



Safety Decisions Programme

The route to 'Taking Safe Decisions'

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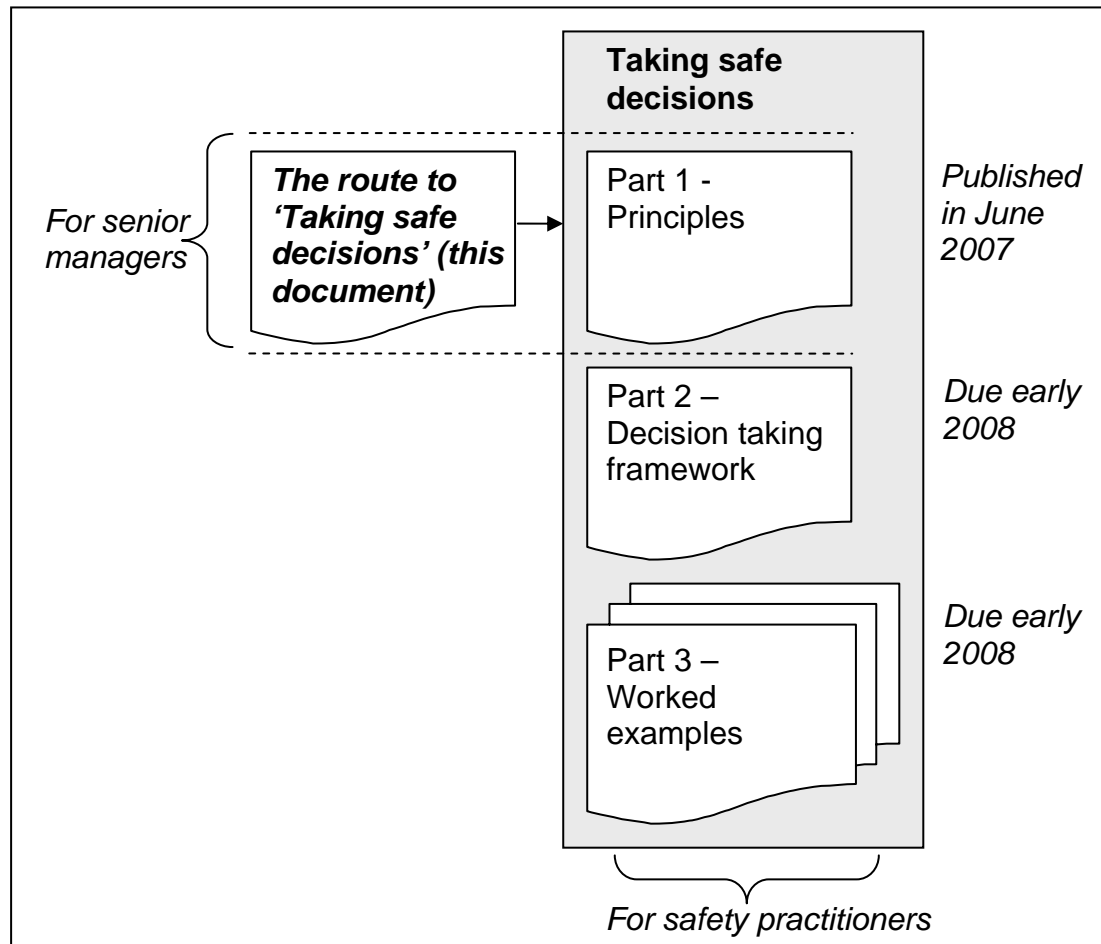
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Hierarchy of documents

Taking Safe Decisions has been developed as comprehensive set of principles and guidance to support decision taking in the GB railway industry. The hierarchy of documents forming and supporting *Taking Safe Decisions* is outlined in the diagram below.



Taking Safe Decisions: Document hierarchy and intended audiences

Taking Safe Decisions consists of three parts:

- Part 1 - A statement of principles (published in July 2007 and available on the RSSB website (www.rssb.co.uk/sdmoukr.asp)).
- Part 2 -The decision taking framework: describing how the principles can be put into practice.
- Part 3: Worked examples: outlining how the framework is applied, using a number of illustrative examples.

These three parts provide guidance targeted at safety practitioners.

Senior managers in the railway industry will be interested primarily in Part 1 of the document, the statement of principles and, for reference purposes, *The route to Taking safe decisions* which describes the logical, research and legal arguments behind the principles.

Glossary of terms

Collective risk

The number of fatalities, or fatalities and weighted injuries per year that would be expected to occur from a hazardous event.

Consequences

The number of fatalities, major injuries and minor injuries resulting from the occurrence of a particular hazardous event outcome.

Fatalities and Weighted Injuries (FWI)

In this document, for the purposes of assigning monetary value to risk, the numbers of major and minor injuries are weighted in recognition of their relatively less serious outcome in comparison to a fatality. The weighting at the time of publication of this document is 0.1 of a fatality for each major injury and 0.005 for each minor injury.

Frequency

The frequency of an event is the number of times it occurs over a specified period of time (e.g. the number of events per year).

Hazardous event

A hazardous event is one that has the potential to lead directly to death or injury (e.g. a derailment, collision or fire).

Individual risk

The probability of fatality per year to which an individual is exposed from the operation of the railway.

Industry

Collective term for companies who take decisions which directly impact upon the GB overground railway network. This primarily includes companies who require certification or authorisation of their Safety Management System under the Railways and Other Guided Transport Systems (Safety) Regulations (ROGS), but excludes the Regulator and Government.

Probability

The likelihood of an event occurring over a specified period of time.

Risk

The risk of an event is calculated by multiplying its likelihood with the severity of its consequences. The Safety Risk Model (SRM) calculates risk in units of FWI per year.

1 Introduction

1.1 Background

1. The legal duties that rail companies must discharge in GB when taking decisions that affect safety are based in a complex mixture of case and statute law. In particular sections 2, 3 and 4 of the Health and Safety at Work Act 1974 (HSWA) require all employers, including railway companies, to reduce risk so far as is reasonably practicable (SFAIRP). There are however few court rulings that help to clarify how the railways can determine what measures are reasonably practicable so there is the potential for conflicting views to exist about how to interpret the law. Ultimately each decision taker is responsible for deciding if the proposed course of action is reasonable, and if necessary, defending that decision in court.
2. The decision taking process takes place in a complex physical and organisational environment. As with all industries the legal requirement to manage safety is therefore only one of a number of considerations that impact upon the taking of decisions.
3. The Safety Decisions Programme (SDP) was established in November 2003 and has been managed on behalf of the industry by Rail Safety and Standards Board (RSSB). The programme was set up following a range of requests from industry stakeholders to:
 - establish a common understanding amongst internal and external stakeholders as to what the railway is expected to deliver with regard to safety.
 - develop a framework of processes and criteria for decision makers to apply.
 - achieve clarity and stability in the safety governance of the railway.
4. Whilst the concept of safety is central to the Programme, it is acknowledged that within businesses, decisions about safety are not made separately, but are very much part of the normal business management processes.
5. At the outset of the programme sixteen questions were put to the industry and Regulator [6.1]. These questions concerned the affordability of railway safety measures and concepts associated with the determination of when risk is being managed ALARP (as low as is reasonably practicable). Responses received highlighted the need to address ambiguity associated with decision taking. The summary of the various responses to the 16 fundamental questions [6.2] shows the range of different opinions at that time.
6. Later, a review by the House of Lords Select Committee on Economic Affairs found similar problems with safety regulation in general, not just in the railway industry, concluding that:

