

## The e-SafetyCase – Electronic or Effortless?

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An Electronic Safety Case (e-SafetyCase) is an alternative structured approach to safety. The purpose of an e-SafetyCase and the information contained within it remains the same as a traditional Safety Case; to demonstrate risks are reduced As Low As Reasonably Practicable (ALARP). However, instead of being a lengthy and complex document, the e-SafetyCase is highly interactive, using clickable links as a means of connecting and navigating the information quickly and easily. Not only does this make it simple, intuitive and user-friendly, but by integrating it with day-to-day operations, it is kept current and evolves with the facility. This ensures there is no disconnect between the safety case and operations; they become one and the same! As a result, the e-SafetyCase not only demonstrates risks are reduced ALARP but it ensures risks are managed ALARP throughout the facility life-cycle; the ultimate goal of any safety management system. If done properly, an effective e-SafetyCase will be so useful and helpful to the workforce that it will naturally evolve hand-in-hand with the facility as routine business. Effortless safety – is that not too good to be true?

This paper will introduce the concept of an e-SafetyCase outlining why, despite being a concept which has been around for some time, it has struggled to gain widespread traction across industry. It will debunk the myths about what an e-SafetyCase is to knock-down the barriers we consider are blocking its widespread use. The majority of the paper will be devoted to demonstrating what an e-SafetyCase looks like using a practical case study, highlighting the significant benefits it delivers to the safe and reliable operation of the facility throughout its lifecycle. In addition, it will demonstrate the flexibility and adaptability of the e-SafetyCase approach to allow the considerable benefits to be realised by any major hazard facility. Finally, it will touch on ground-breaking work being done to further improve the functionality and hence benefits of an e-SafetyCase by blending with wider technological innovations. For example, the integration of virtual and augmented reality to really bring the Safety Case to life through modelling of accident scenarios and emergency response arrangements. Although ambitious, this kind of forward thinking could ultimately change the landscape of safety management in major hazard industries.

**Keywords:** Safety Case, Risk Management, Virtual Reality, Electronic.

### Overview

This paper introduces the concept of an Electronic Safety Case (e-SafetyCase), outlining why, despite being an aspiration which has been around for some time, it has struggled to gain widespread traction across industry. It debunks the myths about what an e-SafetyCase is to knock-down the barriers blocking its widespread use. The majority of the paper is devoted to demonstrating what an e-SafetyCase looks like using a practical case study from an Offshore Wind Farm. This case study illustrates the significant benefits it can deliver to the safe and reliable operation of the facility throughout its lifecycle. In addition, it demonstrates the flexibility and adaptability of the e-SafetyCase approach to allow the considerable benefits to be realised by any major hazard facility. Finally, it touches on the ground-breaking work being done to further improve the functionality and hence benefits of an e-SafetyCase by blending with wider technological innovations. Although ambitious, this kind of forward thinking could ultimately change the landscape of safety management in major hazard industries.

### What is a Safety Case?

Before we start to explore the e-Safety Case concept, we must firstly remind ourselves of what a Safety Case actually is.

A Safety Case is generally accepted as being the written demonstration that a plant, facility, operation, etc. has been designed, conceived and executed in such a way that the major Health, Safety, Security and Environmental (HSSE) risks incurred during its lifecycle are reduced As Low As Reasonably Practicable (ALARP).

They are virtually always written documents and despite best intentions from some to break-down established precedents and norms, and perhaps a lazy approach from others, they often end up being lengthy and complex. Whilst serving their core purpose, they can easily become impenetrable to anyone without direct Safety Case experience, heavily limiting wider benefits.

They cover the major HSE risks thereby ensuring that most effort is focused on managing the risks that could cause greatest impact. They rely on the wider HSSE Management Systems to effectively manage less significant hazards on a proportionate basis.

They are generally associated with a legislative regime and, if one were to be cynical, have evolved in such industries to be a document issued to a regulator to show risk levels are ALARP to obtain a licence to operate. However, in reality, a Safety Case is independent of regulations. It represents good practice. It shows all stakeholders that risk is being managed effectively.



Figure 1: Safety Cases - Dispelling the myths [Ref 1]

Figure 1 summarises the myths we hear time and time again about what Safety Cases are perceived to be (on the left) with the reality of a good Safety Case on the right. This has prompted us to use the Marmite analogy to inject some humour into what is a very dry subject, to try and break down these myths and allow industry to embrace the Safety Case approach and realise the huge benefits it offers. People are rarely ambivalent to a Safety Case. They either love it or hate it. In our experience, the haters usually come with a skewed view of what a Safety Case is. Figure 1 shows the huge un-tapped potential of a Safety Case and the e-Safety Case is ready to deliver on this.

