# HSE information sheet

# Offshore Information Sheet No. 2/2006

# Offshore Installations (Safety Case) Regulations 2005 Regulation 12 Demonstrating compliance with the relevant statutory provisions

## Contents

## Introduction

This information sheet explains the key change in the Offshore Installations (Safety Case) Regulations 2005 (SCR05) with respect to the ALARP demonstration, and provides advice to duty holders on how this change should be addressed in their safety cases.

## General Background

SCR92 required a demonstration that risks to people from major accident hazards had been reduced to the lowest level that is reasonably practicable [the 'ALARP' demonstration]. SCR05 replaces this with a requirement to demonstrate that major accident risks are, or will be, controlled to ensure compliance with the relevant statutory provisions. This information sheet outlines the reason for this change, and explains what needs to be done to make the necessary SCR05 'compliance' demonstration.

In practice most duty holders will not need to make any substantial changes to their current safety cases, nor will the changes require cases to be submitted to HSE for re-assessment.

This information sheet also builds on the published operational principles and guidance used by HSE to make its judgements that duty holders have reduced risks as low as reasonably practicable [the ALARP trilogy [1, 2, 3]]. This note explains how that guidance applies to decisions on the acceptability of safety cases.

### Legal Background

The Health and Safety at Work etc. Act 1974 (HSWA) is the principal source of health and safety legislation in Great Britain. The Act requires employers to ensure so far as is reasonably practicable ("SFAIRP") the health, safety and welfare at work of employees, and others. The meaning of SFAIRP has been the subject of legal judgement in the UK courts (Edwards v National Coal Board). The Act is supported by regulatory requirements, many of which require assessment of risk. For example, Management of Health and Safety at Work Regulations 1999 (MHSWR) r.3 requires a suitable and sufficient assessment of risk for the purpose of identifying measures needed to comply with the relevant statutory provisions.

SCR05 r.12 requires, among other matters, a demonstration by duty holders that;

- all hazards with the potential to cause a major accident have been identified;
- all major accident risks have been evaluated; and,
- measures have been, or will be, taken to control the major accident risks to ensure compliance with the relevant statutory provisions (i.e. a **compliance demonstration**).

A safety case 'compliance demonstration' has to show how a duty holder meets, or will meet, the requirements of the relevant statutory provisions [i.e. HSWA, Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (PFEER), Offshore Installations and Wells (Design and Construction, etc) Regulations 1996 (DCR) and other provisions relevant to the control of major accident risks]. Many of the requirements within the relevant statutory provisions are qualified by phrases such as SFAIRP, ALARP or even, "appropriate with a view to". Where legal duties use these qualifying phrases, they call for similar tests to be applied. Wherever such wording is used this means a duty holder has to show through reasoned and supported arguments that there is nothing else that could reasonably be done to reduce risks further.

However some regulatory requirements are phrased in absolute terms and, as such, regulatory compliance exceeds ALARP. Examples include PFEER r.17 - arrangements for recovery and rescue; and PFEER r.19 - suitability and condition of plant.

The reason for the change, from the SCR92 requirement for an ALARP demonstration to that in SCR05 for a compliance demonstration, is recognition that to have a requirement for an overall demonstration of ALARP in a safety case is in fact contradictory where there are certain legal requirements in relevant legislation that are absolute.

## Standards and Guidance

### HSE Operational Guidance

HSE has produced a suite of operational guidance documents (the ALARP guidelines) intended to help HSE regulatory staff reach decisions about the control of risks and make clear what they should expect from duty holders. The operational guidance sets out principles and guidelines based in part on what the Courts have decided is required of duty holders. The documents are:

a. Principles and guidelines to assist HSE in its judgments that duty-holders have reduced risk as low as reasonably practicable[1];
b. Assessing compliance with the law in individual cases and the use of **good practice**[2]; and
c. Policy and guidance on reducing risks as low as reasonably practicable in **design**[3].

In addition HSE has also published "Reducing Risks, Protecting People - HSE's decision making process" (R2P2)[4]. It is aimed primarily at stakeholders who want to know more about HSE's philosophy in the regulation of health and safety. It is a further development of ideas previously contained in the 1988 Tolerability of Risks from Nuclear Power Stations (TOR) document. HSE takes some of the key concepts from R2P2 and applies them when evaluating ALARP decision-making by duty holders; it

does this to fill in some of the detail needed to make judgements in practice, which are not covered by the Edwards case.

**HSE Offshore Division Guidance**

This guidance should be read in conjunction with the HSE publication Assessment Principles for Offshore Safety Cases (APOSC)[5].

