QSEP

JOURNEY TO ALARP

Name
Job Title
Presentation title and date

REFERENCES

The Policy Statement by the Secretary of State for Defence requires that the MOD:

'Minimise work-related fatalities, injuries, ill-health and adverse effects on the environment, and reduce health and safety risks so that they are as low as reasonably practicable (ALARP)'

DE&S manage a range of complex projects to buy and support the Products, Systems or Services (PSS) that the Front Line Commands (FLCs) need to operate effectively - DE&S ASEMS Clause 5.5 of the Statute Policy states that;

'***Products, Systems or Services shall not have safety risks that have not been formally assessed, justified and declared to be Tolerable and As Low As Reasonably Practicable (ALARP)'***

JOURNEY TO ALARP

The ALARP principle appears ‘relatively simple’– however, it hides significant subtleties and difficulties when applying in a robust and satisfactory manner.

This presentation assists those managing safety risk by providing supplementary guidance to ASEMS – in particular SMP 07 and SMP 08 for:

- Achieving reduction of risk to ALARP,
- Progressively reducing residual risk, and
- Routinely reviewing and revising the PSS individual and cumulative risk ALARP position i.e. maintaining risk at any moment in time to ALARP.

SMPs 06, 07 and 08 as well as SEP leaflets 02/2011 and 03/2011 should be read in conjunction with this guidance

PRINCIPLES

The ‘Health and Safety at Work etc Act’ places a duty on every employer to reduce risks associated with their operations ‘So Far As is Reasonably Practicable’ (SFAIRP). The Health and Safety Executive (HSE) assess the terms SFAIRP and ALARP to ‘mean essentially the same thing’ in that they ‘call for the same set of tests to be applied’.

BOTH USE THE TERM ‘REASONABLY PRACTICABLE’

ALARP recognizes that no activity is risk-free - ***the overriding principle is that equipment must not be operated with risks that have not been formally assessed, justified and declared to be Tolerable and ALARP*** within the relevant MOD Duty Holder Construct under the Defence Safety Authority [DSA].

ALARP VERSUS SFAIRP

- SFAIRP and ALARP are not always interchangeable because legal proceedings will have to employ the particular term cited in the relevant legislation.
- SFAIRP is:
  - The term most often used in the Health and Safety at Work etc. Act and in Regulations, thus,
  - What the courts will judge against; and is, invariably
  - Subjective.
- ALARP is
  - Term used by risk specialists, duty holders and HSE guidance;
  - The level to which HSE expect to see workplace risks controlled; and
  - Requires Duty Holders to exercise judgement and is thus subjective.

REASONABLY PRACTICABLE– HSE VIEW

‘Using “reasonably practicable” allows us to set goals for duty-holders, rather than being prescriptive. This flexibility is a great advantage but it has its drawbacks, too.’

‘Deciding whether a risk is ALARP can be challenging because it requires duty-holders and us to exercise judgement.’

REASONABLY PRACTICABLE

‘Reasonably Practicable’ sits in a ‘hierarchy’ of legal requirements which in order of precedence are:

- **Absolute duty** – the words 'shall' or 'shall not', used in statutory provisions, impose an absolute obligation to do, or not to do, the act in question,
- **Practicable** - the obligation is to do what is necessary to reduce the risk regardless of the cost (in time or money). The measures must be possible in the light of current knowledge and invention .
- **Reasonably Practicable** - a lesser standard than 'practicable'.

ALARP DETERMINATION

The determination of ALARP requires an assessment of:

- An assessment of **the risk to be avoided**.
- **The sacrifice (in money, time or trouble)** involved in taking measures to avoid that risk and,
- A **comparison** of the two and a '**disproportionate test**'.

Consequently SMP 07 defines an ALARP risk as:

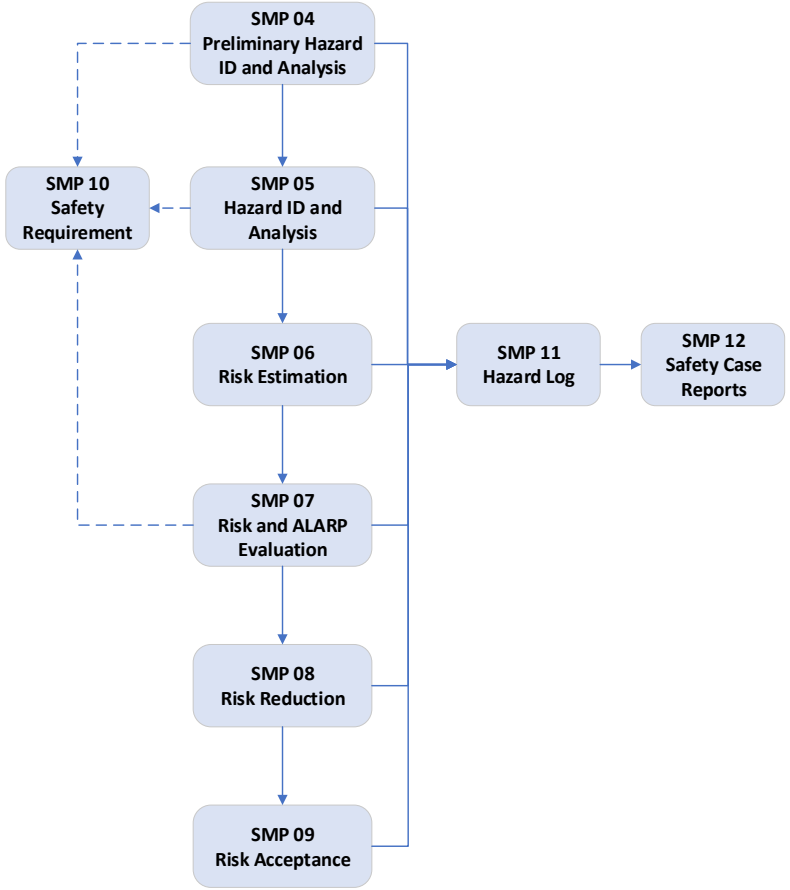
'A risk is ALARP when it has been demonstrated that the cost of any further Risk Reduction, where the cost includes the loss of defence capability as well as financial or other resource costs, is grossly disproportionate to the benefit obtained from that Risk Reduction'

RISK

- ✓ Risks must be only those over which the DH can exercise control or mitigate the consequences through conduct of their undertaking
- ✓ Risks under consideration relate to employees, other workers and members of the public including local communities
- ✓ Risks are assessed using a ‘hypothetical person’
- ✓ Risk controls must be compatible with those individuals at risk

SACRIFICE

- ✓ The Sacrifice is that incurred by the DH when considering taking measures to avert or reduce the risks identified
- ✓ It is ‘measured’ in terms of money, time or trouble
- ✓ It includes the cost of installation, operation and maintenance
- ✓ HSE will not consider the size and financial position of the DH



ASEMS

Risk Management Process

- The ASEMS Processes facilitate the identification and analysis of hazards so that a risk estimation against **clearly defined safety targets and safety requirements** can be made.
- **It is worth noting that a HAZARD is not the same as a RISK.**
- A risk is the **likelihood that a hazard will actually cause** its adverse effects [Risk to Life (RtL) or harm] together with **a measure of the effect – ACCIDENT or OUTCOME**

RISK MANAGEMENT

- Whilst the Project Safety Committee (PSC) is responsible for setting tolerability criteria – this must be done conjunction with the relevant Duty Holder[s] so as to establish the range of threats (or at least the key risk drivers) presented to individuals or groups of individuals.
- The tolerability criteria should be devised such that the aggregated risk posed by the whole system can be assessed.
- The tolerability criteria used for a project must be recorded in its Safety Management Plan or other relevant documentation.