**What is an e-SafetyCase?**

The purpose of an e-SafetyCase, and the information contained within it, remains exactly the same as a traditional Safety Case; to demonstrate risks are reduced ALARP. It is how this information is presented that is the key difference. Instead of being a lengthy, complex written document, the e-SafetyCase is highly interactive and intuitive, using clickable links as a means of connecting and navigating the information quickly and easily. As a result, the e-SafetyCase is accessible and helpful to anyone involved in the safe operation of the facility.

The best way to understand what an e-SafetyCase is, and get an appreciation of the benefits it offers over a traditional paper-based Safety Case, is to take a look at a practical example.

We have developed an e-SafetyCase for an offshore wind farm being built in UK waters. Although not a regulated industry, the client showed a strong appetite for a Safety Case approach as they understood the benefits it delivers.

Before we explore this, we must firstly understand how it was developed as this has a significant bearing on how it is presented.

**Risk Management Process**

A Safety Case should represent the output of a proportionate and practical risk management process which is fully integrated with the project development process for a particular design. Figure 3 illustrates the process adopted as the foundation of this Offshore Wind e-SafetyCase and shows how this meets the three fundamental challenges of effective risk management (see Figure 2).

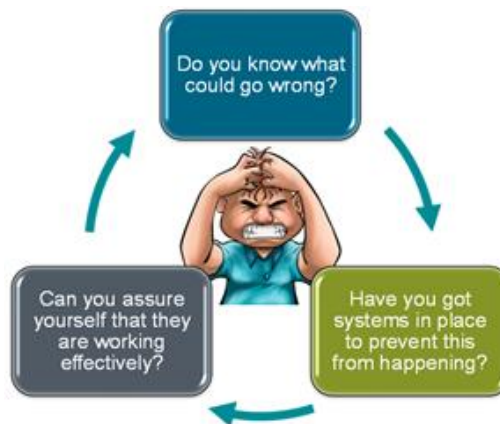


Figure 2: The challenges of effective risk management [Ref 2]

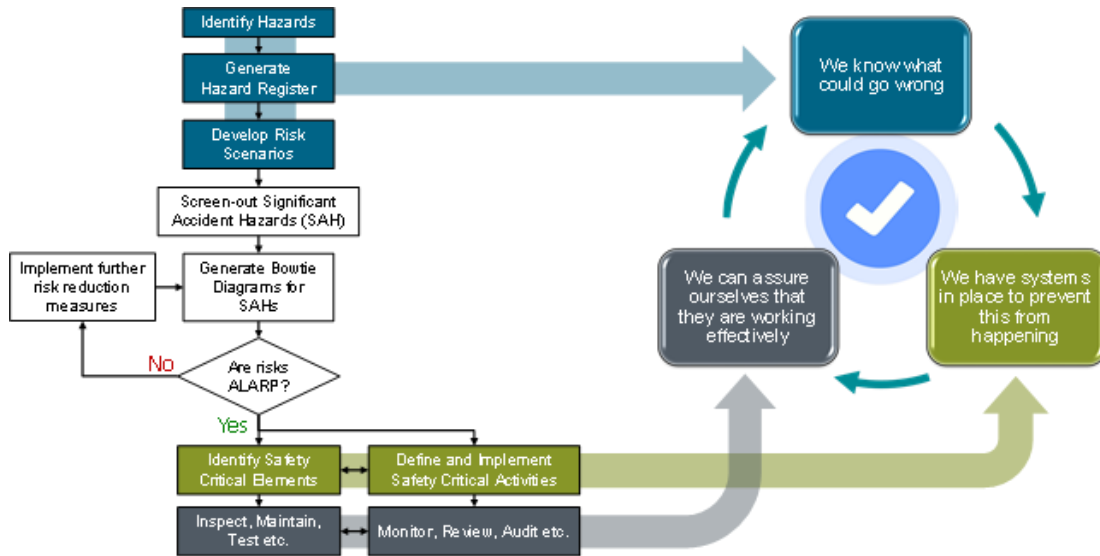


Figure 3: Risk Management Process – the foundation of the e-SafetyCase

**Definitions**

Significant Accident Hazards (SAH) – Although not comparable to, say, the oil and gas industry in terms of ultimate consequences, if the risks associated with offshore wind are inadequately managed, they could still result in fatalities and loss of reputation. Whilst the term “significant” was used instead of “major” to define the hazards screened-out for detailed assessment, the approach is equally relevant to major hazard industries. The only difference being that in applying this approach to major hazard facilities, more hazards are likely to be identified for detailed analysis and/or the screening threshold may rise to ensure a proportionate approach.

Safety Critical Elements (SCE) are defined as those items of equipment or structures whose failure could cause or contribute to a SAH, or the purpose of which is to prevent or limit the consequences of a SAH.

