Department of **Energy, Mines, Industry Regulation and Safety**

GOVERNMENT OF WESTERN AUSTRALIA

WorkSafe Western Australia Petroleum Safety

GUIDE

Decommissioning and management of ageing assets

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Reference

WorkSafe Western Australia, 2024, Decommissioning and management of ageing assets: Guide. Department of Energy, Mines, Industry Regulation and Safety, Western Australia, 24 pp.

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Foreword

Western Australia's work health and safety (WHS) legislation came into force in March, 2022. This new legislation resulted in the amendment of the various petroleum Acts and the repeal of the associated regulations so that all onshore and offshore petroleum, pipeline and geothermal energy operations are now subject to the requirements of the:

- *Work Health and Safety Act 2020* (the WHS Act)
- Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022 (WHS PAGEO Regulations).

A key responsibility for the WorkSafe Group (WorkSafe) continues to be the ongoing risk management and safety requirements for the onshore and offshore petroleum, pipeline and geothermal energy operations. To support these requirements, the guides previously developed have been updated to assist operators to meet their commitments under the WHS Act and WHS PAGEO Regulations.

Application

This Guide is a non-statutory document provided by WorkSafe to assist persons subject to duties under the WHS Act and requirements to conduct audits of the safety management system as prescribed by the WHS PAGEO Regulations.

It has been developed to provide advice and guidance to operators to meet the WHS Act and the WHS PAGEO Regulations requirements administered by WorkSafe.

Who should use this Guide?

You should use this Guide if you are:

- the operator of onshore or offshore petroleum, pipeline or geothermal energy operations under the WHS Act
- responsible for managing ageing assets and decommissioning.

WHS legislation

Under the WHS Act, the WorkSafe Commissioner, an independent statutory officer reporting directly to the Minister, is responsible for performing the functions and exercising the powers of the regulator. Each safety document must be submitted for acceptance by the regulator.

WorkSafe assists the regulator in the administration of the WHS Act and the WHS PAGEO Regulations, including the provision of inspectors and other staff to oversee compliance with the legislation.

No petroleum or geothermal operations can be conducted on any onshore or offshore petroleum, pipeline or geothermal energy operations unless the facility has an operator registered in accordance with the requirements of WHS PAGEO Regulations.

The WHS PAGEO Regulations provided for transitional provisions in relation to facility operators and safety cases in place or submitted before the commencement of the WHS legislation.

Contents

1 Introduction

WHS Act s. 19(3)(b)
Primary duty of care – provision and maintenance of safe plant and structures

WHS PAGEO Regulations r. 27
Safety case required for operations

This Guide has been developed to provide an overview of the processes for the decommissioning and management of ageing assets in relation to onshore and offshore petroleum and geothermal energy operations. Where facilities have been in service for many years, operators should adopt a proactive approach to planning for decommissioning, as well as for monitoring ageing assets to ensure they continue to operate within the established control parameters.

The person conducting a business or undertaking (PCBU), including the operator and titleholder, should address the management of ageing assets so that they continue to operate as required, or if being maintained, do not pose a threat to the health and safety of workers or other persons before the decommissioning and, if appropriate, removal of the assets. The PCBU should not allow infrastructure and equipment to deteriorate to a point where it becomes a health and safety risk and is considered to be too dangerous for removal to be undertaken. Decommissioning and management of ageing assets are phases in the life cycle of assets that need to be covered in an in force safety case before work in this area can be undertaken.

As well as needing to meet the requirements of the *Work Health and Safety Act 2020* (WHS Act) and the Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022 (WHS PAGEO Regulations), the PCBU has a duty to comply with the requirements of the various petroleum and geothermal Acts covering the decommissioning of assets and surrendering of licences in relation to facilities, wells and pipelines. For further information, refer to Section 2.1.

While the Guide has been developed to provide guidance on health and safety related requirements under the WHS Act and associated regulations when decommissioning, it does not cover environmental requirements under other legislation in detail and these should be addressed separately.

For the purpose of this Guide, the term “safety case” is used to cover all of the safety documents referred to in the WHS PAGEO Regulations.

The term “facility” covers offshore and onshore facilities and pipelines, including above ground structures.

2 Decommissioning

WHS PAGEO Regulations r. 27
Safety case required for operations

Decommissioning involves the controlled process of retiring a petroleum or geothermal energy operation from service in a manner that is safe and environmentally responsible.

Due to the varying complexity of facilities, combined with safety, environmental, technical and economic considerations, there is no standard approach to decommissioning. This means that decommissioning each piece of plant or equipment will have its own individual challenges. As such, decommissioning plans and programs should be developed to suit the specific circumstances of each facility or operation.

A facility must have a safety case in force at all times until decommissioning activities are completed and the facility is no longer operating. Any decommissioning related operations or works conducted at a facility must be described within the safety case or in a referenced decommissioning plan that forms part of the safety case documentation.

Where decommissioning activities are being conducted by a third party, bridging documents need to be developed to cover the requirement for simultaneous operations (SIMOPS) and linked to the relevant safety case for management of the decommissioning activities. For further information, refer to Section 2.3.

2.1 Legislative and regulatory requirements

Legislation covering the regulatory requirements for decommissioning is listed in Appendix 1.

The WHS PAGEO Regulations now cover the safety management requirements of the petroleum and geothermal resources facilities under the amended *Petroleum and Geothermal Energy Resources Act 1967* (PAGER Act), *Petroleum (Submerged Lands) Act 1982* (PSL Act) and *Petroleum Pipelines Act 1969* (PP Act) following the repeal of the safety regulations under each of these Acts.

Existing requirements under the Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015 (PAGER RMAR), and Petroleum (Submerged Lands)(Resource Management and Administration) Regulations 2015 (PSL RMAR) for the management of assets developed under the PAGER Act and PSL Act still need to be complied with.

2.1.1 Other relevant WA legislation

Appendix 1 lists a number of other related Acts, which, together with their respective regulations, collectively provide the legal framework for a decommissioning program both onshore and offshore.

