

SQA Advanced Unit Specification

General information for centres

Unit title: Petroleum Production Processes

Unit code: HV5V 48

Unit purpose: On completion of the unit the candidate should be able to explain the production processes involved in the separation of the oil, gas and water, the preparation of water for use in exploration and the purification and compression of gas for distribution.

On completion of the unit the candidate should be able to:

- 1 explain the principles for the separation of oil, gas and water in petroleum production processes
- 2 explain the methods for the treatment of produced and injection waters
- 3 explain the methods for the purification and compression of the gas extracted at a production facility

Credit points and level: 1 SQA Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.*

Recommended prior knowledge and skills: While entry to this unit is at the discretion of the centre, it is recommended that candidates have completed the units HV49 47 *Oilfield Drilling Techniques and Operations: An Introduction*, HV9H 48 *Oilfield Drilling Techniques and Operations* and HV5T 48 *Oil Well Management*. It is also recommended that the Unit *Petroleum Recovery Techniques* is delivered at the same time as this unit.

Core Skills: There are opportunities to develop the core skills of *Numeracy*, *Information Technology*, *Problem Solving* and *Communication* at level 6 in this unit, although there is no automatic certification of core skills or core skills components.

Context for delivery: This unit has been developed as part of the SQA Advanced Diploma in Petroleum Engineering group award, it is therefore recommended that it should be taught and assessed within this group award.

Assessment: This unit will be assessed using a holistic, end-of-unit, closed-book assessment conducted under supervised conditions.

SQA Advanced Unit Specification: statement of standards

Unit title: Petroleum Production Processes

Unit code: HV5V 48

The sections of the unit stating the outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Explain the principles for the separation of oil, gas and water in petroleum production processes

Knowledge and/or skills

- ◆ Function and types of separators
- ◆ Sizing criteria
- ◆ Emulsions and contaminants
- ◆ Production chemicals

Evidence requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ explain the function and types of separators. Candidates must accurately explain from a sample of two of the following list of separators: gravitational, rotodynamic, electrostatic, downhole, subsea, vertical, horizontal, inclined. In their explanation candidates must justify their choice of separators.
- ◆ explain sizing criteria that may be applied for separating solids, liquids or gases. In their explanation candidates must justify their choice of sizing criteria.
- ◆ explain accurately the effects emulsions and contaminants have on the petroleum production processes. Candidates must cover from a sample of two of from the following list: emulsions, sand, asphaltenes, waxes and scales.
- ◆ explain the use of chemicals in petroleum production processes. Candidates must explain the use from a sample of two chemicals from the following list: demulsifiers, defoamers, deoilers, corrosion inhibitors, scale inhibitors, wax inhibitors, flow enhancers.

Sampling must be undertaken in unseen and supervised conditions.

Assessment guidelines

This unit could be assessed using a single assessment covering all three outcomes. The assessment paper could contain both short answer, structured and some extended-response questions. It is expected that the assessment should take a maximum of two hours.

Outcome 2

Explain the methods for the treatment of produced and injection waters

Knowledge and/or skills

- ◆ Water quality
- ◆ Removal of solids
- ◆ Removal of gas
- ◆ Removal of oil

Evidence requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ describe the quality of water required for different situations. Candidates must describe the appropriate quality of water required for either reservoir requirements or discharge limits. Candidates description must include the permitted levels for gases, solids, oils and scales.
- ◆ explain the methods involved in removing solids. Candidates must explain one method from a sample of the following: media filters, cartridge filters or membranes. Candidates must then justify their choice of method for one from a sample of the following: inorganic solids, biomass, bacteria, oils, greases or waxes.
- ◆ explain the methods involved in removing gas. Candidates must select and explain the most appropriate method for the removal of one gas from a sample of the following: oxygen, hydrogen sulphide or carbon dioxide. The methods are either packed towers or reactive chemicals.
- ◆ explain the methods involved in removing oil. Candidates must select and explain an appropriate method for either dissolved oil or dispersed oil. The methods are: interceptors, gas flotation cells, hydrocyclones, coalescers, membranes, or strippers.

Sampling must be undertaken in unseen and supervised conditions.

