signal (for example, in the belief that it was showing a proceed aspect), or had started from rest before passing it, and then attempted to stop at the second signal, but passed it at danger. The reason is that the driver failed to respond to the first stop aspect, and then made no response, or a late response, to the following stop aspect. In this situation the driver was unaware of the initial error, and no recovery was attempted.

b) A train passes a signal at danger, and then continues past one or more signals displaying proceed aspect or indication, subsequently passing another signal at danger. This can occur when a driver had not attempted to stop at the first signal (for example, in the belief that it was showing a proceed aspect), or had started...
from rest before passing it, and then attempted to stop at the next danger signal, but had passed it at danger.

c) A train passes a signal at danger, and then stops before making a movement in the opposite direction, passing another signal at danger. This can occur when the train made two separate movements, with two separate SPADs.

P.8.3 In the circumstances listed below, it is logical for the event to be treated as one SPAD:

a) A train passes a signal at danger, and there is another signal at danger within the distance which it takes the train to stop, and that signal is also passed at danger within the same movement. This can occur if a driver had attempted to stop at the first signal, but was unable to do so (for example, because of excessive speed, or compromised stopping distance) and went past the second signal as a consequence. This is treated as one SPAD at the first signal. The reason is that, following a late response to a signal showing a stop aspect or indication, the driver has attempted to recover from that error, but has been unable to stop the train before passing the second signal.

b) A train passes a signal at danger, and then goes past one or more signals displaying proceed and continues forward normally. This can occur if a driver had not attempted to stop at the first signal (for example, in the belief that it was showing a proceed aspect), or had started from rest before passing it. This is treated as one SPAD at the first signal. The reason is that, apart from the fact that no other signal was passed at danger, once the train had gone past a stop signal showing a proceed aspect, it then came under the protection of fixed signals. Its movement was then protected by the normal signalling system.

P.9 Dissemination of the results of a SPAD investigation

P.9.1 The lead organisation communicates the conclusions of each SPAD investigation and recommendations to:

a) The parties whose employees or contractors were involved in the SPAD.

b) All railway undertakings using the route on which the signal concerned is located or where the in-cab signalled movement authority was exceeded.

c) Other railway undertakings using the rolling stock and/or in-cab signalling equipment involved in the SPAD.

d) The infrastructure manager.

P.9.2 In the case of a formal SPAD investigation, the lead organisation provides a written report of the investigation to all transport operators, other railway industry parties involved in the SPAD, and to RSSB.

P.9.3 Transport operators achieve this by using SMIS as specified in RIS-8047-TOM Reporting of Safety Related Information.

P.9.4 Transport operators may wish to consider, as a minimum:

a) Briefing signallers and train drivers about signals on routes over which they control or operate that have been the subject of more than one SPAD during the past five years.

b) Amending, if appropriate, local instructions or other operational processes.
Definitions

Accident  An unwanted or unintended sudden event or a specific chain of such events which have harmful consequences; accidents are divided into the following categories: collisions, derailments, level-crossing accidents, accidents to persons caused by rolling stock in motion, fires and others. *Source: Railway Safety Directive*

Adverse event  An all-encompassing term which includes Accident, Incident, Near Miss and Close Call.

ATP  Automatic Train Protection.

AWS  Automatic Warning System.

BTP  British Transport Police.

CDP  Competence Development Plan.

Close call  An incident involving a person(s) which does not cause injury or damage, but has the potential to do so.

ERTMS  European Rail Traffic Management System.

Formal investigation  A formally structured investigation of an accident or incident, led by an infrastructure manager, railway undertaking or a person independent of all the parties involved in the accident or incident, applying processes in this document.

IECC  Integrated Electronic Control Centre

Immediate cause(s)  An unsafe act or unsafe condition which causes an accident or incident.

Incident  An ‘incident’ means any occurrence, other than accident or serious accident, associated with the operation of trains and affecting the safety of operation. *Source: CSM RA*

Infrastructure Manager  Infrastructure manager, as defined in the Railways and Other Guided Systems Regulations 2006, means an organisation who: a) In relation to infrastructure other than a station, is responsible for developing and maintaining that infrastructure; b) in relation to a station, the organisation who is responsible for managing and operating that station, except that it shall not include any organisation solely on the basis that they carry out the construction of that infrastructure or station or its maintenance, repair or alteration; c) manages and uses that infrastructure or station, or permits it to be used, for the operation of a vehicle.

