National Unit specification: general information

Unit title: Water Treatment (SCQF Level 5)

Unit code: H002 11

Superclass: TL

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Version: 01

Summary

This is a mandatory Unit within the National Progression Award in Water Operations: An Introduction at SCQF level 5.

The purpose of this Unit is to provide candidates with a general understanding of the water treatment processes employed within the water industry.

This Unit is intended for candidates who have recently joined the water industry and provides an opportunity to develop an understanding of the processes involved in producing drinking water which are used within the operations and business of the water industry. The Unit is also suitable for candidates who have joined the water industry as an apprentice or at a similar level.

Outcomes

1 Demonstrate knowledge and understanding of a range of screening equipment and processes employed in the water industry.
2 Demonstrate an understanding of the role of chemicals for controlling the quality of water used within the water industry.
3 Demonstrate an understanding of clarification systems and related equipment employed within the water industry.
4 Demonstrate knowledge and understanding of the purification and filtering equipment employed within the water industry.
5 Demonstrate an understanding of the disinfection and final treatment processes used within the water industry.
6 Demonstrate knowledge and understanding of the treatment and disposal of sludge from water treatment processes used in the water industry.

General information (cont)

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Recommended entry

Entry is at the discretion of the centre. Candidates doing this Unit do not need any prior knowledge or experience of the water industry. Good skills in communication and ICT will be an advantage.

Credit points and level

1.5 credit(s) at SCQF level 5 (9 SCQF credit points at SCQF level 5*)

**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 Access 1 to Doctorates.*

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes of this Unit Specification.

There is no automatic certification of Core Skills or Core Skill component in this Unit.

National Unit specification: statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Outcome 1

Demonstrate knowledge and understanding of a range of screening equipment and processes employed in the water industry.

Performance Criteria

(a) Accurately describe and explain the function and operation of either a hand raked or a mechanical bar screen used in water treatment.
(b) Accurately describe and explain the function and operation of a band screen used in water treatment.
(c) Accurately describe and explain the function and operation of a microstrainer used in water treatment.

Outcome 2

Demonstrate an understanding of the role of chemicals for controlling the quality of water used within the water industry.

Performance Criteria

(a) Provide an accurate list of the common chemicals used as a coagulant in water treatment.
(b) Explain correctly why we need to add coagulants to the raw water in water treatment.
(c) Explain how pH affects the water treatment process.
(d) Accurately define and outline the differences between coagulation and flocculation.
(e) List the basic materials that polyelectrolytes are made from, describe why they are used and what function they perform.
(f) Define what coagulant residuals are and correctly explain the reasons why they need to be controlled.

National Unit specification: statement of standards (cont)

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Outcome 3

Demonstrate an understanding of clarification systems and related equipment employed within the water industry.

Performance Criteria

(a) Correctly describe the general principles of operation and the common key features of clarification systems used within water treatment.
(b) Correctly describe by means of a simple sketch one example of a clarification tank that uses sedimentation as the basic principle of operation.
(c) Correctly describe by means of a simple sketch one example of a clarification tank that uses floatation as the basic principle of operation.
(d) Correctly explain what is meant by a 'floc blanket' in a clarification tank and what function it serves in the clarification process.
(e) Correctly explain how solids in a clarification tank may be controlled and the systems used to effect this control.

Outcome 4

Demonstrate knowledge and understanding of the purification and filtering equipment employed within the Water Industry.

Performance Criteria

(a) Describe the principles of filtration accurately.
(b) Describe the basic construction of a range of filters by means of a simple sketch, indicating how the flow through it is controlled and maintained.
(c) Explain how cleaning of the filtering equipment identified in (b) and indicate what criteria may be used to determine when cleaning is required.
(d) Correctly describe the advantages and disadvantages of a range of filters used within the water industry.

Outcome 5

Demonstrate an understanding of the disinfection and final treatment processes used within the water industry.

Performance Criteria

(a) Correctly describe at least one substance used for disinfection and how it is controlled.
(b) Correctly describe what factors influence the efficiency of disinfection.
(c) Explain briefly the importance of disinfection residuals.
(d) Explain in general terms why pH correction of the final water is usually required.
(e) Explain briefly what can be done to reduce plumbosolvency.

National Unit specification: statement of standards (cont)

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Outcome 6

Demonstrate knowledge and understanding of the treatment and disposal of sludge from water treatment processes used in the water industry.

Performance Criteria

(a) List the sources of sludge at a water treatment works.
(b) Describe simple consolidation and de-watering systems.
(c) Describe briefly systems available for mechanical de-watering and drying.
(d) Correctly list the options available for final disposal of sludges.

Evidence Requirements for this Unit

Evidence is required to demonstrate that the candidates have achieved all of the Outcomes and Performance Criteria.

Written, oral, diagrammatical or electronic form of evidence should be produced to demonstrate that the candidate has achieved all of the Outcomes and Performance Criteria. The evidence should be produced under supervised conditions to a given brief.

Outcome 1 — Written and/or Oral Evidence

The evidence for this Outcome must be obtained under controlled, supervised and closed-book conditions.

Candidates will need to provide evidence to demonstrate their knowledge and understanding of screening equipment and processes, the range must cover:

- hand or mechanical raked bar screens
- band screen
- microstrainer

Outcome 2 — Written and/or Oral Evidence

The evidence for this Outcome must be obtained under controlled, supervised and closed-book conditions.