Operators must ensure that these Acts and regulations are included in their list of legal requirements to be monitored for change so that any changes can be identified and any items that need to be reviewed by the appropriate subject matter expert and processed through the operator's management of change system. This will ensure that all decommissioning documentation will remain current and include relevant information to any of the legislative requirements referenced.

2.2 Planning and liaising with the regulator

WorkSafe inspectors should be the first point of contact in obtaining acceptance by the regulator for a safety case and associated decommissioning program. Depending on the facility and operations, a decommissioning program may deal with the decommissioning of all facilities located on a petroleum or geothermal energy title or parts of the facilities, including a single installation or pipeline.

These meetings should also include discussion and agreement on the scope of any validations that may be required within the decommissioning program. For further information, refer to Section 3.

This liaison process will help to identify any potential issues, such as the calculation of the safety levy applicable to the facility and any inconsistencies within the safety case, so they can be addressed prior to completion and submission of the safety case for review and acceptance by the regulator.

2.3 Simultaneous operations (SIMOPS) and bridging documents

While there must be an in force safety case covering the activities of decommissioning a facility, there may also be bridging documentation covering the decommissioning activities on part of a facility while other normal day-to-day operations take place on adjacent areas of the facility.

The bridging documentation covering the details of the decommissioning activities will need to be developed and will become an annexure to the in force safety case. This bridging document will cover the management of the simultaneous operations for decommissioning, include details of the risk assessments conducted and any new procedures or processes brought into place for the duration of the SIMOPS.

Risk associated with simultaneous operation and decommissioning projects should be identified through hazard identification (HAZID) studies and risk assessments and any additional procedures or processes associated with these risks will form part of the decommissioning procedures.

Where safety systems are identified as being temporarily out of service due to modifications to plant and equipment, the risks associated with any unavailable safety systems must be identified and procedures included in the decommissioning procedures.

For further information, refer to the *Guides: Bridging documents and simultaneous operations (SIMOPS)* and *Risk assessment and management including operational risk assessment*.

2.4 Decommissioning planning

Decommissioning planning should be included in all stages of a facility lifecycle. The decommissioning and removal of items that are no longer required in the operation of a facility reduces any risks associated with that piece of equipment. It can also reduce costs of maintaining the facility as any equipment that is not in use but is to be eventually decommissioned, has to be maintained, inspected and preserved in good condition in accordance with WHS PAGEO Regulations as outlined in Section 4.

In addition to early consultation with the regulator, titleholders and operators should ensure that consultation takes place with other stakeholders in regards to planning for decommissioning.

Table 1 shows the lifecycle stages and the types of decommissioning activity that should take place during each of these stages. The activities described in each stage are a guide only.

A decommissioning plan should be developed for each facility covering the requirements listed below and also any other unique requirement for a particular facility. The variations and complexity of facilities means that there is no standard decommissioning plan that can be adopted for every project. Therefore, decommissioning plans and programs should be developed to suit the specific circumstances of each petroleum or geothermal energy operation. These decommissioning plans can then be referenced in the safety management system of the in force safety case for the facility.

Table 1 Examples of decommissioning activities at each stage of a PAGEO project (adapted from National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). Planning for proactive decommissioning: Information sheet Table 1)

Stage	Example	Example
1	Project development	• Decommissioning considered in early development activities. • Decommissioning strategy and objectives developed that demonstrate compliance with WHS PAGEO Regulations rr. 32(4)(g), 39(2)(c), 41, 67. • Equipment required to enable decommissioning is incorporated into the project design. • Permanent abandonment of exploration and appraisal wells with no further use.
2	Offshore and onshore operations	• Equipment required to enable decommissioning is installed and commissioned or the ability to include later is incorporated. • All property, including any installed to enable decommissioning, is preserved and maintained in good condition. • Permanent abandonment of exploration, appraisal and production wells with no further use. • Decommissioning of machinery and equipment with no further use. • Review and update of safety management studies, hazard identification (HAZID), hazard and operability (HAZOP) studies for the facility and operations to reflect that risks are reduced so far as is reasonably practicable (SFAIRP) and major accident events are still effectively controlled. • Update of performance standards and asset management and integrity management plans (where appropriate) to reflect the changes that have taken place and document future planned decommissioning. • Update of well management plan and field management plan where required under the PAGER RMAR and PSL RMAR regulations which are then lodged with the regulator.
3	Late life operations	• Continuation of permanently abandoning wells and ongoing decommissioning of machinery and equipment with no further use. • Ongoing and potentially additional maintenance of machinery and equipment to enable decommissioning. • Function testing of unused or preserved equipment installed to support decommissioning. • Review and update of safety management studies, HAZIDs, HAZOPs for the facility and operations to reflect that risks are reduced SFAIRP and identified MAEs are still effectively controlled. • Update of performance standards and asset management and integrity management plans (where appropriate) to reflect the changes that have taken place and document future planned decommissioning. • Update of well management and field management plans where required under the PAGER RMAR and PSL RMAR regulations which are then lodged with the regulator.

Stage	Example	Example
4	Site preparation	• Permanently abandon all remaining wells. • Permanent isolation of facilities and pipelines. • Ongoing maintenance of property in preparation for decommissioning. • Making machinery and equipment safe including the flush and cleaning of hazardous inventories, including petroleum products, chemicals, contaminants and waste products. • Commencement of physical disconnection and dismantling of machinery and equipment in preparation for removal, repurposing and leaving in situ.
5	Removal and remediation	• Final physical disconnection and dismantling of machinery and equipment and property. • Removal of property and/or setting of property not being removed. • Final clean up and remediation of the title area. • Development of final well management plan and field management plan as required under the PAGER RMAR and PSL RMAR regulations and submit to the regulator.
6	Closure	• Comparative site surveys and monitoring against baselines. Expectations for ongoing monitoring will be greater where contaminants exist and/or property has been repurposed or left in situ. • Performance reporting and demonstration that decommissioning obligations have been satisfied made to the regulator.