Safety Critical Activities (SCA) are defined as those activities which are critical to ensuring safety and continued integrity of design, or ensure SCEs continue to function as intended.

**Bowtie Approach**

As illustrated in Figure 3, the Bowtie methodology was used to assess all SAHs.

The Bowtie technique is an extremely powerful way of clearly illustrating how risk is being managed within an operation, business, etc. It helps to ensure that risks are managed rather than just analysed, partly by going beyond the usual risk assessment “snapshot” and highlighting links between the risk controls and management systems.

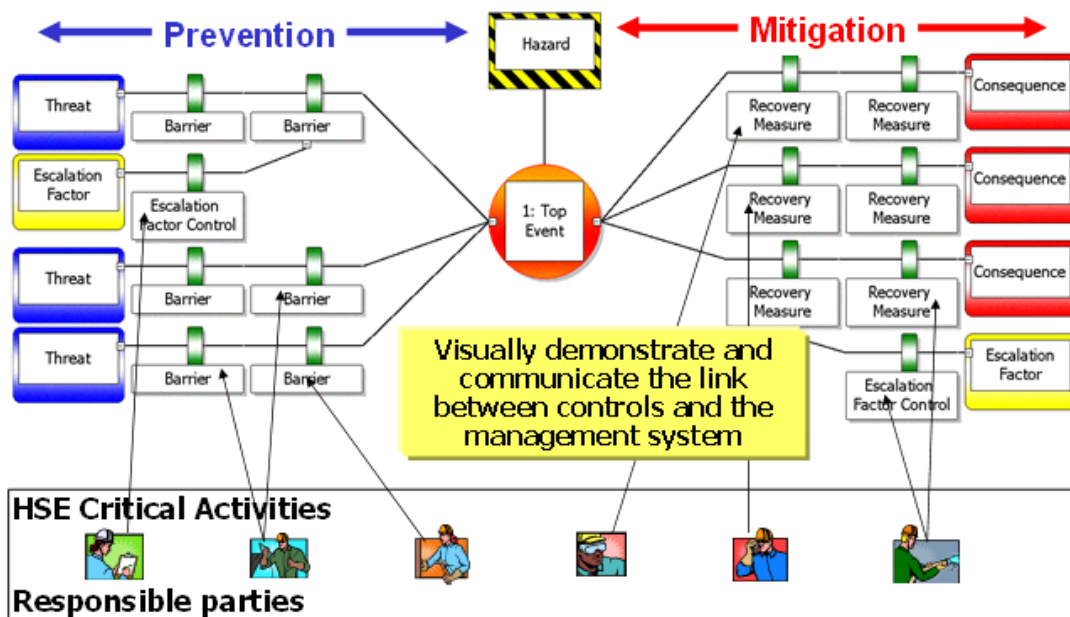


Figure 4: Bowtie Diagram

Figure 4 illustrates the basic structure of a Bowtie diagram, the key elements of which are:

- The **Hazard** which has the potential to give rise to the unwanted event you are concerned about. This is illustrated in the yellow/black striped box.
- The unwanted event you are concerned about if the hazard is realised. This is called the **Top Event** and is the red circle which forms the “knot” of the Bowtie.
- The credible causes of the unwanted event. These are the **Threats** and are illustrated in blue on the left hand side of the diagram.
- The unmitigated **Consequences** of the unwanted event. These are illustrated in red on the right hand side of the diagram.
- An **Escalation Factor** which could compromise the integrity of a barrier.
- The **Barriers** in place to prevent the unwanted event occurring or minimise its consequences. Those on the left hand side of the diagram prevent the hazard being realised and are categorised as **Prevention**. Those on the right hand side limit the ultimate consequences of the hazard if realised and hence represent **Mitigation**. Barriers can also be included to eliminate or reduce the impact of an Escalation Factor on the integrity of a specific barrier, either prevention or mitigation.
- The specific systems, processes, procedures, etc. which must be in place to ensure the integrity of these barriers. This is achieved by identifying the Safety Critical Elements (SCE – plant, equipment, etc.) and their associated Safety Critical Activities (SCA – operations, inspections, checks, etc.), along with the roles, responsibilities and competencies of the people who ensure these work effectively.

This latter point represents the real benefit of the Bowtie methodology. It provides a clear, auditable trail from hazards right through to the specific systems, processes, procedures, etc. implemented, with performance standards and responsibilities clearly assigned, to reduce the associated risks ALARP. It therefore illustrates the complete safety assurance process in a clear picture which can be easily understood by everyone within the organisation.

