

RIAAAT

Recording, Investigation &
Analysis of Accidents

User's Manual

Authorship

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Revision 1.1 (EN): this revision includes the formal definitions of human error and error types.

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Foreword

The investigation of occupational accidents has long been a matter of discussion, mainly among the specialists, but its translation into field practice has only registered real growth on the turn of the new millennium, essentially as a natural consequence of the H&S (Health & Safety) emerging management systems. In Europe, the many H&S Directives have also played a central role in this field by bringing about new requirements and creating new needs. This trend has boosted the development of new methods and tools designed to serve the goal of safety improvement.

The RIAAT¹ process (Recording, Investigation and Analysis of Accidents) intends to promote good practice on matters concerning accidents at work. This tool, which combines a structured methodology with a form-style protocol, is among the key outputs of a research project called *CAPTAR - learn to prevent*. The main objective of the project, as a whole, is to increase the efficiency of how accident information is obtained, treated, and then used to improve safety. It departs from the assumption that the processing of information progresses up in the hierarchy through a cycle of different activities, such as: the initial gathering of accident data, its coding and interpretation (sometimes using pre-defined classification systems), the investigation of causes and underlying factors, and, finally, the way in which the information is used to learn and to develop prevention strategies.

The novelty about RIAAT is that it was designed as a “complete process” that covers the full cycle of accident information; i.e., it flows from the accident/ incident itself, to the final stage of sharing information and learning from the relevant facts.

Purpose of this document

This is a working document that explains the RIAAT process and gives step-by-step guidance on how to use the associated working protocol (form). This is a **user’s manual** for all persons who need to report and investigate accidents at work (e.g.: production supervisors, first-line managers, safety representatives, safety advisors, or the owners/managers of small enterprises).

Structure

This manual starts by introducing the spirit and objectives of the RIAAT process. It then takes the potential user through a guided tour into the details of the protocol (form) associated with this process.

¹ RIAAT: in Portuguese, the last letters (AT) stand for “Acidentes de Trabalho” (Accidents at Work), hence the “T” in the acronym.

RIAAT

Recording, Investigation & Analysis of Accidents

1. Introduction

This is a guidance document for people interested in applying the RIAAT process. The term “process” is used instead of “method” to draw attention that this is more than a method, although a structured methodology is embedded in this process.

The broad definition of any process *implies a set of activities, which transform certain input elements into an output with recognisable “added value”*. In this case the input is the accident (accidental events) and the expected output (goal) is the continuous improvement of safety. The “process” itself engages a cycle of activities: the **recording** of data in a specific format, the **investigation** of the pertinent facts and circumstances, the **analysis** of causes and their interpretation, the setting up of a **plan of action**, and, finally, the identification of the key people with whom to share key information to ensure **organisational learning**. This successive processing of information adds value to the organisation’s level of safety.

To keep the process uncomplicated, a practical *instrument* was developed: the RIAAT form-style protocol, which is explained next in this manual. By filling in this form, the analyst is also applying a specific methodology that is embedded in it, making the whole thing easy to follow.

2. Briefing on the Process

The spirit of RIAAT is to make sure that investigators are able to accomplish the goal (i.e., **extract, retain and share** the relevant lessons) in a time- and cost-effective manner. The novel aspects of this approach are: 1) it covers the full cycle of accident information, from the recording to the learning loop, and 2) the instrument proposed is both a form and a method. Furthermore, the form is built in such a manner that it enables its future conversion into a software tool, incorporating an electronic database. Such conversion, however, will only take place after a period of testing and maturity.

The whole process, just as the associated form, is structured into 4 sequential parts (Fig.1). In certain (rather simple) accidents, this process can be simplified to save time. The details are explained in Section 4 of this manual.

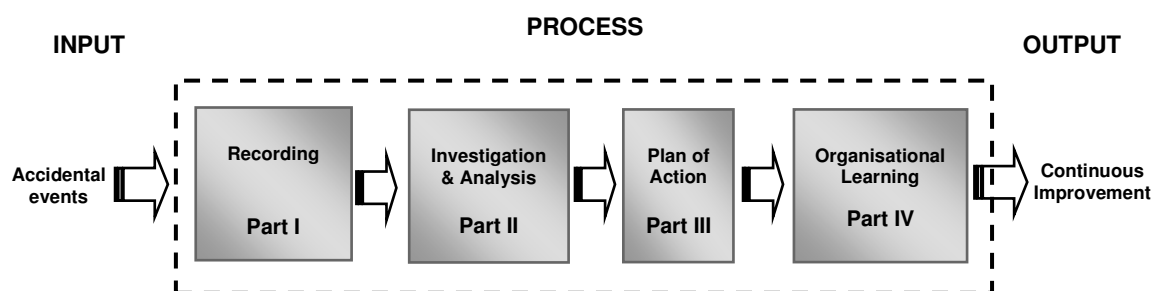


Fig. 1- Illustration of the RIAAT process

3. The accident model behind the methodology

Clarity of ideas promotes quality. So, it is worthy making a clear distinction between a **method** (practical tool, designed to help someone performing a task) and an **accident model** (a theory for explaining the mechanism of an accident).

