

Guidance on Learning From Incidents, Accidents and Events

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Abstract

A number of industry commentators have noted that the energy and allied industries still need to improve in learning lessons from incidents. Partly this view is prompted by the reoccurrence of similar events, and partly by anecdotal evidence of the difficulty of achieving long term changes in behaviour and working processes, when sharing lessons from accidents and incidents.

Previous research has indicated challenges at several stages in the Learning from Incidents (LFI) process including:

- Reluctance to report incidents due to fear of disciplinary action or the perception that reporting does not lead to any change
- Lack of human factors expertise in the analysis of incidents
- Lack of time and resources dedicated to helping people understand and make sense of disseminated lessons
- Overload of recommendations and failure to agree actions with all the involved parties
- Failure to check that implemented changes have addressed the underlying causes and reduced risk.

The Energy Institute (EI) published in 2008, 'Guidance on investigating human and organisational factors aspects of incidents and accidents'. This provides guidance on ensuring human and organisational factors are considered in addition to technical causes when investigating incidents, and has been well used in the industry. Most companies have now implemented formal tools and techniques for identifying why an incident happened. In recognition that the next emerging challenge facing the industry is about learning from, and changing after, an incident, the EI's Human and Organisational Factors Committee (HOFCOM) was asked by the EI's Technical Partner Companies (comprising many of the major energy companies) to update and broaden the original 2008 guidance document. It will now cover the whole LFI process, from reporting and finding out about incidents through to effective learning and changing practices.

The LFI guidance is being produced with the help of a series of industry stakeholder workshops organised by the EI and will act as the initial 'go to' resource for LFI. It will inform on good practice for all key phases of the LFI process, and will draw upon existing material and use the outputs from the stakeholder workshops at which LFI experts have contributed their experience, examples and case studies. This will help to ensure that the guidance document will be suitable for LFI practitioners.

This paper describes the background to the development of the updated guidance document and provides an overview of its contents. This will include a step by step guide to LFI and a summary for managers of the key issues associated with LFI.

Introduction

It is a common experience to hear the phrase "We must learn lessons from this" following a major accident, or a more everyday event such as losing in a sporting competition. Indeed this has become such a common phrase that one may feel that learning lessons is an automatic or natural process. In fact the evidence from accidents and incidents indicates that it can be challenging for major hazard industries to learn effectively from such events.

Following a significant incident, organisations produce a range of responses that indicate that the phrase "We have learnt from this incident" can mean different things to different people. For example it could mean any of the following:

- a. That the team of investigators has understood how and why an incident occurred.
- b. That several people in an organisation now know how to prevent it happening again.
- c. That an organisation has implemented a set of changes (for example in equipment and personnel behaviours) which will prevent this event happening again.
- d. That an organisation has implemented a set of changes which will prevent this event, and similar events, happening again and even learnt about its processes for Learning from Incidents (LFI) as a result of an incident investigation.

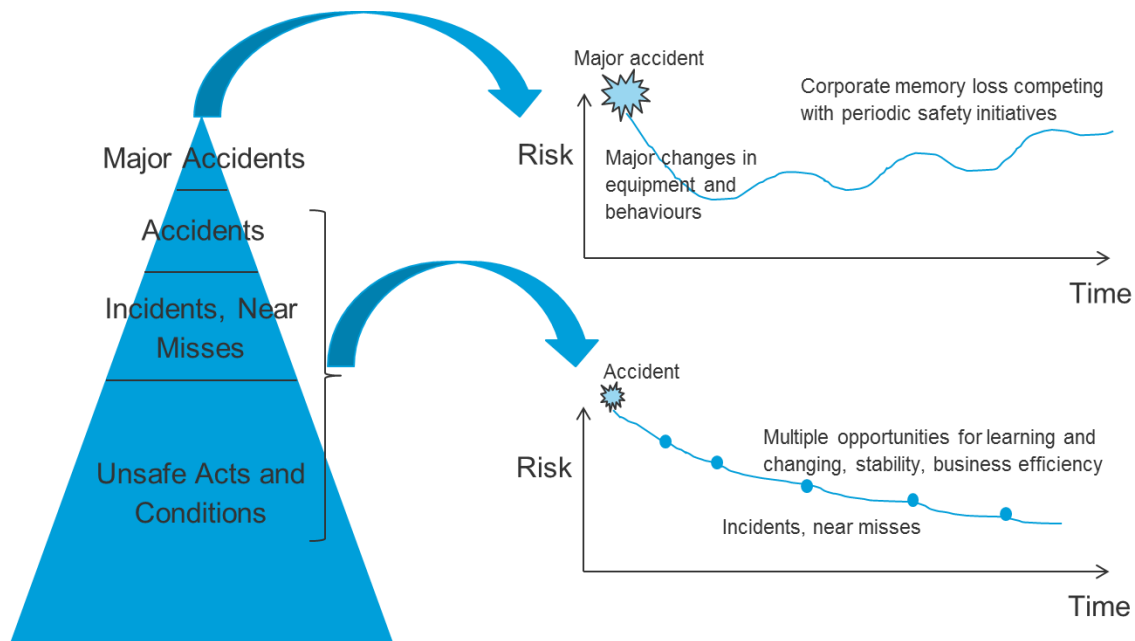
These bullets a - d could be seen as representing a range of learning potential. It would be expected that bullet 'd' would lead to a significantly larger risk reduction than if bullet 'a' alone were achieved.