			CONSEQUENCES					
			Catastrophic	Disastrous	Critical	Major	Marginal	Negligible
Accident Frequency	Frequency Definition	Accident Frequency per annum to Group at most risk	More than 100 deaths	10 to 100 Deaths	1 to 10 deaths	Permanent RIDDOR	Recoverable RIDDOR	Non – RIDDOR
Frequent	Likely to occur repeatedly on the ship during its life.	$>10^{-1}$	A	A	A	A	A	C
Probable	Likely to occur from time to time on the ship during its life.	$10^{-1} – 10^{-2}$	A	A	A	A	B	C
Occasional	May occur once on the ship during its life.	$10^{-2} – 10^{-3}$	A	A	A	B	C	D
Remote	Unlikely to occur on the ship during its life.	$10^{-3} – 10^{-4}$	A	A	B	C	C	D
Improbable	Very unlikely to occur on the ship during its life.	$10^{-4} – 10^{-5}$	A	B	C	C	D	D
Highly Improbable	Extremely unlikely to occur on the ship during its life.	$10^{-5} – 10^{-6}$	B	C	C	D	D	D
Incredible	Extremely rare event.	$<10^{-6}$	C	D	D	D	D	D

RISK MANAGEMENT

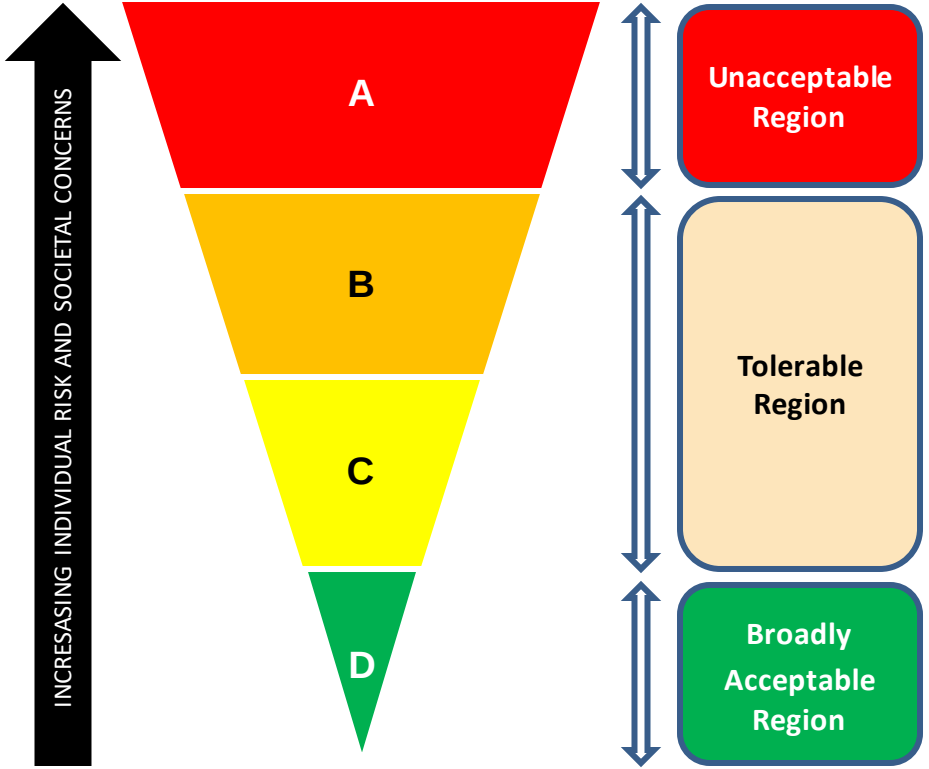
- ASEMS SMP 06 details how risk estimation is to be carried out and recognises that the most common technique used in DE&S is a Safety Risk Classification Matrix (or Risk Matrix).
- The matrix, derived from safety targets and safety requirements, maps values for **probability** (quantitative or qualitative) and **consequence** onto a matrix.
- This allows for a **Classification** of the level of Risk [Accident] and enables the determination of **'tolerability criteria'** as either 'Unacceptable', 'Tolerable' or 'Broadly Acceptable'.

			CONSEQUENCES					
			Catastrophic	Disastrous	Critical	Major	Marginal	Negligible
Accident Frequency	Frequency Definition	Accident Frequency per annum to Group at most risk	More than 100 deaths	10 to 100 Deaths	1 to 10 deaths	Permanent RIDDOR	Recoverable RIDDOR	Non – RIDDOR
Frequent	Likely to occur repeatedly on the ship during its life.	$>10^{-1}$	A	A	A	A	A	C
Probable	Likely to occur from time to time on the ship during its life.	$10^{-1} – 10^{-2}$	A	A	A	A	B	C
Occasional	May occur once on the ship during its life.	$10^{-2} – 10^{-3}$	A	A	A	B	C	D
Remote	Unlikely to occur on the ship during its life.	$10^{-3} – 10^{-4}$	A	A	B	C	C	D
Improbable	Very unlikely to occur on the ship during its life.	$10^{-4} – 10^{-5}$	A	B	C	C	D	D
Highly Improbable	Extremely unlikely to occur on the ship during its life.	$10^{-5} – 10^{-6}$	B	C	C	D	D	D
Incredible	Extremely rare event.	$<10^{-6}$	C	D	D	D	D	D

RISK TOLERABILITY

Risk Class A – Unacceptable Region

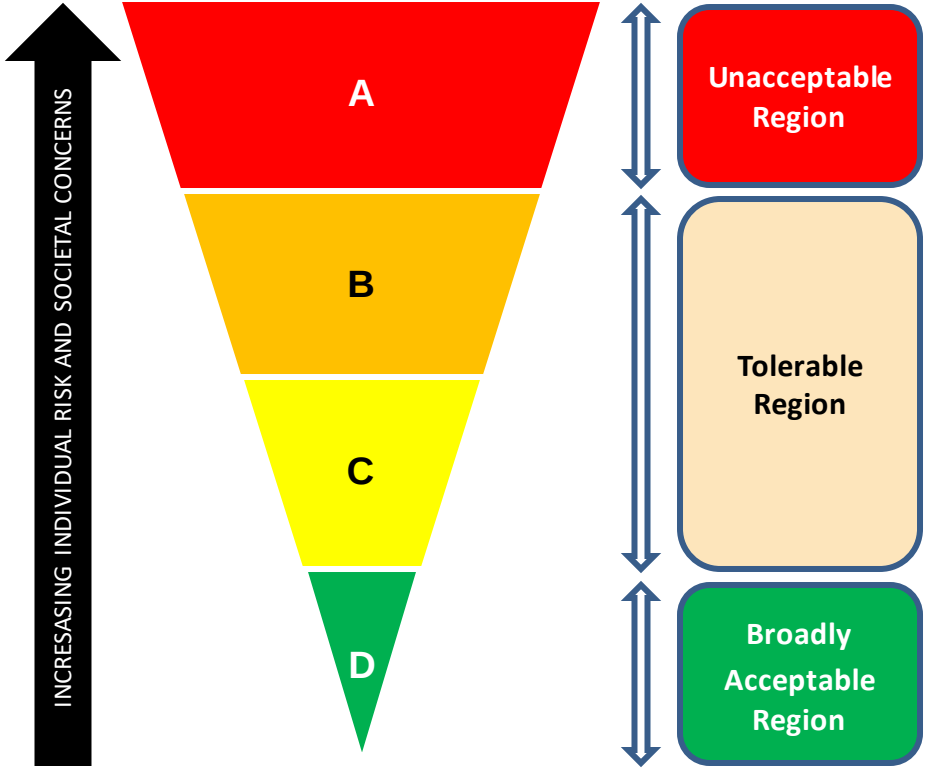
Risks falling in this region would, as a matter of principle, be ruled out unless the activity or practice can be modified to reduce the degree of risk so that it falls in one of the regions below, or there are exceptional reasons for the activity or practice to be retained.