### Significant Accident Hazards & Bowties

The following Significant Accident Hazards (SAH) were identified for the offshore wind farm and Bowtie diagrams were generated for each of these:

1. Electrical hazards
2. Fire hazards
3. Loss of structural integrity
4. Personnel transfer
5. Personnel at height
6. Hydraulic and mechanical systems
7. Hydraulic systems – pressure hazards
8. Vessel transport
9. Helicopter transport
10. Suspended loads
11. External hazards
12. Explosion hazards

### E-SafetyCase Overview

The e-SafetyCase we have developed is presented in a highly visual web-browser style. To illustrate just how simple this concept can be, the version we’re going to show was developed in PowerPoint and turned into a .pdf file. It is therefore accessible on any computer and can be developed and updated using standard software on any PC. Furthermore, it is sized such that it can be readily saved on a laptop or tablet allowing it to be accessed by anyone, anywhere, anytime.

It can be navigated via two separate home pages which the user can toggle between.

Firstly the user can explore the e-SafetyCase from a process perspective (see Figure 5). This is based on a more simplified version of the risk management process illustrated in Figure 3. This allows the user to quickly and easily access the information based on the process through which it has been generated. This allows those familiar with the underlying risk management process to access the information they require in a very quick and highly intuitive way. It also brings the overall safety case together to show how all the elements combine to present a robust justification that risk is being managed ALARP. Finally, it raises awareness of the underlying risk management process to people less familiar with this, promoting an understanding of how risk is being managed across the business.



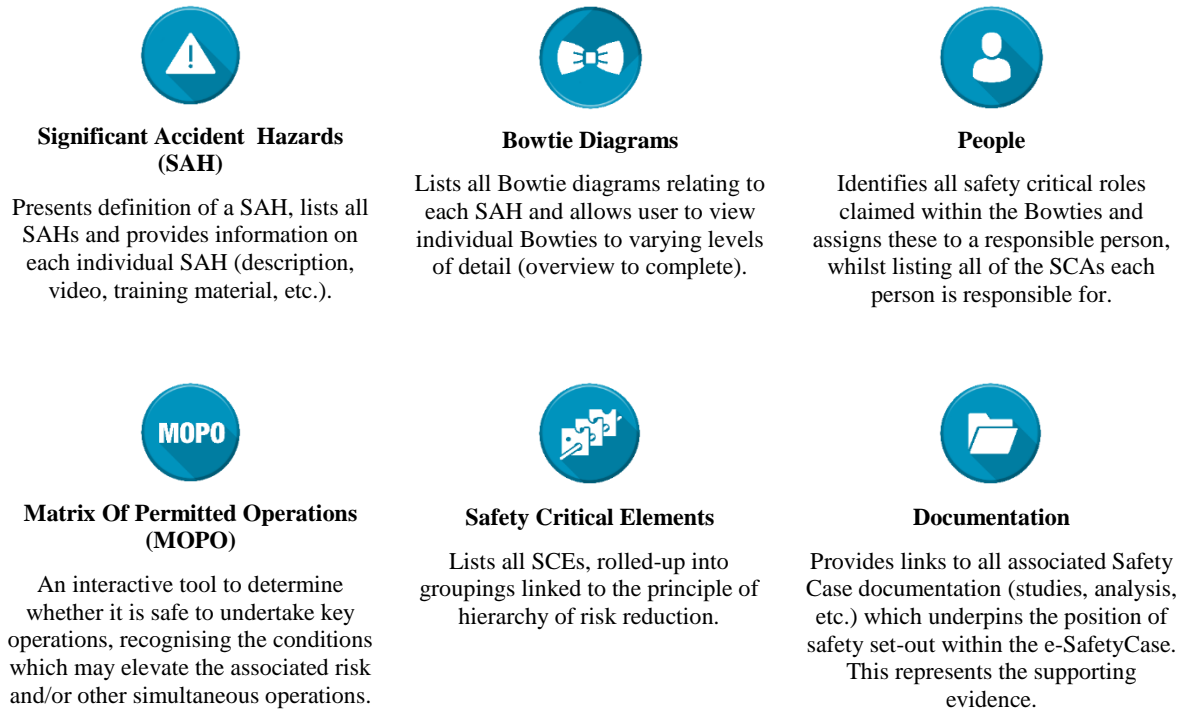
Figure 5: Process View Homepage

Alternatively, the user can switch to an infographic showing all the key elements of the overall wind farm to explore the e-SafetyCase from an asset perspective (see Figure 6). This is particularly useful to someone less familiar with the risk management process or perhaps wants to immediately dive into the detail behind how risk is being managed within a specific element (e.g. turbine, foundation, offshore substation, helicopter, etc.).



Figure 6: Asset View Homepage

On each homepage the user can click on the same set of buttons to access the following information:



The “Feedback” button, when clicked, opens up an e-mail to allow the user to provide feedback directly to the e-SafetyCase owner (e.g. something unclear, something wrong, something which can be improved, etc.). The e-SafetyCase owner collates this feedback and folds this into periodic updates where appropriate.