LFI consists of a series of steps which are covered in more detail below. A number of barriers to learning have been identified within each of these steps by previous research (e.g. Drupsteen 2013 and Lukic 2012) and reiterated in the Energy Institute (EI) organised stakeholder workshops. A central problem, which the EI guidance is intended to help organisations

address, is the difficulty of achieving sustained effective change following an incident, even if there has been a thorough high quality investigation which has successfully uncovered critical underlying causes.

The barriers to learning discussed in this paper can lead to a situation where an organisation neglects the potential lessons from lesser severity incidents, but which could have escalated into major accidents, and only learns when a major accident (MA) actually happens. This is inherently an unstable approach likely to lead to states of higher overall risk as illustrated in Figure 1. If the only changes an organisation is making are in response to Learning from Major Accidents (LFMA) rather than the broad range of potential events, as represented in the accident pyramid in Figure 1, this will typically lead to large disruptive changes following such MA events in which risk will be reduced by large outlays in new safety related equipment, with high associated CAPEX costs and reduced plant availability. Over the longer term however, the memory of these low frequency events will be lost and risk is likely to increase effectively unnoticed as the warning signs (weak signals) offered by incidents are not being effectively processed. Thus solely adopting a LFMA process will lead ultimately to an increased frequency of major events, higher average risks, larger damage costs and more business interruptions. An efficient LFI process will make use of the multiple opportunities for learning leading to a lower risk, more stable business environment as the organisation makes small, optimising adjustments in response to the learning from incidents.

Figure 1. LFI vs LFMA



Although an efficient LFI process should ultimately represent a cost-effective approach, the phrase “Near-misses offer free lessons”, which is sometimes heard amongst safety professionals referring to the aftermath of events that do not cause injury or damage, is potentially misleading. It is not possible to learn effectively from incidents without dedicating resources to this process. In particular time and effort needs to be invested to help personnel make sense of the information produced by investigations. This topic has been the subject of research funded by the EI (Lukic 2012) which will feed into the LFI guidance.

The Energy Institute (EI) published in 2008, ‘Guidance on investigating human and organisational factors aspects of incidents and accidents’ (EI 2008). This provides guidance on ensuring human and organisational factors (HOF) are considered in addition to technical causes when investigating incidents. There were strong indications at the time that HOF were not adequately addressed in incident investigations and the 2008 guidance was aimed at assisting organisations address these factors in a systematic manner. Although this situation may have improved in some organisations the following quote from a recent Society of Petroleum Engineers publication (SPE 2014) indicates that other organisations still find addressing human failures a challenge:

“Researchers, human factors professionals and others across many sectors believe that real learning from incidents has been hindered by a tendency to “blame the human,” or to treat “human error” as an acceptable final explanation of why an incident occurred.”

