NOPSEMA
Australia's offshore energy regulator

GUIDANCE NOTE

ALARP in the context of well integrity

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Core concepts

- One of the main objectives of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011 (OPGGS (RMAR)) is to ensure that the risks to well integrity are reduced to a level that is as low as reasonably practicable (ALARP).
- A well operations management plan (WOMP) has to show how a titleholder meets, or will meet, the requirements of the regulatory provisions relevant to the control of risks associated with loss of integrity of a well. Many of the requirements are qualified by the phrase 'reduce the risks to a level that is ALARP'. This means that the titleholder has to show, through reasoned and supported arguments, that there are no other practical measures that could reasonably be taken to reduce risks further.
- The adopted control measures for any particular identified hazard which could lead to loss of integrity of a well must be shown to collectively eliminate, or reduce the risk of a loss of integrity of a well to a level that is ALARP.
- The approach employed in providing evidence that risks have been reduced to ALARP within a WOMP is at the discretion of the titleholder. In practice, a combination of approaches is likely to be necessary.
- Only by inclusion of a sufficient level of detail of information by the titleholder will NOPSEMA be able to make a judgement on the appropriateness of the WOMP in accordance with OPGGS (RMAR), regulation 5.08 (for new WOMP) or regulation 5.15 (for revised WOMP).
- This guidance note addresses how the ALARP concept can be addressed in the context of a WOMP.

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Abbreviations/acronyms

OPGGS (RMAR)	Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011
ALARP	As low as reasonably practicable
HSE	Health and Safety Executive, United Kingdom
MS	Management system
WOMP	Well operations management plan

Key definitions

The following are some useful definitions for terms used in this guidance note. They are a suggested starting point only and are not prescriptively defined.

Regulations	means the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011
ALARP	this term refers to reducing risk to a level that is As Low As Reasonably Practicable. In practice, this means that the titleholder has to show, through reasoned and supported arguments, that there are no other practicable options that could reasonably be adopted to reduce risks further.
Risk assessment	is the process of estimating the likelihood of an occurrence of specific consequences (undesirable events) of a given severity.
Reasonably practicable	the legal definition on this was set out in England by Lord Justice Asquith in Edwards vs. National Coal Board [1949] who said: *'Reasonably practicable' is a narrower term than 'physically possible' and seems to me to imply that a computation must be made by the owner, 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. Moreover, this computation falls to be made by the owner at a point of time anterior to the accident.* This English decision has since been confirmed by the Australian High Court[1].
Good practice	commonly accepted in the industry and supported by sound engineering principles and relevant internationally accepted standards and guidance, e.g. Oil & Gas UK Well Life Cycle Integrity Guidelines, NORSOK Standard D-010, ISO/DIS 16530 Well Integrity.

[1] Slivak v Lurgi (Australia) Pty Ltd (2001) 205 CLR 304 cited in Bluff & Johnstone (2004) The relationship between Reasonably Practicable and Risk Management (WP 27 ANU National Research Centre for OHS Regulation)

1. Introduction

1.1. Intent and Purpose

This document is part of a suite of documents that provide guidance on the preparation of WOMPs for well(s), as required under the OPGGS (RMAR) and the corresponding laws of each state and Territory where powers have been conferred on NOPSEMA.

This guidance note provides direction on the descriptions that could be included in a WOMP submission as a means of addressing the requirements of the regulations to provide evidence that risks are reduced to a level that is ALARP. The guidance will be of use to those with responsibility for well integrity, and particularly those developing the WOMP for the well(s).

The purpose of the guidance is to explain the objectives of the regulations, to identify the general issues that should be considered and to provide practical examples to illustrate the concepts and potential approaches that can be taken in the preparation of a WOMP. It is not the intention of the guidance to provide detailed approaches or detailed regulatory assessment criteria.

Guidance notes indicate what is required by the regulations, discuss good practice and suggest possible approaches. A regulatory requirement is indicated by the word must, while other cases are indicated by the words should, may, etc. NOPSEMA acknowledges that what is good practice, and what approaches are valid and viable, will vary according to the nature of the scale of activity.

1.2. Summary of the legislative requirements

The following provides a summary of the legislative requirements with respect to providing evidence that the risks to loss of well integrity have been reduced to a level that is ALARP are included as a quick reference throughout this document**.** However, the reader is encouraged to work directly from the regulations.