Whilst the presentation of the Safety Case in such a simple, intuitive and user friendly format is a quantum leap from traditional paper based Safety Cases, the real beauty of the e-SafetyCase is that all of this information is connected together to allow the user to access it via whatever route (or journey) they so choose, via quick and easy links. In very simple terms, the e-SafetyCase brings the Safety Case to life through the navigation triangle illustrated in Figure 7.

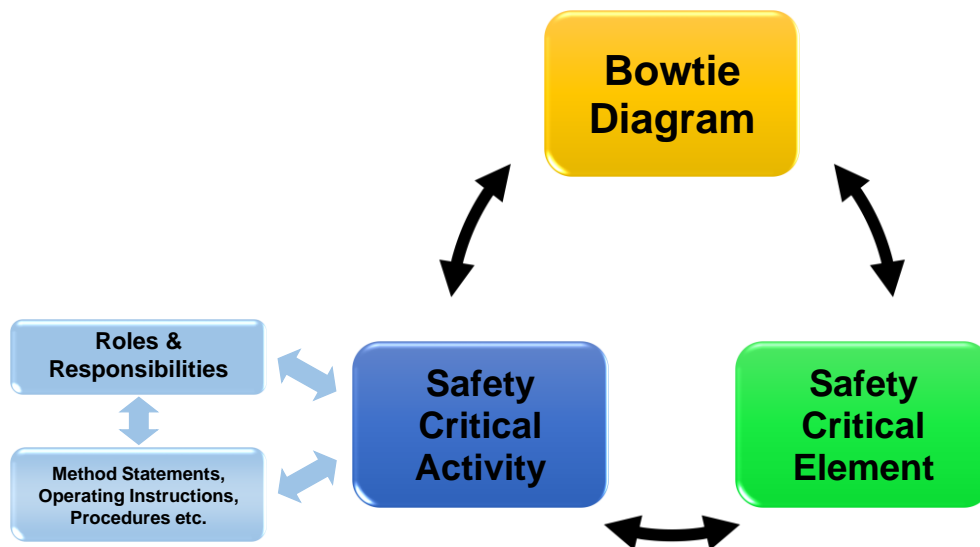


Figure 7: E-SafetyCase navigation triangle

For each SAH the user can, via single clicks, jump between the Bowtie, SCEs and SCAs from any entry point. This allows the user to:

- Gain an understanding of the role each SCE or SCA plays in ensuring risks are reduced ALARP by linking directly to the Bowtie and showing how each fits into the big picture.

- Link directly from a SCE to view the SCA(s) which must be performed to ensure that feature continues to perform its safety function correctly.
- Link directly from a SCA to the associated SCE to understand the feature the activity relates to.
- From a SCA, click directly to the method statement, operating instruction, procedure, etc. which must be followed to complete that activity correctly and identify who is responsible for completing that SCA.
- Quickly and easily identify all SCAs a specific individual is responsible for.

But this simple and easy navigation is not confined to individual SAHs. The links cut across all SAHs, Bowties, SCAs and SCEs and can be accessed both from a process and asset perspective.

The example user journeys described in Table 1 illustrate the flexibility and benefits an e-SafetyCase offers.

No	User	Requirement
1	Service Technician	Familiarise himself/herself on the important factors in executing a safe transfer from marine vessel to offshore wind turbine whilst transiting out to the wind farm using the e-SafetyCase downloaded onto a mobile device.
2	Marine Controller	Refresh himself/herself of all the SCAs they are responsible for to ensure he/she performs these roles effectively.
3	Maintenance Technician	Find the method statement to allow him/her to complete one of their designated SCAs and watch an instructional video on how to complete that task.
4	HSE Manager	Assess potential vulnerability to a recent incident on a similar wind farm by interrogating the resilience of the barriers included within the relevant Bowtie diagram based on the findings of the incident investigation.
5	Regulator	Understand how the risk of fire is being managed within a wind turbine to form a view as to whether this risk is being managed ALARP.

*Table 1: Example e-SafetyCase user journeys*

### What it is not....

It is important to recognise that the e-SafetyCase described here does not present a live risk monitor or risk “dashboard”; something which, confusingly, is often termed an e-SafetyCase. This is something industry clearly has an appetite for but is a very different challenge to that being explored here. Work is ongoing to develop tools to do this and hopefully these could ultimately be blended with this e-SafetyCase concept to provide a complete, holistic solution to managing risk within a major hazard facility.

### What benefits does an e-SafetyCase offer?

It goes without saying that an e-SafetyCase has to do what a traditional paper based Safety Case does; demonstrate risk is reduced ALARP. The real benefits of an e-SafetyCase come from the extra things it can do. It's a Safety Case, but not as we know it!