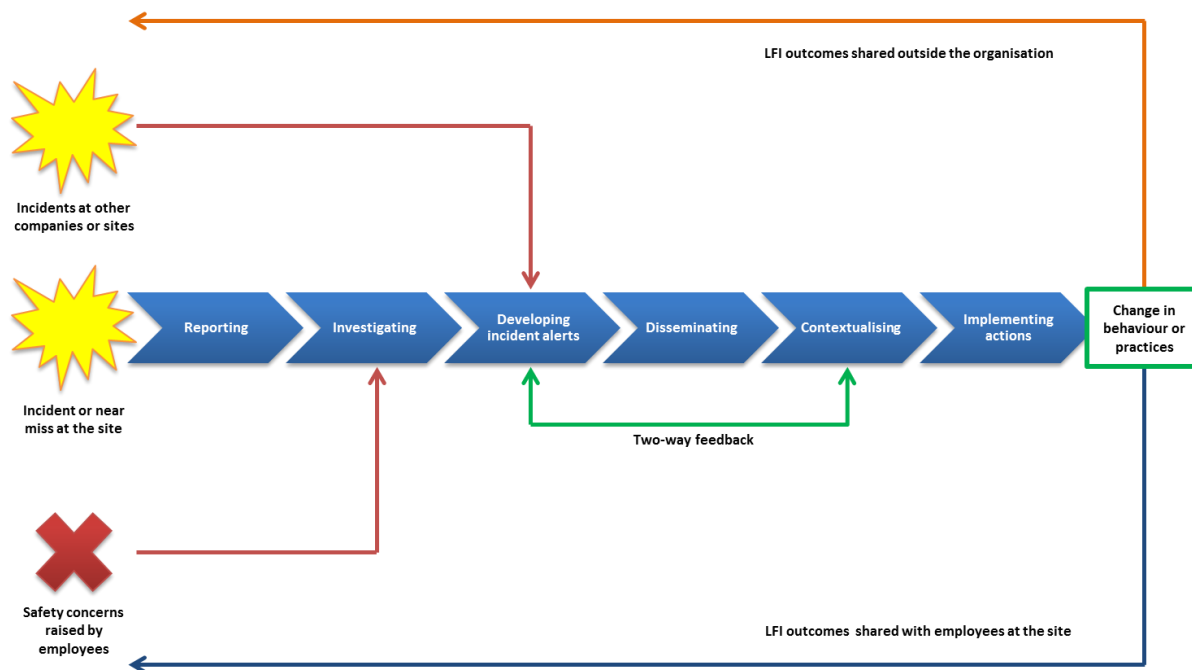
Thus the original objectives of the EI 2008 incident investigation guidance still appear to be valid. In recognition that the next emerging challenge facing the industry is about learning from, and changing after, an incident, the EI’s Human and Organisational Factors Committee (HOFCOM), together with the Stichting Tripod Foundation, were tasked to update and broaden the original 2008 guidance document. It will now cover the whole LFI lifecycle, from reporting and finding out about incidents through to effective learning and changing practices.

The updated guidelines should be ready in the second half of 2015. This paper describes the background concepts around LFI, some of the themes to emerge from the stakeholder workshops and provides an overview of the guidance material.

Previous LFI Studies

Research at the Glasgow Caledonian University (GCU) has led to the following model of LFI (Figure 2). The main steps (blue block arrows) following an incident at an organisation's site are described as: reporting, investigating, developing incident alerts, disseminating information from the investigation, contextualising (allowing personnel the opportunity to relate the information to their work and determine its relevance to them) and finally implementing actions. Additional inputs to this process can be incidents at other sites or indeed in other organisations and safety concerns raised by employees. The output from the process should be changes in behaviour or practices which reduce the chance of reoccurrence and the sharing of the LFI outcomes with others in the organisation and outside the organisation where relevant.

Figure 2. Glasgow Caledonian University's LFI Process Model



This model is being used as a basis for an LFI toolkit which the EI is currently trialling and which is expected to be available in the first half of 2015.

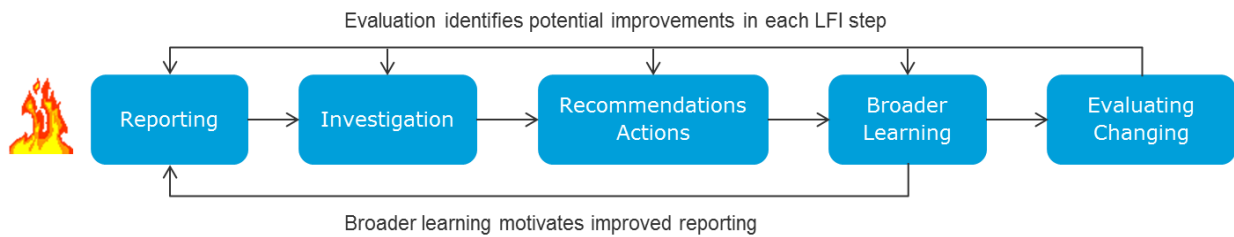
The GCU research has helped identify a number of important factors relevant to individual learning:

- Individuals need to understand the context of incidents in order to draw meaningful lessons that they can apply at their workplaces. Time needs to be allocated for reflection on lessons and sense-making.
- There needs to be encouragement from an organisation to individuals to challenge the status quo and reflect on organisational practices to gain maximum learning potential from incidents.
- Individuals learn best through active engagement - e.g. a scenario-based approach as demonstrated in the oil and gas sector (Lardner 2011).
- Learning for managers is critical as well as for frontline staff - this needs to be catered for within LFI.
- The quality and credibility of the individuals delivering messages and lessons is critical. For example learning from a peer who has been involved in an incident might be more effective than hearing something second hand from a supervisor or manager.