2.5 Worker involvement in decommissioning planning

WHS Act s. 47
Duty to consult workers

WHS Act s. 48
Nature of consultation

WHS PAGEO Regulations r. 38
Involvement of workers

The operator of a facility must demonstrate that there has been effective consultation with, and participation of, workers in the decommissioning planning process and associated relevant risk assessments. By drawing on the experience, knowledge and ideas of workers, operators are more likely to identify all hazards and choose effective control measures.

Workers are entitled to take part in consultations and to be represented by a health and safety representative who has been elected for their work group. Consultation with workers and their health and safety representatives is required at each step of the risk management process forming part of the decommissioning planning.

Operators should ensure that contributions from workers are considered on the basis of technical and working knowledge and are not dominated by individual persons or groups within the organisation.

Those workers involved in the decommissioning planning and risk assessment process should assist with:

- developing the risk assessment process
- forming the team and scheduling for consultation
- considering a range of methods for consultation, such as via email, surveys, an intranet health and safety page and conducting meetings
- conducting the consultations and reviewing any results or outcomes
- implementing any actions arising from the process
- assisting in provision of feedback of the consultation outcomes to the rest of the workforce.

For more information, refer to the *Guide: Involvement of workers and the Code of practice: Work health and safety consultation, cooperation and coordination*.

2.6 Cost and recovery assessments

When planning the decommissioning program, titleholders and operators should include an overall cost estimate of the decommissioning options and an explanation of how the estimate was arrived at. Failure to do this planning accurately may result in decommissioning and removal of redundant plant and equipment not being completed as scheduled and possibly falling into disrepair which could ultimately affect the safety of workers at the facility.

Decommissioning work can cover a number of years and estimated expenditure should be split on a year by year basis. In cases where more than one facility is being decommissioned, the expenditure should be split by facility as well.

Where commercial tendering processes are required for the decommissioning, information should be included to this effect and that accurate costings and confirmation of the final decommissioning option are dependent on the outcome of this tendering process.

The main goal in field management is to maximise the recovery of resources before commencing cessation of production and decommissioning. It therefore follows, that detailed final planning for decommissioning should commence in advance of recovery of petroleum reaching an economic limit and cessation of production, normally occurring during the late production decline phase of the field's life. This is usually some years prior to cessation of production in the case of larger offshore operations, which carry a higher level of complexity in planning than onshore fields.

During this end phase, the field will still be generating cash flow and decommissioning costs will factor into determining when production should cease permanently. This is an iterative process which will be repeated as and when significant changes are made to a field's operating configurations that affect the recovery of petroleum.

2.7 Offshore coastal waters facilities and wells

PSL Act s. 104
Surrender of permits etc.

The *Guidelines to Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015*, provide a detailed overview of the requirements for well and field management up to and including the decommissioning of the assets and the surrender of the relevant titles when decommissioning is complete.

Operators should utilise this document to ensure they comply with all legislative requirements when decommissioning in Western Australian coastal waters.

The diagram below shows the various decommissioning options available to offshore titleholders.