RISK TOLERABILITY

Risk Class D – Broadly Acceptable Region

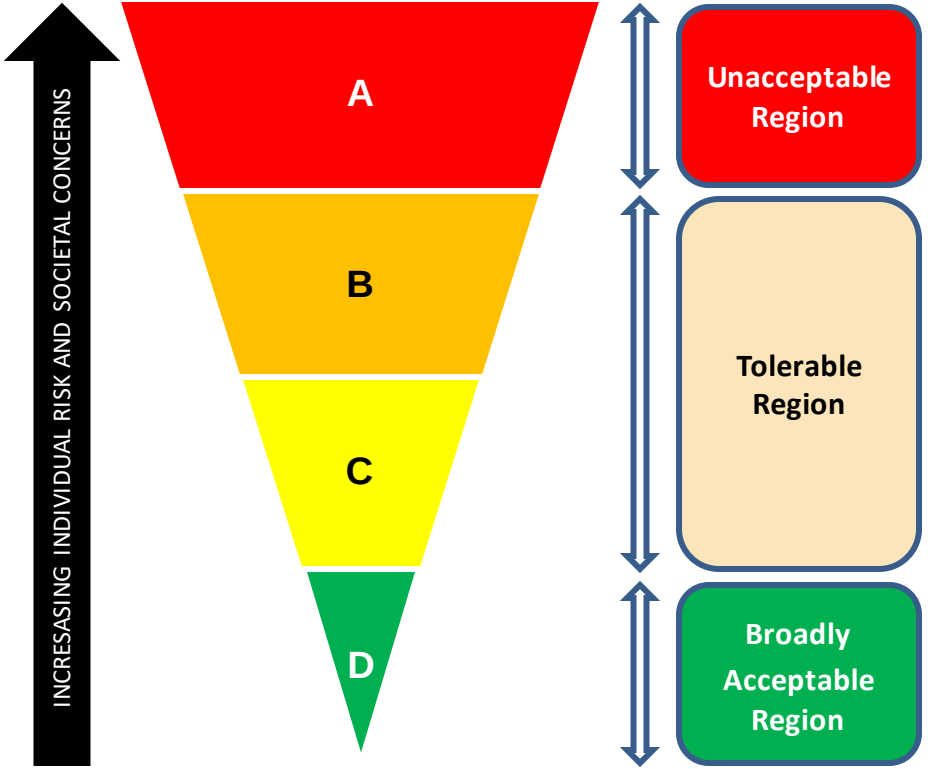
Risks falling into this region are generally regarded as insignificant and adequately controlled. HSE regulators, would not usually require further action to reduce risks unless reasonably practicable measures are available – nonetheless duty holders must reduce risks wherever it is reasonably practicable to do so or where the law so requires it.



RISK TOLERABILITY

Risk Class B or C – Tolerable Region

- Risks in this region are from activities that people are prepared to tolerate in order to secure benefits. In this example the region has 2 intermediate boundaries.
- Two or more intermediate boundaries may be used to show:
  - levels of risk that receive different treatments, e.g. different regulator required for risk acceptance or,
  - a different factor for demonstrating a ‘grossly disproportionate cost’.

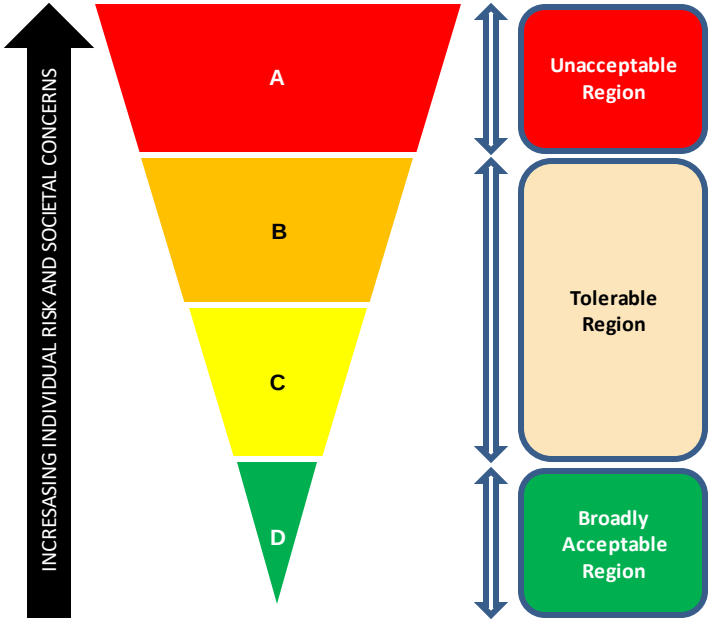


RISK TOLERABILITY

Risk Class B or C – Tolerable Region

For Risks in this region the expectation is that:

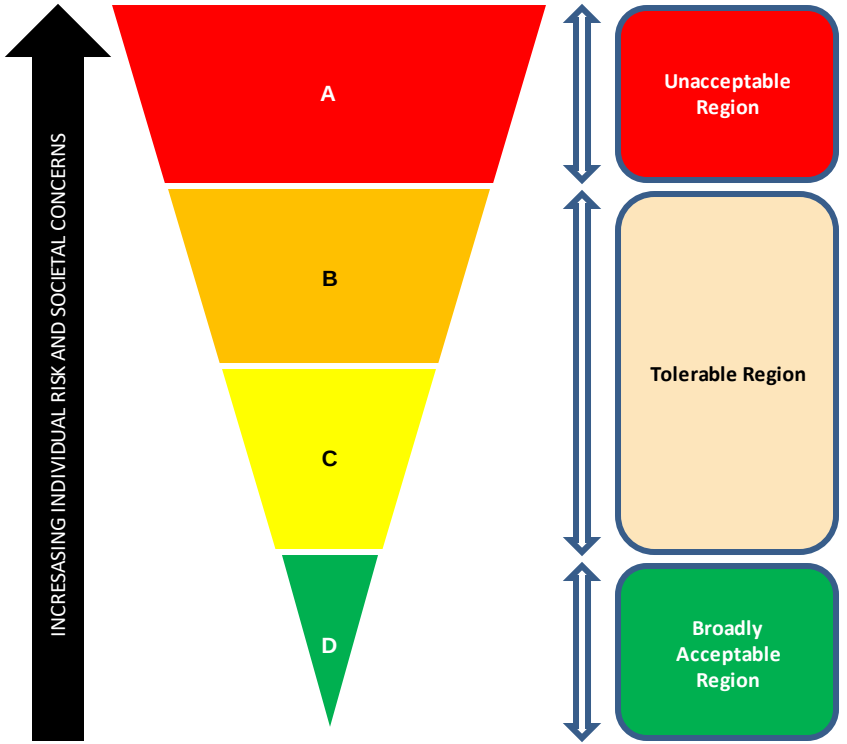
- the nature and level of the risks are properly assessed and the results used properly to determine control measures
- the residual risks are not unduly high and kept ALARP and,
- the risks are periodically reviewed to ensure that they still meet the ALARP criteria - for example, by ascertaining whether further or new control measures need to be introduced to take into account changes over time, such as new knowledge about the risk or the availability of new techniques for reducing or eliminating risks.