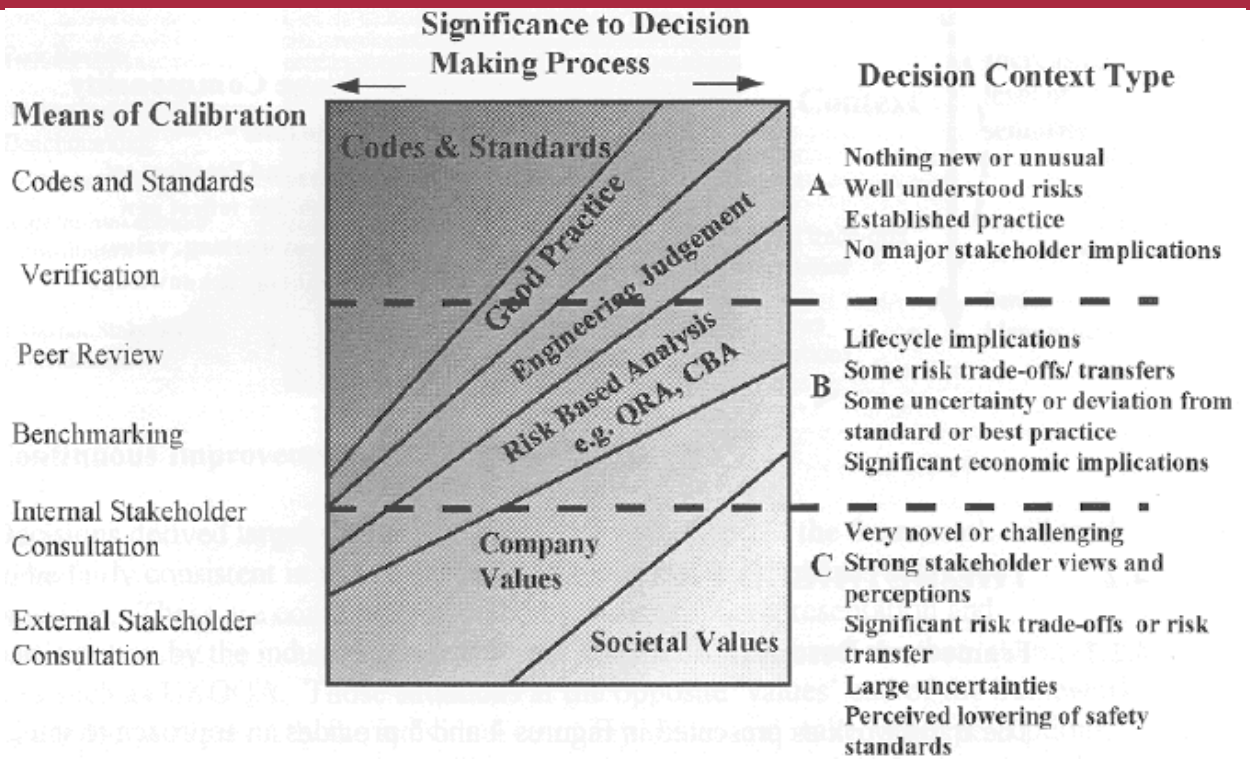
**Industry Guidance**

Oil & Gas UK has produced helpful guidelines for assisting with the risk related decision-making process and for recording and demonstrating the robustness of the decision. HSE, BCECA, BROA, IADC, OCA, IUOOC together with representatives of the workforce, assisted in the preparation of the framework document: **Industry guidelines on "A Framework for Risk Related Decision Support" – Oil & Gas UK.**

These guidelines describe a framework that is intended to help decision-makers assess the relative importance of codes and standards, good practice, engineering judgement, risk analysis, cost benefit analysis and company and societal values when making decisions. They aim to encourage the development of transparent decision making processes, thereby helping duty holders meet their regulatory obligations.

A summary of the framework is shown in the diagram below. It is essential to make reference to the Oil & Gas UK guidelines themselves for detail on their use. The framework diagram is complex and its interpretation can be very subjective. The approach to application of the framework varies from company to company.

**A Decision Support Framework for Major Accident Hazard Safety**




Oil & Gas UK have also produced guidelines that provide an approach for addressing the impact of uncertainty on QRA. The guide seeks to promote awareness of the sources of uncertainty in QRA, how to address these, and to highlight some of the key benefits and limitations of undertaking an analysis of uncertainty - **Guidelines for "Quantitative Risk Assessment Uncertainty" – Oil and Gas UK**

**Key Concepts**

It is important to understand the concepts underpinning considerations of reasonable practicability. The HSE ALARP Guidelines[1, 2, 3] set out in plain terms what HSE believes the law to require of those who are under a duty to reduce risks as low as is reasonably practicable.