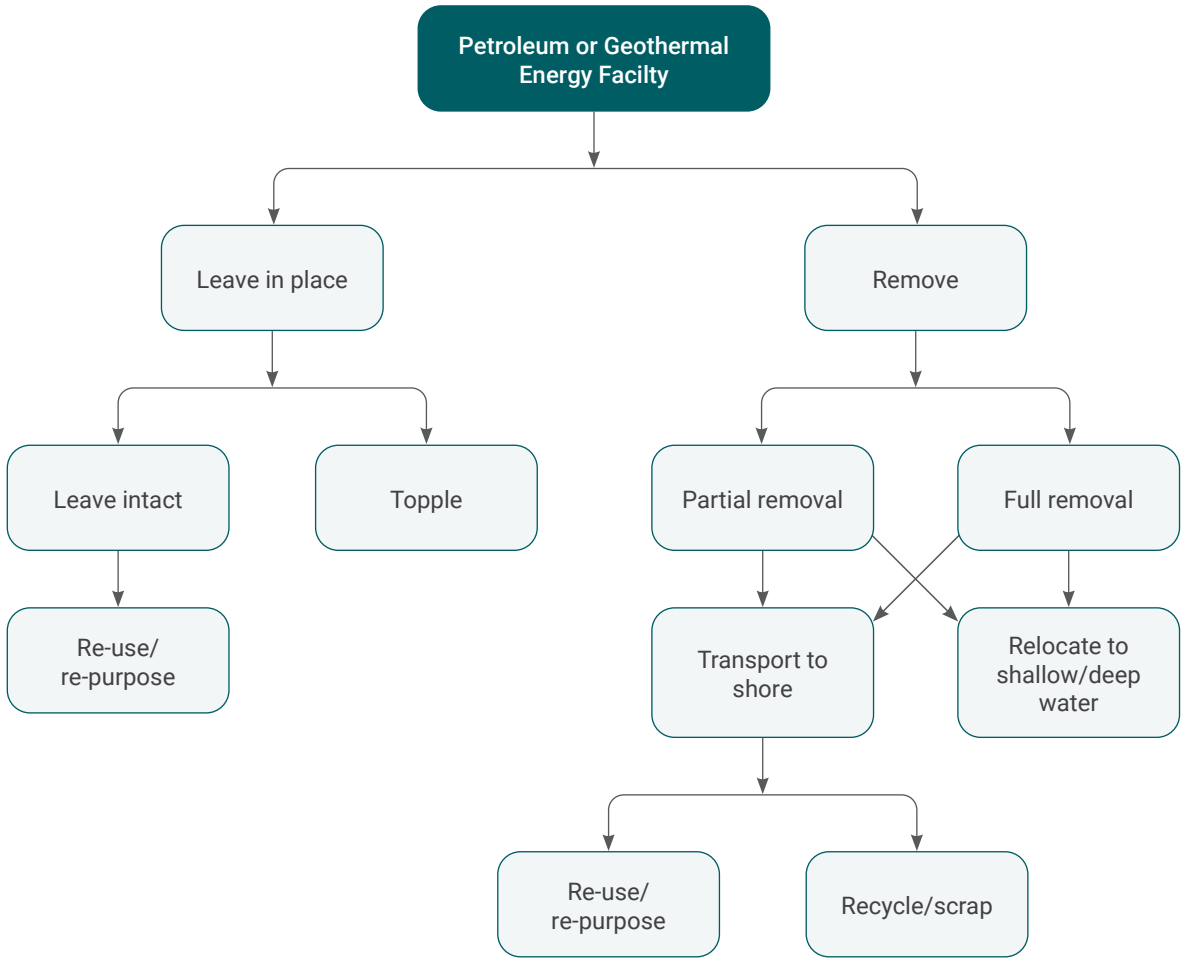

Figure 2. Decommissioning options for offshore facilities

The following major offshore components may require decommissioning at the end of a project:

- surface infrastructure – concrete and steel platforms including topsides and jackets
- floating installations – floating production facilities (FPSOs)
- subsea systems – wellheads, production modules, anchors, CGSs, mattresses
- pipelines – trunklines, rigid flow lines, flexible flowlines, umbilicals
- risers and turret moorings.

The options for the decommissioning of the various components should be considered in a consultative manner and documented for future reference. This should include a comparative risk assessment covering each of the options available to enable informed decisions on the best methodology suited to the decommissioning of the equipment.

The risk assessments should take into account that any items relevant to a safety critical element (SCE), or are included in a performance standard for a major accident event (MAE), are maintained until decommissioning activities are complete. These areas may be relevant to emergency response requirements when workers are on the platform. An example of this requirement is the maintenance of certification of cranes on platforms being used for well intervention as well as emergency response.

Examples of offshore decommissioning options may include:

- complete removal, disposal onshore or offshore
- partial removal, disposal onshore or offshore
- abandonment in situ
- alternate use, either within the oil and gas industry or other industries/purposes

Once the decommissioning program and procedures have been finalised, the document should be formally approved by the operator and submitted to the regulator as an addendum to the relevant facility safety case for review and acceptance. This document will then serve as a bridging document for SIMOPS as outlined in Section 2.3.

When decommissioning is complete, operators must update the well management plans (WMP) and the field management plans (FMP) to include the details of decommissioning/abandonment of the wells and submit these plans to the regulator, as required under the RMAR regulations.

When the titleholder has met all the relevant requirements set out in PSL Act s. 104, an application may be made for the surrender, or partial surrender, of the instrument, being a permit, lease, licence, infrastructure licence or pipeline licence, covering the decommissioned area.

2.8 Onshore facilities and wells

PAGER Act s. 98
Surrender of permits etc.

The *Guidelines to Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015* provides a detailed overview of the requirements for well and field management up to and including the decommissioning of the assets and the surrender of the relevant titles when decommissioning is complete.

Operators should utilise this document to ensure they comply with all legislative requirements when decommissioning onshore in Western Australia.

When a natural gas well is no longer actively producing, it must be decommissioned. This also applies to exploration wells that did not identify commercially viable reserves of natural gas. Operators are required to update the well management plans to include details of the decommissioning activities to take place and submit the updated plan to the regulator. These updated plans should include:

- an activity program detailing the decommissioning procedure for each well and showing pre and post-decommissioning schematics
- justification that the well is no longer economical to produce
- a descriptive procedure on decommissioning of the well(s), including removal of the wellhead(s) and rehabilitation of the site.

If an entire production/exploration field is to be decommissioned, the FMP must be updated to include the decommissioning procedures and a description of the decommissioning of the wells including removal of the wellheads. The updated FMP should also cover the removal of the surface facilities and rehabilitation of the area.

As with offshore coastal waters, the submission of the updated FMP and the decommissioning activities provided must demonstrate that the program is in accordance with good industry practice, standards and codes.

Once decommissioning is complete, operators must update the WMPs and the FMP to include the details of decommissioning/abandonment of the wells and submit these plans to the regulator as required under the PAGER RMAR and PSL RMAR regulations.

When the titleholder has met all the relevant requirements set out in the PAGER Act s. 98, an application may be made for the surrender, or partial surrender, of the licence covering the decommissioned area.

2.9 Pipelines

PP Act s. 23
Surrender of licence

Pipeline decommissioning and abandonment is generally conducted because:

- a pipeline has reached the end of its useful lifespan and future use is no longer economically viable
- the oil and gas reserves it serves have been exhausted and there is no longer a product to convey.

Pipeline decommissioning refers to a series of planned and executed actions required to remove a pipeline or network of pipelines from activity safely. Commonly employed methods of decommissioning include:

- pipeline nitrogen purging
- pipeline pigging, filling and plugging.

Pipeline abandonment is another term used to describe a decommissioning procedure. In order for a pipeline to be defined as abandoned, activities eliminating all combustible fluids conducted during the service life must be carried out. In addition, all connections to any active production areas must be severed and all associated facilities sealed.

For those pipelines operated and managed in accordance with AS 2885.3 *Pipelines - Gas and liquid petroleum, Part 3: Operation and maintenance*, section 10 covers the abandoning of a pipeline in detail.

2.9.1 Pipeline decommissioning – offshore and onshore

Pipeline decommissioning procedures vary depending on the location of the pipeline. These activities can be broadly divided into offshore and onshore groups.

Offshore

Offshore pipeline groups include subsea pipelines and oil rig lines. The procedure for decommissioning oil rigs or subsea pipelines are similar and include pipeline retrieval, retirement in situ, and preservation on-site for future reactivation.

In the case of offshore pipelines, operators may prefer the preservation and retirement in situ option as pipeline retrieval offshore is costly in terms of capital and manpower expenditure with increased risk to worker safety during removal and possible contamination from residual pipeline contents leaking during excavation.

Pipeline abandonment in situ means the pipelines will go through standard procedures to remove fire and explosion hazards including flushing and pipeline cleaning before they are disconnected from the oil and gas supply and sealed at both ends.