Candidates will need to provide evidence to demonstrate their knowledge of the role of chemicals in controlling the quality of water supply, by showing that they can identify and provide explanation for:

- types of coagulants and chemical names
- function and behaviour of coagulants
- role of pH correction and agents used
- definitions of coagulation and flocculation
- role, function and behaviour of polyelectrolytes
- significance of coagulant residuals

National Unit specification: statement of standards (cont)

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Outcome 3 — Written and/or Oral Evidence

Candidates will need to provide evidence to demonstrate their knowledge of clarification systems, by showing that they can:

- describe the general principles and common key features for two clarification systems
- describe the process of sedimentation as the basic principle of operation for one clarification tank
- describe the process of floatation as the basic principle of operation for one clarification tank
- explain the function of floc blanket
- explain two methods used for removal of solids from clarification systems

Evidence may in written, oral, diagrammatical or electronic form but must be the individual's own response.

Outcome 4 — Written and/or Oral Evidence

Candidates will need to provide evidence to demonstrate their knowledge and understanding of the purification and filtering processes, by describing the basic principles, operations and construction of the following range of equipment:

- slow sand filters
- rapid gravity filter
- pressure filter
- membrane filters

Evidence may in written, oral, diagrammatical or electronic form but must be the individual's own response.

Outcome 5 — Written and/or Oral Evidence

Candidates will need to provide evidence to demonstrate an understanding of the disinfection and final treatment processes covering:

- one disinfection type, its substance and dose control
- factors that influence disinfection such as disinfectant doses: concentrations and efficiency
- importance of disinfectant residuals, least four key points
- reasons for pH correction of final water
- plumbosolvency prevention and how it can be reduced

Evidence may in written, oral, diagrammatical or electronic form but must be the individual's own response.

National Unit specification: statement of standards (cont)

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Outcome 6 — Written and/or Oral Evidence

Candidates will need to provide evidence to demonstrate their knowledge and understanding by identifying and describing:

- a minimum of three sources of sludge at a water treatment works
- two simple consolidation and de-watering systems
- two mechanical de-watering and drying systems
- a minimum of four final disposal of sludges

Evidence may in written, oral, diagrammatical or electronic form but must be the individual's own response.

Outcomes can be assessed individually or holistically through an integrated exam or project based assignment.

National Unit specification: support notes

Unit title: Water Treatment (SCQF Level 5)

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 60 hours.

Guidance on the content and context for this Unit

This is a mandatory Unit within the National Progression Award in Water Operations: An Introduction at SCQF level 5.

This Unit is intended to give candidates background information on the principles and processes used by water undertakings to produce drinking water.

The water industry employers have identified a need to ensure that the water industry is able to access and develop a sustainable competent workforce to facilitate cross functional working. The industry has developed, with Energy and Utility Skills and industry regulators, a framework based on National Occupational Standards for "competent operators" which all UK water undertakers have agreed to adopt. This Unit has been developed to align with specific element of these National Occupational Standards:

Treatment Process Operations

- monitor and maintain the quality of treatment processes
- receive, store and handle processing chemicals
- receive and store sludge for processing
- on-site sampling
- on-site storage
- samples and measurements for quality assurance

The emphasis is on providing an understanding of the reasons why treatment is necessary and how the techniques and systems used effect an improvement in quality of the raw water.

Guidance on learning and teaching approaches for this Unit

It is intended that this qualification should be delivered as much as possible with reference to actual industry practices and processes. With this in mind, it would be beneficial if candidates had access to water industry installations and systems.

Tutorial delivery methods include a variety of teaching methods which will enhance the learning experience, including face to face tutorials, field trips, group discussion and networking candidate's industrial experience and expertise, visiting industry specialists, work related project activities, etc.

It is strongly recommended that a structured site visit to a water treatment works should form part of the learning and teaching approach to this Unit.

National Unit specification: support notes (cont)

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Guidance on approaches to assessment for this Unit

As part of the NPA in Water Operations: An Introduction at SCQF level 5 this Unit can be assessed as part of an integrated examination in the form of an extended response paper at the end of each year and an assignment on a given topic at the end of each year.

The Unit, individually can be assessed an holistic approach or by a combination of assignment and an integrated end examination, where all Evidence Requirements are covered in a bank of questions.

The evidence for this must be obtained under controlled, supervised conditions.

Witten, oral, diagrammatical or electronic form of evidence should be produced to demonstrate that the candidate has achieved all of the Outcomes and Performance Criteria.

Opportunities for the use of e-assessment

Research has indicated that it is important to retain face to face contact with the candidates and opportunities for networking with other water industry personnel. In the event of any centre wishing to deliver this Unit on a fully open learning basis, then it would be highly desirable that prospective candidates have access to water industry installations and work experience to enable them to undertake this course.

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

National Unit specification: support notes (cont)

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Opportunities for developing Core Skills

In this Unit candidates will develop aspects of Core Skills at SCQF level 5 through contextualised activities designed to support the candidate develop their general understanding of the water treatment processes employed within the water industry.

Development of Core Skills elements will take place through learning and teaching activities as well as through practical activities which candidates will be involved in planning and delivering and reflection of such activities.

In this Unit candidates will through development of their knowledge and understanding of the key aspects of the water supply, be provided the opportunity to develop the following Core Skills:

Communication — both Oral and Written

- small group working, discussion
- verbal and written instructions
- written responses to wide range of questioning techniques

Problem Solving — Critical Thinking; Planning and Organising; Reviewing and Evaluating

- applying knowledge and understanding to a series of tasks
- completing assignments through effective planning and organising within groups and individually
- self evaluation

Information and Communication Technology — Accessing and Processing Information

- conducting research on current technologies applied within the industry
- using technology to present findings

Working with Others

- participating in assignments designed to reinforce the candidate's learning through group activities

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**

History of changes to Unit

Version	Description of change	Date