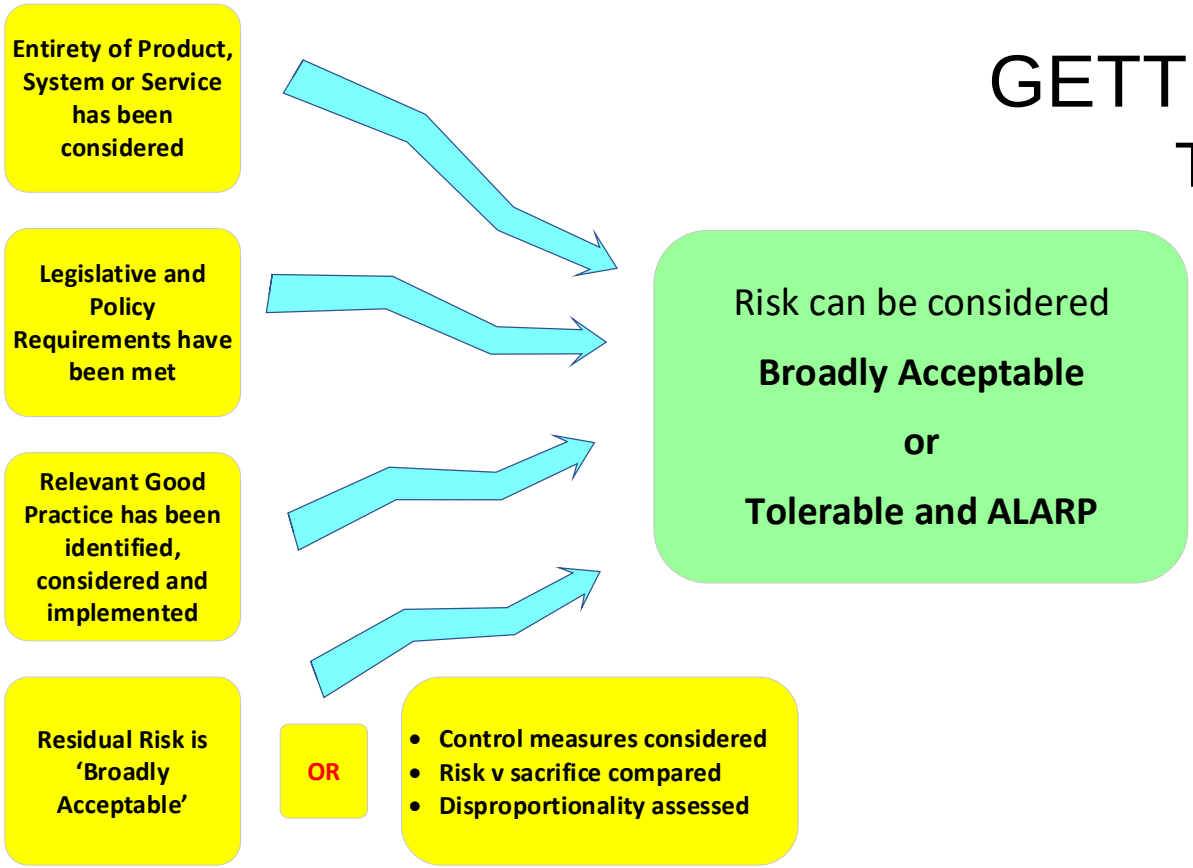
RISK TOLERABILITY

Risk Class B or C – Tolerable Region

- In tolerating a risk, it means that it is not regarded as negligible or something that can be ignored, but something that must be kept under review and reduced still further if-and-when it can be.
- ‘Tolerable’ does not mean ‘acceptable’.
- For a risk to be ‘acceptable’ it means that, for purposes of life or work, society is prepared to take the risk ‘as it is’ without further mitigation.



GETTING TO ALARP
THE TESTS



GETTING TO ALARP
TEST - MEETING LEGISLATIVE REQUIREMENTS

- Legislative requirements should form an essential part of the PSC/DH agreed safety target[s], safety requirements and tolerability criteria. This ensures that they are considered as an intrinsic element of risk assessment and analysis.
- Within the United Kingdom (UK) we comply with all legislation which extends to the UK (including legislation giving effect to the UK's international obligations).
- Overseas we apply UK standards and comply with relevant host nations' standards – whichever is the more stringent .
- Where there are exemptions or derogations from either domestic or international law to defence, we introduce standards and management arrangements that produce outcomes that are, so far as reasonably practicable, at least as good as those required by legislation.
- Where there is no relevant legislation, our internal standards aim to optimise the balance between risks and benefits. This does not mean avoiding risks but managing them responsibly, on the basis of impact and likelihood.

TEST - MEETING LEGISLATIVE REQUIREMENTS

ISSUES

- It is important to:
  - Ensure that only **relevant legislation** is held in the Safety Register.
  - Maintain an audit trail [argument] of how **compliance is achieved/maintained** or,
  - How **non-compliance is managed.**

- **The 'search' can be difficult – try:**
  - Legislative Registers held by other Teams – **WARNING - The legislative register should not be read across from one project to another.**
  - Defence Safety Authority and Regulators;
  - HSE, Professional Societies, Suppliers, contractors and consultants**;**

GETTING TO ALARP
TEST - GOOD PRACTICE

Within HSE, Good Practice is the generic term for:

'those standards for controlling risk which have been judged and recognised by HSE as satisfying the law when applied to a particular relevant case in an appropriate manner'

Sources of written, **recognised good practice** include:

- HSE Approved Codes of Practice (ACOPs) - these give advice on how to comply with the law; they represent good practice and have a special legal status.
- HSE Guidance;

Other written sources **which may be recognised** include:

- Guidance produced by other government departments;
- Standards produced by Standards-making organisations (e.g. BS, CEN, CENELEC, ISO, IEC);
- Defence or NATO Standards
- Guidance agreed by a body representing an industrial/occupational sector.

TEST - GOOD PRACTICE

'Good practice', as understood and used by HSE, can be distinguished from the term 'best practice' which usually means a standard of risk control above the legal minimum.

