

GUIDANCE ON RISK

for the engineering profession

Guidance on Risk for Engineering Professionals

This guidance describes the role of professional engineers and technicians in dealing with risk, and their responsibilities to society. It lists six principles to guide and motivate professional engineers and technicians in identifying, assessing, managing and communicating about risk.

- 1. Apply professional and responsible judgment and take a leadership role**
- 2. Adopt a systematic, broad and holistic approach to risk identification, assessment, management and review**
- 3. Comply with legislation and codes, but be prepared to suggest or promote further improvements**
- 4. Ensure good contextual communication with the others involved**
- 5. Ensure that sustainable systems for oversight and scrutiny are in place**
- 6. Contribute to public awareness of risk**

Risk is referred to both explicitly and implicitly in several Engineering Council documents including the UK Standard for Professional Engineering Competence (UK-SPEC) and other associated documents.

This guidance is intended as an introduction to risk and aims to encourage all those working in engineering to adopt risk management thinking in their practice. It applies across all sectors of engineering. Sector-specific context and practical step-by-step guidance are not included. For that, users are encouraged to refer to

material published by a range of sectoral organisations, including engineering bodies, governments and corporates. Some links are available on the Engineering Council's risk website pages: www.engc.org.uk/risk.

The Engineering Council will review this guidance periodically and welcomes comments on it. Professional engineering institutions (PEIs) and Professional Affiliates are encouraged to use it to assist them in developing guidance for their members.

Risk

ISO 31000¹ defines risk as 'the effect of uncertainty on objectives'. This definition allows for variability and the positive consequences of uncertainty as well as the negative. ISO's definition includes the following:

Risk is often expressed in terms of a combination of the potential severity of a series of events, the associated likelihood of occurrence and the opportunity for detection.

The probability, frequency of occurrence, detectability and impact of an event are factors which should be considered in any analysis of risk.

Risks are often thought of as being negative, however, there can be unexpected positive outcomes.

According to ISO 31000, a risk management process identifies, analyses, evaluates, treats, monitors, records, reports and reviews risks. Within this document, the use of the term 'risk management' includes all of the above.

¹ International Organization for Standardization (ISO) 31000 is the standard related to risk management.

The role of the engineering professional in risk

The engineering profession recognises that risk is an inherent part of all engineering activities. Engineering professionals² have a significant role to play in appropriately managing risk.

Risk is present in all engineering activities as a result of uncertainty as well as inherent hazards. Some elements of risk may be quantified, while others may be evaluated in a more qualitative way. Nevertheless, novel engineering activities will often involve a degree of uncertainty where previous experience offers an incomplete guide. However, excessive risk aversion might lead to technological stagnation and deny society potential benefits.

Therefore it is important for engineering professionals to understand the level of risk that is acceptable in pursuit of objectives – **the risk appetite**. Risk appetite defines the boundaries within which risk-based decision making can occur, be controlled and expectations set. Some elements of an engineering activity will be non-negotiable and there will be no appetite for risk. In all cases, there is a need for engineering professionals to exercise informed judgment and leadership in order to manage the risk, consistent with their organisation's defined risk appetite. All risk decisions should be pursued in line with risk appetite.

Society's perception of risk may differ from the engineering professional's, and therefore they should strive for clarity when communicating about risk, and communicate in terms understandable by non-specialists.

² In this Guidance, 'engineering professionals' means registered engineers and technicians, as well as non-registrants engaged in engineering including tradespeople, students, apprentices and trainees. Non-engineers managing or teaching engineering professionals should be made aware of this Guidance.

Through the effective management of risk, engineering professionals should be able to:

- manage activities in fulfilment of the accepted risk appetite
- improve the reliability and effectiveness of their product, process or service
- minimise the impact of potential problems or adverse effects
- maximise the impact of potential benefits or helpful outcomes
- provide early warning and definition of potential threats
- help ensure demonstrable compliance with regulation as a minimum
- contribute to improving the resilience of their organisations
- protect revenue and enhance value for money
- articulate and manage uncertainty surrounding the decisions being made

Risk is an inherent part of every engineering activity. Risk management in accordance with risk appetite is an essential part of engineering.

Risk management is also practised by other professionals with whom engineering professionals work in multi-disciplinary teams.

Principles to guide engineering professionals

These six principles will guide an engineering professional when managing and communicating about risk, and help to ensure that risk issues are recognised as important considerations in all engineering activity. They may be included as part of an organisation's risk management policy, with risk management plans describing how the principles will be applied in that organisation.

A range of quantitative, qualitative and systematic methods exist for the management of risk. However, the behaviour of people is central to the success of the risk management process, for example in ensuring that those inside and outside the organisation feel confident in highlighting risks. Therefore the engineering professional will need to pay attention to human and cultural perspectives as well as purely technical aspects.