'In our view, the use of ill-defined and ambiguous terms in risk management and regulatory documents is generally unhelpful. There is a danger that they can induce an excessively cautious attitude to risk. We recommend that terms such as ALARP, Gross Disproportion and the Precautionary Principle should be more clearly defined or replaced with more specific and unambiguous requirements and concepts.' [6.3 pp25]

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7. At the outset of the Programme railway health and safety regulation was the responsibility of the Health and Safety Commission and Executive (HSC/E). This document highlights issues that existed in the regulatory position and in various regulatory guidance documents produced by the Health and Safety Executive (HSE) and Her Majesty's Railway Inspectorate (HMRI) in this period. On 1st April 2006 responsibility for health and safety regulation was transferred to the Office of Rail Regulation (ORR). Since this time the Programme has engaged in consultation with the ORR in order to ensure that the principles described in *Taking Safe Decisions*, and its supporting documents, are transparent and clear.
 8. The ORR is currently reviewing the previous HSE/HMRI guidance relating to the use of the "so far as is reasonably practicable" (SFAIRP) principle in making decisions, and in particular the use of cost benefit analysis (CBA) to support such decisions. There will be two ORR documents: the first, dealing specifically with the use of CBA, will, after consultation, be published early in 2008. It will be followed by a second document which sets out the more general framework. Publication of Part 2 of 'Taking safe decisions', the Decision taking framework, is to be aligned with the publication of the ORR guidance on the use of CBA.

1.2 Process for building consensus

9. The initial work of the Programme was informed by research commissioned to survey good practice in decision taking both in the rail industry [4.1, 4.2] and in other industries [4.3].
10. A 'Think Tank' was established at the commencement of the programme to enable industry stakeholders to review research findings and technical papers and steer the technical progress of the programme. It has met regularly throughout the duration of the programme [2.2] and comprised members from throughout the industry and government. The Office of Rail Regulation (ORR) and Department for Transport (DfT) attended the meetings as observers.
11. In February 2005, following initial research and discussion, RSSB published *How safe is safe enough?* (HSISE) [1.1]. The document presented an overview of how British railway companies take decisions that could affect safety and identified a number of outstanding issues where further work and research was required. HSISE was published as an industry document and briefed out widely across industry.
12. Following the publication of HSISE, work streams were begun to progress the work of the Programme. Discussion documents were prepared to present the findings of the first two workstreams: *Valuing Safety* [1.2] and the *Decision-Taking Framework* [1.3] and these were put out to consultation in March and April 2006. This resulted in a large number of formal responses being received from industry [2.4, 2.5]. A programme of consultation workshops was subsequently undertaken to support this process [2.3]. A period of consensus building followed the consultation, leading to a statement of the industry consensus: *Taking Safe Decisions* [1.4].
13. The work to draw together all of the safety decisions programme into final documents for publication has been overseen by the Safety Policy Group, which is a sub group of the RSSB Board and comprises the nominated representatives of all categories of RSSB membership, together with observers from the DfT and ORR
14. The full set of documents will comprise *Taking Safe Decisions*, the *Decision Taking Framework* with supporting worked examples and *the route to Taking safe decisions*

(this document). The other documents mentioned in paragraphs 10 and 11 will be withdrawn when these are all published.

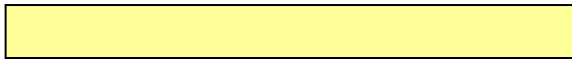
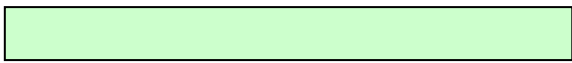
15. *Taking safe decisions* was approved for publication on 22nd May 2007 by the Safety Policy Group and RSSB Board. *The route to Taking safe decisions* was approved for publication by the Safety Policy Group on [10 October 2007]

1.3 Purpose of this document

16. The purpose of this document is to describe:
- The key areas of ambiguity about how to take decisions affecting safety that existed prior to the work of the Safety Decisions Programme.
 - The clarified industry consensus position on safety decision taking principles that was agreed through the work of the programme.
17. Reference is provided to all research, legal arguments and consultation findings that fed into the debate leading to the development of *Taking Safe Decisions*.

1.4 Structure of this document

18. Table 1 summarises the two contrasting positions on key decision taking principles and practice. The first, in the left hand column, describes perceptions existing prior to the establishment of an industry consensus. The second, in the right hand column, describes the industry consensus position following consultation and discussion. *Taking Safe Decisions* has been published as a document which is acceptable to all parties on the basis of this knowledge. To make the summary table easier to interpret, green boxes have been used to indicate areas of industry consensus and yellow boxes have been used to show those areas where there was not initially a consensus:

Text box colour	Status of text box contents
	Initial area of ambiguity:
	Initial area of clarity:
	Industry consensus position:

19. Section 2 presents the arguments that support the assertions made in the table providing explicit reference to any relevant documents, research and consultation evidence. Because of the complexity of the issues and their interrelation it is essential that the table is used to navigate through and interpret the meaning of the supporting text in section 2. Section 3 presents the main conclusions of the document. The full list of supporting references is provided in Section 4.
20. Numbers in square brackets refer to documents listed as supporting documents in section 4 of the report. These documents are archived with this report so that all key references are readily available.