Onshore

Onshore pipeline decommissioning processes include:

- cleaning the pipeline with pig devices
- flushing with an inert gas (typically nitrogen)
- disconnection of the decommissioned pipeline from any product supply sources
- in situ abandonment or alternatively, pipeline recovery can be utilised with the aim to reuse.

If the titleholder or operator opts for onshore decommissioning where the pipeline is recovered, operators can arrange to channel the materials into scrap metal or be reworked into other useful components for use at another location.

2.9.2 Surrender of pipeline licence

The *Petroleum Pipelines Act* (PP Act) s. 23 covers the surrender of a pipeline licence.

This section sets out all the requirements to be met by a licensee or operator before they apply for consent to surrender the licence. Consent to surrender a licence will not be given if any of the conditions have not been met to the satisfaction of the Minister.

2.10 Post decommissioning

2.10.1 Monitoring and maintenance

During the decommissioning planning titleholders and operators need to include a period after decommissioning is complete for monitoring and reporting to the regulator. The purpose of this monitoring phase is to confirm the efficacy of the decommissioning program undertaken and needs to be put in place for each facility being decommissioned as there is no "one size fits all" applicable to these reporting periods and frequencies due to the complexity of the decommissioning programs.

Once the Minister is satisfied that all the conditions of a monitoring program have been met the titleholder may submit an application for surrender of the instrument covering the title where decommissioning has taken place.

2.10.2 Responsibilities

In addition to the actual decommissioning, titleholders are also responsible for the costs and liabilities relating to the removal of property and rehabilitation of a licence area following decommissioning to ensure the site is safe and will not impact on the health and safety of workers.

Post-decommissioning costs for monitoring the effectiveness of the decommissioning activities for an agreed period of time are also the titleholder's responsibility. The time period will be determined on a case-by-case basis and could be expected to be in terms of multiple of years, with a requirement for annual reporting of observations made during the monitoring exercises.

3 Validation

WHS PAGEO Regulations r. 67

Validation of proposed operations and proposed significant changes to operations

A validation is a statement in writing by a competent independent person (the validator), in relation to a proposed facility or proposed significant change to an operation, including decommissioning of the facility.

The safety case for decommissioning, and also the decommissioning program documentation, must include details of any required validation. Prior to submitting the safety case and before any instructions are given to the nominated validator, the scope of the validation must be prepared by the operator and agreed to by the regulator.

The regulator may require the operator to provide a validation on any significant change to the facility operations, including decommissioning of a facility.

A validation is a statement in writing by a competent independent person (the validator), in relation to proposed decommissioning of the facility.

The regulations provide for the operator and the regulator to agree on the scope of the validation for a proposed facility or significant changes to an existing facility. Prior to the commencement of validation, the operator must prepare a scope of validation to be accepted by the regulator before any instructions are given to the nominated validator.

The scope of validation needs to be appropriate for the activities that will take place for the proposed operation or significant change to an operation and should include details of the proposed validator. The scope of validation should contain evidence of the selection criteria for the validator, their competence and experience in all aspects that are to be validated and their independence.

It is expected that the operator will liaise with the regulator in a timely manner enabling the scope of validation to be agreed, the validation conducted and a report completed and submitted to the regulator to allow acceptance of the safety case. Agreement on the scope of validation may require multiple meetings and discussions to resolve any differences in expectations, especially in the case of more complex decommissioning operations.

If the operator and regulator cannot reach agreement on the scope of the validation then the operator is unable to complete the validation and submit the safety case for decommissioning of a facility.

The scope of validation should not just be simply a list of identified safety critical elements of the decommissioning operation to be validated but should contain additional information for the benefit of the regulator and also the proposed validator. Examples of this information includes:

- an overview of the proposed decommissioning operation – this should be a high level overview with consideration being given to the inclusion of a drawing of the layout identifying the areas to be decommissioned and if relevant an indication of the order in which individual areas of the facility will be decommissioned, to aid the regulator and the proposed validator

- a description of the process – this should be used for the identification of the items for validation should be included in the scope
- details of the relevant codes and standards – these should be identified for each safety critical element. The link between the selected item and the code or standard to be applied should be clearly stated in the scope of validation and each code and standard should be correctly identified by title, reference number. The operator should include instructions in the scope of validation to the validator to confirm, as part of the validation process, that the codes and standards selected are appropriate for the decommissioning of the safety critical systems being validated
- relevant safety studies, analysis reports and safety documents – these should cover the decommissioning activities and be referenced in the scope of validation and linked to the safety critical elements identified.
- a clearly defined deliverable.

Prior to nomination of a validator the operator, who has provided the material for validation, must satisfy the regulator that each person who is proposed to undertake the validation has the necessary competence, ability and access to data to arrive at an independent opinion on the matter being validated.

The completed validation must establish that the decommissioning of a facility as well as any proposed significant change to the operation incorporates measures that will protect the health and safety of persons at or in the vicinity of the facility and are consistent with the formal safety assessment of the operation.

A copy of the validation statement must be submitted to the regulator by the operator upon receipt from the validator.

Where the decommissioning relates to a single item of equipment or machinery, a validation may not be required if this decommissioning can be undertaken under the operator's management of change procedures and processes. Operators can verify whether or not a validation is required during the initial meeting with the regulator when proposing decommissioning of a facility.

For further information, refer to the *Guide: Validation requirements*.

3.1 Verification of decommissioning requirements

It is recommended that during the phases of decommissioning, operators should conduct a verification exercise to ensure that the agreed scope of validation has been covered. Development of an action tracking list during this exercise should include details of critical items such as the previously identified MAEs and SCE controls that needed to be retained until all decommissioning has been completed.

Where partial decommissioning is being conducted for specific areas of a facility which will result in the reintroduction of hydrocarbons to the facility, the action tracking list should provide evidence that decommissioning work has been completed safely and the reintroduction of hydrocarbons can take place.