Regulations – Object of Part 5

Reg 1.04A The object of Part 5 of these regulations is the maintenance of the integrity of offshore petroleum and greenhouse gas wells, by ensuring that risks to well integrity are reduced to as low as reasonably practicable.

Regulations – Criteria for acceptance of WOMP

Reg 5.08 For regulation 5.07, the criteria for acceptance of a well operations management plan for a well are:

(d) that the plan demonstrates how the risks to the integrity of the well will be reduced to as low as reasonably practicable

Regulations – Criteria for acceptance of WOMP

Reg 5.09(1) The matters that must be included in a well operations management plan are the following:

(c) a description and explanation of the design, construction, operation and management of the well, and conduct of well activities, showing how risks to the integrity of the well will be reduced to as low as reasonably practicable;

(e) a description of the control measures that will be in place to ensure that risks to the integrity of the well will be reduced to as low as reasonably practicable throughout the life of the well, including periods when the well is not operational but has not been permanently abandoned;

(i) a description of the arrangements that will be in place for suspension and abandonment of the well, showing:

(i) how, during the process of suspending or abandoning the well, risks to the integrity of the well will be reduced to as low as reasonably practicable.

2. Application of the ALARP principle

A WOMP has to show how a titleholder meets, or will meet, the requirements of the regulatory provisions relevant to the risk to integrity of a well. Many of the requirements are qualified by the phrase 'reduce the risks to a level that is as low as reasonably practicable'. This means that the titleholder has to show, through reasoned and supported arguments, that there are no other practical measures that could reasonably be taken to reduce risks further.

The concept of 'reasonably practicable' is central to the WOMP. It allows titleholders to set goals for their own performance rather than following prescriptive requirements. It also allows NOPSEMA to accept or refuse to accept the titleholders' arrangements under the WOMP. This flexibility is a great advantage but it can be challenging because it requires people to exercise judgement with respect to how they are going to manage their risks. In the great majority of cases, a decision can be made by referring to existing 'good practice' that has been established. However, for complex situations it may be difficult to reach a decision on the basis of 'good practice' alone. There may be some situations, for example in the case of new technology, where there is no relevant 'good practice' that can be followed. In these situations other decision-making techniques need to be applied to inform judgment.

Other regulators such as the United Kingdom's Health and Safety Executive (HSE) and the Norwegian Petroleum Directorate have been successfully administering well management for many years. The HSE, in particular, has developed constructive guidance on the topic of the application of ALARP (available on the HSE website www.hse.gov.uk) and readers are encouraged to make reference to it. However, it is essential to bear in mind that while there are parallels in the regulatory approach, there are also important variations

in the wells regulation legislation between the UK and Australia, and as such the HSE guidance should only be referred to for concepts and principles.

Key aspects of the HSE guidance are distilled in this guidance note with respect to how to go about constructing an ALARP argument.

2.1. How to use ALARP

Using 'reasonably practicable' allows the regulations to set goals for titleholders, rather than being prescriptive. This flexibility is a great advantage but also has its disadvantages. Deciding whether a risk is ALARP can be challenging because it requires titleholders to exercise judgement. In the great majority of cases, it can be decided by referring to existing 'good practice' that has been established by a process of discussion with service providers to achieve a consensus about what is ALARP.

2.2. Why do I need to know about ALARP

ALARP is fundamental to the work of the titleholder organisation and it is important that everyone, whatever their role, knows about it. Some specific reasons to know about ALARP and its relationship with good practice, include:

- **Titleholders** need to know about ALARP because when they make proposals for controlling risks, they need to make sure that, as far as possible, those controls will reduce the risks to the integrity of the well to ALARP
- **NOPSEMA** needs to know about ALARP to decide whether titleholders have reduced their risks to ALARP as required by the law.

2.3. What is meant by reasonably practicable?

'ALARP' and 'reasonably practicable' are defined in the key definitions for this guidance note.

In essence, making sure a risk has been reduced to ALARP is about weighing the risk against the sacrifice (whether in money, time or trouble) needed to further reduce it. To avoid having to make this sacrifice, the titleholder must be able to show that it would be grossly disproportionate to the benefits of risk reduction that would be achieved. Thus, the process is not one of balancing the costs and benefits of measures but, rather, of adopting measures except where they are ruled out because they involve grossly disproportionate sacrifices.