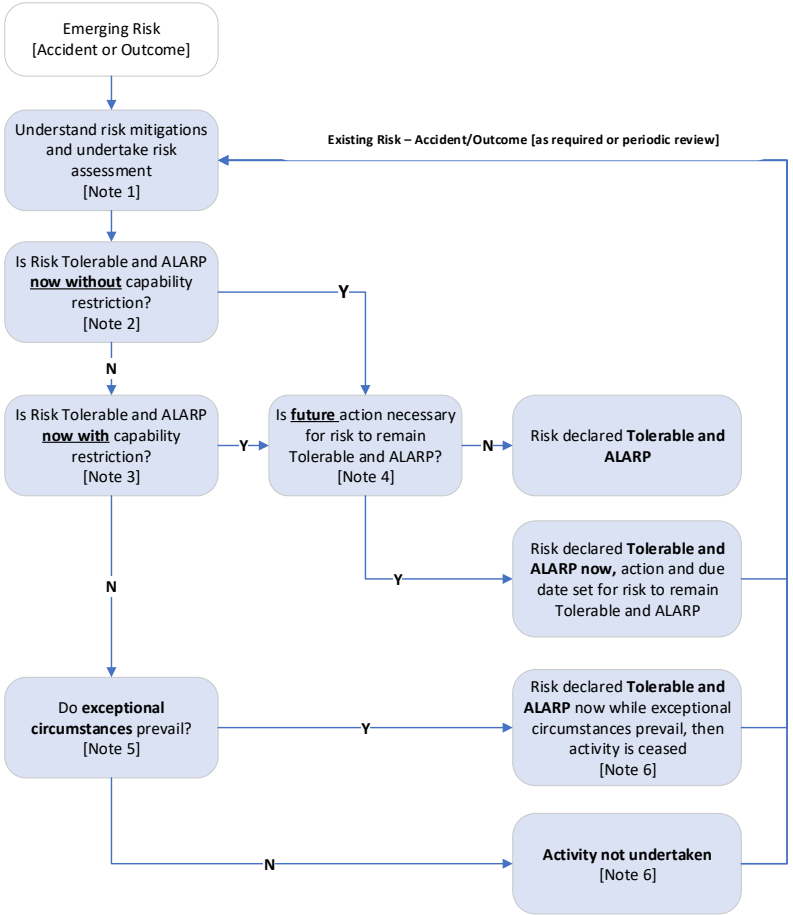
Compliance with relevant good practice alone **may be sufficient** to demonstrate that risks have been reduced ALARP – agreed by the PSC/Duty Holder.

However, depending on the level of risk and complexity of the situation, it is also possible that **meeting good practice alone may not be sufficient to comply with the law**. This would require duty-holders to:

- review their accident scenarios and risk management arrangements (for prevention, control and mitigation);
- identify what good practice is relevant;
- comply with the good practice (to the extent to which it is applicable);
- ask the question - are there any other measures which would be effective in further reducing the risks?
- determine whether the extra measures are reasonably practicable and implement those that are.

GOOD PRACTICE
ISSUES

- Applicability
  - Military usage may be different to civilian good practice
  - Defence Standards – infrequent updates and latency of contract amendments;
- Who judges applicable “good practice” ?
  - DSA Regulators
  - SME
- New Technology
  - New hazards but no standards exist, therefore “good practice” not established.
- Good practice may change over time because, for example, of technological innovation which improves the degree of control, cost changes or because of changes in management practices.
- Good practice may also change because of increased knowledge about the hazard and/or a change in the acceptability of the level of risk control achieved by the existing good practice.
- Accidents, Inquiries, near Misses, Court Judgements etc may change good practice and societal views.



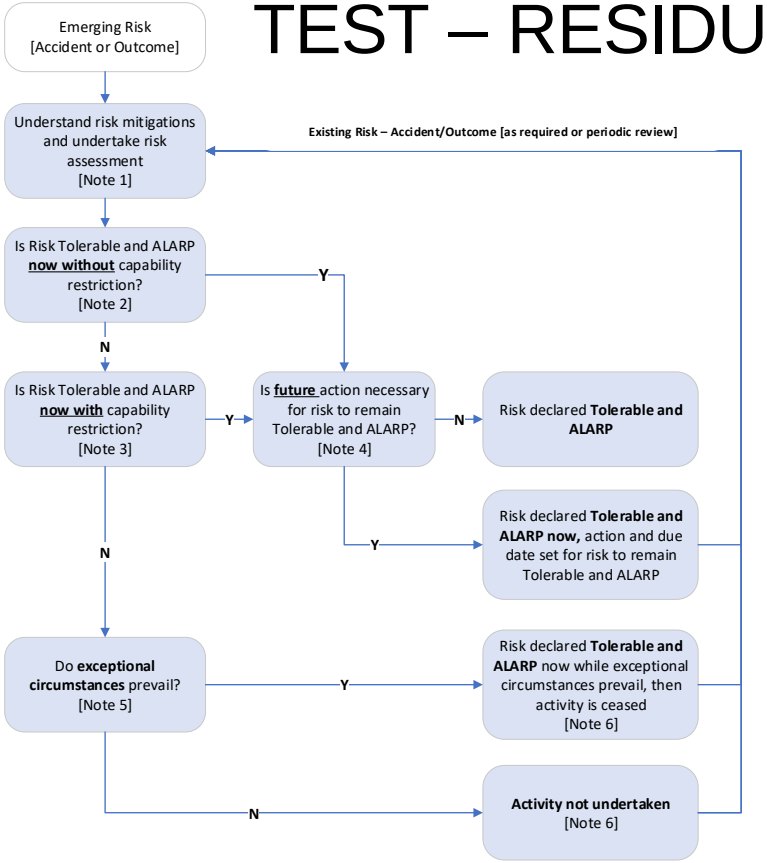
GETTING TO ALARP

TEST – RESIDUAL RISK & MILITARY CONTEXT

The procedure illustrated opposite has been developed for use in MOD, it;

- can be applied to a wide range of scenarios and is consistent with current UK legislation, HSE guidance and MOD policy;
- identifies a series of steps to be taken as part of the ALARP decision process and provides guidance on how they are to be applied.
- takes account of the level of safety risk being managed describing the extent of evaluation and demonstration that should be applied.

TEST – RESIDUAL RISK & MILITARY CONTEXT



NOTES

1. Level of analysis and technique adopted to be proportionate to the level of risk. Risk mitigations should be considered firstly by elimination or reduction through design, secondly through procedures, restrictions or limitations.

2. Operating Duty Holder to be informed/involved as appropriate. Additional procedures may be required for risk to be ALARP & Tolerable.

3. Operating Duty Holder to be involved. Additional restrictions or limitations may be required for risk to be ALARP & Tolerable.

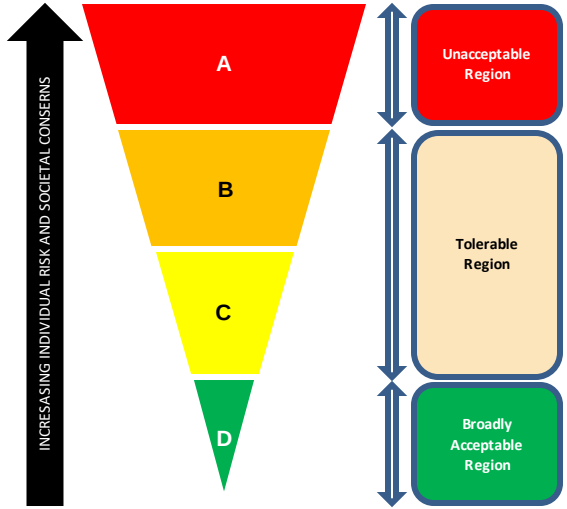
4. Future changes in legislation, regulation or standards, or opportunities such as technological advances that enable safety improvements to be made, may invalidate current Tolerable and ALARP status.