The methodology embedded in the RIAAT process is rooted in two well-know models of accident causation. **Part I**, for instance, integrates the Eurostat (2001) methodology, which, in turn, borrows much from the “deviation” principle, made popular in the 1980s (e.g.: Kjellén, 1984a,b; 1998).

Part II, on the other hand, deals with causation analysis and is explicitly based on the model of "organisational accidents", proposed by Reason (1997). Reason's model outlines three main levels of concern: the organisation and its management, the workplace and the person (or team). These are the three layers where one should search for causes and their underlying factors, and, reversibly, for improvement opportunities.

Another very important feature in Reason's theory is the distinction between "active failures" and "latent failures" (or latent conditions): both are sub-dimensions of causality, but they occur at different levels and circumstances. In short, it can be said that **active failures** are all those that played an active part in the accidental chain of events. They 'made the difference' and provoked the accident. Generally speaking, they correspond to the immediate causes of an accident. Examples are, for instance: an erroneous action of a worker, such as pushing the wrong button or using a wrong tool, a machine that jammed and went out of control, a defective tool, or the leak of a dangerous chemical. These are generally easy to identify and are observable events. These should be recorded in the field "Full Accident Description" (Part I).

In contrast, **latent failures** (or conditions) are more difficult to find as they correspond to weaknesses hidden in the organisation. They are not likely to provoke accidents by themselves; instead, their manifestations - or malign effects - only become visible when combined with the active failures. Examples are, for instance: poor maintenance practices, inefficient management of contractors, inadequate training policies/decisions, or poor design of plant or equipment.

In the adapted model underlying the RIAAT process there is another (external) level where to search for non-conformities, which is the H&S Law (Fig.2). The philosophy behind this representation can be summarised as follows:

- a) People's **unsafe acts and behaviours** can cause an accident; indeed, frequently these are the most immediate causes. Therefore it is necessary to search for this type of occurrences, and analyse the reasons behind them, with the purpose of devising the appropriate prevention strategies.
- b) On the other hand, the characteristics of the **local workplace** can influence people's behaviour (negatively or positively). This is also an important element where to look for the hazards and hazardous conditions pertinent to the accident. It is likely that a number of failures will be identified in this level; and so will be the associated corrective and improvement actions.

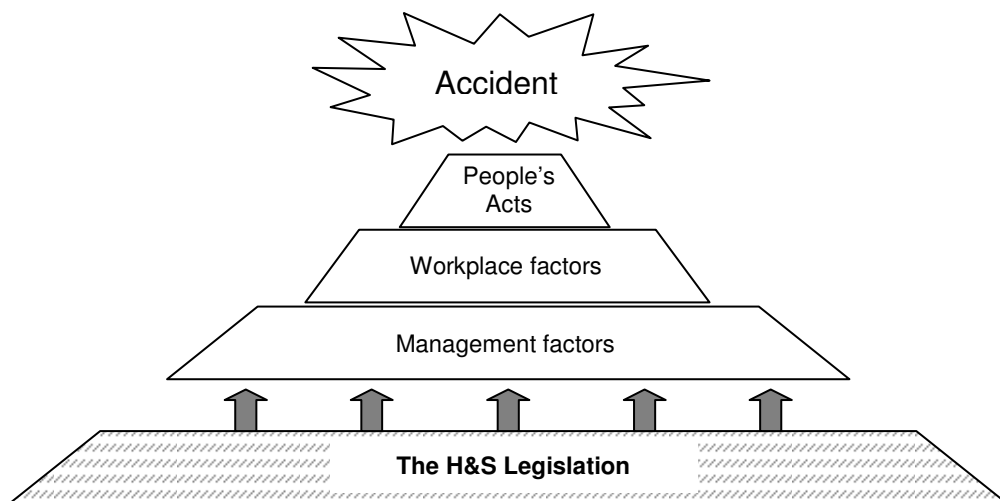


Fig. 2- the accident's model underlying the analysis in Part II (adapted from Reason, 1997)

c) Within the organisation boundaries, the **management's control and policy** are key safety issues. The management's priorities, budgeting and policies have an impact on the workplace and the working conditions. Searching for organisational conditions (i.e., weaknesses) is fundamental to improve matters.

d) Finally, the **H&S legislation** is also an important part of the investigation process. Complying with legal requirements is the first responsibility of any management; even though this is a (poor) minimalist strategy for dealing with safety, it constitutes the first preventive step in any organisation;

as such, identifying possible legal breaches should be part of a good investigation. On the other hand, the external bodies involved in Law enforcement and Law making (e.g.: inspectors and regulators), should also be aware of legal constraints that seem to be more of a problem than help. Sometimes, legal weaknesses (or incongruence) are identified in the aftermath of an accident and/or a dangerous occurrence.

The hierarchical search throughout the above levels will dictate the Plan of Action in **Part III**.

Other theoretical foundations have been included in this tool, namely the principles of the “learning organisation” (e.g.: Reason, 1997; Turner and Pidgeon, 1997; Kjellén, 2000; Koorneeff, 2000), which are particularly useful in **Part IV** of the procedure.