4 Managing ageing assets

WHS PAGEO Regulation r. 32(4)(g)
Safety management system for operation

WHS PAGEO Regulations r. 39(2)
Adequacy of design, construction, installation, modification or maintenance

WHS PAGEO Regulations r. 41
Machinery and equipment

Machinery and equipment must be maintained throughout the lifecycle of the facility and methodically managed to ensure the risk control levels are maintained at a level that is minimised so far as is reasonably practicable (SFAIRP).

Management of ageing assets should be an integral part of the operator's procedures and processes for:

- maintenance and repair
- inspection, testing and monitoring
- integrity management.

While the age of an asset must be taken into consideration, the condition of the equipment and how it has changed over time should also be taken into consideration. Material deterioration and damage (usually, but not necessarily, associated with time in service) also has an ageing effect on equipment with an increasing likelihood of failure over the operational lifetime.

4.1 Ageing effects

Operators should have detailed knowledge about the ageing effects on their facilities. As equipment ages, the ability of safety critical elements (SCEs) to achieve their performance standards in terms of functionality, availability, reliability and survivability can decline and there is potential for all aspects of performance to be affected.

Spare parts may no longer be available or become more difficult to obtain for older equipment and maintenance teams may lose familiarity with it. This can result in delays to repair, with the equipment remaining in a failed state for longer periods. Reliability of older equipment can decline as ageing occurs which can cause critical technical controls to become more likely to fail to respond on demand, or fail during operation. Failures may occur more frequently as individual components wear out at about the same time and consequently cause accelerated wear-out elsewhere.

SCEs perform different functions that work to reduce the occurrence and escalation of MAEs. Understanding their function as barriers and their relative performance when assets are ageing is important to ensure safety requirements are met.

4.2 Risk management for ageing assets

Operators should have a risk management framework in place for identifying issues that may arise from ageing assets. This framework should be clearly documented within the safety management system of the in force safety case.

Once ageing damage becomes apparent across a facility, existing approaches to management of SCEs may not be sufficient and the requirement for a more proactive and integrated approach should be adopted. This approach would require operators to evaluate the actual condition of the controls and establish what additional resources, including skills and knowledge, may be needed to rectify the problems.

The asset management and integrity systems for the facility should incorporate these requirements as part of the lifecycle management for ageing assets. Operators should ensure that part of this risk management process is the maintenance of the certification of equipment required for lifting and removal of decommissioning plant and equipment. Safety of workers can be impacted if they are required to work on a facility where decommissioning if required but there is no current certification for the fitness of lifting equipment such as cranes at the site.

The use of health and safety and quality management system standards AS/NZS ISO 45001 and AS/NZS ISO 9001 may be useful to operators, enabling them to adopt the plan-do-check-act model as a process for driving continuous improvement within their safety management and asset management systems.

The framework depicted in Figure 4 shows the six processes and the links between them that make up the key management system areas required to collect data and complete verification and audit requirements necessary to accurately monitor ageing assets.

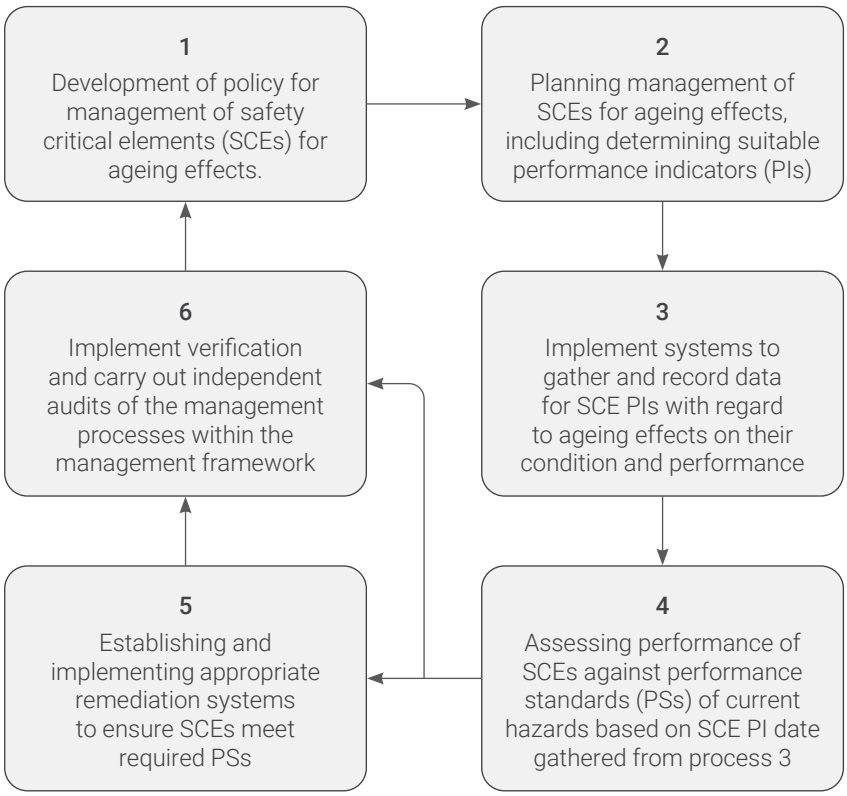

Figure 4 Framework of processes for management of ageing assets
(adapted from NOPSEMA. *Ageing assets and life extension: Guidance note Figure 4.1*)

Additional information for each of the six processes shown in Figure 4 are summarised below.

Process 1 Leadership and policy development

This area of the framework should include the development of a corporate policy for the management of ageing assets and the SCEs within the facilities as a whole. This process should be led by senior management and should also include the following sub-processes:

- Define the top level strategic goals for the management of ageing effects on SCEs for generic hazards during continued operation.
- Develop a corporate strategy/policy for management of ageing effects on SCEs.
- Allocate responsibilities to workers with suitable skills, knowledge and resources to meet the requirements.

