



Higher National Unit Specification

General information

Unit title: Water Operations: Activated Sludge and Advanced Waste Water Treatment Processes (SCQF level 7)

Unit code: H7FF 34

Superclass: TL

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Unit purpose

This Unit is suitable for learners who wish to understand the principles and processes involved in advanced waste water treatment processes and who are currently employed in, or who are seeking employment in the water industry or a related role.

It is designed to give you a good understanding of the principles and practices involved in activated sludge and advanced waste water treatment processes. It will increase the understanding of existing or potential Water Industry Managers, Team Leaders and Technicians. It will help prepare Water Industry employees in non-operational posts to be able to move into or fulfil more operational related roles.

Successful learners will develop the skills and knowledge associated with, and required for, roles in activated sludge and advanced waste water treatment processes.

On completion of the Unit the learner will be able to:

- 1 Explain the activated sludge processes in waste water treatment.
- 2 Explain the settlement of activated sludge and final settlement tank design.
- 3 Evaluate the process variations used in advanced waste water treatment.
- 4 Evaluate remedial processes for non-compliance.

Credit points and level

1.5 Higher National Unit credits at SCQF level 7: (12 SCQF credit points at SCQF level 7)

Higher National Unit specification: General information (cont)

Recommended entry to the Unit

It would be beneficial though not essential for learners to have some Water Industry experience in Waste Water Treatment or Networks.

While entry is at the discretion of the centre it would be expected that learners will have completed the Higher National Unit F53M 34 *Water Operations: Waste Water Treatment Process* or equivalent before they begin this Unit.

Core Skills

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

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

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Equality and inclusion

This Unit Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. Centres need to consider the individual needs of learners when planning learning experiences, selecting assessment methods or considering alternative evidence.

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

Higher 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.

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. Learners 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 activated sludge processes in waste water treatment.

Knowledge and/or Skills

- ◆ Activated sludge process theory
- ◆ Operation and maintenance of activated sludge systems
- ◆ Carbonaceous and ammoniacal oxidation
- ◆ Aeration method, oxygen transfer theory
- ◆ Calculation of oxygen requirement
- ◆ Calculation of loading rates and Food to BioMass ratio (FM)
- ◆ Health and safety considerations with regard to activated sludge systems

Evidence Requirements

Learners are required to provide written or oral recorded evidence. The evidence will be generated under supervised conditions in response to an assignment or unseen questions. Evidence through presentation will be supported by evidence of research and planning.

Evidence for the Knowledge and/or Skills in this Outcome will be generated through sampling. Each learner will need to provide evidence to demonstrate they can examine five of the seven Knowledge and/or Skills items.

Any sampling process must be 'unseen' by the learner before the assessment. That is, learners are expected to fully prepare the range of knowledge and skills and not be able to predict a chosen sample.

Subject to the sampling process described above, learners will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes by showing that they can:

- ◆ describe the function of common components of an activated sludge plant.
- ◆ explain the principles of operation of the activated sludge treatment process.
- ◆ describe process control systems.
- ◆ define the technical terminology and Units of measurement used in activated sludge treatment process control.
- ◆ describe the maintenance of plant and equipment used in activated sludge treatment.

Higher National Unit specification: statement of standards (cont)

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- ◆ explain safe practice in the operation of activated sludge plants.
- ◆ investigate the biochemistry of activated sludge.
- ◆ describe the chemistry of activated sludge.
- ◆ describe the waste water industry design criteria applied to activated sludge treatment.
- ◆ describe conditions required for nitrification.

Outcome 2

Explain the settlement of activated sludge and final settlement tank design.

Knowledge and/or Skills

- ◆ Final settlement tank design and operation
- ◆ Common faults and failure modes
- ◆ Mass flux theory
- ◆ Calculation of maximum permissible load
- ◆ Reactor configuration and mixing regime

Evidence Requirements

Learners are required to provide written or oral recorded evidence. The evidence will be generated under supervised conditions in response to an assignment or unseen questions. Evidence through presentation will be supported by evidence of research and planning.

Evidence for the Knowledge and/or Skills in this Outcome will be generated through sampling. Each learner will need to provide evidence to demonstrate they can examine four of the five Knowledge and/or Skills items.

Any sampling process must be 'unseen' by the learner before the assessment. That is, learners are expected to fully prepare the range of Knowledge and Skills and not be able to predict a chosen sample.

Subject to the sampling process described above, learners will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes by showing that they can:

- ◆ describe the process of settlement of activated sludge.
- ◆ measure the settle ability of sludges.
- ◆ identify causes of bulking.
- ◆ identify major groups of organisms associated with bulking.
- ◆ examine control of bulking.
- ◆ calculate final settlement loadings.