Determining whether risks have been reduced as low as is reasonably practicable involves an assessment of the risk to be avoided, and an assessment of the sacrifice (in money, time and trouble) involved in taking measures to avoid that risk, and a comparison of the two. Any risk sits on a spectrum from very low (where it is very unlikely that it would be possible to reduce the risk further) through to levels of risk that are so high that the risk assessment (and implementation of risk reduction measures) must be rigorous, exhaustive and transparent. The greater the initial level of risk under consideration, the greater the degree of rigour required to demonstrate that risks have been reduced so far as is reasonably practicable.

The basis on which the comparison is made involves the test of 'gross disproportion' (qv).

**Inherently safer design** - the HSE guidance on ALARP makes reference to the general principles of prevention identified in MHSWR Schedule 1, and indicates that it is **good practice** (though **not** enforceable) to apply these principles as a hierarchy. Duty holders are entitled to apply these general principles as they see fit. However, HSE Inspectors will encourage the incorporation of inherently safer design features where appropriate. Risks should be assessed in an integrated manner (i.e. not in isolation from one another) so that the "full picture" is assessed across the whole system.

**Choosing between options** - a selection among options may be needed at any stage in any project, not least at the design stage, which will involve making a choice between differing design concepts for the project as a whole. In making choices it is good practice for duty holders to consider the risks involved in the whole life cycle of a project. However it is expected that a new installation would not give rise to a residual level of risk greater than that achieved by the best examples of existing good practice for comparable functions. The reasonable practicability of any further risk reduction should be measured against **this** baseline.

In considering whether a proposed design, for example, will reduce risk to people and ensure regulatory compliance a duty holder will need to have a safety management system (SMS) that is capable of delivering an appropriate design.

**Good practice** - where the law requires that risks to people have been reduced as low as reasonably practicable the application of relevant good practice may be acceptable as a sufficient demonstration of part (or all) of the risk v. sacrifice computation. Good practice may change over time because of technical innovation, or because of increased knowledge and understanding. The criteria for the evolution of information into good practice are set out in the HSE ALARP guidance. The OSD Guidance for the Topic Assessment of the Major Accident Hazard Aspects of Safety Cases (GASCET)[6] provides information on the benchmark standards (ACoPs, national and international codes and standards etc) currently considered to represent good practice.

Authoritative good practice can be considered to set the risk benchmark, though it does not prescribe the methods by which risks must be controlled. While good practice informs, it neither constrains, nor substitutes for, the need for professional judgement. Good practice generally represents a preferred approach, however it is not the only approach that may be taken. Where a duty holder wishes to adopt a different approach to controlling risks, and can show that the risks from the proposed approach are similar to that which would have been achieved through adoption of good practice and are ALARP for that approach, they will normally be doing enough to comply with the law.

**Reverse ALARP** - duty holders have from time to time tried to show through QRA/CBA that **moving to a less protected situation** will meet the legal requirement to reduce risks ALARP, sometimes arguing that the increase in risk is more than balanced by gains in reduced operational costs or increased operating profit - a "reverse ALARP" argument. The legal requirement to reduce risks as **low** as reasonably practicable

would rule out HSE accepting a less protected but significantly cheaper approach to the control of risks.

**Changed circumstances** - duty holders may wish to introduce new processes, new technology or alter the conditions in which equipment is operated in response to changed circumstances. Such changes may result in a change to the risk profile - some risks may increase. This is permissible provided measures are taken to ensure that the risks are reduced as low as reasonably practicable for the new situation. Arguments in support of changed circumstances should be distinguished from those concerning reverse ALARP **(qv)**.

**Precautionary principle** - the precautionary principle is described as the philosophy that should be adopted for addressing hazards that are subject to high scientific uncertainty. The precautionary principle is invoked where

- There is good reason to believe that harmful effects may occur to human, animal or plant health or the environment; and
- The level of scientific uncertainty about the consequences or likelihood is such that risk cannot be assessed with sufficient confidence to inform decision-making.

Therefore, invocation of the precautionary principle may be appropriate in addressing the introduction of genetically modified plants where there is good reason to believe that the modifications could lead to harmful effects on existing habitats, and there is a lack of knowledge about the relationship between hazard and the consequence. In the offshore industry the hazards and consequences are well understood and hence conventional assessment techniques can be used to evaluate the risks, using a cautionary approach rather than application of the precautionary principle. Therefore invocation of the precautionary principle is extremely unlikely to be appropriate offshore.