Researchers from TNO (Drupsteen 2013) have also developed useful LFI models with steps that are similar to the ones in Figure 2. They conducted perception surveys among companies from a range of industries (including those with major hazard potential) and discovered that there were significant losses in potential learning at every main step of the LFI process. Their final conclusion was that less than 10% of potential learning was being utilised.

Based on these models and other references (e.g. BSi 2014) the EI guidelines will be structured according to the following steps (Figure 3):

Figure 3. EI Guidelines Structure



The consensus from the research literature and from the stakeholder workshops is that LFI is not just about generating information from incidents from which learning will follow. Rather it is about ensuring that this information is actually used to make sustainable changes to equipment, processes or behaviours that increase safety over the long term.

HOF Failure Model

The incident investigation parts of the EI guidelines will be structured around a generic model of HOF failures. This is illustrated in Figure 4 and consists of:

- A barrier model representing the main preventive and mitigation barriers for the relevant accident/ incident.
- Links between each barrier and sets of progressively deeper causal factors - immediate (sometimes known as “direct”), Performance Influencing Factors (PIFs, also known as Performance Shaping Factors), and underlying causes (or “root” causes).

The progressive causal layers can be seen as a process of repeatedly asking “Why”. Examples of these layers could be:

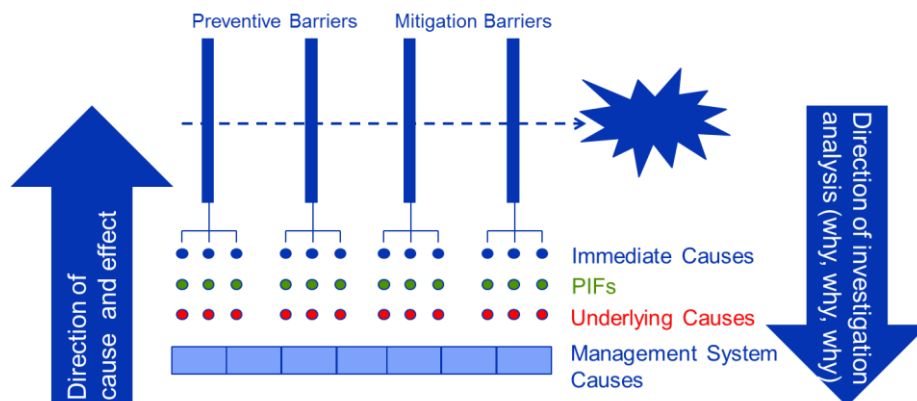
- Immediate - e.g. operator fails to follow procedure
- PIFs - e.g. fatigue, poorly written procedure
- Underlying causes - e.g. poorly written procedure for a recently refurbished piece of equipment was due to failure of the Management of Change process with insufficient reviewing of the updated procedures. Fatigue was linked to a failure to safety assess a change in shift patterns.

Underlying causes are likely to relate to deficiencies in the Safety Management System (SMS) or other elements of the wider management system (e.g. procurement or human resources).

This process of drilling down to underlying causes will get well beyond the final “explanation” of an incident as “human error”. If an organisation addresses the underlying causes of the human failures identified this is likely to have a longer term impact on reducing the likelihood of not just this event re-occurring but all other potential events linked to the inadequate management system element.

A barrier model works well for Major Accident Hazard (MAH) industries which rely on defence in depth. If there has been a significant event then usually multiple barriers will have failed. This model is therefore well suited to illustrating and visualising the multiple causes present in most significant events. Even if a barrier model is not included explicitly in a formal incident investigation technique, “barriers” in a general sense will receive consideration in an investigation; hence this model is of general applicability.