Higher National Unit specification: statement of standards (cont)

Unit title: Water Operations: Activated Sludge and Advanced Waste Water Treatment Processes (SCQF level 7)

Outcome 3

Evaluate the process variations used in advanced waste water treatment.

Knowledge and/or Skills

- ◆ Membrane plants
- ◆ Oxygen enriched plants
- ◆ Hybrid plants
- ◆ Sequence batch reactors
- ◆ Package plants
- ◆ Reactor configuration
- ◆ Denitrification
- ◆ Phosphorus removal

Evidence Requirements

Learners are required to provide written or oral recorded evidence. The evidence will be generated under supervised conditions in response to an assignment or unseen questions. Evidence through presentation will be supported by evidence of research and planning.

Evidence for the Knowledge and/or Skills in this Outcome will be generated through sampling. Each learner will need to provide evidence to demonstrate they can examine three of the eight Knowledge and/or Skills items.

Any sampling process must be 'unseen' by the learner before the assessment. That is, learners are expected to fully prepare the range of knowledge and skills and not be able to predict a chosen sample.

Subject to the sampling detailed above, learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe two different process variations using the Activated Sludge process.
- ◆ evaluate two different process variations using the Activated Sludge process.
- ◆ conduct process control calculations to design an Activated Sludge plant.
- ◆ investigate nutrient removal processes.

Higher National Unit specification: statement of standards (cont)

Unit title: Water Operations: Activated Sludge and Advanced Waste Water Treatment Processes (SCQF level 7)

Outcome 4

Evaluate remedial processes for non-compliance.

Knowledge and/or Skills

- ◆ Common process problems
- ◆ Process Monitoring tests
- ◆ Process variations failure modes
- ◆ Overloading
- ◆ Bulking
- ◆ Foaming

Evidence Requirements

Learners are required to provide written or oral recorded evidence. The evidence will be generated under supervised conditions in response to an assignment or unseen questions. Evidence through presentation will be supported by evidence of research and planning.

Evidence for the Knowledge and/or Skills in this Outcome will be generated through sampling. Each learner will need to provide evidence to demonstrate they can examine five of the six Knowledge and/or Skills items.

Any sampling process must be 'unseen' by the learner before the assessment. That is, learners are expected to fully prepare the range of knowledge and skills and not be able to predict a chosen sample.

Subject to the sampling detailed above, learners will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes by showing that they can:

- ◆ describe failure modes and common faults with activated sludge plants and other advanced waste water treatment processes,
- ◆ identify and rectify faults causing poor effluent quality from activated sludge plant,
- ◆ analyse process diagnostic data,
- ◆ evaluate process solutions to achieve compliance.



Higher National Unit: Support Notes

Unit title: Water Operations: Activated Sludge and Advanced Waste Water Treatment Processes (SCQF level 7)

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

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 Unit is suitable for learners who wish to understand the principles and processes involved in advanced Waste Water treatment processes and who are currently employed in, or who are seeking employment in the water industry or a related role.

It is designed to give you a good understanding of the principles and practices involved in Activated Sludge and Advanced Waste Water Treatment Processes. It will increase the understanding of existing or potential Water Industry Managers, Team Leaders and Technicians. It will help prepare Water Industry employees in non-operational posts to be able to move into or fulfil more operational related roles.

Successful learners will develop the skills and knowledge associated with, and required for, roles in Activated Sludge and Advanced Waste Water Treatment Processes.

Students are expected to have completed Unit F53M 34 *Water Operations: Waste Water Treatment Process* before they attempt this Unit.

Ideally, whilst undertaking this Unit you will have access to Waste Water treatment sites. If you don't have access yourself the centre delivering the Unit will, in most cases, be able to arrange site visits.

There are four Outcomes in this Unit and these are outlined below.

Outcome 1: Explain the activated sludge processes in waste water treatment.

For Outcome 1 you will cover the Development of Activated Sludge Systems, Activated Sludge Process Theory, Microbial growth and metabolism, Aeration Method, Oxygen transfer theory, Calculation of Oxygen requirement, Calculation of Loading rates, Oxidation of nitrogen compounds and Health and Safety considerations specific to Activated Sludge Systems.

Outcome 2: Explain the settlement of activated sludge and final settlement tank design.

For Outcome 2 you will cover Final Settlement Tank Operation, Common faults and Failure modes, Mass Flux theory, Calculation of maximum permissible load on a final tank and the effect on settlement of Reactor Configuration.

Higher National Unit: Support Notes (cont)

Unit title: Water Operations: Activated Sludge and Advanced Waste Water Treatment Processes (SCQF level 7)

Outcome 3: Evaluate the process variations used in advanced waste water treatment

For Outcome 3 you will cover process variants — Membrane plants, Oxygen enriched plants, Hybrid plants, Sequence batch reactors, Package plants, Reactor configuration, Denitrification and Phosphorus removal.