The duty of the operator to maintain machinery and equipment in a safe condition, without risk to health and safety of workers, no matter the stage of the facility's lifecycle does not vary depending on the size, complexity or liquidity of the operator or titleholder.

Operators and titleholders should ensure that there is adequate budget available for the ongoing maintenance of ageing assets up to and including decommissioning of the equipment and machinery to ensure the health and safety of workers at a facility.

Process 2 Planning

Planning the management of SCEs for ageing effects forms the second process of the framework based on the strategy and policy developed under process one.

Planning done at each individual facility by the asset management team should include:

- interpreting the strategy for a particular facility and its SCEs
- updating the MAEs for the facility that could be affected by time and the age of the facility
- reviewing the suitability of the performance standards established for the SCEs with respect to the updated MAEs
- determining the risk controls in place for the SCEs to ensure they meet the requirements of the performance standards
- defining performance indicators as measures.

Processes 3 and 4 Performance indicators

Process three and process four cover the requirement to collate data available in relation to the SCE performance and the assessment of that data against the performance standards themselves.

Operators should monitor the results of inspections and testing on ageing assets and then proceed to identify any shortcomings against the performance standard requirements of the SCEs.

The ongoing gathering of information and identification of failures or backlogs found within the maintenance management system, as described in the safety case, should enable the operator to prioritise the shortcomings in SCE performance and their risk control systems. This will assist in determining appropriate remediation to restore the performance to an acceptable level.

Process 5 Remediation requirements

The fifth step in the planning process should cover the implementation of the necessary remediation requirements to bring the SCEs back to a level where they meet the required performance standards.

Long and short term remediation requirements should be addressed to meet the safety and operational demands of the equipment covered by the SCEs.

Process 6 Verification and audits

The final step is to ensure there are methods of verification of the process put in place and a well-structured audit system that can be utilised to ensure the requirements of the processes set out above are being addressed and that there are actions in place to remediate any issues where data is either not being collected effectively or the steps are not being put in place to bring the performance of SCEs back to an acceptable level

4.3 Maintaining records

Maintaining accurate records for ageing assets is vital to the ongoing support of plant and equipment associated with these facilities.

Records should be included in the operator's maintenance management system detailing any failure events of plant and equipment and how repairs and return to service has been managed. This information should be supported by asset management plans which detail:

- the plant and equipment installed at a facility
- the number of years it has been in service
- any key failure events, how they were managed and the repairs undertaken to bring the unit back into service
- upcoming inspection and service requirements due for the next five years
- a detailed program of service and maintenance over the ensuing 12 months
- details of any parts that may be required and have a long lead time or may be impacted by the age of the equipment making it difficult to obtain parts.

Maintaining accurate historical information on plant and equipment also enables a continuance of knowledge and understanding of equipment within the workforce. Equipment will often be in service longer than workers supporting the equipment are retained in the workforce. Failure to accurately document details of inspections and maintenance could adversely affect the continued fit for purpose condition.

Appendix 1 Legislation

Petroleum and geothermal energy activities are legislated under the:

- *Petroleum and Geothermal Energy Resources Act 1967 (PAGER Act)*
- *Petroleum (submerged Lands) Act 1982 (PSL Act)*
- *Petroleum Pipelines Act 1969 (PP Act)*

The safety regulations under these Acts have now been repealed and replaced by the Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022.

The following regulations for the management of resources. i.e. field and well management continues to be applicable under the PAGER Act and PSL Act

- Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015 (PAGER REMAR)
- Petroleum (Submerged Lands) (Resources Management and Administration) Regulations 2015 (PSL RMAR)

The following legislation may have underlying regulations to be taken into consideration when developing plans for decommissioning in Western Australia:

- *Petroleum and Geothermal Energy Safety Levies Act 2011*
- *Radiation Safety Act 1975*
- *Health (Miscellaneous Provisions) Act 1911*
- *Rights in Water and Irrigation Act 1914*
- *Biodiversity Conservation Act 2016*
- *Conservation and Land Management Act 1984*
- *Contaminated Sites Act 2003*
- *Dangerous Goods Safety Act 2004*
- *Planning and Development Act 2005*
- *Land Administration Act 1997*
- *Environmental Protection Act 1986*
- *Shipping and Pilotage Act 1967*
- *Jetties Act 1926*

Appendix 2 Glossary

The following terms are defined for the purposes of this Guide.

Key terms	Meaning
Asset Management Plan	Plan developed by operators which identifies assets under their control and the procedures and processes in place to maintain those assets in a safe and fit-for-purpose condition and provide estimated life cycle for major overhaul or replacement
Competent person	A person who has acquired through training, qualification or experience the knowledge and skills to carry out the task. The definition of 'competent person' in the Work Health and Safety (General) Regulations prescribes specific requirements for some types of work such as diving.
Facility	**Geothermal energy facility** – a place at which geothermal energy operations are carried out and includes any fixture, fitting, plant or structure at the place **Petroleum facility** – a place at which petroleum operations are carried out and includes any fixture, fitting, plant or structure at the place **Mobile facility** – includes an onshore drilling rig The term facility has been adopted throughout this document to cover offshore and onshore facilities and pipelines including aboveground structures associated with onshore pipelines.
FMP	Field management plan as required under the Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015.(RMAR)
Geothermal energy operation	Means an operation to: • explore for geothermal energy resources • drill for geothermal energy resources • recover geothermal energy • or is any other kind of operation that is prescribed by the regulations to be a geothermal energy operation for the purpose of this definition and carry on of such operations and the execution of such works as are necessary for that purpose.
HAZID	Hazard identification
HAZOP	Hazard and operability
Instrument	Title document being a permit, lease, licence, infrastructure licence or pipeline licence.
Integrity Management Plan	Plan developed by operator to manage the integrity of the plant and equipment on their facilities and document methods of maintaining those assets in a safe and fit-for-purpose condition and provide estimated life cycle for major overhaul or replacement