**Uncertainty** - uncertainties need to be recognised and addressed. There should be a bias towards health and safety if the conclusions are to be credible. Where the uncertainties are large, a more cautionary approach is likely to be appropriate, for example by adopting inherently safer designs **(qv)**. [NB cautionary approach and precautionary principle **(qv)** do not mean the same thing and should not be confused.] A method of dealing with uncertainty is to make the QRA deliberately conservative or to increase the proportion factor in estimating gross disproportion.

**Quantitative risk assessment [QRA]** - QRA is a powerful tool for showing risk relationships. The process of undertaking a QRA can lead to a better understanding of the important features contributing to risk and weaknesses in systems, as well as allowing a numerical estimate of residual risk to be derived. The quality of the modelling and the data will affect the robustness of the numerical estimate and the uncertainties **(qv)** 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 be misleading and can result in decisions that either do not meet adequate levels of safety, or

overestimate the real risks. In general an approach that uses information from engineering and operational analysis, supplemented where appropriate by QRA, will lead to more robust decisions. Further guidance is contained in Offshore Information Sheet 3/2006 Guidance on Risk Assessment for Offshore Installations[7].

Current safety cases are likely to make reference to the results of QRA expressed in terms of:

- **IRPA**: Individual Risk Per Annum, this is the chance of an individual becoming a fatality. An IRPA of $1 \times 10^{-3}$ would mean for each individual, every year, there is a 1 in 1000 chance of a fatal accident.

- **PLL**: Potential Loss of Life is proportional to the sum of all the IRPAs. In simple terms PLL is related to IRPA by the relationship IRPA = PLL x fraction of time an individual is offshore per year/PoB. For example an installation with a PoB of 50, working 2 weeks on, 2 weeks off (fraction of time offshore per year is 0.5) with each person having an IRPA of $1 \times 10^{-3}$ then the PLL would be $10^{-1}$ [$10^{-3}$ x 50/0.5]. This means that a fatality would be expected on the installation on average once in every 10 years.

- **TR impairment**: This is the chance per year that the temporary refuge (TR) will be unable to perform in the way stated in the safety case. It is represented as a frequency per year, with an upper bound of no higher than $1 \times 10^{-3}$. In other words no more than once in every 1000 years would there be an event that would prevent the TR from functioning as described in the safety case. (See also, societal concerns).

**Gross disproportion** - if a measure is practicable and it cannot be shown that the cost of the measure is grossly disproportionate to the benefit gained, then the measure is considered reasonably practicable and should be implemented.

**Cost benefit analysis** - CBA is the numerical assessment of the costs of implementing a design change or modification and the likely reduction in fatalities that this would be expected to achieve. It suffers from the same problems as QRA **(qv)** when used as an input to decision-making, and therefore it should be used cautiously in support of qualitative or engineering arguments. In making this assessment there is a need to set criteria on the value of a life or implied cost of averting a statistical fatality (ICAF).

R2P2 sets the value of a life at £1,000,000 and by implication therefore the level at which the costs are disproportionate to the benefits gained. In simplistic terms a measure that costs less than £1,000,000 and saves a life over the lifetime of an installation is reasonably practicable, while one that costs significantly more than £1,000,000, is disproportionate and therefore is not justified. However case law indicates that costs should be grossly disproportionate and therefore costs in excess of this figure (usually multiples) are used in the offshore industry. In reality of course there

is no simple cut-off and a whole range of factors, including uncertainty **(qv)** need to be taken account in the decision making process.

In the offshore industry there is a need to take account of the increased focus on societal (or group) risk, i.e. the risk of multiple fatalities in a single event, as a result of society's perceptions of these types of accident. Therefore the offshore industry typically addresses this by using a high proportion factor for the maximum level of sacrifice that can be borne without it being judged 'grossly disproportionate'; this has the effect of increasing the ICAF value used for decision-making. The typical ICAF value used by the offshore industry is around £6,000,000, i.e. a proportion factor of 6. OSD considers this to be the minimum level for the application of CBA in the offshore industry.

Use of a proportion factor of 6 ensures that any CBA tends towards the conservative end of the spectrum and therefore takes accounts of the potential for multiple fatalities and uncertainty. Although a proportion factor of 6 tends to be used, there are no agreed standards and it is for each duty holder to apply higher levels if appropriate, for example in very novel designs.

**Societal concerns** - HSC/E takes account of societal concerns (i.e. society's response to an incident) and reflects these in the regulatory regime in which the duty holder is operating. Societal concern due to the occurrence of multiple fatalities in a single event is known as societal risk **(qv)** and is usually defined in the context of members of the public. For offshore activities, where the workers are isolated and members of the public are unlikely to be affected, the term "group risk" is often used.