5. Operating Duty Holder to lead. Exceptional circumstances are where failure to conduct an activity presents a greater risk to safety or national security than ceasing the activity. Begin investigation of potential safety improvements.

6. Activity is that associated with the hazard under consideration. Investigate and implement options as soon as possible to establish risk as ALARP & Tolerable and permit activity.

TEST – RESIDUAL RISK

Residual Risk lies in the Broadly Acceptable Region



Further Risk Control measures identified

SHOULD I DO MORE?

YES – Compare Risk v Sacrifice + Gross Disproportionality Test

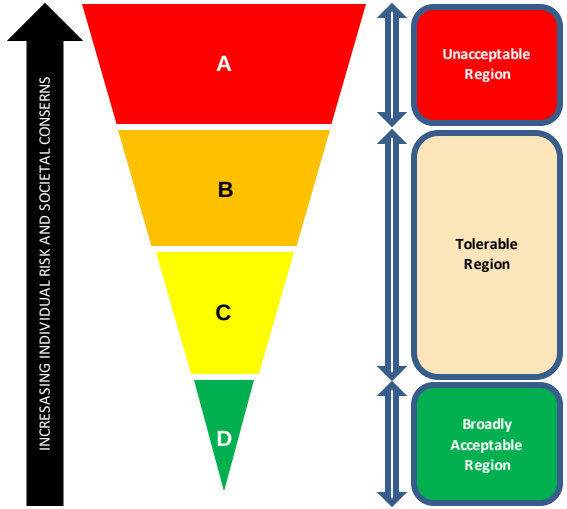
No additional 'Reasonably Foreseeable' Risk Control measures identified

SHOULD I DO MORE?

NO – Complete 'ALARP' statement

TEST – RESIDUAL RISK

Residual Risk lies in the Tolerable Region



Further Risk Control measures identified

SHOULD I DO MORE?

YES – Compare Risk v Sacrifice + Gross Disproportionality Test

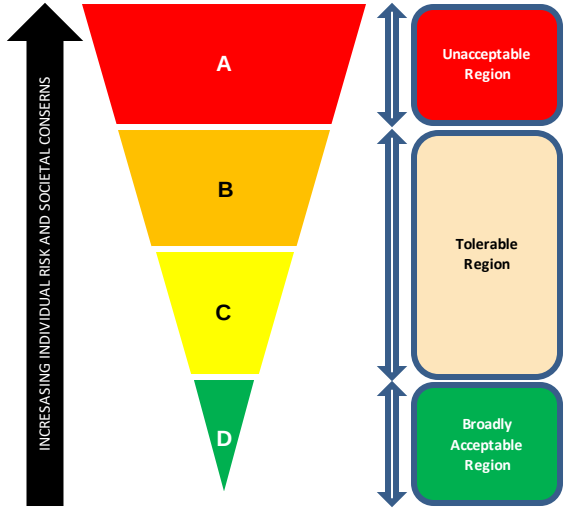
No additional 'Reasonably Foreseeable' Risk Control measures identified

SHOULD I DO MORE?

YES – Consider capability restriction + and/or complete ALARP statement

TEST – RESIDUAL RISK

Residual Risk lies in the Unacceptable Region



Further Risk Control measures identified

SHOULD I DO MORE?

YES – Risk must be reduced

No 'Reasonably Foreseeable' Risk Control measures identified

SHOULD I DO MORE?

YES – **c**onsider with Duty Holder if '***exceptional circumstances'*** apply – if none then **cease/do not undertake activity.**

GETTING TO ALARP
RISK V SACRIFICE + GROSS DISPROPORTIONALITY

Residual Risk lies in the Broadly Acceptable Region

The level of formal analysis of control options should be commensurate with the risk

A summary ALARP statement containing a reasoned argument why further risk reduction measures are not 'reasonably practicable' to implement may be suffice

Residual Risk lies in the Tolerable Region

The level of formal analysis of control options should be commensurate with the risk

Evidence based ALARP statement together with analysed risk reduction options that should include a formal qualitative or quantitative Cost Benefit Analysis [CBA]

Its important to tell a story of "what you didn't do" and why not, as much as it is to state "what you decided to do".

COST BENEFIT ANALYSIS
WORKED EXAMPLE

ACCIDENT RISK

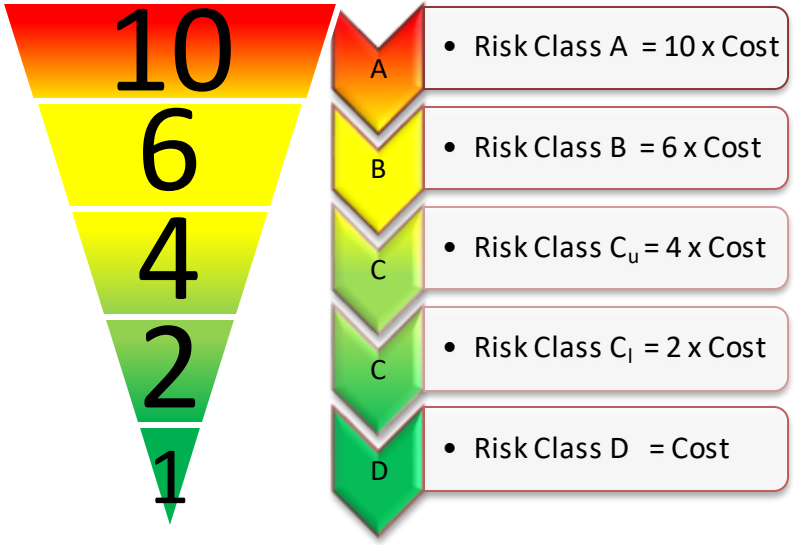
- ✓ WORSE CASE SEVERITY **2 DEATHS**
- ✓ PROBABILITY OF **1 IN 1000 [0.001 0R A X 10^{-3}]**
- ✓ EQUIPMENT HAS **20 YEARS** SERVICE REMAINING BEFORE DISPOSAL
- ✓ **VALUE PER FATALITY [VPF]** FOR DEATH IN ACCIDENT IS **£2M**

CALCULATIONS

BENEFIT [in monetary terms] OF PREVENTING ACCIDENT = **FREQUENCY** X **VPF [PER FATALITY]**

- ✓ **ANNUAL** = **0.001** x £4M [**VPF** x **2 deaths**] = £4,000 per year of platform life
- ✓ **LIFETIME** = **0.001** x £4M [**VPF** x **2 deaths**] x **20 years service** = £80,000

COST BENEFIT ANALYSIS
APPLYING GROSS PROPORTIONALITY



To show that any control measure is grossly disproportionate requires that

$$\frac{\textbf{Costs}}{\textbf{Safety Benefits}} \geq \textbf{Disproportion Factor [DF]}$$

which can also be written as

$$\textbf{Costs} \geq \textbf{DF x Safety Benefits}$$

Worked Example – differing DFs may be allocated in proportion to the level of risk as shown opposite

- ✓ If Class B then Costs = £24k/annum [6 x £4k] or £480k lifetime [x 20]
- ✓ If Class D then costs = £4k/annum or £80k lifetime

These values are often seen as a 'risk budget' in that any control measure that costs less than the annual or lifetime figure should be considered to be "reasonably practicable" to implement.