Key terms	Meaning
Maintenance Management System	System developed by operators and described within the safety management system of the in force safety case to manage the inspection, testing and maintenance of all plant and equipment in a safe and fit-for-purpose condition
Major accident event (MAE)	An event connected with a facility, including a natural event, having the potential to cause multiple fatalities of persons engaged at or in the vicinity of the facility.
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
Offshore coastal waters	The area extending seaward from the low tide mark on the coastline to the outer limit of the continental shelf.
Onshore area	The area within the limits of the state of Western Australia including internal waters that is landward of the low tide mark, such as rivers or creeks.
Operator	A person who has, or will have, the day-to-day management and control of operations at a facility and is registered as the operator of the facility under r.22(3).
PAGER Act	*Petroleum and Geothermal Energy Resources Act 1967* (as amended).
PAGER RMAR	Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015.
Performance standard	A standard established by the operator defining the performance required for a safety critical element typically defining the functionality, availability, reliability, survivability and interdependency of the safety critical element.
Person conducting a business or undertaking (PCBU)	A PCBU is an umbrella concept capturing all types of working arrangements or relationships. A PCBU includes a company, unincorporated body or association and sole trader or self-employed person. Individuals who are in a partnership that is conducting a business will individually and collectively be a PCBU. A reference to a PCBU includes reference to the operator of a facility.
Petroleum operation	Means an activity that is carried out in an area in respect of which a petroleum title is in force, or that is carried out in an adjacent area, for the purpose of any of the following: • exploring for petroleum • drilling or servicing a well for petroleum • extracting or recovering petroleum • injecting petroleum into a natural underground reservoir • processing petroleum • handling or storing petroleum • the piped conveyance or offloading of petroleum.

Key terms	Meaning
Pipeline	A pipeline licensed under the *Petroleum Pipelines Act 1969* as amended or under the *Petroleum (Submerged Lands) Act 1982* (as amended).
PP Act	*Petroleum Pipelines Act 1969* (as amended).
PSL Act	*Petroleum (Submerged Lands) Act 1982* (as amended).
PSL RMAR	Petroleum (Submerged Lands) (Resource Management and Administration) Regulations 2015.
Safety case	Documented provisions related to the health and safety of people at or in the vicinity of a facility, including identification of hazards and assessment of risks; control measures to eliminate or manage hazards and risks; monitoring, audit review and continual improvement
Safety critical element (SCE)	Any item of equipment, system, process, procedure or other control measure the failure of which can contribute to an MAE.
SFAIRP	So far as is reasonably practicable
SMS	Safety management system
Validation	A statement in writing by an independent person in respect of the design, construction and installation of a facility, that complies with r. 67.
WHS Act	*Work Health and Safety Act 2020*
WHS PAGEO Regulations	Work Health and Safety (Petroleum and Geothermal Energy Operations) Regulations 2022
WMP	Well Management Plan as required under the Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015
Worker	Any person who carries out work for a person conducting a business or undertaking, including work as an employee, contractor or subcontractor (or their employee), self-employed person, outworker, apprentice or trainee, work experience student, employee of a labour hire company placed with a 'host employer' or a volunteer

Appendix 3 Further information

Petroleum safety guidance

Interpretive guidelines

- *Development and submission of a diving safety management system*
- *Development and submission of a safety case*
- *Development and submission of an onshore facility safety case – drilling operations*

Guides

- *Audits, review and continual improvement*
- *Bridging documents and simultaneous operations (SIMOPS)*
- *Dangerous goods and hazardous chemicals in petroleum, pipeline and geothermal energy operations*
- *Decommissioning and management of ageing assets*
- *Demonstration of risk reduction so far as is reasonably practicable (SFAIRP)*
- *Diving start-up notices*
- *Emergency response planning*
- *Facility design case*
- *Hazard identification*
- *Health and safety leading and lagging performance indicators*
- *Human factors fundamentals for petroleum and major hazard facility operators*
- *Human factors self-assessment guide and tool for safety management systems at petroleum and major hazard facility operations*
- *Identification of major accident events, control measures and performance standards*
- *Inspections – Land-based drilling rigs*
- *Involvement of workers*
- *Management of change*
- *Nomination of an operator*
- *Records management including document control*
- *Risk assessment and management including operational risk assessment*
- *Validation requirements*

Australian and international standards

- AS 2885.3 – *Pipelines – Gas and liquid petroleum – Part 3 Operation and maintenance*
- AS/NZS ISO 31000 *Risk management – Guidelines*
- AS ISO 55001 *Asset management – Management system requirements*
- AS ISO 55002 *Asset Management – Management systems – Guidelines on the application of ISO 55001*
- ISO 15663-1 – *Petroleum and natural gas industries – life cycle costing – Part 1 Methodology*

Codes of practice

- *Mentally healthy workplaces for fly-in fly-out workers in the construction and resources sector*
- *Psychosocial hazards in the workplace*
- *Workplace behaviour*

See the WorkSafe website for approved codes of practice on a range of related topics such as *Managing the risks of hazardous chemicals in the workplace, Confined spaces, Managing the risk of falls at workplaces, Managing risk of plant* and *Managing the work environment and facilities*.

Other resources

WorkSafe WA

- *Discriminatory, coercive and misleading conduct – Interpretive guideline*
- *How to determine what is reasonably practicable to meet a health and safety duty – Interpretive guideline*
- *The health and safety duty of an officer – Interpretive guideline*
- *The meaning of 'person conducting a business or undertaking' (PCBU) – Interpretive guideline*

Other sources for decommissioning and ageing assets

Department of Energy, Mines, Industry Regulation and Safety

- *Guidelines to Petroleum and Geothermal Energy Resources (Resource Management and Administration) Regulations 2015*
- *Guidelines to Petroleum (Submerged Lands) (Resource Management and Administration) Regulations 2015*

National Offshore Petroleum Safety and Environmental Management Authority

- *Planning for proactive decommissioning*
- *Ageing assets and life extension*
- *Complying with your decommissioning obligations*
- *Decommissioning compliance plan*

GOVERNMENT OF WESTERN AUSTRALIA

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WS.Jan24_1288