In reality many decisions about risk and the controls that achieve ALARP are not so obvious. Factors come into play such as ongoing costs set against remote chances of one-off events. It requires judgment, and there is no simple formula for computing what is ALARP.

2.4. Definition of a hazard

A hazard, in respect to the risk to well integrity, is a property of a substance (formation fluids) or a phenomenon, or an activity that can cause adverse effects. For example:

- acidic gas (e.g. H2S or CO2) in the reservoir fluids can cause deterioration of well barriers by corrosion (tubing, casing, wellheads, packers, etc.)
- cementing failures during well construction can cause leak paths to develop
- poor well design can compromise the effectiveness of well barriers

- environmental forces, e.g. wind and wave cyclic motions can cause failure of well barriers as well as erosive and corrosive influences.
- geological formations (e.g. fracture, faults, squeezing salts) can damage a well barrier during drilling and production.

2.5. Definition of a risk

A two-part concept, risk is the likelihood that the hazard will actually cause its adverse effects together with a measure of the effect. Likelihoods can be expressed as probabilities (e.g. 'one in a thousand'), frequencies (e.g. '1000 cases per year') or in a qualitative way (e.g. 'negligible', 'significant', etc.). The effect can be described in many different ways, for example:

- the probability of a blowout while drilling a development well is one in 2850 wells drilled
- the risk of a well experiencing a surface blowout during a workover, frequency is 1.8×10^{-4}.

Source: OGP: Risk Assessment Data Directory Report No. 434-2, March 2010

2.6. Deciding by good practice

In most situations, deciding whether the risks are ALARP involves a comparison between the control measures a titleholder has in place, or is proposing, and the measures NOPSEMA would normally expect to see in such circumstances, e.g. relevant good practice. Good practice is defined as commonly accepted in the industry and supported by sound engineering principles and relevant internationally accepted standards and guidance, e.g. Oil & Gas UK Well Life Cycle Integrity Guidelines, NORSOK Standard D-010 and ISO/DIS 16530 Well Integrity.

Once what is good practice has been determined, much of the discussion with titleholders about whether a risk to integrity of the well is, or will be ALARP, is likely to be concerned with the relevance of the good practice, and how appropriately it has been or will be implemented. Where there is relevant, recognised good practice, NOPSEMA expects titleholders to follow it. If they want to do something different, the titleholder must be able to demonstrate to NOPSEMA's satisfaction that the measures they propose to use are at least as effective in controlling the risk.

3. Key principles

It is important to understand the key principles underpinning ALARP. The following descriptions have been adapted from HSE information sheet no. 2/2006 and the Oil & Gas UK Guidance on risk decision making, Issue 2 July 2014.

Reasonable practicability – determining whether risks have been reduced ALARP involves an assessment of the risk to be avoided, and an assessment of the sacrifice (in money, time and effort) involved in taking measures to avoid that risk, and a comparison of the two. A risk may sit 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 very high. The greater the initial level of risk under consideration, the greater the effort likely to be required to demonstrate that risks have been reduced to a level that is as low as reasonably practicable, however, just because the initial level of risk may be low doesn't mean it may not be reasonably practicable to reduce it further. The basis on which the comparison is made involves the test of 'gross disproportion'.

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. The criterion is reasonably practicable not reasonably affordable: justifiable cost and effort is not determined by the budget constraints/viability of a project.

Inherently safer design – it is good practice to apply the principles of a hierarchy of control, including:

- prevention of potential events
- separation of people from the consequences of potential events
- control of the magnitude and frequency of an event
- mitigation of the impact of an event on people
- emergency response and contingency planning.

Titleholders are entitled to apply these general principles as they see fit. However, NOPSEMA promotes the incorporation of inherently safer design features, where appropriate.

Choosing between options – for new wells or brown-field redevelopment well(s), 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 well(s) as a whole. In making choices titleholders should consider the risks involved over the whole life cycle of a well(s). However, it is expected that a new well 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. WOMPs should show that the lowest risk option has been selected in all cases, or why the selected higher risk option is ALARP.