Finally, RIAAT has also incorporated ideas from a number of other (alternative) methods and their subsequent re-editions, such as: Investigating Accidents & Incidents (HSE, 2004), 3CA (NRI-3; Kingston, 2002- 2007) and WAIT (Jacinto, 2003- 2009). From WAIT, in particular, it has imported a set of classification schemes, which have now been updated and improved.

4. Step-by-Step guidance on the process’ protocol (form)

As already mentioned, the main instrument supporting the RIAAT process consists of a standard form (*c.f.* Appendix 6.4), in which the methodology is inserted. The form is structured into 4 parts, each of each designed for a specific purpose within the process illustrated in Fig.1.

4.1 PART I - Recording (Sections 1- 3)

This is a plain record of the accident, stating the basic facts and circumstances. The form is self-explanatory and all you need to do is filling in the applicable fields (1-3). It is in Part I that you will record all the "active failures" identified, in order to later investigate the factors that have contributed to them.

To facilitate linkage to the “official” notification report, this part of the form is aligned with the Eurostat methodology and the fields marked with E are harmonised variables of the European system. If you decide to code the information, simply refer to the Eurostat (2001)¹ classification. The advantage of coding information in this way is that you will be able to compare your (internal) accident statistics with others; it may be a useful instrument for benchmarking.

Additionally, Part I enables compliance with legal requirements (*c.f.* last page of the Form).

4.2 PART II - Investigation & Analysis (Sections 5- 8)

This is a very important step of the process. It intends to help you find and register the relevant causes and the underlying factors contributing to them. These include both types of failures: the active failures, which have triggered the accident, and also those that have facilitated its occurrence (latent failures or conditions).The theoretical “model” behind the analysis framework has already been explained (Fig.2).

Preliminary arrangements - before filling in Part II, you should start by **interviewing** the relevant people: the victim, any witnesses and the victim’s supervisor. In case of significant trauma (physical or psychological), it is recommended that the interview with the victim does NOT take place in the day of the accident. The interview guidance in Appendix 6.2 is provided to assist in this task. These interviews, *per se*, will give you valuable information and also a basis for deciding the appropriate level of investigation.

Investigating takes time and costs money. The amount of effort for doing it should be decided on a cost-oriented way, as only certain events (accidents or dangerous occurrences) offer real ground for learning. The RIAAT process proposes three levels of investigation: Basic, Medium and In-Depth. Each organisation should have pre-defined criteria for establishing the level of investigation, but you may also follow the “decision-tree” provided in Figure 3.

¹ Suggestion: after familiarisation with the ESAW methodology (Eurostat, 2001), and to facilitate your coding task, you can print the classification schemes of the variables included in the Form and attach them to this manual.

If you decide that this particular event deserves an **in-depth** analysis,

consider setting up a small **team** to benefit from different opinions and other points of view. In this case, you should follow all the steps in the RIAAT process, including the multi-causality analysis proposed in sections 5-8 of the Form. Otherwise, you may simply adjust Part II to your needs and then proceed to Part III.

Part II integrates an analysis framework subdivided into 4 main sections (5-8). In each one, you are requested to analyse a particular cluster of factors ("layer") and to establish what barriers / safety measures would have been helpful to avoid the problem, or at least to mitigate the harm. This first round search for barriers will be useful soon after, to decide the Plan of Action.

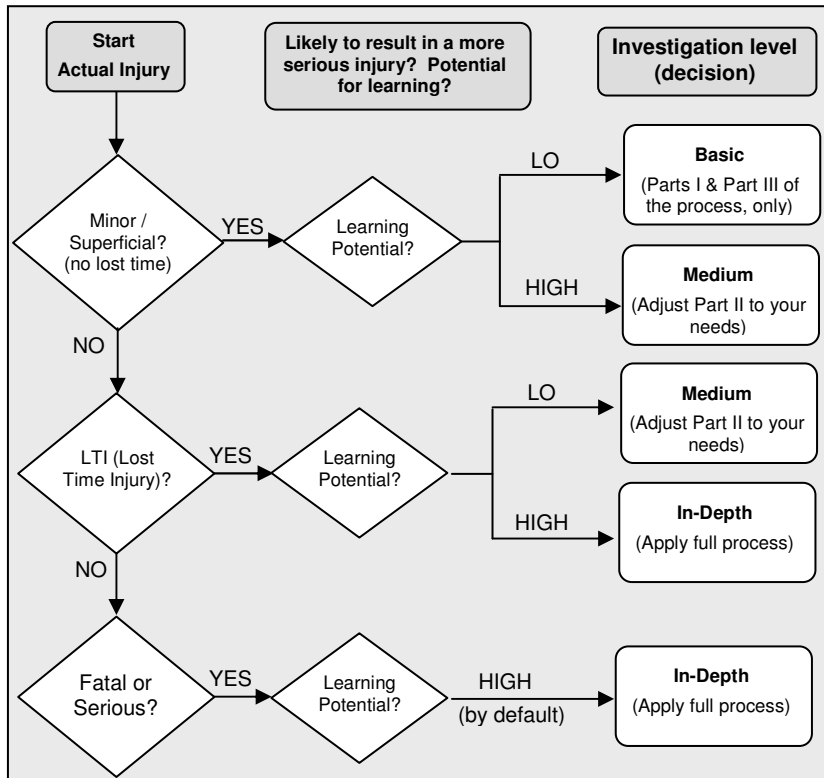


Fig. 3- Decision tree for the level of investigation

Section 5	People - Human Failures
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Objective: to find out and analyse any human (erroneous) actions that have caused or have contributed to the accident.