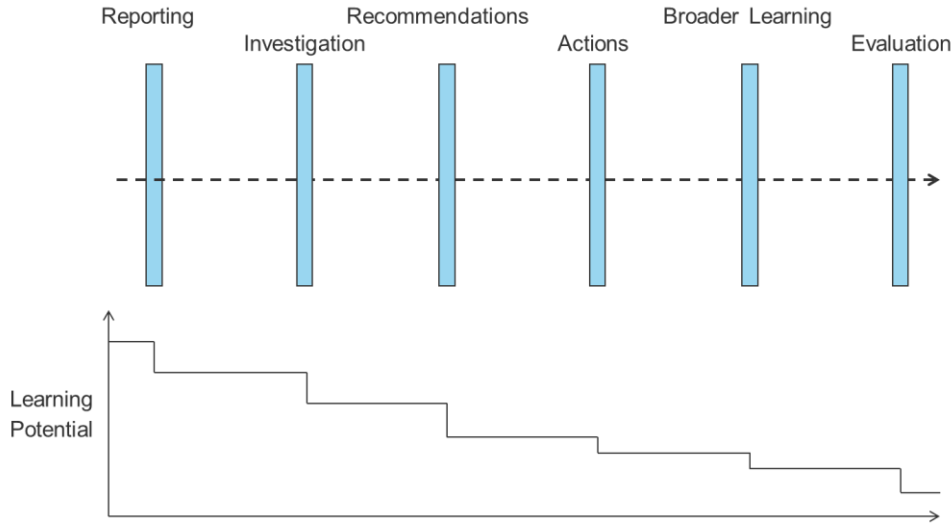
Figure 4. HOF Failure Model



Outputs of Workshops and Literature Review

The concept of a barrier model has been transposed from the accident model above and applied also to the LFI process. In Figure 5 it is postulated that there are a series of barriers to learning which exist in each of the main LFI steps. These barriers lead to the loss of learning potential that TNO has identified (Drupsteen, 2013). The following sub-sections identify some of the main barriers in each step and summarise good practices and examples discussed in literature or at the stakeholder workshops.

Figure 5. LFI Barrier Model



Reporting

The first point to make about this step is that whilst many incidents will be formally reported, some of the raw material inputting to the LFI process is informally reported, and some events are not reported at all. An organisation may identify relevant incidents from other sources, e.g. casual conversations, at safety meetings, toolbox talks, etc. “Acquiring incident information” might be a more accurate phrase than reporting, but reporting fits better with formal SMS descriptions and is used in the EI guidelines.

Research has indicated that at least 20 incidents per actual accident need to be reported to drive organisational learning (Bridges 2000). However, it is clear that there are major barriers at this first step which can dramatically reduce learning potential. Some of these are summarised in Table 1.

Table 1. Barriers to Effective Reporting and Potential Enablers

Barriers to Effective Reporting	Enablers for Reporting
Fear of being blamed or professionally embarrassed	<ul style="list-style-type: none"> • Long-term engagement and commitment to a Just Culture. • Making “user experience” a positive one. In an ideal world the initial reaction of the supervisor to a report should be ‘thank you’ but often it is not! • If culture is immature consider confidential or even anonymous reporting.
Belief that nothing will be done in response to report	<ul style="list-style-type: none"> • However the event is reported (e.g. verbally or online) provide timely feedback and keep the reporter updated on progress and when something changes. • If practical try and involve reporters in developing the solution, on the basis that they will be more likely to implement it and report again in the future. • Feedback at end of LFI process to demonstrate that reports lead to effective changes.

Barriers to Effective Reporting	Enablers for Reporting
Not understanding what should be reported (lack of awareness about what is important) - can be confusion about what constitutes a reportable incident	<ul style="list-style-type: none"> • Develop a list of examples that illustrate high-learning-value incidents, particularly near misses. • Train personnel on the examples. • Use safety meetings to capture and communicate near misses that were not previously identified. • Try and develop common understanding of important barriers and important safety Performance Indicators.
Apathy – not understanding the value of reporting, instead seeing reporting and investigations as taking unnecessary time and effort which should be avoided	<ul style="list-style-type: none"> • Provide incentives for reporting, e.g. prizes for reports that lead to the largest safety/ business improvements. • Provide disincentives for non-reporting, e.g. if an event is reported no disciplinary action is taken but disciplinary action is taken if an event is not reported but subsequently discovered.
Over-complex reporting systems	<ul style="list-style-type: none"> • Make reporting system straightforward (not requiring too much from the reporter). • Avoid multiple systems that confuse the reporter and do not talk to each other. • Review system from user’s perspective - is reporting a positive experience?