**Societal risk** - There are no established criteria for offshore societal risk and instead decision-making is based on individual risk with an allowance for multiple fatalities made through high value decision-making criteria. In effect this means the use of high cost per life values in cost benefit analysis.

Although there is no specific requirement to estimate group risk, APOSC[5] indicates a need for a safety case to demonstrate temporary refuge (TR) integrity - this could be considered as a measure of societal risk. The requirement is to demonstrate that the frequency with which accidental events will result in a loss of TR integrity, within the minimum stated endurance time, does not exceed the order of 1 in 1000 per year. As for individual risk this frequency should be reduced to a lower level wherever reasonably practicable and where the frequency is close to 1 in 1000 per year, acceptance that further risk reduction measures are 'grossly disproportionate' should be only on the basis of a very rigorous demonstration.

**Safety management system [SMS] -** A demonstration of regulatory compliance should be supported by the duty holder's SMS to ensure;

- appropriate control measures are, and remain, in place;
- control measures are maintained in good working order and repair are dependable and effective when required and able to perform as intended;

- risks are periodically reviewed to see if further controls are appropriate.

**Demonstrating compliance with the relevant statutory provisions – what is required by SCR05?**

For the purposes of a safety case, a SCR05 r.12 demonstration of compliance with the relevant statutory provisions is a description of the management process by which a duty holder has reached the conclusion that all the measures that could be applied to reduce risks from each of the identified major accident hazards are appropriate and that nothing more can be done. The process is a key element of a duty holder's safety management system.

It has been a common misunderstanding that risks being 'tolerable' and being 'ALARP' mean the same thing; this is not the case. Having established that risks are tolerable - through application of relevant good practice, professional judgement, experience etc, and where necessary supported by reference to the use of appropriate risk assessment techniques - the next step is to consider whether the relevant legal test has been satisfied, for example have the risks been reduced so far as is reasonably practicable. This involves looking to see if there are ways in which remaining risks can be further reduced.

There is no single correct way in which to demonstrate compliance with the relevant statutory provisions. However it is expected that for each major accident hazard identified for the installation, the demonstration would contain elements of the following process:

- Identification and consideration of a range of potential measures for further risk reduction,
- Systematic analysis of each of the identified measures and a view formed on the safety benefit associated with each of them,
- Evaluation of the reasonable practicability of the identified measures,
- The implementation (or planned implementation) of the identified reasonably practicable measures,
- Recording of the process and results, and these are summarised in the safety case.

The systematic analysis of options for reasonable practicability should make reference to relevant good practice and sound engineering judgement. Again, where appropriate this should be supported by reference to appropriate use of risk assessment techniques. If a measure appears practicable and the cost of the measure is not grossly disproportionate to the benefit gained, then the measure is reasonably practicable and should be implemented.

The management process described in the demonstration of compliance with the relevant statutory provisions should also show that a duty holder has considered the

integrated picture when assessing risk and not a partial view from considering each hazard in isolation, rather than across the whole system.

The safety case should show that the process of ensuring risks are controlled to ensure regulatory compliance has been an iterative one in which it has been necessary for a duty holder to go through the process a number of times. This will assist in providing a convincing demonstration that major accident risks are controlled to ensure regulatory compliance.

## References

1. Principles and guidelines to assist HSE in its judgements that duty holders have reduced risks as low as reasonably practicable - http://www.hse.gov.uk/risk/theory/alarp1.htm
2. Assessing compliance with the law in individual cases and the use of good practice - http://www.hse.gov.uk/risk/theory/alarp2.htm
3. Policy and guidance on reducing risks as low as reasonably practicable in design - http://www.hse.gov.uk/risk/theory/alarp3.htm
4. Reducing Risks, Protecting People, HSE's decision making process [R2P2] - Reducing Risks, Protecting People - R2P2
5. Assessment Principles for Offshore Safety Cases - http://www.hse.gov.uk/offshore/aposc190306.pdf
6. Guidance for the Topic Assessment of Major Accident Hazard Aspects of Safety Cases (GASCET) - http://www.hse.gov.uk/offshore/gascet/gascet.pdf
7. HSE Offshore Information Sheet 3/2006 Guidance on Risk Assessment for Offshore Installations - http://www.hse.gov.uk/offshore/sheet32006.pdf
8. SPC/Permissioning/09 HID's approach to ALARP decisions http://www.hse.gov.uk/foi/internalops/hid/spc/spcperm09.pdf

## Further Information

Any queries relating to this sheet should be addressed to:

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This information sheet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.