Investigation  A process conducted for the purpose of accident and incident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and, when appropriate, the making of recommendations.
Lead organisation

The railway undertaking or infrastructure manager responsible for managing the processes of local or formal investigations defined in this document and identified by applying criteria in this document.

Learning from Operational Experience

The process by which knowledge from the operation of systems is gained, exchanged and used, leading to continuous improvement and the development of a positive safety culture.

Local investigation

An investigation of an accident or incident, for which a formal investigation is not required, by an infrastructure manager or a railway undertaking, using its defined company procedures and requirements in respect of remit and results defined in this document.

Near miss

An incident involving a train(s) which does not cause injury or damage, but has the potential to do so.

NEBOSH

National Examination Board in Occupational Safety and Health.

ODDRS

On Board Driving Data Recording Systems.

ORR

Office of Rail and Road.

RAIB

Rail Accident Investigation Branch.

Railway Undertaking (RU)

Any private or public undertaking the principal business of which is to provide rail transport services for goods and/or passengers, with a requirement that the undertaking must ensure traction; this also includes undertakings which provide traction only. Source: Article 3 (a) of Directive 2004/49/EC.

RETB

Radio Electronic Token Block.

Safety authority

The national body entrusted with the tasks regarding railway safety in accordance with Directive 2004/49/EC (the Railway Safety Directive). In Great Britain the safety authority is the Office of Rail and Road (ORR).

Safety Management Intelligence System (SMIS)

Safety Management Intelligence System is a system for supporting rail industry parties in carrying out their responsibilities for health, safety and environment management.

Signal passed at danger (SPAD)

Signal passed at danger means any occasion when any part of a train proceeds beyond its authorised movement to an unauthorised movement; ‘unauthorised movement’ means to pass:

a) A trackside colour light signal or semaphore at danger, order to STOP, where an Automatic Train Control System (ATCS) or train protection system is not operational;

b) The end of a safety related movement authority provided in an ATCS or train protection system;

c) A point communicated by verbal or written authorisation laid down in regulations; or
d) Stop boards (buffer stops are not included) or hand signals,
   But excludes cases in which -
e) Vehicles without any traction unit attached or a train that is unattended run away past a signal at danger; or
f) For any reason, the signal is not turned to danger in time to allow the driver to stop the train before the signal.

SORA  Signal Overrun Risk Assessment.
SRRT  SPAD Risk Ranking Tool.
SSC   Signal Sighting Committee.
SSI   Solid State Interlocking.
TOPS  Total Operations Processing System.
TPWS  Train Protection and Warning System.
Train A train is defined as (a) traction unit(s) with or without coupled railway vehicles, including light locomotive and self-propelled rail vehicle operating in rail mode, with train data available operating between two or more defined points.

Transport operator Any railway undertaking or infrastructure manager.
TRUST Train Running Under System TOPS.
Underlying cause(s) Any factors which led to the immediate causes of accidents or incidents, or which resulted in such causes not being identified and mitigated.
References

The Standards catalogue gives the current issue number and status of documents published by RSSB: http://www.rssb.co.uk/railway-group-standards.co.uk.

RGSC 01 Railway Group Standards Code
RGSC 02 Standards Manual

Documents referenced in the text

Railway Group Standards

GERT8000 The Rule Book

RSSB Documents

RIS-0737-CCS Rail Industry Standard for Signal Sighting Assessment Requirements
RIS-3118-TOM Incident Response Planning & Management
RIS-3350-TOM Communication of Urgent Operating Advice
RIS-8047-TOM Reporting of Safety Related Information
RIS-8250-RST Reporting High Risk Defects
RSSB (2016) Taking Safe Decisions
RSSB (2016) Supporting a fair culture - creating appropriate plans after incidents (T1068)

Other References

CIRAS Confidential Incident Reporting & Analysis Service Ltd
Common Safety Method for Risk Evaluation and Assessment (CSM RA) The CSM RA is a framework that describes part of the common mandatory European risk management process for the rail industry
Department of Transport Investigation into the Clapham Junction Railway Accident. A Hidden QC (1989)
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Railways and Transport Safety Act 2003
The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (CDG)
The General Data Protection Regulation (GDPR)
The Railway and Other Guided Transport Systems (Safety Regulations) 2006
The Railways (Accident Investigation and Reporting) Regulations 2005
The Safety Representatives and Safety Committees Regulations 1977

Other relevant documents
RSSB Documents
RSSB (2016) Risk based training needs analysis toolkit