Good practice – within the HSE and their ALARP guidance documentation, good practice is the term used for those standards for controlling risk which have been judged and recognised by the HSC (Health and Safety Commission) as satisfying the law when applied to a particular relevant case in an appropriate manner. This is not the case in Australia. NOPSEMA has not endorsed any 'approved codes of practice' or standards to allow them a special legal status. The term 'good practice' in NOPSEMA guidance documentation therefore is taken to refer to any well-defined and established standard or codes of practice adopted by an industrial/occupational sector, including 'learnings' from incidents that may yet to be incorporated into standards. Good practice generally represents a preferred approach; however it is not the only approach that may be taken. While good practice informs, it neither constrains, nor substitutes for, the need for professional judgement. Good practice may change over time because of technical innovation, or because of increased knowledge and understanding.

Changed circumstances – titleholders may wish to introduce new processes, new technology or alter the conditions in which equipment is operated in response to changes in circumstances. Such changes may result in a change to the risk profile with an associated increase in risk. This may be permissible provided control measures are taken to ensure that the risks are reduced as low as reasonably practicable for the new situation.

Risk uncertainty – it is expected that risk related decision making should be made with sufficient certainty and understanding of both the likelihood and consequence of an event occurring. Where there is uncertainty a precautionary approach to demonstrate risks are ALARP should be taken.

Precautionary approach – uncertainty is not used as reason for not implementing effective control measures. Uncertainties in risk are replaced by conservative (worst case) assumptions resulting in controls being more likely implemented. Titleholders should use a precautionary approach where there are greater levels of uncertainty in the determined consequence or likelihood, for example, from the use of new technology, disagreement in opinions or limited relevant industry standards. In cases where uncertainties are present controls should take precedence over the economic considerations by titleholders.

4. What ALARP descriptions are required in the WOMP?

In order to maintain risks at a level that is ALARP it is essential that control measures remain effective. The information provided in the WOMP in support of the ALARP argument should cover the following aspects as a minimum:

- performance standards have been established
- performance is measured against set performance standards within well construction, inspection, maintenance and management systems
- there is periodic review of the process by which performance standards are established and maintained, including checks that the right things are being measured.

4.1. What are the fundamental approaches to consider for ALARP demonstration?

There is no prescribed methodology for demonstrating that the necessary control measures have been and will continue to be identified to reduce risks to ALARP. However, there are several basic approaches which may be used to support a titleholder's provision of evidence and justification within the WOMP. Titleholders could consider using one or more of these approaches, but should also be prepared to consider developing specific approaches appropriate to their well(s). In practice, it is likely that most wells will require a combination of approaches.

In order to provide evidence that the risks are reduced to a level that is ALARP, it is a fundamental requirement to demonstrate that the hazard identification and risk assessments carried out have been systematic and detailed, as they provide the foundation on which to base the control measure selection.

The following approaches may be considered:

Risk criteria approach – define criteria that is considered to correspond to 'reducing risk to a level that is ALARP', assess performance quantitatively or qualitatively (using matrices for example) and compare against the criteria.

Comparative assessment of risks, costs and benefits – evaluate risk and associated costs for a range of control measure options for the well(s) and compare the relative merits of the different options, selecting the options which are practicable.

Comparison with codes and standards – compare design, the management system framework and operational procedures against recognised national, international or industry standards, codes of practice, guides etc.

Audit against good practice – audit the basis and implementation of the management system, including operations and maintenance systems, against good practice for offshore well(s).

Technical analysis – evaluate control measures in technical terms; assess strengths and weaknesses, e.g. effectiveness, functionality, availability, reliability, technical feasibility, compatibility, survivability, correspondence of control measures to risks, appropriateness of performance standards, etc.

Improvement approach – demonstrate the extent of relative improvements in performance for the well(s) based on past, present and planned modifications and enhancements.

Judgement approach – present considered judgements as to the suitability of control measures and the management systems, or the perceptions of a cross-section of various stakeholders, e.g. key members of service providers, senior management, peers, plus independent observers.

Practical tests – demonstrate that the management system and/or control measures function effectively, using for example well control simulations, pit drills etc.

Peer reviews – review with like-minded peers in the industry.