As previously described, this e-SafetyCase provides multi-dimensional links to allow any individual involved or interested in the safe operation of the offshore wind farm to quickly and easily access the information they need to perform their role effectively. It houses all of the information to ensure, demonstrate and support safe, reliable operation in one place and puts this at the fingertips of the right people in a format that suits them. This delivers three key benefits:

1. It brings the information within the Safety Case to life in a simple, interesting and engaging way promoting a better understanding of safety and better safety compliance across the facility. As opposed to a traditional paper-based Safety Case, which tends to sit on a shelf gathering dust, an e-SafetyCase can actually promote and drive safe operations by encouraging feedback from the field that allows it to be improved and optimised to the benefit of the overall facility.
2. By providing access to all of this information in a very simple and intuitive way, it becomes helpful and useful to anyone involved in the operation of the facility, not just those concerned about safety. When information is useful, it is well used, and so there is a natural incentive to keep it up to date. As a result, the e-SafetyCase evolves with the facility, ensuring there is no disconnect between the Safety Case and operations; they become one and the same (see Figure 8). This overcomes the huge limitation of traditional paper-based Safety Cases; they are a burden to maintain and if they do not evolve with the facility, safety is inevitably compromised.



**Figure 8:** An e-SafetyCase bridges the gap between operations and safety

- By linking directly to traditional management system documentation such as procedures, method statements, job descriptions, etc., the e-SafetyCase provides a seamless link from the arguments as to why something should be safe right through to the documentation provided and responsibilities discharged to make sure it is actually safe. This is a significant improvement over traditional paper-based Safety Cases which tend to stop with the “why?” – the snapshot at that moment in time when the case was written.

So, in summary, the key benefit of an e-SafetyCase is that it:

- Provides an accessible, engaging and intuitive basis of safety which proactively drives and encourages safe operations;
- naturally evolves hand-in-hand with the facility as routine business; and
- provides a seamless link between hazards and the actions people need to take to ensure risk is reduced ALARP.

Effortless safety – is that not too good to be true?

### So why aren't all Safety Cases electronic?

The e-SafetyCase approach has been around for some time, but has struggled to gain widespread traction across industry, potentially due to misconceptions about the complexity and hence cost of development or the need for bespoke software. In reality, it's just about presenting information in a different and more accessible way, created using simple software found on most computers. What's more, this format can be applied to any industry for any facility. The cost of generating an e-SafetyCase is no greater than a paper-based Safety Case. All the underlying analysis, studies, etc. remain identical, it is just the final presentation that is different. If the decision to present the Safety Case in an “electronic” format is taken early, then it can be developed at no cost or programme penalty compared with a traditional paper-based version.

Another possible reason for not developing an e-SafetyCase is the concern that maintaining and updating it is too difficult and time consuming. Although updating the e-SafetyCase may seem more onerous than a traditional Safety Case, with a good management of change log and guidance, updating the e-SafetyCase should be no more taxing than updating a traditional Safety Case. It may just need someone with a different skill-set. Indeed, as previously demonstrated, an effective e-SafetyCase will be so useful and effective it will naturally evolve hand-in-hand with the facility as a natural part of routine business.

There's a danger the e-SafetyCase grows into a catch-all document due to the extra functionality it offers, however the intended focus of the e-SafetyCase should not be lost; it should not replace existing management systems or document systems but rather act as a link and interface into these complementary existing systems.

### Future Developments

The e-SafetyCase concept has significant scope for further development and improvement by embracing wider technological innovations. A good example of this potential is the work we are doing to blend the e-SafetyCase with Virtual Reality (VR) to truly bring the Safety Case to life by immersing the user within the actual facility and overlaying Safety Case information on the plant itself, thus removing the disconnect between the facility and its Safety Case.

VR technology has evolved significantly over recent years and is now available in very affordable and accessible formats such as Google's cardboard VR goggles (see Figure 9). These goggles incorporate special lenses and accommodate a standard mobile phone. The lenses translate moving images played on the phone's screen via compatible Apps into a 3D VR experience. The positional sensors within the phone are synchronised with the image being played on the device such that when the user tilts their head or turns around, they see the corresponding view creating a highly realistic, 360° immersive experience. In addition, a button on the side of the goggles taps the mobile phone screen allowing the user to select options built into the video footage played on the mobile device providing an interactive experience.