Brief description: human actions are among the most frequent causes of accidents and dangerous occurrences. In this step the investigator should identify human failures with the aim of devising appropriate prevention barriers. The classification scheme presented in Figure 4 is adopted from Reason's (1990 and 1997) work and it helps you to make the distinction between Errors and Violations (c.f. Appendix 6.1 for definitions).

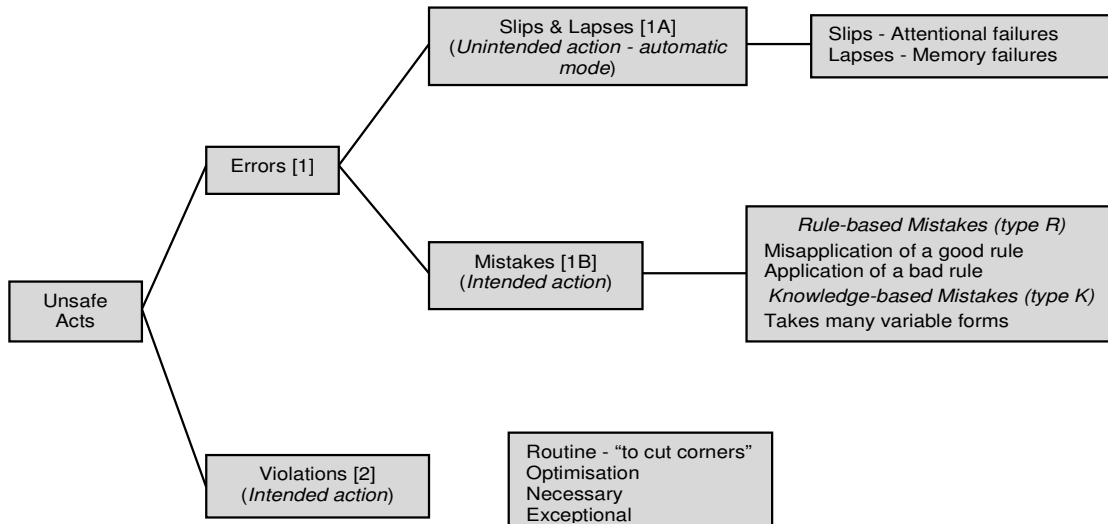


Fig.4 – Human Error Types/ taxonomy (adapted from Reason, 1990, p.207)

This distinction is important, since the prevention strategies might be quite different. A violation implies that the person has consciously infringed an established safety rule, although there was no intention to cause harm, i.e., it is a non-malevolent act. The Error types, on the other hand, may be categorised into Slips & Lapses and Mistakes; the first are unintended actions, usually performed in an “automatic” mode, whereas the second are intended actions that failed to achieve their goal. In the later case, increasing the person’s knowledge of his/her job and safety precautions is likely to be a good measure to prevent recurrence. In contrast, more knowledge may not help in the prevention of “automatic” / unintended actions, for which a physical barrier or an alarm may be more efficient.

In the RIAAT Form you should write down a brief description of what happened and then tick the appropriate code to register whether it was a violation or an error (and which basic type of error). These codes are mutually exclusive, i.e., only one is applicable.

Individual Contributing Factors (ICS) can either trigger or influence human errors and behaviours; Appendix 6.3 (Table 1) gives you a list of possibilities. If you find evidence that any of these apply, you can register the relevant items in section 5.2 of the Form.

Finally, section 5.3 invites you to think about prevention; i.e., to identify the appropriate safety barriers that would help preventing the failures; these can be physical, organisational (non-physical) or combined barriers. Avoid fuzzy and generic suggestions; be specific. If you are unsure, write the idea with a question mark (?).

Associated Classifications: see Appendix 6.3 (Table 1).

Section 6	Work Place Factors (WPF)
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Objective: to identify what factors within the workplace have given, directly or indirectly, a negative contribution to the event being analysed.

Brief description: identifying the workplace factors associated with the accidental failures is a way of describing the specific context in which the failures occurred. This provides a way of capturing the essential aspects of the situation and the conditions of work, particularly those that call for improvement. To this purpose, RIAAT provides a list of Work Place Factors (WPF) that is subdivided into several classes in which to search for possible contributors.

Once you have established which factors are relevant in this event, section 6.2 of the Form directs you to set up prevention by deciding what barriers could have prevented / controlled the problems found. Avoid fuzzy and broad suggestions; be specific. Use a question mark (?) if you are unsure about a specific item. You can always come back to it and discuss with others.

Associated Classifications: see Appendix 6.3 (Table 2).

Section 7	Organisational & Management Factors (OMF)
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Objective: to find out organisational and management factors (or weaknesses) that may have facilitated the previous accidental events and the unsatisfactory working conditions.

Brief description: in this step you are asked to scrutinise a set of management functions that have implications on safety. The classification list provided is subdivided into five main clusters and these should help you to find out where the main pitfalls are, at the management level.