Assessment guidelines

This unit could be assessed using a single assessment covering all outcomes. The assessment paper could contain both short answer, structured and some extended-response questions. It is expected that the assessment should take a maximum of two hours.

Outcome 3

Explain the methods for the purification and compression of the gas extracted at a production facility

Knowledge and/or skills

- ◆ Gas dehydration methods
- ◆ Gas sweetening methods
- ◆ Sulphur disposal and recovery methods
- ◆ Gas compression methods

Evidence requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ explain the methods involved in gas dehydration. Candidates must explain two methods from a sample of the following: Membranes, absorption, adsorption, low temperature extraction, hydrates, dew points, glycols, contactors, reboilers.
- ◆ explain the methods involved in gas sweetening. Candidates must explain two methods from a sample of the following: membranes, reactive chemical desorption, physical desorption, carbonates, iron sponge, zinc, molecular sieves, amines, chemical complexation.
- ◆ explain the methods involved in sulphur disposal and recovery. For sulphur disposal candidates must cover either combustion or sulphate conversion. For sulphur recovery, candidates must cover either liquid sulphur production or patented processes.
- ◆ explain the methods involved in gas compression. Candidates must explain the methods used to meet particular pressure and volume requirements for either a reciprocating or centrifugal compressors. The explanation must include a consideration of drivers, power sources, intercooling and light ends separation and recovery.

Sampling must be undertaken in unseen and supervised conditions.

Assessment guidelines

This unit could be assessed using a single assessment covering all outcomes. The assessment paper could contain both short answer, structured and some extended-response questions. It is expected that the assessment should take a maximum of two hours.

Administrative information

Unit code: HV5V 48

Unit title: Petroleum Production Processes

Superclass category: YB

Original date of publication: November 2017

Version: 01

History of changes:

Version	Description of change	Date

Source: SQA

© Scottish Qualifications Authority 2008, 2017

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

For further information, please call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our [Centre Feedback Form](#).

SQA Advanced Unit Specification: support notes

Unit title: Petroleum Production Processes

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this unit

This unit is a mandatory unit within the SQA Advanced Certificate and the SQA Advanced Diploma in Petroleum Engineering. It is designed to provide candidates with an understanding of the production processes involved in the separation of the oil, gas and water, the preparation of water for use in exploration and the purification and compression of gas for distribution.

Outcome 1

The following topics will be introduced:

Functions and types of separators:

- ◆ gravitational
- ◆ rotodynamic
- ◆ electrostatic
- ◆ downhole
- ◆ subsea
- ◆ vertical
- ◆ horizontal
- ◆ inclined

Sizing criteria:

- ◆ gas velocity
- ◆ residue time
- ◆ Stokes' law
- ◆ turbulence

Production chemicals:

- ◆ demulsifiers
- ◆ defoamers
- ◆ deoilers
- ◆ corrosion inhibitors
- ◆ scale inhibitors
- ◆ wax inhibitors
- ◆ flow enhancers

Emulsions and contaminants:

- ◆ emulsions
- ◆ sand
- ◆ asphaltenes
- ◆ waxes
- ◆ scales

Outcome 2

Outcome 2 will introduce the following topics:

Water quality:

- ◆ reservoir requirements
- ◆ discharge limits
- ◆ environmental effects
- ◆ reservoir economics
- ◆ gases
- ◆ solids, oils and scales

Removal of solids:

- ◆ media filters
- ◆ cartridge filters
- ◆ membranes
- ◆ inorganic solids
- ◆ biomass
- ◆ bacteria
- ◆ oils
- ◆ greases and waxes

Removal of gas:

- ◆ oxygen
- ◆ hydrogen sulphide
- ◆ carbon dioxide
- ◆ packed towers
- ◆ reactive chemicals

Removal of oil:

- ◆ dissolved and dispersed oil
- ◆ interceptors
- ◆ gas flotation cells
- ◆ hydrocyclones
- ◆ coalescers
- ◆ membranes
- ◆ strippers

Outcome 3

This outcome deals with the following topics:

Gas dehydration:

- ◆ membranes
- ◆ absorption
- ◆ adsorption
- ◆ low temperature extraction
- ◆ hydrates
- ◆ dew points
- ◆ glycols
- ◆ contactors
- ◆ reboilers