		Initial area of clarity	
		Initial area of ambiguity	Industry consensus position
1 Purpose		To achieve clarity in the process for taking decisions, so that all stakeholders, both within and outside the industry, know: <ul style="list-style-type: none"> • who is responsible for taking decisions • what process and criteria they should apply and • what factors they should take into account in their decision. 	
2.1 How does the duty holder determine its legal duty?		<p>HSWA requires the duty holder to:</p> <ul style="list-style-type: none"> • Consider whether or not an activity lies within the scope of the undertaking • Where the activity does lie within the scope of the undertaking, carry out that activity in such a way as to minimise any risk arising from it SFAIRP <p>The duty holder must also comply with all other relevant legislation and mandatory requirements.</p>	
2.2 How does the duty holder determine whether the risk is reduced SFAIRP?	2.2.1 How is the judgement made?	<p>The duty holder is responsible for determining if a safety measure is reasonably practicable. The judgement will be informed by some comparison of risks and costs. The value of preventing a statistical fatality VPF is used to attribute value to risk. The value is published annually by the Department for Transport (DFT) in HEN1 (for 2007 this is £1.573 million per Fatality and Weighted Injury (FWI)).</p> <p>It was unclear what degree of disproportion between risks and net costs were considered 'gross'</p>	<p>When safety improvements are being considered and the cost is less than the monetary values of the safety benefit determined by applying the VPF duty holders, generally, implement the improvement. Where the cost is above the monetary value of the safety benefit, professional judgement is applied in determining whether the cost is grossly disproportionate to the safety benefit and it is reasonably practicable to implement the improvement. In making this judgement, particular attention is paid to:</p> <ul style="list-style-type: none"> • The degree of uncertainty in the assessment of costs and safety benefits • The range of potential safety consequences.
	2.2.2 How are societal values taken into account?	The VPF is derived from Willingness to Pay (WTP) studies. It is therefore a measure of societal values.	
	2.2.3 How is societal risk taken into account?	It was unclear whether and to what extent a judgement about what is reasonably practicable should reflect societal risk.	Societal risk refers to the collective risk relating to major accidents. All ALARP assessments involve consideration of collective risk. However, the extent of societal risk does not, of itself, change the VPF or affect the way in which a judgement is made about reasonable practicability taking into account costs and benefits.
	2.2.4 How does individual risk affect the decision?	It was unclear whether and to what extent the judgement about what is reasonably practicable varies as a function of the total level of risk to which particular groups of people are exposed.	The legislative requirement to reduce risks, so far as is reasonably practicable, and the application of the VPF, applies equally in respect of all segments of the population regardless of the particular levels of risk to which they are exposed as individuals.
	2.2.5 How is uncertainty in the assessment of risks taken into account?	The degree of uncertainty in the CBA must be taken into account in the judgement of whether risk has been reduced SFAIRP.	It was unclear whether and to what extent the test of gross disproportion was intended to account for any uncertainty in the assessment of risk
2.3 When would the duty holder go beyond its legal duty?	<p>A duty holder may elect to go beyond its legal duty for commercial reasons.</p> <p>The circumstances under which a duty holder might choose to go beyond its legal duty were unclear because the precise legal duty was unclear.</p>	A duty holder might choose to implement safety measures that go beyond what is reasonably practicable or that control the risk arising from hazards that lie outside its undertaking, for commercial, reputational or other reasons. However in the industry's judgement it is not legally obliged to do so and is therefore not committing a crime if it chooses not to implement such safety measures.	
2.4 When is the matter an issue of policy?	It was unclear whether or not the Regulator expected duty holders to take account of 'societal concerns' when making a judgement about whether or not a measure was reasonably practicable	The government may respond to 'societal concerns' by creating legislation where they believe this is necessary. The industry may choose to take account of 'societal concerns' for business reasons, but these considerations do not impact upon the determination of what is reasonably practicable.	

Table 1: Summary of initial clarity and ambiguity in the decision taking principles and how ambiguity has been resolved

2 Findings and Supporting Arguments

2.1 How does the duty holder determine its legal duty?

2.1.1 Initial area of clarity

HSWA requires the duty holder to:

- Consider whether or not an activity lies within the scope of the undertaking
- Where the activity does lie within the scope of the undertaking, carry out that activity in such a way as to minimise any risk arising from it SFAIRP

The duty holder must also comply with all other relevant legislation and mandatory requirements.

21. Railway companies should ensure that the decisions that they take that can affect safety comply with criminal law, including all prescriptive legislation and the general duties imposed by the 1974 Health and Safety at Work Act (HSWA)¹. These are:
 - To ensure, so far as is reasonably practicable, the health, safety and welfare at work of all their employees
 - To conduct their undertakings in such a way as to ensure, so far as is reasonably practicable, that persons not in their employment are not exposed to risks to their health or safety.
22. Obviously, where specific legal requirements apply, they must also be complied with.
23. Individual companies' duties in civil law – negligence, nuisance, occupiers of property etc – are essentially the same as those of any other company or person.

2.2 How does the duty holder determine whether the risk is reduced SFAIRP?

2.2.1 How is the judgement made?

Initial area of clarity

The duty holder is responsible for determining if a safety measure is reasonably practicable.

The judgement will be informed by some comparison of risks and costs. The value of preventing a statistical fatality VPF is used to attribute value to risk. The value is published annually by DFT in HEN1 (for 2007 this is £1.573 million per Fatality and Weighted Injury (FWI)).

24. When taking decisions, the duty holder must satisfy themselves that a particular safety measure is reasonably practicable. If a decision were ever to be questioned in court a magistrate or jury would apply the reasonable practicability test.
25. *Edwards v the National Coal Board*² is one of the key cases that provides clarification as to what a company's legal duty is. The ruling in this case states that:

¹ Health and Safety at Work etc Act 1974. (Elizabeth II 1974. Chapter 37)

² 1. ALL ENGLAND LAW REPORTS. Edwards vs. National Coal Board. 1949, vol. 1, pp. 743–749.

'... a computation must be made ... in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) is placed in the other, and that, if it be shown that there is a gross disproportion between them - the risk being insignificant in relation to the sacrifice - the defendants discharge the onus on them.'

26. This statement was adopted with approval by some judges in later cases and has formed the basis of health and safety policy since HSWA was enacted in 1974. There is broad consensus within the industry and the regulatory community that part of the decision-taking process will be an evaluation and comparison of the financial costs of implementing the proposed measure against the estimated safety benefits of its implementation. This evaluation may be a detailed quantitative analysis or a qualitative assessment, or something between the two. In all cases professional judgement will be applied.
27. There is also a broad consensus that the value for preventing a fatality (VPF) should be used to convert risk into a financial value to enable direct comparison between costs and benefits. The VPF that is used by railways is the same as that defined by DfT for use in appraising the viability of investments for roads. This view was endorsed in a Parliamentary debate on 5 June 2003, Hansard GC273 (Ref. 1):

Lord McIntosh of Haringey: *It is true that in the past there has been a different assessment of the value of a fatality in a road accident as opposed to a rail accident. ... If you have lost a loved one, it does not matter whether that occurred in a road, rail or aviation accident. That is the direction in which the Government are moving.*

For many years we have published an annual report which sets out the value of preventing a highway fatality. That has to be taken into account by the Highways Agency and local transport authorities when they are considering road safety improvements. The current value is £1.2 million at 2001 prices per fatality saved on the roads. We think that there should be the same standards for rail safety as for road safety. That is the principle that we adopt. The rail industry itself has set a higher figure but, clearly, it is up to that industry to review the figure that it uses.

28. The 'annual report' to which the Minister referred is Highways Economic Note 1 (HEN1) (Ref. 2). The latest edition explains how the figure is derived:

Para 3: Since 1993, the valuation of both fatal and non-fatal casualties has been based on a consistent willingness-to-pay (WTP) approach. This approach encompasses all aspects of the valuation of casualties including the human costs and the direct economic costs i.e. an amount to reflect the pain, grief and suffering and the lost output and medical costs associated with road accident injuries.

29. Research project T430 [4.4] investigated the VPF and found that it was a sensible figure to use in both the road and rail industries. To ensure that decisions address risk in all its forms a value is placed on preventing injuries as well as fatalities.

30. The term FWIs (Fatalities and Weighted Injuries) is used to refer to the resulting measure applying the following ratio:

Value of preventing a fatality = value of preventing 10 major injuries or 200 minor injuries

31. However as part of the Safety Decisions Programme research has been undertaken into the empirical basis of these ratios [4.5]. Phase 1 of the research has been completed. This has identified that the current weight given to minor injuries is

possibly too great and that improved consideration of the weightings can be obtained. Further empirical analysis is being undertaken for Phase 2 of the project. This may lead to a proposal for a revision to the FWI ratios used in the industry.