The key stages of managing risk are:

- systematic **identification** of causes
- **evaluation** of the severity of potential consequences
- **treatment** of the risk which includes:
 - consideration for eliminating or minimising the cause or consequence
 - identification of control and mitigative measures for remaining causes
 - identification and closure of plans to manage gaps identified
- **monitoring** of measures for risk management

- **recording and reporting** the steps and status of the risks by maintaining the system employed to manage them
- **reviewing** the performance of the risk management system periodically, driving continuous improvement

1. Apply professional and responsible judgment and take a leadership role

Engineering professionals should demonstrate by example a commitment to safety, reliability and ethical conduct through the professional management of risk, from the inception of any engineering activity. They should clearly demonstrate the standards by which they expect risks to be managed, thus setting an example to others. In doing so, engineering professionals should:

- be prepared to challenge assumptions and proposals
- ensure that safety receives appropriate consideration
- assess the balance of risk and benefit
- strive for all those involved to be able to identify potential problems and opportunities
- ensure that any engineer reporting to them has the opportunity to maintain competence in the process of risk management
- lead others in improving practice

2. Adopt a systematic, broad and holistic approach to risk identification, assessment, management and review

The factors that give rise to risk are interdependent and cannot be examined in isolation. It is vital in managing risk to be aware of this interdependency and, rather than dealing with risks one-by-one as they arise, use approaches that deal with whole systems. This requires engineers to:

- make risk management an integral part of all engineering activity and decision making
- look beyond purely technical considerations, to address non-technical factors, including social, economic, environmental and political perspectives
- don't discount weak signals without further consideration
- ensure that human factors are considered
- adopt a decision-making approach that is proportionate to the risk and consistent with their organisation's defined risk appetite
- aim to quantify the risks with as much precision as is relevant, sufficient and can be supported by the evidence
- ensure consideration of high severity, low frequency events along with low severity, high frequency events
- be responsive to changes in the operating environment
- look for connections, patterns and relationships between risks and opportunities
- bear in mind that risk assessment should be used as an aid to professional judgment and not as a substitute for it

3. Comply with legislation and codes, but be prepared to suggest or promote further improvements

Regulations and codes are generic. They can only deal with anticipated events and cannot predict every possible situation. Engineering professionals should take a measured, yet challenging, approach to potential risks, whether or not regulations apply. They should:

- act in accordance with codes of conduct
- know about and comply with the law in countries where they are operating or where their products or services will be used
- recognise and understand the intent behind standards and codes, and understand when their limits are being approached
- comply with current relevant legal requirements governing engineering risk issues
- seek advice where necessary
- where it is practicable, seek further improvements, thus embedding a culture of seeking continuous improvement
- be open-minded and avoid hiding behind regulations

4. Ensure good contextual communication with the others involved

Communicating effectively with all stakeholders is important to ensure that risks and their implications are understood properly. Within an organisation, risk management should be communicated as a core value. Engineering professionals should:

- establish strong, honest and effective two-way communication within and beyond their organisation
- establish a consultation and feedback process about risks with all stakeholders, including the public and local community
- express clearly the balance of risk and benefit
- communicate clearly assumptions made during the risk management process
- communicate clearly individuals' responsibilities in managing risk over the lifetime of the engineering activity
- encourage a culture of 'open reporting' and a spirit of questioning and learning from others
- avoid a 'good news only' or closed culture

5. Ensure that sustainable systems for oversight and scrutiny are in place

Effective oversight and assurance processes are important safeguards in controlling risks. They should be challenging, and carried out with independence from those creating the risk or attempting to control it. Engineering professionals should:

- be aware that risk assessment documentation may be used in incident investigations

- ensure that effective oversight and assurance procedures and systems are in place, and are sufficiently independent
- ensure that roles, responsibilities and accountabilities are understood and clearly defined, especially where functions are outsourced
- include assessment of culture
- not limit assurance to audit or physical systems

6. Contribute to public awareness of risk

The perception of risk among the public is influenced by a range of factors, including emotional ones. Engineering professionals have an important role in raising awareness and understanding about actual levels of risk and benefit, and helping to prevent misconceptions. They should:

- be prepared to engage in public debate on the perceived risks and benefits
- ensure that discussion with the public includes management of risk
- ensure that the public are informed about all aspects of risk management
- explain the quantitative and qualitative aspects of risk with clarity and supporting evidence
- be honest and clear about assumptions
- be prepared to challenge misrepresentations
- communicate to the public its role in risk management




+44 (0)20 3206 0500

info@engc.org.uk

engc.org.uk

 Engineering Council

 TheEngC

 Engineering Council

 [theengineeringcouncil](https://www.instagram.com/theengineeringcouncil)

Publication of extracts from this document are encouraged, subject to attribution to the Engineering Council. Registered Charity: 286142. Published: October 2021. Please refer to the Engineering Council website to ensure that you have the current version. Images © This is Engineering.