Consultation and technical expertise – meeting e.g. drill/complete well on paper with technical personnel and assess plans.

4.2. NOPSEMA's consideration

NOPSEMA will evaluate the titleholders approach in terms of its robustness, transparency and appropriateness to the well(s) in terms of its consideration of acceptability of a WOMP. The titleholder should therefore define the underlying rationale, criteria and decision-making basis for the case.

The description must be convincing; this means that the rationale for deciding the completeness of the risk identification and the adequacy of the measures employed should be supported and accompanied by all assumptions made and conclusions drawn. Where appropriate, it should present/summarise the results of supporting studies that have been performed.

The description should demonstrate that the process was systematic which means that it followed a fixed and pre-established scope. Finally, the degree of analysis in support of the demonstration should be proportionate to the risk and to the complexity of the well(s), risks and the control measures.

5. Summary of factors in selecting or rejecting control measures

Methodology for understanding controls	Points to consider
Control measure hierarchy • elimination • prevention • reduction • mitigation	Is there a control higher up the hierarchy that would more effectively manage the hazard? Where appropriate, is there a spread of controls across the hierarchy?
Types of control measure • technical (hardware/software) • other (MS/procedural) • proven technology	Is there an appropriate spread of technical and other controls?

Common mode failures	Have failure modes been identified for each control measure and then compared to identify common mode failures?
Layers of protection • design Standards • control Systems • operating procedures • safety devices • emergency systems	Are the layers of protection provided adequate for the level of risk posed by the hazard? Are the right service provider/contract personnel involved? Is there enough information to provide adequate design? Are there proven procedures?
Operating circumstances • environment • operating conditions • activities being carried out	Have the controls been assessed for effectiveness over the range of different operating circumstances they may have to operate in?
Focus of control measure	Does the relative importance or vulnerability of the control measure justify a higher depth of scrutiny than others?
Effective • functionality • availability • reliability • survivability	Has the functionality, availability, reliability and survivability, been established for each control measure? Have means of improving these aspects been considered?
ALARP	Has each control measure been assessed for practicability, and those found practicable been implemented while those found to be not practicable noted as such with sufficient justification?

6. Risk assessment and providing evidence

Titleholders must adopt a comprehensive and systematic method for assessing the risks to the integrity of the well(s). Some titleholders may choose to adopt quantitative methods, particularly if this is common practice in their company, whereas others may choose to adopt qualitative methods. The results of such assessments should be used to support the evidence that necessary control measures have been identified, and to show that risks are eliminated or reduced to a level that is ALARP. NOPSEMA expects the titleholder to justify the adopted risk assessment methodology and associated risk acceptance criteria as being suitable and appropriate to the specific well(s).

6.1. Risk assessment tools

Approaches to formal safety assessment are discussed in numerous publications, and in NOPSEMA's Risk Assessment Guidance Note (N-04600-GN1613), so only limited details of risk assessment methods are provided in this guidance note. ISO 17776, in relation to offshore production facilities, may provide further guidance on tools and techniques for hazard identification and risk assessment. The requirement is for the

titleholder to select an approach which supports decision-making on control measures. Risk assessment will be an important part of this process, by showing that risks are reduced to a level that is ALARP and by showing that decision-making relates to the level of risk.

6.2. Risk criteria

Many titleholders may elect to assess and evaluate risks in a quantitative or semi-quantitative manner, and to develop criteria against which to compare the estimated risk levels. It must be noted, however, that all risk assessment is subject to uncertainty. For this reason, most approaches evaluate risk based on broad ranges of risk, rather than on specific criteria.

7. Use of industry codes and standards

For most wells, compliance with industry standards, codes or guidance may play an important role in providing evidence that necessary and appropriate control measures have been identified and adopted. In principle, such standards may be ISO standards, international industry practices, recommendations, standards and guidelines such as those from the Oil & Gas UK guidelines, Norwegian NORSOK standard and American Petroleum Institute, ASTM, ISO, etc. However, the existence of a published standard does not imply that it is always useful or appropriate to apply. Whichever standards are being used, these standards, and the control measures that they apply, should all be shown to be suitable and appropriate to the specific well, taking account of its type, scale, activities, location, etc. Titleholders have the responsibility to consider the available standards, specify the appropriate one, enforce compliance, and use the system or equipment correctly.