32. The test of reasonable practicability outlined in paragraph 24 might be satisfied in a number of ways. In many cases, simple inexpensive controls can be adopted on the basis of qualitative analysis, using professional judgement. If there is established good practice, and it can be shown to be valid and appropriate in the particular circumstances envisaged, then this suggests that the practice is reasonably practicable. However, a more quantitative approach, using formal cost benefit analysis, may be used to support a judgement when:
- The risks and/or controls are complex
 - The costs are high, either for a single location or when applied to similar situations across the whole network
 - There are a number of alternative options and it is not immediately clear which is the most effective and efficient.
33. Problems in the interpretation of 'reasonable practicability' can arise when the industry wants to do something that may increase risk. This may appear, at first sight, to be an improper thing to consider but there are many occasions when it would be entirely rational to allow risk to increase in order to manage safety better overall or remove controls that have a disproportionate effect on cost or performance for little safety gain. However, if the risk was managed to a lower level once, the argument goes, how could an increased level of risk be regarded ALARP? This leads to a view that the ALARP principle operates like a ratchet, working to increase safety but with no mechanism to allow risk controls to be relaxed or redistributed no matter what the circumstances.
34. It is accepted within industry that there may be some occasions when it is acceptable to increase one aspect of risk in the interests of improving the level of safety overall. Risk assessment is not a one-off task but an area of work that should be regularly revisited so that current circumstances can be taken into account. The concept of arguing for the removal of a risk control is often referred to in the industry as "reverse ALARP", although this term is not widely accepted as what is actually proposed is a re-application of the ALARP test in light of improved understanding or changed circumstances.
35. Research project T224 [4.6] investigated this issue (amongst others) and concluded that it is permissible to remove/reduce risk controls that can no longer be shown to be reasonably practicable. The latter case could arise if:
- the cost of the control increased (due to obsolescence, for example),
 - the safety benefits reduced (due to the effect of other controls) or
 - it was found that the control had never been justified under the ALARP principle.

Initial area of ambiguity

It was unclear what degree of disproportion between risks and net costs is considered 'gross'.

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36. The Edwards judgement provides a judicial statement of the meaning of 'reasonably practicable'. The judgement creates a bias in favour of safety by stating that a measure can only be ruled out when its costs and benefits are in 'gross disproportion' rather than just in 'disproportion'. Therefore the literal interpretation of the judgement is that a disproportionate response to risk is required. This view is reflected in all HSE and HMRI guidance notes [3.1-3.7].
37. The HSE has stated that there was no precise defined factor or algorithm for what constitutes grossness. For example it states in *Tolerability of risk from nuclear power stations* (TOR) [3.1] that:
- 'Precise values for this multiplier have never been defined by the courts and neither the regulator nor the regulated have sought this; both recognise the drawbacks associated with trying to regulate by means of (arbitrary) numbers'*
38. However, HMRI proposed such an approach for the railway industry. Appendix 1 of HMRI's *ALARP guidance and general principles* [3.2] offered some quantitative 'gross disproportion' factors that it called 'rules of thumb' which varied from 1 to 10. These suggested factors had no basis in empirical evidence. The use of 'disproportion factors' was also proposed in *HMRI Specific Cost Benefit Analysis (CBA) Checklist* [3.3].
39. The industry does not need a mechanistic process for making judgements about reasonable practicability. However a clear set of criteria is needed, against which judgements can be made. In their document *ALARP guidance and general principles* the HMRI proposed that 'societal risk' and the level of 'individual risk' are two of the criteria that should be applied. However, logical arguments for the exclusion of each of these reasons are presented in sections 2.2.3 and 2.2.4. The referenced guidance documents do not provide any helpful criteria against which judgements concerning reasonable practicability can be made.
40. Other HSE guidance documents offered contrasting and sometimes conflicting guidance [3.4, 3.5, 3.6 and 3.7].

Industry consensus position

When safety improvements are being considered and the cost is less than the monetary values of the safety benefit determined by applying the VPF duty holders, generally, implement the improvement. Where the cost is above the monetary value of the safety benefit, professional judgement is applied in determining whether the cost is grossly disproportionate to the safety benefit and it is reasonably practicable to implement the improvement. In making this judgement, particular attention is paid to:

- The degree of uncertainty in the assessment of costs and safety benefits
- The range of potential safety consequences.

41. The consensus industry position is based on a staged approach to determining what is reasonably practicable. To determine what is reasonably practicable, a reasoned judgement that balances estimates of safety benefits against estimates of costs (time, money and inconvenience) is made. There are various ways in which it can be determined whether or not this test has been met. If there is established good practice, and it can be shown to be valid and appropriate in the particular circumstances envisaged, then this suggests that the practice is reasonably practicable. Where no established good practice exists then the judgement must be based on an estimation of costs and benefits. The balancing of costs and safety

benefits can be undertaken quantitatively or qualitatively; professional judgement will be applied in all cases.

42. For a quantitative analysis the approach is to compare the cost per statistical fatality avoided (CPF) with the value of preventing a fatality (VPF). If the cost is less than the monetary value of the safety benefit determined by applying the VPF we, generally, implement the improvement. Where the cost is above the monetary value of the safety benefit, we apply professional judgement in determining whether the cost is grossly disproportionate to the safety benefit and it is reasonably practicable to implement the improvement.
43. The judgement of whether or not it is reasonably practicable to implement the improvement will be informed by the confidence in risk and cost estimates. The decision taker might feel the need to err on the side of caution in the judgement. This uncertainty could be significant when risks relate to high severity-low frequency incidents like train collisions, or where incidents could result in a wide range of different outcomes, with differing severities.
44. The judgement will need to be informed by information and analysis. RSSB research proposed a framework to assist in the process of taking a decision that suggests the appropriate depth of analysis for different types of decision [4.7].

2.2.2 How are societal values taken into account?

Initial area of clarity

The VPF is derived from Willingness to Pay (WTP) studies involving members of the public. It is therefore a measure of societal values.

45. In the safety decisions programme we use the term 'societal values' to refer to the public's underlying sense of what is right and what is wrong. Societal values are factored into the decision making process using the VPF which is the estimated financial value(s) that the average member of the public proactively attributes to the prevention of a statistical fatality. RSSB research [4.4] investigated the logical and empirical basis for this approach. The VPF is traceable back to studies of the public's Willingness to Pay (WTP) to reduce risk. These measure the public's preferences when they are informed about the risk and the circumstances of its occurrence, and when they are taken though the issues in a rational way. Societal values and our measurements of them do not change suddenly as a reaction to events such as accidents. Societal values are therefore different to 'societal concerns', which are addressed in section 2.4.
46. The VPF is usually defined as the amount that the average member of the general public is willing to pay to reduce the average level of risk to the average victim. This may be estimated by asking a representative sample of the public how much they would be willing to pay to reduce the probability of various low-frequency harmful events, then weighting to calculate the amount that this implies should be spent to avoid one statistical fatality. In principle it is a robust and logical definition, and, because it uses people's opinions on situations that might affect them or others, it is a direct measure of societal values.
47. It is worth pointing out that, although the term VPF is widely used, it is perhaps an unhelpful one because of the possible connotation that the number represents the value of a life. This is not true, since it is neither the amount that the general public would be willing to pay to prevent a particular person from dying, for example by mounting a rescue, nor the amount that they would be willing to pay to save the life of

a known individual or an unknown one. Rather, the number represents the amount the general public would be willing to pay to reduce the *probability* of an event which might cause harm or even death. The VPF is sometimes referred to as the Value of Preventing a Statistical Fatality (VPSF) to clarify its probabilistic nature.