Once again, after finding the pertinent weak points, you are requested to give specific ideas on what corrective actions are needed to improve the management of safety; register your proposals in section 7.2 of the Form.

Be specific on your suggestions, but remember that top management changes may need more discussion before being decided. Restrain from big changes based on one single accident; significant changes should take place at a latter stage, after appropriate consideration.

Additionally, if your organisation has already implemented a formal H&S Management System, the proposals need to be translated into the system. The Management Review meeting is probably the best opportunity to decide what adjustments need to be done.

Associated Classifications: see Appendix 6.3 (Table 3).

Section 8	Legal Factors - H&S Legislation
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Objective: to acknowledge legal breaches that may have come into light during the investigation of this occurrence. To make sure that legal requirements are complied with.

Brief description: the ultimate function of the H&S Law is to encourage managers to prevent, control or attenuate the outcome of undesirable events, i.e., regulations are intended to reduce risk. This step urges you to verify whether any of the failures /problems identified so far can be considered as a legal breach or omission. If so, use this section of the Form to list the applicable documents for further attention and correction. The old excuse “didn’t know” is not at all acceptable and you must make sure that the legal framework is adequately implemented by your organisation.

Associated Classifications: Not applicable. Use the legal references.

4.3 PART III - Plan of Action (Sections 10-11)

This part of the process is about making it right and it consists of two main steps whose titles are already self-explanatory.

Section 10	Verify your Risk Assessment
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Objective: to ensure that all applicable Risk Assessments (RA) are complete and/or are reviewed in the light of this particular accident.

Brief description: assessing the risks in the workplace is a legal duty. As a general rule, the level of detail in a risk assessment (RA) should be broadly proportional to the risk; the spirit of the law is that employers must take precautions as far as reasonably practicable to maintain safe workplaces. Furthermore, organisations have to keep records of their risk assessments.

In this step you are encouraged to verify whether the hazards, human (unsafe) actions, etc., involved in this particular occurrence had actually been considered in the applicable risk assessment(s). If RA exists ask why it failed to prevent this particular case. Establish if the RA is still good enough, or if it needs improvement /revision. This exercise may reveal that, although a risk assessment was actually carried out, it was not good enough and failed to identify all possible hazards and associated risks, or even that the risks were not adequately ranked. In such cases, corrections must be done, and the assessments must be revised.

If revision is recommended enter this in next section 11.

Section 11	Plan of Action
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Objective: to establish an adequate plan of action based on the principle “as far as reasonably practicable”. You can also consider the HSE (2004) hint of a SMART plan of action (i.e., Specific, Measurable, Agreed, Realistic and Time-scaled).

Brief description: this section addresses the specific actions to be taken to prevent or control the problems /faults identified. To establish the final plan start by compiling and reworking all the suggestions given previously in sections 5 to 8. If some of them were marked as “unsure” (?), this is a good moment to discuss it further with other competent people (e.g.: safety representatives, safety specialists, managers, suppliers, etc.). As far as possible, decide the priorities based on effectiveness criteria and some kind of cost-benefit analysis.

Sections 12 and 13 are reserved for signatures of both the proponent and the verifier.

4.4 PART IV - Learning (Sections 14-15)

These two last steps deal with organisational learning, which keeps feeding the “loop” of safety improvement.

Section 14	Lesson(s) Learnt / Discussion
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Objective: to make sure that the important lessons are extracted and knowledge is used.

Brief description: the real “added value” of any investigation process is to uphold safety learning across the whole organisation. However, not all occurrences offer the same opportunity. In this section, the RIAAT Form prompts you to answer these key questions:

1)- Was any relevant lesson learnt from this particular case? If so, what and who did learn? This is better answered after a group discussion. Try to be concise and objective: pinpoint the vital aspects of the “problem – solution”.

2)- Is this case eligible for future training purposes? Keep in mind that people tend to respond better to real situations, which are close to them, rather than hypothetical simulations.

Section 15	Dissemination / Diffusion
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Objective: to make sure that the important lessons are shared with targeted people.

Brief description: dissemination of information is the necessary next step. By default, information on all accidents should be disseminated internally, but the extent of this will depend on the case. Overloading people with information may be counterproductive, as they will stop paying attention. In this section of the Form you are encouraged to identify the main “targets” with whom to share information, especially “the solutions”. Depending on the situation, the targeted people can be a number of specific individuals (e.g.: workers, supervisors or managers), a professional group, or even a number of external partners. Once you have established whom, it is time to decide how, i.e., what is the best communication means.

Finally, please note: this is not the END of anything. If your organisation truly intends to achieve *continuous improvement* (the process output), then any progress must be monitored and the looping must continue.

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6. Appendices

6.1 Glossary of terms and acronyms

Acronyms

ICF – Individual Contributing Factors

WPF – Work Place Factors

OMF – Organisational and Management Factors

Terms used and definitions

Accident at work ^(E) – **or occupational accident** – a discrete occurrence in the course of work which leads to physical or mental harm. This includes cases of acute poisoning and wilful acts of other persons, but excludes deliberate self-inflicted injuries and accidents on the way to and from work (the latter are called commuting accidents). Note: this is the Eurostat harmonised definition, and it *implies the existence of a victim*.