Examples were provided at the stakeholder workshops where reporting rates had dramatically increased following adoption of some of the enablers suggested in Table 1. The next steps in the LFI process then need to be effective to make use of these higher reporting rates.

Investigation

Incident investigation is considered to cover both the fact finding and analysis stages recognising that iterations between these stages will be required to eventually validate hypotheses of what happened and why. Key issues within this step that impact overall LFI effectiveness centre around the resources dedicated to the investigation and the techniques adopted.

Some organisations may struggle to provide competent investigation personnel especially to cover specialist topics such as HOF aspects. There are techniques available to make the analysis of causes more structured and transparent but it is important to treat them always as “servants” and not the “masters” and be flexible in how they are used. Table 2 describes further some of the main barriers and enablers relevant to resource constraints and techniques.

Table 2. Barriers to Effective Investigation and Potential Enablers

Barriers to Effective Investigation	Enablers for Investigation
Lack of personnel trained in HOF	<ul style="list-style-type: none"> • Obtain assistance from other part of organisation or outside body. • Set up easy to use templates/ checklists that enable a non-HOF specialist to determine underlying causes for non-complex incidents (however, be realistic about what less resourced investigations can achieve). • Provide HOF ongoing training for investigators. • Review panels to check investigation findings including recommendations.
How to classify and prioritise reported incidents. Do you end up selecting the ones with the most potential for learning?	<ul style="list-style-type: none"> • All classification schemes (whether based on actual severity of outcome, potential severity, risk of reoccurrence, learning potential, etc.) have strengths and weaknesses. Do not become too constrained by definitions and boundaries (e.g. concerning near miss, incident, accident, dangerous occurrence etc.) • Random deep dives (e.g. on every tenth reported event) can act as a quality control check on your classification scheme. They can also be used to train up investigators and test the overall LFI process.

Barriers to Effective Investigation	Enablers for Investigation
Reluctance of personnel to provide full story - worry of being blamed or incriminating others	<ul style="list-style-type: none"> • Establish the right atmosphere in interviews - it's about learning..... • Use approaches that make the interviews less intimidating, e.g. walk around the site with the personnel during initial discussions and consider the pros and cons of interviewing groups of personnel together (this can have powerful learning potential).
Difficulty of establishing why people did something - they themselves might not know	<ul style="list-style-type: none"> • Recognise that the investigation is not about proving why something happened - it is about the learning. What made this event more likely to happen (e.g. were fatigue factors a potential influence?) • Discourage the 'why did you do it?' question - the motivation is not that helpful, and vulnerable to hindsight or reinterpretation. Ask more neutral and open questions such as "Take me through what happened".
Investigation report is overlong, a blow by blow account of the investigation rather than a concise report on what has been learnt	<ul style="list-style-type: none"> • Include a one page summary that can be readily used and shared. • Define principles/ good practices that help make a report a tool for learning, e.g. use of diagrams to show where people were, photographs of area / equipment, short sentences, keeping detailed technical language / explanations in an appendix, etc.
Lack of early learning - the time to produce a final report can be lengthy and the temptation can be to postpone wider learning until all the facts are known definitively	<ul style="list-style-type: none"> • Send out incident alerts. • Possibly run learning group sessions in parallel to formal investigation.

An important point coming from Table 2 and the stakeholder workshops more generally was to see investigation as a step within LFI and not an end in itself. A number of examples were provided of high quality investigations that have not led to significant changes, i.e. LFI had failed.

Recommendations and Actions

This was identified as a common area of weakness in the stakeholder workshops. Numerous examples were provided of recommendations not being actioned several months after an investigation had been completed. Even well-resourced investigations with competent/ experienced investigators can end up making a set of recommendations that for a variety of reasons are never implemented. Table 3 lists some of the more important barriers relating to these stages and relevant enablers that can lead to improvements.

Table 3. Barriers to Effective Recommendations and Actions and Potential Enablers

Barriers to Effective Recommendations and Actions	Enablers for Recommendations and Actions
Recommendations are not accepted by line management	<ul style="list-style-type: none"> • Make line management define the recommendations, with investigators approving them (pros and cons to this - pro is that line managers are more motivated to implement resulting actions; con is that they may be tempted to make recommendations that are easy to action rather than leading to long term improvements). • Involve line management in the review of the recommendations so they understand the context and have the opportunity to question the investigation team on the value of the recommendations.
Recommendations are not accepted by frontline personnel - can be a perception that actions that come down from management/investigators following an investigation are divorced from understanding of what is happening day-to-day	<ul style="list-style-type: none"> • Involve frontline personnel in discussing potential risk reducing measures and developing recommendations. • Hold briefing sessions with frontline personnel at which draft recommendations are presented and discussed.