48. Our research tallies with the official position that the VPF should be adopted by the Railway Industry as the means of determining the financial value of prevented risk when demonstrating that the risk is ALARP. Research, commissioned by RSSB [4.8] used opinion survey techniques, similar to those used to derive WTP values to determine whether the VPF was stable and fixed in all circumstances. The research made use of quantitative comparisons of the relative value attributed to each of a set of scenarios. The quantitative results were analysed to calculate the relative WTP values attached by the general public to avoiding each scenario. The baseline case was an adult rail passenger behaving responsibly and killed in a single-fatality rail accident. The study found that there were no scenarios identified for which those surveyed believed that a figure higher than the VPF should be applied. The research found that:

- the value attributed to a multi-fatality accident was no higher than that attributed to the equivalent number of single fatality accidents
- the value attributed to accidents thought to inspire dread (for example death in a fire) is not higher than any other.

49. Therefore this indicates that there is no justification for scaling up the VPF to take account of societal values since they are already taken into account in the existing value. It is therefore logical and sensible to use the accepted VPF value in all such circumstances. The industry is strongly in support of this logical approach (see for example the ATOC submission [2.1]).

50. This finding echoes those of a previous study, undertaken a time when Railtrack applied two different VPFs, one of which was much higher than the VPF applied on the roads (Ref. 3). The authors of that work concluded that:

'If we focus on those who are regular rail users, it would appear that their preferences and attitudes to risk per se provide no justification for Railtrack's higher VPF . . . of some 2.8 times the DETR roads figure. The results therefore suggest that if a justification for Railtrack's higher figure is to be found, then it will almost certainly need to be sought in considerations other than the preferences of the travelling public.'

2.2.3 How is 'societal risk' taken into account?

Initial area of ambiguity

It was unclear whether and to what extent a judgement about what is reasonably practicable should reflect societal risk.

51. The *tolerability of risk from nuclear power stations* [3.1] defined societal risk as the combined human, monetary and political costs of major accidents. According to this definition societal risk comprises of:

- The collective risk associated with a major accident
- The financial impact of a major accident

-
- The political implications of a major accident
52. Although it is clear that, according to the Edwards judgement, the industry should take account of the human and an appropriate portion of the financial costs, there is no logical or legal argument for the industry to take account of the political costs of a major accident in determining what is reasonably practicable. Such considerations are intangible and would introduce significant bias into the industry's decision taking process that could result in inappropriate and inconsistent levels of expenditure to reduce risk.
53. Some HSE/HMRI documents have contributed to uncertainty about the concepts of 'societal risk' and the related term 'societal concern' and implied that the industry should factor political considerations into its decisions about reasonably practicability. For example the HSE state that [3.5 – principles and guidelines]:
- 'We believe that it is right that, in all cases, the judgement as to whether measures are grossly disproportionate should reflect societal risk, that is to say, large numbers of people being killed at one go. This is because society has a greater aversion to an accident killing 10 people than to 10 accidents killing one person each'*
54. The industry disagree with the concept that 'societal risk' should determine what is reasonably practicable in the way suggested. Our research, [4.8] has strongly contradicted the HSE statement that the public has a greater aversion to multi-fatality accidents. Our research concluded that the public has no greater aversion to multi-fatality accidents or to accidents thought to inspire dread when taken through the issues is a rational way using WTP studies.
55. During consultation [2.3, 2] some duty holders said that the adoption of this approach by HMRI inspectors was problematic, and that they are pressured into taking actions that they consider unnecessary to address the inspectors' perception of 'societal risk' – interpreted as a regulatory perception of possible public and political concern. In addition to forcing them to take decisions they considered unnecessary, uncertainty about whether or not duty holders could be prosecuted for not taking such issues into consideration, and about the degree to which they should take these issues into account, is another potential cause of risk aversion in the industry and a driver of inertia in industry decision taking.

Industry consensus position

Societal risk refers to the collective risk relating to major accidents. All ALARP assessments involve consideration of collective risk. However, the extent of societal risk does not, of itself, change the VPF or affect the way in which a judgement is made about reasonable practicability taking into account costs and benefits.

56. Risk is widely understood to refer to the product of the likelihood of an accident and the severity of its consequences. The industry is convinced that in the Edwards judgement it is this objectively estimated risk that is referred to in the 'quantum of risk'. The industry therefore interprets societal risk to mean the collective risk relating to a major accident, as defined by the HSE in their consultation document on societal risk [6.6] which states:
- We refer to the chance of accidents that could harm a number of people in one go as 'societal risk'. It is in effect a measure of several combined issues - what things could go wrong at such sites, how likely they are to happen and how many people could be affected as a result?*

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57. The approach described in *HMRI ALARP guidance and general principles* [3.2] is consistent with the industry interpretation, that although major accidents result in socio-political consequences, these issues have no place in the formulation of the legal duty:

“Societal concerns arise when a serious accident occurs (with adverse socio-political consequences)...Duty holders generally need only take into account one element of societal concern – societal risk – which they can do by identifying the high consequence-low frequency events and weighting them accordingly when making an ALARP demonstration... The other elements of societal concern are taken into account when developing the regulatory framework and need not be considered by duty holders.”

58. When taking decisions in industry the total collective risk averted by a measure is multiplied by the VPF to determine the safety benefit. Therefore societal risk is factored into decisions in this way. There is no further escalation of the VPF required because of the extent of societal risk, or any political concerns that might arise as a result of a major accident.

59. The Industry position is that 'societal concern' is not in any way a measure of risk and therefore there is no legal reason why it should be taken into account in a determination of reasonable practicability. In the ATOC submission, made on behalf of all TOCs, it states that it is important that the industry approach to decision taking:

“deliberately excludes any factor relating to subjective perception of risk...ATOC Members do not believe that this concept has any part in a formulation of legal duty”

60. According to this view such considerations should be for the Regulator and Government to take into account directly via legislation, or for companies to address optionally through factoring them into their business considerations (see section 2.3).

2.2.4 How does the tolerability of individual risks affect the decision?

Initial area of clarity

The tolerability of risk framework is a conceptual model and its application is not mandated through legislation. The legislative requirement to reduce risks, so far as is reasonably practicable, applies equally in respect of all segments of the population regardless of the particular levels of risk to which they are exposed as individuals.

61. The HSE framework for the tolerability of risk (TOR) describes some of the criteria that the HSE applies when taking decisions and is encapsulated in the diagram of Figure 1.