Incident ^(O) – this is a generic term to describe any work-related event in which an injury or ill-health or fatality occurred, or could have occurred. An incident where the harmful consequences are not actually present may also be referred to as a “near-miss” or a “dangerous occurrence”.

Deviation ^(E) – the last deviant event from normal, which leads to the accident. This is the description of what occurred in an abnormal way. It is a deviation from the normal way of working, from the normal process. The Deviation is the event leading to the accident – the closest deviation, in time, to the contact. The Deviation needs to be associated (linked) with a Material Agent (example: breakage of material + rope). Note: this is the harmonised definition, for use in official notification forms.

Contact – Mode of injury ^(E) – only applies to victim(s) – the contact that injured the victim(s). It describes how the victim was hurt (physical or psychological contact) by the Material Agent that caused the injury. If there are several Contacts – Modes of injury, the one causing the most serious injury must be recorded. The Contact needs to be associated (linked) with a Material Agent (example: struck by + a vehicle). Note: this is the harmonised definition, for use in official notification forms. “Contact” corresponds to the “accident” itself.

Human Error ^(R)

According to Reason, “human error occurs when a sequence of planned actions fails to achieve its intentional result, either because the actions did not go as planned or because the plan (mental plan) was inadequate”.

Error Types ^(R)

The error types can be classified into the following levels of “cognitive performance”:

Slips and Lapses ^(R) – Unintended actions. Slips refer to attentional or perceptual failures in observable actions, while lapses are internal mental events, generally involving memory failures.

Rule-based mistakes (*R type*) – Intended actions. These errors are “mistakes” associated with behaviors that require application of rules or procedures. A typical question to make to characterize performance at this level is whether the procedure or rule exists.

Knowledge-based mistakes (*K type*) – These errors are “mistakes” at the level of individual knowledge; they occur when a worker faces new situations, for which he has no rules or applicable knowledge. These are linked, for instance, with difficult diagnosis.

^(E) European ESAW nomenclature (Eurostat, 2001)

^(O) OHSAS 18001:2007

^(R) James Reason definitions (Reason, 1990; 1997)

Violations ^(R)

Deliberate Violations – violations, in general, are deviations from safe operating procedures, standards, or rules. *Deliberate violations are intended*; these are *non-malevolent* acts, which must be distinguished from sabotage (in which, both the act and the damaging outcome are intended). Reason's (1990) classification considers three major categories of deliberate violations. These are:

Routine violations – typically involve corner-cutting, taking the path of least effort between two task-related points. These short-cuts can become a *habitual* part of a person's behaviour, particularly when the work environment is one that rarely sanctions violations and rewards compliance. Routine violations are frequently promoted by "clumsy" or too restricted working procedures, which direct actions towards what seems to be a longer-than-necessary pathway. A typical example is the deactivation of a machine guard (defence), because it makes a task slightly easier or quicker to perform.

Optimising violations – also called violations for the "thrill of it". These reflect the fact that human actions serve a variety of motivations and that some of these are not in any way related to the functional/task aspects. An example is a driver whose functional goal is to get from A to B, but in the process he/she can optimise "the joy of speed", or indulge in aggressive instincts. Tendency to optimise non-task goals can become part of an individual's "style" (e.g.: macho-style attitudes, for instance).

Necessary violations – in this case, non-compliance is seen as *essential* in order to get the job done. Whereas routine and optimising violations are directly linked to personal goals (i.e., less effort or thrills), necessary violations have their primary origins in particular work situations. They are commonly provoked by organisational failings with regard to the site, tools or equipment (e.g.: time pressure, insufficient staff, right equipment not being available or even extreme weather conditions). In certain but rare circumstances, these can be **exceptional violations**, where non-compliance is seen as crucial (e.g.: trying to rescue a fellow worker, or saving company's property); in such situations, the person believes, falsely, that the benefits outweigh the risks.

6.2 Interview guidance

This guidance is adapted from the Method WAIT and is designed to help the interviewer; the questions are intended to all people involved in the accident, regardless of whether they were injured or not (e.g.: witnesses).

These are *questions* that direct people to think (and reflect) about other less obvious details, which might have been forgotten or overlooked during their first statement on the accident. The extra information gathered by this manner may be very useful to help everybody understand what other factors or motives had influenced the accident (rather than just what happened).

Important: to attain the best results and full co-operation, the interviewer must start by explaining the objectives of these questions, i.e., the need to collect information and to obtain an appropriate understanding of the accident, for finding ways of improving safety. To everyone, it should be clear that the main objective is not about assigning blame (neither to the individuals, nor to management). Putting the person(s) at ease is crucial. Interviews should be as private as possible. At the end, make sure you repeat the explanation(s), to check if your understanding was accurate.

1. Were you doing your usual work when the accident happened?
If not, give more details (why a different task? For how long have you been doing it? Did you receive training or instructions before starting the new task?)
2. Are you aware of the risks (and safety procedures) of your normal workplace? Can you list them? Please give examples.
3. Did you know about the risks associated with this particular task (i.e., the specific task being carried out when the accident occurred)? If not, please explain. If yes, and in your opinion, why did the situation get out of control?
4. Do you remember taking any quick decisions during the events? Any attempt of avoiding what was happening?
5. Did any "other event", unexpected, or unusual, happened at the time of the accident? What?
6. Were you under pressure to complete the work?
7. Was all equipment working properly?