Gas sweetening:

- ◆ legislation
- ◆ corrosion
- ◆ sales specifications
- ◆ membranes
- ◆ reactive chemical and physical desorption
- ◆ carbonates
- ◆ iron sponge
- ◆ zinc
- ◆ molecular sieves
- ◆ amines
- ◆ chemical complexation

Sulphur disposal and recovery:

- ◆ combustion
- ◆ sulphate conversion
- ◆ liquid sulphur production
- ◆ patented processes

Gas compression:

- ◆ pressure and volume requirements
- ◆ reciprocating and centrifugal compressors
- ◆ drivers and power sources
- ◆ intercooling and light ends separation and recovery

Guidance on the delivery and assessment of this unit

This unit will probably be delivered as part of a group award designed to provide candidates with technical knowledge and skills for employment in the petroleum engineering industries.

While the use of case study material is particularly recommended for both learning and teaching components of this unit, other suggested teaching and learning methods for this unit could include: the use of visual aids, information communication technology (ICT), group lectures and discussion, practical demonstrations, question and answer sessions, directed study, industrial/site visits.

Formative work for this unit could include group discussion and role play emphasising workplace health and safety issues and events specific to petroleum engineering. Such an approach could be beneficial to those candidates without industrial experience.

Assessment strategies for this unit will use a closed-book end-of--unit test covering all outcomes, although it may be possible, that under certain circumstances each outcome will be assessed using short individual tests. If this method is chosen the assessment will also be conducted under closed-book supervised conditions.

Opportunities for developing core skills

There are opportunities to develop the core skills of *Communication*, *Information Technology*, *Problem Solving* and *Numeracy*, both at SCQF level 6 in this unit, although there is no automatic certification of core skills or core skills components. This SCQF level 8 unit deals with complex information covering a range of production processes, which will require candidates to access a wide range of resources to support their learning. This will involve reading and interpreting information from textbooks as well as online resources. These learning, teaching approaches as well as the requirement for the assessment to contain some extended-response questions will allow candidates to develop their *Information Technology* and *Problem Solving* Core Skills at SCQF level 6. The fact that much of the information will be in graphical form and that calculations will have to be carried out will ensure that candidates will be developing *Numeracy* at SCQF level 6.

Open learning

If this unit is delivered by open or distance learning methods, additional planning and resources may be required for candidate support, assessment and quality assurance. A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes.

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

General information for candidates

Unit title: Petroleum Production Processes

This unit is about the production processes involved in the separation of the oil, gas and water, the preparation of water for use in exploration and the purification and compression of gas for distribution.

Before undertaking this unit it is expected that you already have knowledge and experience of unit HV5T 48 *Oil Well Management*.

You will gain knowledge and understanding of the following:

Outcome 1

Functions and types of separators: gravitational, rotodynamic, electrostatic, downhole, subsea vertical, horizontal, inclined.

Sizing criteria: gas velocity, residue time, Stokes law, turbulence.

Production chemicals: demulsifiers, defoamers, deoilers, corrosion inhibitors, scale inhibitors, wax inhibitors, flow enhancers.

Emulsions and contaminants: emulsions, sand, asphaltenes, waxes, scales.

Outcome 2

Water quality: reservoir requirements, discharge limits, environmental effects, reservoir economics, gases, solids oils and scales.

Removal of solids: media filters, cartridge filters, membranes, inorganic solids, biomass, bacteria, oils, greases and waxes.

Removal of gas: oxygen, hydrogen sulphide, carbon dioxide, packed towers, reactive chemicals.

Removal of oil: dissolved and dispersed oil, interceptors, gas flotation cells, hydrocyclones, coalescers, membranes, strippers.

Outcome 3

Gas dehydration: Membranes, absorption, adsorption, low temperature extraction, hydrates, dew points, glycols, contactors, reboilers.

Gas sweetening: legislation, corrosion, sales specifications, membranes, reactive chemical, physical desorption, carbonates, iron sponge, zinc, molecular sieves, amines, chemical complexation.

Assessment for this unit is likely to take the form of a single end-of-unit test covering all the outcomes. This assessment will be closed-book and conducted under supervised conditions.