Outcome 4: Evaluate remedial processes for non-compliance.

For Outcome 4 you will cover common process problems, monitoring tests, process variations, failure modes, legislation and regulations related to discharges to controlled waters, bulking and foaming.

Guidance on approaches to delivery of this Unit

The Unit should be delivered by a planned blend of class room based teaching and individual research. The individual research done by the learner should be directed and supported by assessors at the centre.

It would be beneficial if learners had previously completed the level 7 Unit *Water Operations: Waste Water Treatment Process* or equivalent before this Unit begins.

The course work to be used for the Unit should be introduced at an early stage and could be available and supported online.

Centres should facilitate and direct a varied approach to teaching and learning which could include group work, field trips and classroom activities. This is particularly important with learners who don't have experience of this Unit subject at work. Centres should monitor and adjust the teaching approach to meet the needs of individuals or particular learner groups who may have significantly different initial knowledge and experience.

Guidance on approaches to assessment of this Unit

As an example, assessment for this Unit could be through an assignment which sets out a scenario for the learners to follow and which then requires them to apply their learning to a real life challenge. As an illustration the scenario could invite the learner say as a member of a capital investment project team to report on a major upgrade or replacement of a waste water treatment works. The details of which could be provided by the learner from a real example at work or if this is not possible by the assessor.

If the scenario, led by the assessor, ensures the learners look at and report on two or three advanced treatment options and then have to consider the consequences of changing permit conditions many of the learning Outcomes will be covered.

A particular challenge for a centre with this approach is to ensure the scenario sets out but also limits the work required. For example if for some particular process plant final design figures are required the scenario should say so. If the scenario is asking for just draft design or sufficient detail for feasibility it should also say so.

Higher National Unit: Support Notes (cont)

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With the above assignment example as the learner has freedom to select their own solution to a real or given problem it is likely that some Evidence Requirements will not be covered. If the assignment scenario is designed well the items not covered could then be readily assessed through unseen questions.

Centres will develop an assessment strategy which complies with SQA policies and guidelines and meets all learning Outcomes. Elements of individual Evidence Requirements may be sampled.

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. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

It is possible to assess learners by combinations of Outcomes, or by a single holistic assessment encompassing all Outcomes. Assessment should be conducted under supervised conditions. The assessment(s) should consist of an appropriate balance of calculations and short written answers. If a single assessment covering all Outcomes is used, it should not exceed three hours in duration.

Centres are encouraged to design assessments that take a holistic approach with questions or assignments giving opportunity for learners to demonstrate evidence for two or more Outcomes at the same time.

Opportunities for e-assessment

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 learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

There are opportunities to develop the Core Skills of *Communication, Information and Communication Technology (ICT)* and *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

All Outcomes require learners to produce written and/or oral evidence which considers the effective treatment of waste water. If this evidence is presented in an appropriate format this may offer learners the opportunity to develop the Written and/or Oral component of the Core Skill *Communication* at SCQF level 6.

Higher National Unit: Support Notes (cont)

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This Unit may also provide opportunities to develop the Core Skill *Information and Communication Technology* at SCQF level 6 as learners may utilise *Information and Communication Technology* to research and understand different water treatment processes. They may also use information technology to present information including tables, graphs and diagrammatical representations of treatment processes in their assignments for this Unit.

The Unit may also provide opportunities to develop the Core Skill *Problem Solving* in particular the Core Skill component of Critical Thinking at SCQF level 6. This can be shown through the learner dealing with a situation or issue where variables may be relatively complex. They can identify the variables and relationships between them. By evaluating the situation and potentially devising a new approach which may be justified.

History of changes to Unit

Version	Description of change	Date

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General information for learners

Unit title: Water Operations: Activated Sludge and Advanced Waste Water Treatment Processes (SCQF level 7)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This Unit is intended to be delivered as part of the HNC Water Operations Qualification. It is designed to give you a good understanding of the principles and practices involved in activated sludge and advanced waste water treatment processes.

While entry is at the discretion of the centre this Unit is designed to build on the content of the Higher National Unit F53M 34 *Water Operations: Waste Water Treatment Process*. Learners would normally be expected to have complete F53M 34 first.

It is suitable if you wish to understand the principles and processes involved and are currently employed in, or are seeking employment in a water treatment environment or a related role. Ideally, whilst undertaking this Unit you will have access to waste water treatment sites.

The assessment for this Unit will be through well planned course work and structured assignments. The course work and assessment will give opportunities to develop the Core Skills of *Communication, Information and Communication Technology (ICT)* and *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.