8. Did the working environment (noise, light, dust, space, other people around, etc.) affect you in any way?
9. Did you feel thirsty, hungry, hot or cold, pain, or anything else causing you physical discomfort immediately before the accident happened? If yes, explain what and how it affected you.
10. Did you feel particularly tired? Why?
11. Did any emotional problems (professional, personal or family) affect you on this day?
Please note: *you are not asked to give details of your personal life – just try to explain if there was anything really serious disturbing your mind, and in what manner it affected your performance.*
12. Did you need to break, or ignore, any of the established safety rules?
For instance: not wearing PPE, using a different tool, doing a different routine, disconnecting a machine safe-guard, other?. If so, explain the circumstances and reasons for doing so (for instance: it becomes a “routine” and everybody else does the same, to feel less uncomfortable, to be able to do your job on time, for very exceptional reasons?).
13. Were there any language or cultural problems – or misunderstandings – between you and your colleagues at the place and time of the accident?
14. Did you have to rely on another person or on a new colleague with whom you had never worked before?
15. Do you feel you had enough knowledge and experience to deal with the problems of this particular case?
16. Do you feel you have enough training, *in terms of safety needs*, to do your normal job? Would you need further training in any area? If so, please explain.
17. Were you carrying out more than one task simultaneously?

Now that you have completed the interview, please answer these further three questions, to give your own contribution for improvement:

- (1) In the light of this case do you think anything should have been done differently?
- (2) Do you think any improvements could be made?
- (3) Is there any other comment/contribution you wish to make?

6.3 Classification schemes of causal factors (ICF, WPF and OMF)

The classification schemes proposed here in Tables 1-3 were imported and adapted from the method WAIT – Work Accidents Investigation Technique (Jacinto, 2003 -2009)

Table 1 – Classification for Individual Contributing Factors (ICF)

Individual Contributing Factors (ICF) (a) (These factors may influence behaviour or contribute to human failures; the items listed are not mutually exclusive and more than one may apply simultaneously)	
Code	Heading
00	No information or not applicable
10	Temporary factors
11	Memory failure - some information was forgotten, or incorrectly recalled (e.g.: the wrong name for something)
12	Fear / Threats - in this case, actions do not seem to follow any specific plan or principle, but rather look like trial-and-error. The person may seem paralysed (e.g.: fear of failure or losing the job, threats of aggression from other co-workers, etc.)
13	Distraction - shift in attention - attention was caught by something else. The task may not be completed, or loss of orientation may occur.
14	Inattention - a signal or an event was missed due to inattention. Is similar to "observation missed", but inattention is a random event, whilst observation can be explained as a cognitive function.
15	Fatigue - the person's response (mental or physical response) is reduced due to fatigue / tiredness.
16	Intrinsic human variability - typical manifestations are: lack of, or reduced precision, uncoordinated movements, or an increasing number of actions fail to achieve their purpose.
17	Physical / physiological stress - e.g.: pain or discomfort, hunger or thirst, intoxication due to alcohol or other substance, etc. Manifestation can take many different forms.
18	Mental / psychological stress - e.g.: time pressure, monotonous or repetitive task, personal or family problems, emotional state, etc. Manifestation can take many different forms.
19	Other individual contributing factors of this category – not specified above (use free text format)
20	Permanent factors
21	Permanent physical or psychological condition - e.g.: deafness, bad eyesight, colour blindness, dyslexia, claustrophobia, chronic illness or other disability.
22	Personality - aspects related to the person's character or personality (e.g.: nervousness, irritability, stubbornness, aggressiveness, passiveness, overconfidence, over optimism, shyness, etc.)
29	Other individual contributing factors of this category – not specified above (use free text format)
99	Other individual contributing factors not listed in this classification (use free text format)

(a) Most of the above factors were adopted from Hollnagel's (1998) classification

Table 2 – Classification for Work Place Factors (WPF)