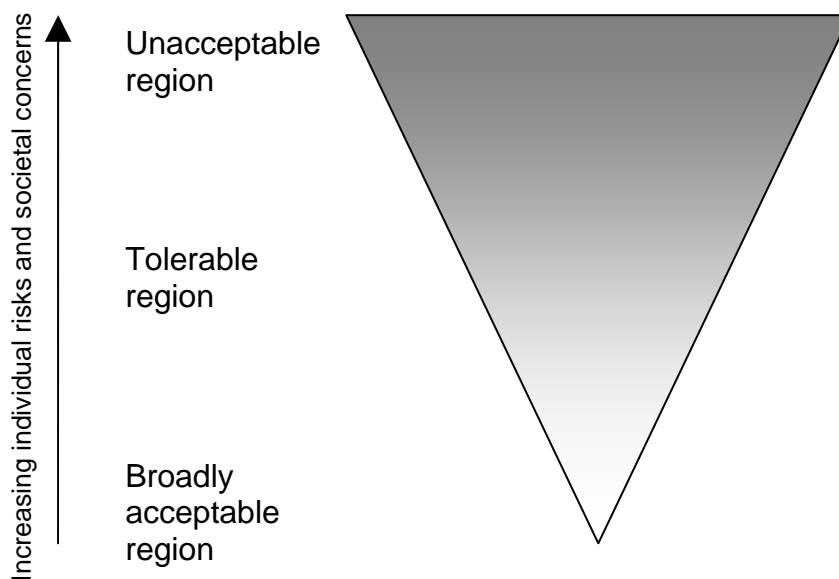


Figure 1: HSE Framework for the tolerability of risk (taken from R2P2)

62. Reducing Risks, Protecting People (R2P2) states that for practical purposes, a particular risk falling into the unacceptable region is regarded as unacceptable by the Regulator, whatever the level of benefits associated with the activity. The light zone at the bottom represents a broadly acceptable region. Risks falling in this region are generally regarded by the Regulator as insignificant and adequately controlled. The zone between the unacceptable and the broadly acceptable region is named the tolerable region. This is the area in which the Regulator will tend to focus its activity to satisfy itself that risk is reduced ALARP.

Initial area of ambiguity

It was unclear whether and to what extent the judgement about what is reasonably practicable varies as a function of the total level of risk to which particular groups of people are exposed.

63. Although there was broad awareness of the TOR framework across industry there was uncertainty about the degree to which its application was relevant to decisions undertaken by duty holders. Some stakeholders commented that the models and diagrams used within the policy documents and the terminology used are not themselves part of the statutory framework of the HSWA. They saw the TOR model as primarily something that is used internally by the Regulator as part of the permissioning regime.
64. However in some documents the HSE stated that 'individual risk' is a key consideration in determining what is reasonably practicable. Some ALARP guidance from the HMRI implied that duty holders should use the level of individual risk to determine the 'factors of disproportion' to apply when determining whether a measure is ALARP. HMRI guidance on ALARP for its inspectors [3.2] stated that 'factors of disproportion' should be applied to the VPF to introduce an imbalance between costs and risks. The factors were:

'(i) low baseline individual risk and no societal risk, disproportion factor 1-2

(ii) low baseline individual risk and societal risk applies, disproportion factor 3

(iii) high baseline individual risk, disproportion factor 3-10 depending on the level of individual risk'

65. The stated reason for these factors were to indicate 'how hard HSE is prepared to push duty-holders to do more to control risk' indicating that the HSE was not itself confident that this approach represented a sound interpretation of the law. The issue of societal risk is addressed in section 2.2.3.

Industry consensus position

The legislative requirement to reduce risks, so far as is reasonably practicable, and the application of the VPF, applies equally in respect of all segments of the population regardless of the particular levels of risk to which they are exposed as individuals. However, the priority and effort applied to analysing risks and developing potential measures for further risk mitigation increases in line with the total level of risk to which particular groups of people are exposed as individuals.

66. The industry considers that the TOR Framework is a useful conceptual model for considering levels of risk exposure, particularly for the Regulator to prioritise its attention on certain types of risks. However, its application is not mandated on duty holders through legislation. Bearing this in mind, the question that was posed to industry was: how should the total level of risk to which individuals are exposed be factored into the decision taking framework by duty holders in a way which most sensibly informs that process?
67. The industry has sought to clarify that, regardless of where risk to an individual lies in the TOR framework, risk must always be as low as is reasonably practicable. The legislative requirement to reduce risks, so far as is reasonably practicable, and the application of the VPF applies equally in respect of all segments of the population regardless of the particular levels of risk to which they are exposed as individuals.
68. The total level of risk to which individuals are exposed can be factored into the decision taking process by allowing it to inform the setting of priorities for the development of risk control measures. Duty holders consider how risk is distributed across particular defined segments of the population. The priority and effort applied to analysing risk and developing potential measures for further risk mitigation increases in line with the level of risk to which people in each segment are exposed. So for example, where the people in one segment of the population are exposed to a high level of risk, a duty holder would focus attention on considering what measures / options might be appropriate to reduce risk to those people. However the same ALARP and commercial criteria discussed elsewhere in this document would be applied to each option.

2.2.5 How is uncertainty in the assessment of risks taken into account in the legal decision?

Initial area of clarity

The degree of uncertainty in the Cost Benefit Analysis (CBA) must be taken into account in the judgement of whether risk has been reduced SFAIRP.

69. There is broad consensus in the industry that risk assessment is an uncertain process, and that this uncertainty must be taken into account when taking a judgement about the relative balance to be struck between costs and risks. This view is also reflected in the HSE document R2P2 [3.4], which states that:

“The quality of the modelling and the data will affect the robustness of the numerical estimate, and the uncertainties in it must always be borne in mind when using the estimate in risk management decisions. The use of numerical estimates of risk by themselves can, for several reasons including those above, be misleading and lead to decisions which do not meet adequate levels of safety. In general, qualitative learning and numerical risk estimates from QRA should be combined with other information from engineering and operational analyses in making an overall decision.”

Initial area of ambiguity

It was unclear whether and to what extent the test of gross disproportion was intended to account for any uncertainty in the assessment of risk.

70. Many within the industry believed that the Edwards judgement, and the use of the term ‘gross disproportion’ implicitly acknowledged that risk assessment was an inherently uncertain process, and that therefore there was a need to err on the side of caution when estimating risks and comparing them with costs. Given that ‘societal risk’ and the total level of risk incurred by specific groups of people are not reasons for increasing the VPF, uncertainty remains the only logical rationale for an interpretation of reasonable practicability that goes beyond the VPF. However no HSE guidance acknowledged this point or proposed uncertainty as a reason for additional expenditure.
71. Another concept relating to uncertainty is the ‘precautionary principle’. The precautionary principle is a concept intended to help decision makers take account of risk where the potential harmful consequences are very serious, irreversible or geographically widespread, but understanding of the scale or likelihood of those consequences is poor. Serious or irreversible consequences here are interpreted to be related to society as a whole, rather than relating to injury or death of an individual. R2P2 [3.4] invokes the precautionary principle by saying:
- “...the precautionary principle is invoked for hazards where, because of the uncertainty involved, it is not possible to apply the conventional techniques of risk assessment to assess the risks involved...”*
72. This inserts additional confusion regarding how to address such risks.

Industry consensus position

Uncertainty in estimation of risks is taken account in any assessment or analysis and should inform the ALARP judgement. However the benchmark in the test of reasonable practicability, the VPF, stays the same.

73. Sections 2.2.2 and 2.2.4 argue that there is no justification for escalating the threshold of expenditure in an ALARP analysis due to either ‘societal concerns’ or ‘individual risk’. Therefore the only logical reason that remains for increasing the threshold of expenditure in an ALARP argument in certain circumstances is consideration of uncertainty in risk estimates used to support a decision. The industry view is that the professional judgement aspect of reasonable practicability should be primarily a judgement of the level of risk reduction and its comparison with cost.
74. Estimation of risk is an inherently uncertain process and this uncertainty would only have been more pronounced at the time of the Edwards judgement, when most techniques used today had not yet been invented. Uncertainty is particularly high when we are considering low frequency - high severity events such as major train

collisions. This uncertainty might result in risk estimates varying over a significant range. The use of a conservative risk estimate might result in significantly different expenditure to that indicated by the use of the risk estimate calculated to be most likely.