Further guidance is available in the NOPSEMA's Control Measures and Performance Standards Guidance Note (N-04600-GN1617).

Technical guidance and standards include, for example; Oil & Gas UK – Well Life Cycle Integrity Guidelines, Oil & Gas UK – Well Decommissioning Guidelines, Oil and Gas UK - Guidelines for the Abandoment of Wells, International Association of Oil & Gas Producers – Capping and Containing recommendations, NORSOK standard D-010 – Well integrity in drilling and well operationsand ISO 16530-1 Petroleum and natural gas industries – Well integrity - Part 1: Life cycle governance.

These standards have been developed using industry expertise, responding to previous accident and incident experience and, in general, prescribe specific design and operational solutions. The aim of technical standards is to ensure that wells are designed, constructed and operated using good industry practices and sound engineering principles, ensuring the risks will be reduced to ALARP. However, it is an established part of good well integrity management to make use of risk assessment to identify hazards and minimise risks. Compliance with technical standards provides a sound design basis for offshore wells, but does not replace risk assessment altogether.

8. Good practice and reasonable practicability

In determining what is reasonably practicable (or not), the courts usually do so in the context of an incident and therefore take an 'event focus' – they consider in hindsight an alleged breach associated with a particular incident, and each incident is judged on a case by case basis. Due to the event focus of prosecutions, courts traditionally have not been concerned with what proactive steps might need to be taken by a titleholder to address risk across a well. In contrast, risk management provisions in the regulations are framed as a proactive and holistic process, to prevent or control risks before failures occur rather than simply reacting to them when they do.

In the decision by Lord Asquith, the computation associated with reasonably practicable "falls to be made by the owner at a point of time anterior to the accident". Furthermore, in regard to what is 'practicable', the test of gross disproportion applies: 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 must be implemented. This reinforces a precautionary approach by requiring the requisite control measures to be implemented unless there is an obvious imbalance between the sacrifice (cost) and the risk, and further that as risk levels rise so too does the sacrifice (cost) that could reasonably be considered as being grossly disproportionate.

In determining what is reasonably practicable, the starting point for the risk/sacrifice computation should be the current situation. Titleholders should also consider the adequacy of the relevant good practice. A titleholder's management system should incorporate processes to monitor changes to applicable codes and standards. When a code or standard is updated to a higher standard, the well should be examined to see if it can be brought up to the new standard. Any such upgrades must be undertaken if it is reasonably practicable to do so.

Well design should conform to current good industry practice, as a starting point. Other potential options should be considered to determine whether further risk reduction measures are reasonably practicable. As a guide, designers can aim and compare against levels of well integrity that are known to have been achieved in other 'good practice' designs.

The use of good practice at the design stage is essential to demonstrating achievement of ALARP. Therefore, it is important that the titleholder capture all of the relevant information about risk-reduction decisions made during the early design stages. This should include use of sound design principles as well as codes, standards and guidance. The earlier a titleholder undertakes an ALARP evaluation, the greater the ability to reduce risks to a level that is ALARP. Practicability is reduced as the project progresses and inherent well integrity opportunities are often lost beyond the concept selection stage. As previously mentioned, the criterion is reasonably practicable, not reasonably affordable: justifiable cost and effort is not determined by the budget constraints/viability of the project.

9. Some misconceptions about ALARP

Some misconceptions about what ALARP means have evolved over the years. An explanation of some of these misconceptions and why they are incorrect is given below.

Ensuring that risks are reduced to ALARP means that we have to raise standards continually

- In addition to the requirements of the OPGGS Act and regulations, it is part of NOPSEMA's philosophy to seek continual improvements in standards. However, we need to make sure that we encourage improvements in a responsible way.
- Deciding whether the risk of something has been reduced to ALARP is a separate exercise from seeking a continual improvement in standards. Of course, as technology develops new and better methods of risk control become available. Titleholders should review what is available from time to time and consider whether they need to implement new controls. But that does not mean that the best risk controls available are necessarily reasonably practicable. It is only if the cost of implementing these new methods of control is not grossly disproportionate to the reduction in risk they achieve that their implementation is reasonably practicable. For that reason, NOPSEMA accepts that it may not be reasonably practicable to upgrade older equipment to modern standards. However, there may still be other measures that are required to reduce the risk to ALARP. For example, partial upgrades or alternative measures.