Work Place Factors (WPF) (These factors are not mutually exclusive and more than one may apply simultaneously)	
Code	Heading
00	No information
10	Physical environment / Working environment
11	High level of noise or mechanical vibration
12	Insufficient / inadequate illumination
13	Thermal discomfort (temperature extremes, too dry or too humid)
14	Uncomfortable / unhealthy atmosphere (presence of fumes, dust, smoke, etc.)
15	Dangerous place (pit, confined space, high voltage, radiation)
16	Poor housekeeping and cleaning
17	Insufficient / narrow working space; inadequate layout
19	Other workplace factor of this category – not specified above (use free text format)
20	Equipment / Tools (includes PPE - Personal Protective Equipment)
21	Instrumentation and sensor gauges – unreliable, difficult to read, or insufficient
22	Difficult access to machine controls; difficult to reach
23	Insufficient or inadequate tools or equipment; temporarily out of order; unavailable at that moment and place
24	Badly maintained equipment and tools or badly installed
29	Other influencing factor of this category – not specified above (use free text format)
30	Task / Job-related
31	Unclear job description (unclear allocation of function or responsibility)
32	Interference, influence from other people's work or presence (this includes colleagues, visitors, or public in general)
33	High task demand, multiple tasks, insufficient time (workload pressure)
34	Monotonous / repetitive work
35	Irregular working hours / not the usual (e.g.: "on call", overtime)
36	Shift work / night work (although regular)
37	Inexperience / not familiarised with the task or technology / training inadequacies
38	Handling a "difficult" object that may reduce visibility or body balance/ stability (e.g.: too large, extremely small, heavy, sharp edges, awkward shape, etc.)
39	Other workplace factor of this category – not specified above (use free text format)
40	Competence: professional qualifications, training and experience
41	Lack of technical ability, lack of qualifications for specific tasks (e.g.: driving vehicles, cranes or heavy machinery, welding work, work with explosives, hyper baric work, etc.).
42	Insufficient education (school level) and / or inappropriate for the task and its responsibility
43	Lack of training, inappropriate training or insufficient.
44	Inexperience, unfamiliar with the task or technology (even if you have received some training)
49	Other workplace factor of this category – not specified above (use free text format)
50	Information /Communication (includes formal and informal ways)
51	Inadequate / poor instructions and procedures (e.g.: insufficient, difficult to read, unpractical to use, incomplete text, mismatch to actual equipment, etc)
52	Mislabelling (not labelled, incorrect, ambiguous, difficult to read)
53	Ambiguous communications or signals between people - includes body language and gestures
54	Complacency with "risk taking" behaviours, systematic "bad examples" given by supervisors and managers
59	Other workplace factor of this category – not specified above (use free text format)
60	External environment: Weather / Natural phenomena (working outdoors)
61	Working under bad weather conditions (heavy sun, rain, hail, strong wind, lightning, storm, etc)
62	Slippery floor and surfaces due to: snow, ice, mud, etc (in the way or in the working yard)
69	Other workplace factor of this category – not specified above (use free text format)
99	Other workplace factors not listed in this classification (use free text format)

Table 3 – Classification for Organisational and Management Factors (OMF)

Organisational and Management Factors (OMF)	
(These factors are not mutually exclusive and more than one may apply simultaneously)	
On each cluster listed, check for weaknesses and inadequacies; find opportunities for management improvement	
Code	Heading
00	No information
10	General Management
11	Leadership and Administration (manager's commitment, financial and investment strategies, definition of goals, co-ordination, directives, roles and responsibilities, company values, etc.)
12	Management of change (e.g.: management of social and commercial pressure, introduction of new products and technologies, downsizing or re-engineering processes, etc.)
13	Communication - strategies and practices (means of communicating, employee involvement, sharing information and safety practices with contractors and suppliers, etc.)
14	Hiring & placing (e.g.: recruitment and selection policy, staffing levels and competence, etc.)
15	Purchasing policy (e.g.: control of suppliers and goods)
16	Management of contractors
17	Quality and Environmental Management (Policy and Systems)
18	Management of incompatibilities between Production, Quality and Safety goals
19	Other organisational and management factor of this category – not specified above (use free text format)
20	Procedural
21	Procedures and Practices implemented (design of work and workplace, design of working instructions, specifications, work planning & scheduling, permits-to-work, etc.). Note that "formal" (written) procedures are not necessarily more efficient than the informal ones.
22	Level of Supervision (enough? The role of supervisors is clearly established and understood? Are the supervisors setting up good examples?)
29	Other organisational and management factor of this category – not specified above (use free text format)
30	Technical
31	Maintenance management (maintenance policy, planning and scheduling of interventions, records, allocation of resources, etc.)
32	Levels of automation
33	Human-machine and Human-system interfaces (including ergonomic aspects of interface design). Usability aspects (easy to use? intuitive? requires specialized training?)
34	Design of facilities and equipment (including ergonomic aspects, layout and availability)
35	Engineering (physical) controls and barriers and their adequacy
36	Hardware and software systems (technical know-how? adequacy? enough resources?, etc.)
39	Other organisational and management factor of this category – not specified above (use free text format)
40	Training & Competency
41	Training policy (general aspects: budgeting, plans, scheduling, amount of training given, etc.)
42	Identification of specific training requirements (particular skills and competencies required for each task and each person)
43	Measurement of training effectiveness (methods to assess if training was sufficient and has achieved its objective)
49	Other organisational and management factor of this category – not specified above (use free text format)
50	Safety - specific
51	Safety Policy and effectiveness of H&S management
52	Risk assessments (up to date? sufficient? complete? recommendations implemented? etc.)
53	Safety Committees and Representatives and their actual involvement / participation (if applicable)
54	Emergency plans, resources, procedures and their effectiveness
55	Reporting & Recording procedures (safety problems, accidents, dangerous occurrences, health monitoring, responses to previous accidents / incidents, etc.)
56	H&S legal requirements (compliance level, implementation problems, etc.)
59	Other organisational and management factor of this category – not specified above (use free text format)
99	Other organisational and Management factors not listed in this classification (use free text format)

6.4. RIAAT standard form (the process' protocol)

This is provided separately, as an MSWord.doc file, to enable writing directly in the form and making reproductions.