*Figure 9: Google's Cardboard VR Goggles*

We have developed a prototype e-SafetyCase augmented with VR for a Wind Turbine Fire Safety Case. The Safety Case is viewed via an app downloaded onto a standard tablet device. Where VR enhances the Safety Case, a VR icon appears, which, when clicked, launches a VR snippet on a separate mobile device located within the Google goggles. The user can then put on the goggles and actually experience that element of the Safe Case in real, absolute terms. Some examples of the enhanced functionality this delivers include:

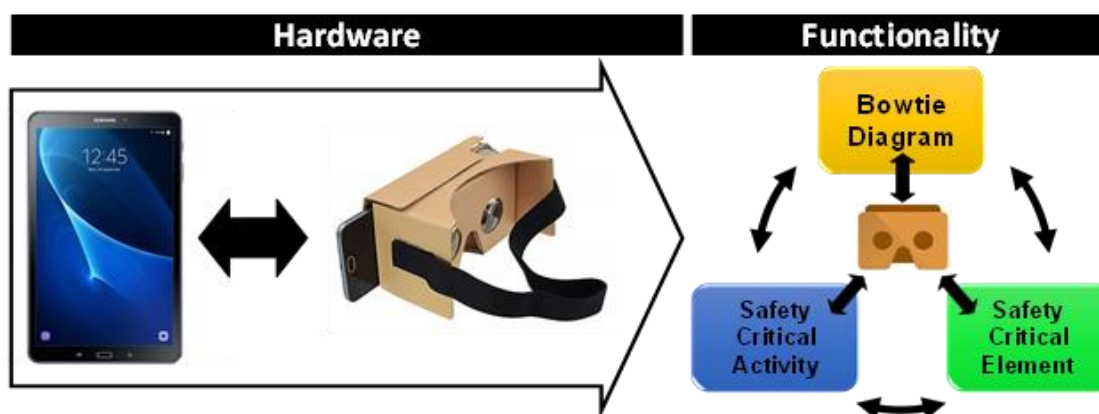
- A VR icon appears next to a SCE within a Bowtie diagram. Clicking the icon within the Bowtie launches a VR snippet which allows the user to see where that feature exists within the wind turbine in real terms and to understand its size, scale, configuration, etc. just as if they were physically there within the turbine itself.
- A VR icon appears next to the SCAs assigned to a responsible person. Clicking the icon launches a VR snippet which allows the user to see that feature so that they can experience in real terms how they must go about completing that activity.
- A VR icon appears next to the key stages of the various Escape, Evacuation and Rescue (EER) routes from the wind turbine in the event of all credible fire scenarios. Clicking these icons launches VR snippets which allow the user to experience the complete escape route, including;
  - the physical route they must follow;
  - the location of EER equipment (e.g. immersion suit, harness and descent device to allow an external escape from the nacelle of the turbine through the rear escape hatch as a last resort);
  - the time they are expected to take to progress through the route to ensure they can escape before it is compromised (based on findings of the EER study, supported by fire and smoke modelling);
  - the things they need to do at each stage (e.g. put on harness, connect to decent device, clip device onto anchor point, open escape hatch, etc.), and;
  - the extent to which visibility is likely to drop as they progress through the escape route by simulating the results from the supporting fire and smoke modelling.

This delivers two key benefits:

- It allows operators to familiarise themselves with EER arrangements – providing an excellent training tool.
- It provides confidence (or otherwise) in the adequacy and acceptability of overall EER provision by allowing users to test, in a safe, virtual environment, whether escape can be completed safely before the overall route is compromised, thereby reinforcing the integrity of the case. Don't just read about why something is safe, experience it!

However, the direction of travel is not just one way. When wearing the goggles to view the VR snippets, the user can click the button on the side of the goggles to access related information which can be viewed back on the tablet. For example, SCEs are highlighted within the VR model and when clicked (via the button on the goggles) a simple menu opens-up allowing the user to select and then view (back on the tablet) either:

- The Bowties where that SCE is claimed;
- the SCAs associated with that SCE; or
- instructional videos associated with that SCE.



*Figure 10: e-SafetyCase augmented with Virtual Reality*

As illustrated in Figure 10, this two-way connectivity greatly improves the e-SafetyCase user experience from the version previously demonstrated (see Figure 7). The VR complements the e-SafetyCase, further bringing it to life, whilst also being a real life navigational tool for the Safety Case itself making it even more accessible, intuitive and easy to navigate.

The Holy Grail for any Safety Case is for the plant itself to show why it is safe. An e-SafetyCase augmented with VR goes a long way towards achieving this.

### Perceived limitations of e-SafetyCase versus paper-based Safety Case

As the saying goes; “the proof of the pudding is in the eating!”. As with any other innovation, e-SafetyCases will only become the established norm if they are better than what already exists. They must never be championed as an academic or theoretical crusade - they will rise or fall based on this very practical test. So, before significant time, effort and money is spent on the development of e-SafetyCases, as any good Safety Case author should always do, we must critically challenge whether they are indeed better than traditional paper-based Safety Cases by considering the following potential limitations:

1. *Ease of accessibility – can they really be “accessed by anyone, anywhere, anytime”?*

By making the e-SafetyCase available as an App which can be downloaded onto a standard mobile device, yes it can. Most people have an electronic device which they could download the App onto. Also, the price of this technology is dropping all the time and so the cost to the company of providing all Safety Case users with a tablet would be small in comparison to the cost of developing the Safety Case itself.