Barriers to Effective Recommendations and Actions	Enablers for Recommendations and Actions
Too many recommendations and too many are loosely worded	<ul style="list-style-type: none"> • Prioritisation of recommendations based on risk assessment. • Review process for recommendations to check they eliminate the causes of the event while being reasonably practicable and within the control of the organisation. • Organisations should follow guidance on recommendation wording (ideally provide examples of good and bad wording).
Insufficient weight given to HOF in developing recommendations	<ul style="list-style-type: none"> • Check that there are recommendations that link to the different causation levels in the HOF failure model. • Ensure that recommendations are appropriate to the relevant human failure type (e.g. if failure was due to a slip, extra training would probably not be an appropriate recommendation).
Insufficient checks that recommendations will effectively reduce risk	<ul style="list-style-type: none"> • Check that recommendations are risk proportionate and that will not inadvertently increase risk (linked to management of change process). • Review boards to vet recommendations.
Backlog of actions build up (not just from incident investigations but also from audits, safety tours, etc.)	<ul style="list-style-type: none"> • Leadership needs to allocate sufficient resources to clearing out actions (particularly those priority actions). • Audits and follow ups of investigation recommendations.

Improving the processes around producing and handling recommendations and the resulting actions will help implement the local learning associated with a specific event and lay the foundations for broader learning.

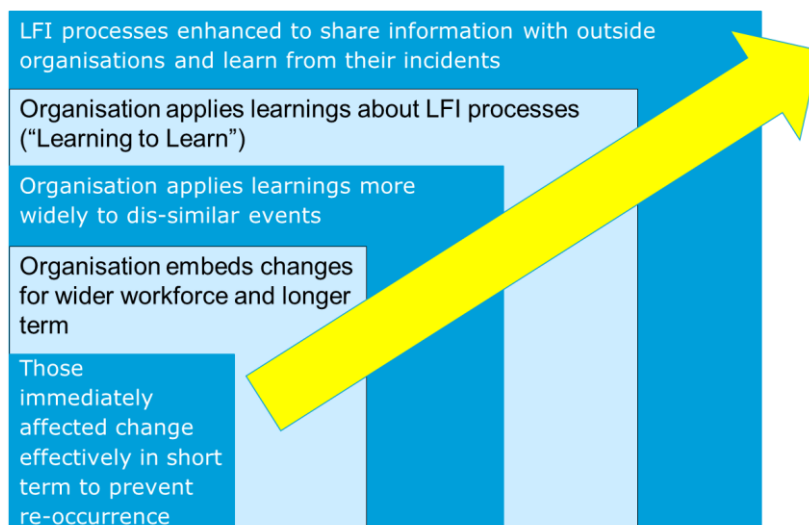
Broader Learning and Evaluation

Broader learning can refer to:

- Reaching more people in the organisation who may be affected by the same problems and risks revealed in the investigation (i.e. a wider geographic/ functional reach within the organisation).
- Affecting people in the longer term, i.e. several years from now, perhaps long after the memory of the incident has dissipated.
- Applying the learning to a broader range of incidents (similar and dis-similar).
- Learning about the LFI processes themselves as well as incident causation/ prevention.
- Reaching people outside the organisation.

The broadening effect of these aspects on LFI is illustrated in Figure 6.

Figure 6. Broadening Learning



There are clearly difficult challenges in reaching a wider group of people, well beyond those immediately affected by an incident, and helping them learn from an incident. Ideally one would want to understand the learning needs of different audience groups, such that outputs from an investigation can be relayed in a meaningful way. Some of the wide range of challenges to broader learning are listed in Table 4 with suggested enablers.

The final step in LFI is evaluation of the overall process. Monitoring “hard”, mechanistic measures such as proportion of investigation recommendations overdue should be relatively straightforward. However, probably just as important will be difficult to measure factors such as indicators of corporate memory and changes in personnel attitudes following incidents. This appears to be an area where more work needs to be done to establish a common set of good practices.