75. However the clearest way to account for such uncertainty would not be to arbitrarily insert a factor of disproportion but to consciously try to estimate its extent and to do so explicitly within the analysis. Ultimately more money might be spent for this reason, but the VPF itself would not change.
76. Research into the precautionary principle [4.6] concluded that RSSB should re-assure senior players in the industry that the precautionary principle is not generally something that they need to take into account as part of their safety decision-making process. It is more likely to be an issue on health and environmental grounds, but even here the rail industry rarely introduces radically new products or processes. Since the precautionary principle is not a legal requirement, if a situation were to arise that met the criteria for the precautionary principle the industry's response should be driven by the desire to protect its reputation and avoid regulatory intervention.

2.3 When would the duty holder go beyond its legal duty?

2.3.1 Initial area of clarity

A duty holder may elect to go beyond its legal duty for commercial reasons.

77. It is acknowledged by all parties that there are circumstances where duty holders may choose to take decisions which go beyond the legal duty, for commercial reasons. Not all decisions which impact upon safety are taken for the reason that they are considered reasonably practicable. It is important that reasonable practicability is not retrospectively assumed in such cases, since in principle this might lead to a situation in which any decision taken that had an impact on safety would effectively become a precedent when similar circumstances arise elsewhere. This would result in inability to take major investment decisions properly. It is easy to see how confusion in this area could lead to risk aversion, given uncertainties about precisely where legal duties lie.
78. The view that there are circumstances where the industry would go beyond its legal duty is strongly held and it appears that this point is acknowledged within the regulatory community, for example the HMRI CBA guidance [3.3] states that:

'In the event of a major accident occurring, significant issues for duty holders include:

- *Reputation*
- *Share price*
- *Customer base and market share.*

Although these issues are not ones that HSE would require a duty holder to consider they can often play a significant part of any judgement on whether to invest in new or safer technology.'

2.3.2 Initial area of ambiguity

The circumstances under which a duty holder might choose to go beyond its legal duty were unclear because the precise legal duty was unclear.

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79. Because of all of the uncertainty previously identified there were differing views about where legal duties end. This meant that there was equivalent uncertainty as to when a company was in fact going beyond its legal duty. This lack of clarity about how to determine the legal duty resulted in a blurring between commercial and legal reasons for taking a decision. A duty-holder should know whether it has implemented a measure through choice or to fulfil its legal duty. Where this is not clear, the danger is that a culture will result where legal duties are assumed which aren't really justified either by the law or by practical needs. If the measures are considered to be legally mandated they cannot easily be removed. This will tend to create an increased cost base for the industry.

2.3.3 Industry consensus position

A duty holder might choose to implement safety measures that are not reasonably practicable or that control the risk arising from hazards that lie outside its undertaking, for commercial, reputational or other reasons. However in the industry's judgement it is not legally obliged to do so and is therefore not committing a crime if it chooses not to implement such safety measures.

80. This principle was a key point in the ATOC consultation submission [2.1] which stated:

"A duty holder may elect to go beyond its legal duty and take steps that are not in fact proportionate when objectively viewed. It may do so for a variety of reasons. That may include a deliberate decision to react to arguably unjustified but sensitive perceptions. However it is important that the decision taking framework recognises this category of decision as wholly distinct from issues of legal duty and does then not therefore in future erroneously set the bar at an incorrect level for itself or for others".

81. The industry position flows naturally from the previous points of consensus already presented. As there is a clear industry consensus as to what the legal duty is, there is a clear view as to when duty holders are going beyond that duty. For example, as described in Section 2.2.2, societal concern is not believed to be relevant to the determination of what is reasonably practicable. However it may be sensible for companies to take account of such concerns for business reasons. This would be a business judgement to be made optionally by the particular company concerned.
82. RSSB has undertaken research [4.9, 4.10] to help understand societal concerns and therefore use this understanding to encourage better business decision making. The resulting research proposes the development of a model to be used to support major decisions that are likely to cause significant societal concern. Scores from a ranking exercise are combined together within the model. This produces an overall score for seven axes of societal concern associated with the scenario, again between 0 and 10, which may be represented graphically. Each diagram forms a societal concerns 'signature' for different types of accident. Work is ongoing to determine whether such an approach can be used to help decide the best way in which railway companies should take account of societal concern from a business perspective.
83. Work has also been undertaken into how the industry can improve its engagement with stakeholders [4.11]. Societal concern can be managed to an extent by considering who is likely to be most concerned about a particular issue, and how to engage with them to reassure them and to take their views into account where appropriate.

2.4 When is the issue a matter of policy?

2.4.1 Initial area of ambiguity

It was unclear whether or not the Regulator expected duty holders to take account of 'societal concerns' when making a judgement about whether or not a measure was reasonably practicable

84. As noted in section 2.2.3, HSE/HMRI documents offered different and sometimes contradictory guidance about whether or not duty holders should take societal concern into account in their determination of what is reasonably practicable.
85. The HSE's apparently contradictory position reflects a tension between government and industry responsibilities. The government can mandate measures on the railway industry that reflect public attitudes and opinion, which are the components of 'societal concern', in addition to the underlying level of accident risk. There is no disagreement on this point. The industry view, as discussed in section 2.2.3, is that the inclusion of such considerations in the determination of what is ALARP is not sensible. However where large scale accidents occur questions of responsibility for safety and public accountability are raised. The approach advocated by the HSE could be perceived as a 'pressure valve' by which, in the face of such pressure the industry could be perceived to share responsibility beyond its legal duties. Although this may be desirable for the government of the day from a political perspective, it adds uncertainties into the industry decision taking process that may lead to risk aversion or excessive cost. The HSE partially acknowledged this in *Principles and guidelines to assist HSE in its judgement that duty holders have reduced risk as low as is reasonably practicable* [3.6] which states that:

'There is no guidance from the courts as to whether societal concerns should be taken into account by duty holders in deciding what is grossly disproportionate.'

2.4.2 Industry consensus position

The government may respond to 'societal concerns' by creating legislation where they believe this is necessary. The industry may choose to take account of 'societal concerns' for business reasons, but these considerations do not impact upon the determination of what is reasonably practicable.

86. The HSE's stated position is that such factors should not be taken into account by duty-holders. *R2P2* states that:
- 'Duty holders' action on societal concern is limited to instituting the measures set out by HSC/E in the control regimes which are required by regulations enacted to address the hazard concerned, and in associated guidance.'*
87. *R2P2* was produced to define how HSE discharges its responsibilities as safety regulator. According to this document, the duty holder need only react to 'societal concern' with specific control regimes that are mandated by the regulations. An example of this in the railway industry would be the 1999 Railway Safety Regulations which amongst other things mandated the widespread installation of the Train Protection and Warning System (TPWS).
88. An objective analysis of risk undertaken by industry showed that the widespread installation of TPWS was not reasonably practicable (Ref. 4). However there was perceived to be significant 'societal concern' following the occurrence of major train

accidents. This was a driver behind the government decision to mandate this measure through legislation and therefore to provide funding for it.