2. *As previously demonstrated, an e-SafetyCase provides lots of peripheral benefits, but does it actually deliver on its core function – demonstrating a safe position?*

As previously described, an e-SafetyCase is founded on the same risk management process, studies, analysis, assessments etc. as a traditional paper-based Safety Case. The only difference is how this information is presented, with these differences delivering the wider, peripheral benefits described elsewhere within this paper.

3. *A regulatory Safety Case is a strictly controlled document and for very good reason. How can an e-SafetyCase deliver the same level of control?*

One thing a traditional paper-based Safety Case and an e-SafetyCase have in common is they are both deliverables that have a defined status and identity. As such, change management can be controlled in an identical way using existing processes. These will ensure revisions are developed, implemented, reviewed and approved by competent people, with updates strictly controlled to ensure that people only use the latest, approved version. Whether the Safety Case is presented on paper or in electronic format is immaterial in this regard. Indeed, the days of a SafetyCase being a printed book issued to a small number of approved users are (largely!) long gone. The traditional paper-based Safety Case has morphed into an electronic document which can be downloaded off servers and e-mailed around organisations. An e-SafetyCase presents no greater challenge to that which is already being managed.

Making the e-SafetyCase available as an App does introduce additional challenges, particularly around security, but other businesses, with similar sensitive information which is version critical, manage these challenges effectively; e.g. finance/banking and e-commerce. In these examples, these challenges are managed in the public domain (the App is publicly available). There is no need for an e-SafetyCase to be publicly available with access only granted to approved users, thereby introducing another level of control.

4. *Regulated industries expect a traditional paper-based Safety Case. This is what they are used to and, indeed, the regulator has invariably shaped the format, structure, content etc. of these. Will regulators accept an e-SafetyCase?*

An e-SafetyCase does exactly the same job as a traditional paper-based Safety Case; it provides a robust demonstration of safety. The difference is in how this information is presented. With an e-SafetyCase being more accessible, intuitive and easy to navigate than a traditional paper-based Safety Case, it should make a regulator’s job easier and so should be welcomed as a positive development. Indeed, it is a fundamental expectation of any regulator

that operators embrace ways of reducing risk. With an e-SafetyCase providing an accessible, engaging and intuitive basis of safety which proactively drives and encourages safe operations, as previously described, it should be viewed favourably, provided the challenges above are adequately managed. Further support and engagement and buy-in would be gained by actively involving them in the development of the e-SafetyCase concept, allowing it to be developed to meet their specific needs.

Regardless of the above position, it is worth remembering that an e-SafetyCase is founded on the same risk management process, studies, analysis, assessments etc. as a traditional paper-based Safety Case. It would therefore be simple to also present it in the established, traditional format accepted within that industry. An e-SafetyCase which can be viewed in “traditional” and “electronic” modes would therefore provide the best of both worlds.

5. *Software projects are notorious for mushrooming in scope and complexity and blowing budgets and programmes. Would the development of e-SafetyCases suffer these problems?*

An e-SafetyCase template would be developed as a tightly controlled project based around a detailed specification developed by the Safety Case users. This template would then be used to generate all future Safety Cases ensuring a consistent, proportionate approach. Clearly the scope and complexity of the e-SafetyCase could mushroom, but this can be managed through this one-off project. From that point onwards, the established blueprint will prevent individual e-SafetyCases being overly complex. This is actually an improvement over traditional paper-based Safety Cases where experience shows that they can tend to grow and expand unnecessarily from project to project.

It will ultimately be the users (the designers, operators, managers, regulators etc. of major hazard facilities) who will decide whether the e-SafetyCase has a future.

There is clearly evidence that an e-SafetyCase can be at least as good as a paper-based Safety Case in terms of its core purpose of demonstrating a safe position. Adding in the wider, peripheral benefits it offers, there would appear to be a strong case to offer these users the chance to trial the concept so that they can make the ultimate decision. Let the people decide!

## Conclusions

In today's world where answers to most questions can be Googled instantaneously, isn't it time the safety world caught up? The development of an e-SafetyCase is no more onerous than a conventional Safety Case, it's just different. Maintenance is no more onerous either. Indeed, an effective e-SafetyCase will be so useful and effective it will naturally evolve hand-in-hand with the facility as routine business.

Climbing the learning curve is a small price to pay for the considerable benefits this concept offers; providing an accessible, engaging and intuitive basis of safety which proactively drives and encourages safe operations.

Taking things further, the e-SafetyCase can be blended with technological innovations such as Virtual Reality to further bring it to life. This kind of ambitious approach has the potential to change the landscape of safety management in high hazard industries.

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