However, risk v sacrifice is not merely a simple mathematical calculation

COST BENEFIT ANALYSIS
ISSUES

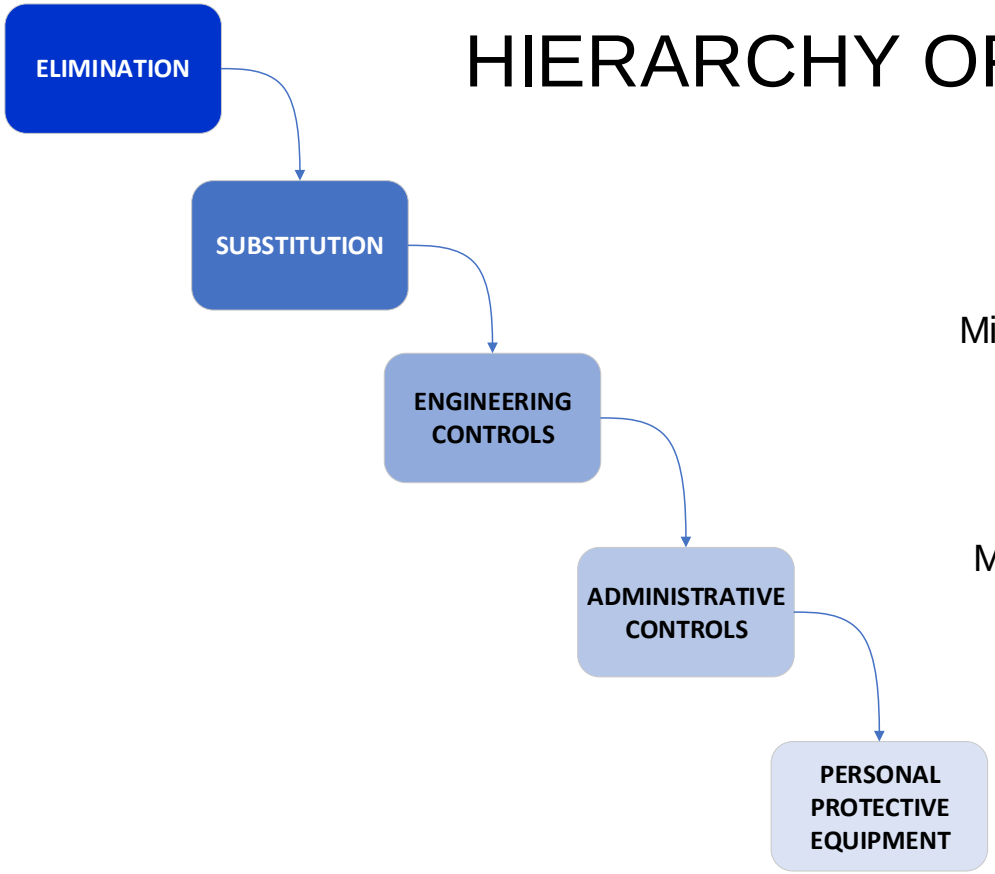
- **Determination of the DF factors** to use is not always a simple exercise
- **Time to implement controls** and monitor their effectiveness needs to be considered
- **Life extension 'creep'** can invalidate previous CBAs making a 'hindsight' determination that controls should have been implemented
- **VPF need to be consistently applied** and is often difficult to calculate
- May need to make a more qualitative judgement by applying **common sense** and/or exercising **professional judgment**, or **experience**
- CBA cannot argue against a statutory duty

COST BENEFIT ANALYSIS
ISSUES

- **Estimation of the severity and the probability aspects** of risk may be more qualitative than quantitative.
- In reality PSS Hazard Logs will contain multiple Accidents with differing Risk Classifications – **it is important to have oversight of the cumulative risk to ensure the 'risk budget' is effectively used**
- Need to **balance the benefit** from having a 'global' solution to a risk that may prove grossly disproportionate when a more local solution would be considered reasonably practicable
- It is important to **conduct sensitivity analysis** around the variables in the CBA
- CBA on its own does not constitute an ALARP case

Ultimately, the Duty Holder must consider the societal concern over whether the risk remains 'tolerable'

HIERARCHY OF CONTROLS



Mitigation strategies should follow the HSE Hierarchy of Control.

More details on risk reduction techniques can be found in SMP 08

MAKING AN ALARP STATEMENT

- Formal ALARP statements should be made by the relevant DH
- DH facing organisations may be requested for ‘an opinion’
- The ALARP statement should outline the basis how you:
  - ✓ Complied with all relevant legislation, policy and safety requirements;
  - ✓ Implemented relevant ‘good practice’;
  - ✓ Assessed the risk
  - ✓ Considered other reasonably foreseeable control measures and implemented any which were reasonable practicable and showed that the rest were grossly disproportionate to be applied;
  - ✓ Showed that the risk and associated risk reduction control measures were regularly reviewed;
  - ✓ Addressed societal concern.

Through Life and beyond it shall show how you proved that it was neither practicable nor reasonably practicable to do more than was in fact done to satisfy the duty or requirement, or that there was no better.

MAKING AN ALARP STATEMENT

- ALARP is judgement about a risk **today**.
- **Tomorrow** the risk may not be ALARP
- Eventually, over a longer period of time, **the risk will not be ALARP due to:**
  - New/amended Legislation, regulation etc.
  - New/amended standards,
  - Evolving best practice,
  - Technology advances,
  - Degradation,
  - Control measure effectiveness,
  - Failure data and accidents/incidents etc

REGULAR REVIEW OF RISKS IS REQUIRED TO REMAIN OR RETURN TO ALARP

MAKING AN ALARP STATEMENT

- Not taking action to protect people (workers or public) from avoidable danger is a criminal offence.
- An accident does not need to happen for action to be taken against an employer (directors or managers).
- If action is taken it is up to the defendant to prove everything reasonably practicable was done to comply with the relevant H&S legislation.

In any proceedings for an offence under any of the relevant statutory provisions consisting of a failure to comply with a duty or requirement to do something so far as is practicable or so far as is reasonably practicable, or to use the best means to do something, it shall be for the accused to prove (as the case may be) that it was not practicable or not reasonably practicable to do more than was in fact done to satisfy the duty or requirement, or that there was no better.