89. The industry does not attempt to factor societal concerns into its determination of the legal duty. However these concerns can have a significant impact upon a company's commercial viability. Therefore duty holders may, and very often do, take such concerns into account when determining whether or not a decision is sensible from a business perspective. This is a separate consideration as to whether or not a particular measure is reasonably practicable (see section 2.3).

3 Conclusions

90. The work of the safety decisions programme has served to raise awareness of the different interpretations and assumptions relating to decision taking that have historically existed across the GB rail industry. This raised awareness has allowed for improved understanding and greater consensus which has lead directly to the publication of *Taking Safe Decisions* as a documented statement of how the industry takes decisions which impact upon safety.

4 Archived supporting documents

91. This section lists the fundamental supporting documents to this report. These documents are saved in the file with this document to form an immediately traceable record of the content and findings of the Safety Decisions Programme.

	Document title	Date/Issue No	Organisation
Industry guidance, standards and publications			
1.1	How safe is safe enough?	Edition 1a, February 2005	RSSB
1.2	Valuing Safety	February 2006	RSSB
1.3	Decision Taking Framework	27 th February 2006	RSSB
1.4	Taking Safe Decisions	22 nd May 2006	RSSB
Industry consultation			
2.1	Response of ATOC Members to RSSB Discussion Documents: Valuing Safety and Decision Taking Framework	2 nd May 2006	ATOC
2.2	Records of Safety Decisions Programme Think Tank meetings	-	-
2.3	Valuing Safety & Decision Taking Framework: Consultation workshop records	Spring 2006	Various
2.4	Consultation responses to 'Valuing Safety'	Spring 2006	Various
2.5	Consultation responses to 'Decision-Taking Framework'.	Spring 2006	Various
Regulatory guidance			
3.1	The tolerability of risk from nuclear power stations http://www.hse.gov.uk/nuclear/tolerability.pdf	Copyright 1988, Revised 1992	HSE
3.2	HMRI ALARP guidance and general principles http://www.rail-reg.gov.uk/upload/pdf/risk-alarpguidance.pdf	-	HSE
3.3	HMRI Specific Cost Benefit Analysis (CBA) Checklist http://www.rail-reg.gov.uk/upload/pdf/risk-cbachecklist.pdf	-	HSE
3.4	Reducing Risks, Protecting People http://www.hse.gov.uk/risk/theory/r2p2.pdf	First published 2001	HSE
3.5	HID's approach to ALARP decisions http://www.hse.gov.uk/foi/internalops/hid/spc/spcperm09.pdf	-	HSE

	Document title	Date/Issue No	Organisation
3.6	Principles and guidelines to assist HSE in its judgement that duty-holders have reduced risk as low as reasonably practicable http://www.hse.gov.uk/risk/theory/alarp1.htm	-	HSE
3.7	HSE principles for Cost Benefit Analysis (CBA) in support of ALARP decisions http://www.hse.gov.uk/risk/theory/alarpcba.htm	-	HSE
Research Reports			
4.1	A Survey of Current Practices in Safety-Related Decision Making	T126	RSSB
4.2	The Ethical Basis of Rail Safety Decisions	T230	RSSB
4.3	Decision-Making Practices and Lessons from other Industries	T266	RSSB
4.4	The Definition of VPF and the Impact of Societal Concerns	T430	RSSB
4.5	The Weighting of Non-Fatal Injuries	To be published	RSSB
4.6	A review of principles of decision-making in the rail industry	T224	RSSB
4.7	UK Rail Industry Decision-Making Volume 1: Framework Overview Volume 2: Compendium of Case Studies Volume 3: Guidance for Practitioners	T431 T439	RSSB
4.8	The Value of Preventing a Fatality and Societal Concerns	T616 – to be published	RSSB
4.9	Modelling Societal Concerns: Development and Calibration of a Model for Gauging Societal Concern for the Railway Industry	T517	RSSB
4.10	Modelling Public Attitudes to Risk	T644 – to be published	RSSB
4.11	Engaging Stakeholders in Safety Decision Making: Approach to Stakeholder Engagement	T436	RSSB

Legal documents and arguments			
5.1	Health and Safety at Work etc Act 1974	31 st July 1974	UK government
5.2	Summary of the steps taken by GB railway companies by which they comply with the criminal law regarding safety.	Version 6 22 nd December 2006	RSSB- Industry
5.3	RE: OFFICE OF RAIL REGULATION: Draft enforcement policy statement – the ALARP principle: Opinion.	27 th February 2006	Henderson Chambers
Miscellaneous			
6.1	The Fundamental Sixteen Questions about Safety on our Railways - Some Answers	July 2004	RSSB
6.2	Safety Decisions Programme – Analysis of Responses to 'Fundamental 16 questions about safety on our railways'	Sept 2004	RSSB
6.3	Government Policy on the Management of Risk http://www.publications.parliament.uk/pa/ld200506/ldselect/ldconaf/183/183i.pdf	June 2006	House of Lords - Select Committee on Economic Affairs
6.4	Green Book, Appraisal and evaluation in central government	January 2003	HM Treasury
6.5	Guidance on the Preparation of Risk Assessments within Railway Safety Cases	GE/GN8561 Issue 1 June 2002	RSSB
6.6	Proposals for revised policies to address societal risk around onshore non-nuclear major hazard installations	CD212 April 2007	HSE
6.7	Railway risks, safety values and safety costs. Proceedings of the Institution of Civil Engineers Transport 158 Pages 3–9, Paper 13852	February 2005 Issue TR1	ICE

5 References

92. This section lists the supporting references to the text
1. McIntosh, Lord (2003). Official Report of the Grand Committee on the Railways and Transport Safety Bill. House of Lords Hansard, 5 June 2003, Column GC273.
 2. Highways Economic Note No. 1: 2004.
<http://www.dft.gov.uk/pgr/roadsafety/ea/highwayseconomicnoteno12004>
(This is the most recent publication which describes how to escalate the VPF year on year. The process described is used annually to calculate the rail industry VPF).
 3. Burton T., Chilton S., Covey J., Gilbert H., Jones-Lee M., Loomes G., Pidgeon N., Robinson A., Spencer A. and Twist J. Valuation of the Benefits of Health and Safety Control: Follow-up Study. HSE Contract Research Report 315/2001, HSE Books, Sudbury, 2001.
 4. Profile of safety risk on the UK mainline railway, Report No. SP-RSK-3.1.3.11, Issue 3, February 2003

6 Abbreviations

ALARP	As low as is reasonably practicable
ATOC	Association of Train Operating Companies
CBA	Cost Benefits Analysis
DfT	Department for Transport
FWI	Fatalities and Weighted Injuries
HMRI	Her Majesty's Railway inspectorate
HSC	Health and Safety Commission
HSE	Health and Safety Executive
HSISE	How Safe is Safe Enough
HSWA	Health and Safety at Work Act
ORR	Office of Rail Regulation
R2P2	Reducing Risks, Protecting People
ROGS	Railways and Other Guided Transport Systems (Safety) Regulations 2006
RSSB	Rail Safety and Standards Board
SDP	Safety Decisions Programme
SFAIRP	So far as is reasonably practicable
SRM	Safety Risk Model
TOR	Tolerability of risk from nuclear power stations
TPWS	Train Protection and Warning System
VPF	Value of Preventing a Fatality
WTP	Willingness to Pay