- NOPSEMA's decision about what is ALARP will also be affected by changes in knowledge about the size or nature of the risk presented to the integrity to the well. If there is sound evidence to show that the hazard presents significantly greater risks than previously thought, then of course NOPSEMA should press for stronger controls to tackle the new situation. However, if the evidence shows the hazard presents significantly lesser risks than previously thought, then NOPSEMA should accept a relaxation in control provided the new arrangements ensure the risks are ALARP.

If a few employers have adopted a high standard of risk control, that standard is ALARP

- Some titleholders implement standards of risk control that are more stringent than good practice. They may do this for a number of reasons, such as meeting corporate social responsibility goals, or because they strive to be the best at all they do, or because they have reached an agreement with their staff to provide additional controls. It does not necessarily follow that these risk control standards are reasonably practicable, just because a few organisations have adopted them. Until such practices are evaluated and recognised by NOPSEMA as representing good practice, you should not seek to enforce them (whether at a policy level or an operational one). It is also acceptable for a titleholder to choose to relax from a self-imposed higher standard to one which is accepted as ALARP.

Ensuring that risks are reduced ALARP means that we can insist on all possible risk controls

- ALARP does not mean that every measure that could possibly be taken (however theoretical) to reduce risk must be taken. Sometimes, there is more than one way of controlling a risk. These controls can be thought of as barriers that prevent the risk being realised and there is a temptation to require more and more of these protective barriers, to reduce the risk as low as possible (the so-called 'belt and braces' approach). It must be remembered ALARP means that a barrier can be required only if its introduction does not involve grossly disproportionate cost.

Ensuring that risks are reduced to ALARP means that there will be no well integrity incidents

- ALARP does not represent zero risk. We have to expect the risk arising from the hazard to be realised sometimes, and so for harm to occur, even though the risk is ALARP. This is an uncomfortable thought for many people, but it is inescapable. Of course we should strive to make sure that titleholders reduce and maintain the risks ALARP, and we should never be complacent but, nevertheless, we have to accept that risk from an activity may never be entirely eliminated.

10. Critical factors for success

NOPSEMA expects the titleholder to address at least the following specific factors in their consideration of ALARP in the WOMP submission:

- Timeliness – the earlier a titleholder undertakes an ALARP evaluation, the greater the ability to reduce risks to a level that is ALARP.
- WOMP content that is consistent with the requirements specified in the regulations.
- Involvement of people who know the type of well(s) or a very similar operation.

- Access to a wide range of reference material such as standards, industry guidelines, lessons learned, etc.
- Description with a sufficient level of detail that explains the means by which the titleholder ensures suitability of the design, construction, operation, maintenance and intervention that is appropriate to the well(s).
- A transparent and robust presentation of evidence showing that the adopted control measures reduce risk to ALARP.
- A transparent and robust presentation of evidence that the titleholder's management system provides for and will continue to provide for reduction of risk to ALARP, and that the management system is comprehensive and integrated.
- ALARP decisions are evidenced with supporting documentation e.g. peer reviews.

11. References, acknowledgements and notes

Offshore Petroleum and Greenhouse Gas Storage Act 2006

Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011

UK HSE Principles and Guidelines to assist HSE in its judgements that duty holders have reduced risk as low as reasonably practicable

UK HSE Policy and guidance on reducing risks as low as reasonably practicable in design

The UK offshore oil and gas industry guidance on risk-related decision making (Oil & Gas UK, 2014)

Note: All regulatory references contained within this Guidance Note are from the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and the associated Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011. For wells located in Victorian designated coastal waters, please refer to the Victorian *Offshore Petroleum and Greenhouse Gas Storage Act 2010* and the associated Offshore Petroleum and Greenhouse Gas Storage Regulations 2011. For facilities located in other designated coastal waters, please refer to the relevant State or Northern Territory legislation.

NOPSEMA would like to acknowledge the UK Health and Safety Executive (HSE) for their guidance information available on their website.

For more information regarding this guidance note, please contact NOPSEMA.

- Telephone: +61 (0)8 6188 8700; or
- Email: wompguidance@nopsema.gov.au