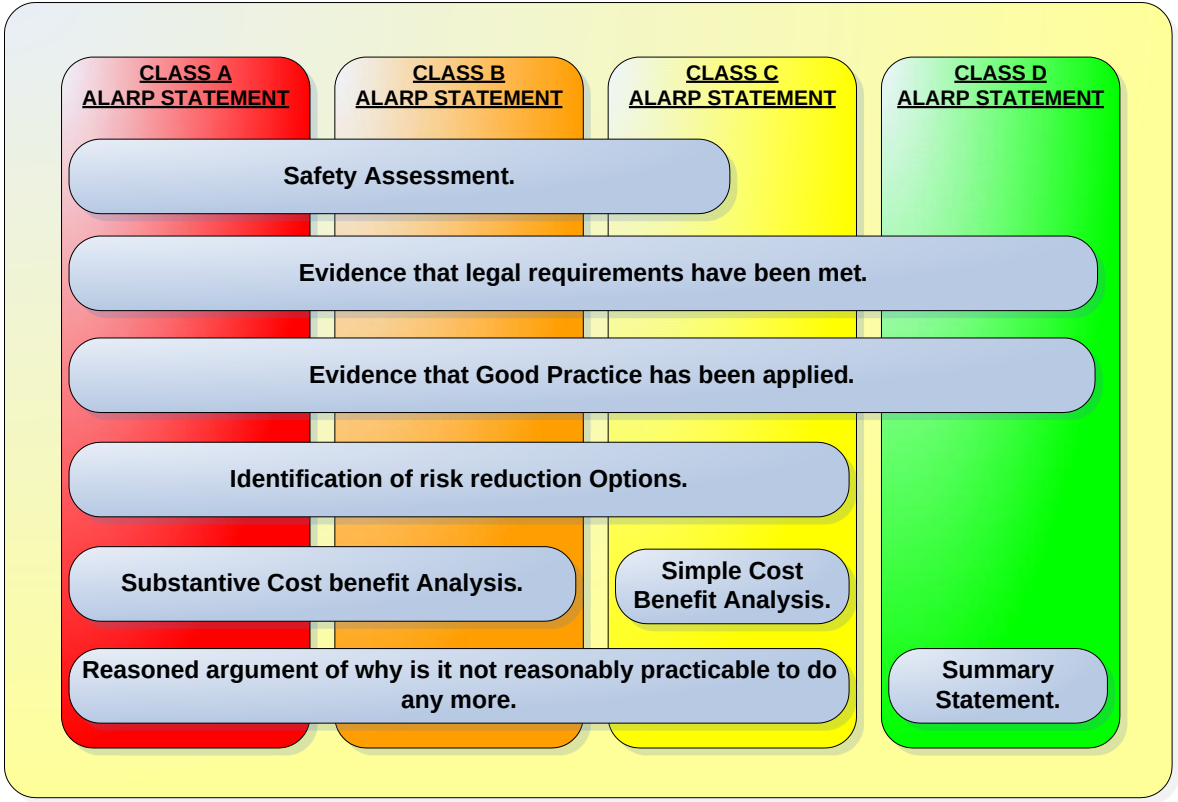
ALARP STATEMENT - PITFALLS

- Accepting ALARP on the basis of budget limitations
- Tempting to adjust the tolerability criteria when addressing a failure
- Unjustified Assumptions
- Difficult to judge if legislative compliance achieved
- Limited ‘search’ for ‘good practice’
- Good Practice is implemented but not appropriate
- Lack of or poor demonstration of gross disproportion (risk v sacrifice)
- Open ended actions – a promise to be ALARP in the future
- No evidence of regular review of control measures
- Lack of diversity in the argument made
- Poor record keeping in particular within the Hazard Log

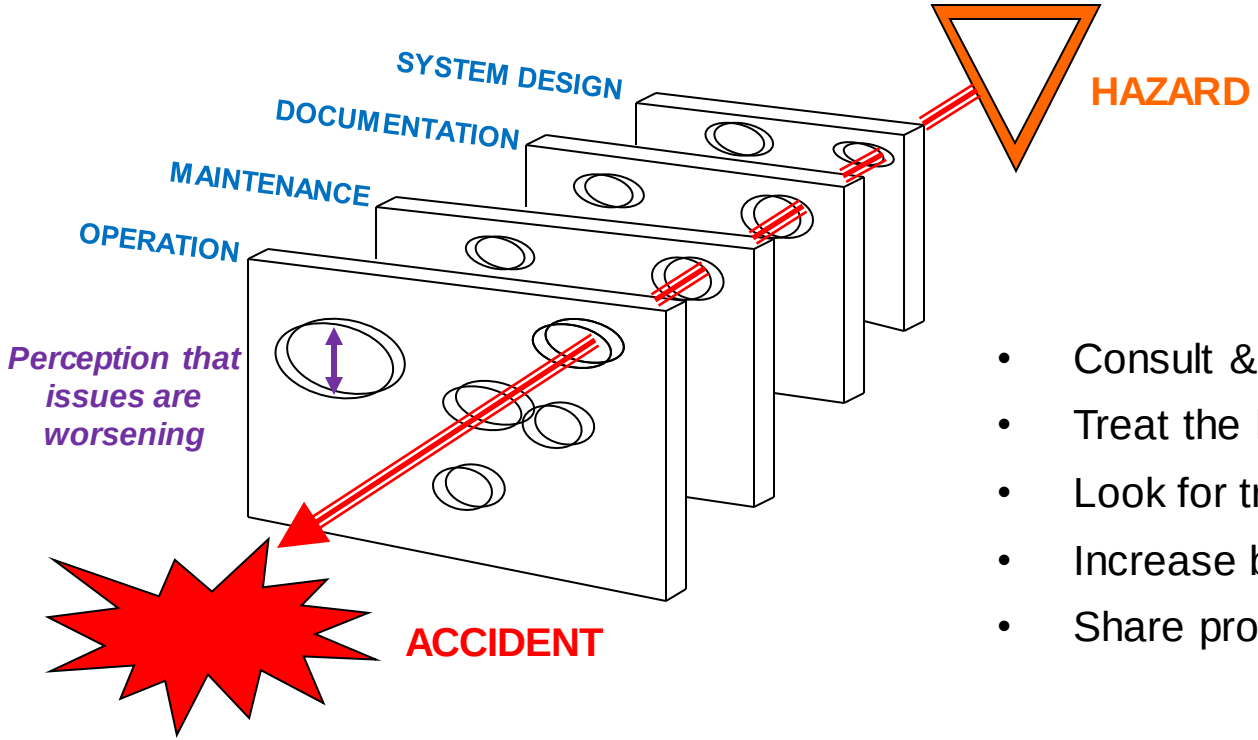
HSE – FOUR ALARP FALLACIES

1. Ensuring that risk are reduced ALARP means that we have to raise standards continually
2. If a few employees have adopted a high standard of risk control, that standard is ALARP
3. Ensuring that risks are reduced ALARP means that we can insist on all product risk controls
4. Ensuring that risks are reduced to ALARP means that there will be no accidents or ill-health

ALARP Statements - Proportionate to Risk



‘SWISS CHEESE’ END TO END SAFETY MODEL



- Consult & communicate
- Treat the holes, watch creep
- Look for trends & address them
- Increase barrier thickness
- Share problems

REFERENCES

- Policy Statement by the Secretary of State for Defence.
- DSA01.2 Implementation of Defence Policy for Health, Safety and Environmental Protection.
- DSA01.2 Implementation of Defence Policy for Health, Safety and Environmental Protection
- The Green Book.
- Managing Risks to the Public: Appraisal Guidance. HM Treasury, 2005.
- Cost Benefit Analysis Checklist. HSE
- The Principles for Cost Benefit Analysis (CBA) in Support of ALARP Decisions. HSE.
- Principles & Guidelines to Assist HSE in its Judgement that Duty Holders Have Reduced Risk As Low As Reasonably Practicable. HSE.
- Reducing Risks, Protecting People (R2P2), HSE.
- ALARP at a glance. HSE

WARNING - RISK COMPENSATION!