Table 4. Barriers to Effective Broader Learning and Evaluation and Potential Enablers

Barriers to Effective Broader Learning and Evaluation	Enablers for Broader Learning and Evaluation
Difficulty in identifying broader lessons	<ul style="list-style-type: none"> • Leadership and technical review of investigations to identify broader lessons for dissemination. • Stakeholder identification - knowing your audience helps identify what parts of investigation/ lessons will be most relevant and also give ideas for modes of dissemination.
Common methods of sharing lessons and learning are often passive and over-simplified summaries (lacking in context)	<ul style="list-style-type: none"> • Make use of interactive sessions - use an incident to develop locally relevant scenarios that can be run as team sessions to identify causes and risk reducing measures. • Train supervisors in facilitation skills to run such sessions. • Do not confuse access to incident information with learning!
Insufficient time to reflect and make sense of material from investigations	<ul style="list-style-type: none"> • Leadership needs to clearly demonstrate value placed on LFI and be prepared to allocate sufficient resources. • Build reflection sessions into schedules of safety meetings and toolbox talks.
Legal constraints on sharing incident information widely	<ul style="list-style-type: none"> • Early engagement with the legal team so that they can understand what is trying to be achieved with LFI and they can advise on the legal risks. There is then the opportunity to devise a process that is the best compromise of the competing concerns. • An organisation should have in place a documented and tried and tested Incident Response Protocol incorporating “legal privilege” for internal investigations when appropriate, and access to legal advice in the event of an incident that is likely to give rise to criminal proceedings. • Turn lessons learnt quickly into good practice guidance which can help others learn but without carrying the same liability risks.
Difficulties in relating to other organisations’ incidents - especially when they are in a different industry	<ul style="list-style-type: none"> • Make use of these in safety meetings and encourage personnel to relate them to their workplace, possibly using the interactive session/scenario approach outlined above. • Convert external incidents learning into the same format as used for internal events. • Try and create a common language of understanding incidents, e.g. the bow ties that the UK aviation industry has created for its highest risk accident categories.

Barriers to Effective Broader Learning and Evaluation	Enablers for Broader Learning and Evaluation
Embedding change for the long term can be difficult given normal corporate memory loss	<ul style="list-style-type: none"> • Use more experienced employees who are experienced in LFI to help revise and extend key procedures, manuals etc. prior to their release or retirement. • Provide links between past incidents and changes, e.g. if a procedure changes following an event provide a reference to that incident in the rewritten procedure, some permit systems bring up a list of events relevant to that task/ equipment, etc. • Provide a database of recommendations/ actions from incidents and what changes have occurred. • Provide training in past accidents/ incidents. • Improve the link between risk analysis and LFI (e.g. ensure that risk analyses take account of past accidents/ incidents that have happened internally to organisation and externally).
Difficulty of assessing whether an organisation has learnt from an incident or a set of incidents	<ul style="list-style-type: none"> • Develop indicators relating to mechanics of the LFI process, e.g. whether investigation reports are overdue, timely implementation of actions, non-compliances with reporting and investigation arrangements, etc. • Also develop indicators relating to what changes have occurred following incidents and whether these changes are effective in risk reduction. For this an organisation may need to be more creative, e.g. active measurement of learning through interviewing affected personnel one year after an event, or relating changes to a set of safety KPIs.

The lists of potential barriers in Tables 1-4 help explain the findings of significant losses of learning potential in many organisations. It is hoped that the good practices and enablers included in the EI guidelines will help people active in LFI reduce these losses thereby improving risk management in their organisations.

Guidelines

As noted above the draft EI guidelines are being developed with input from existing literature and stakeholder workshops. The workshops have been particularly valuable in the areas where existing guidance is lacking, such as around broader learning from incidents.

The guidelines will be structured around the main steps in LFI (see Figure 3) and will include good practices to address the various barriers to learning and useful examples and case studies to illustrate this good practice.

A summary of LFI suitable for managers will be included to ensure that the value of LFI is appreciated and that sufficient resources will be dedicated to this important topic.

Conclusions

The objectives of the EI LFI guidelines are to:

- a) Act as the initial 'go to' resource for LFI, but pointing to other more detailed resources as necessary;
- b) Inform on good practice for all key phases of the LFI process; and
- c) Focus not just on accident/incident investigation but also learning.

A set of stakeholder workshops has helped to complement the review of available literature and guidance and will improve the practicability of the guidelines.

It is hoped that these guidelines will be a useful addition to existing material on incident investigation. The descriptions of barriers to effective learning and good practice enablers provide a structure for any organisation to improve its LFI process.

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