



Higher National Unit specification

General information

Unit title: Fundamentals of Sustainable Resource Management: Science and Technologies (SCQF level 7)

Unit code: H65J 34

Superclass: QE

Publication date: January 2014

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit enables learning and development for those aspiring to be, or are already employed within the Waste Sustainable/Resource Management Sector. It is designed to provide the learner with an understanding of science and technologies used within the Waste Sustainable/Resource Management Sector. It is aimed principally at learners who aspire to work or are already employed within the Waste Sustainable/Resource Management

Outcomes

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

- 1 Explain the function and role of recycling facilities.
- 2 Explain the function and role of anaerobic digestion and composting.
- 3 Explain the function and role of pyrolysis and gasification, energy from waste/thermal treatment systems.
- 4 Explain the function and role of landfills.
- 5 Research and evaluate emerging technologies within the wastes and sustainable resource management sector.

Credit points and level

2 Higher National Unit credits at SCQF level 7: (16 SCQF credit points at SCQF level 7)

Recommended entry to the Unit

Entry is at the discretion of the centre.

Higher National Unit specification: General information (cont)

Unit title: Fundamentals of Sustainable Resource Management: Science and Technologies (SCQF level 7)

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. 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.

Higher National Unit specification: Statement of standards

Unit title: Fundamentals of Sustainable Resource Management:
Science and Technologies (SCQF level 7)

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

Explain the function and role of recycling facilities.

Knowledge and/or Skills

- ◆ Technologies employed at recycling facilities for the reprocessing and reuse of both domestic and industrial source materials
- ◆ Contribution of recycling facilities to sustainable resource management and the wider community and environment

Outcome 2

Explain the function and role of anaerobic digestion and composting.

Knowledge and/or Skills

- ◆ Scientific principles and operational technologies.
- ◆ Process management and control
- ◆ Contribution to sustainable resource management
- ◆ Uses and impacts of the products to the wider community and environment

Outcome 3

Explain the function and role of pyrolysis and gasification, energy from waste/thermal treatment systems.

Knowledge and/or Skills

- ◆ Scientific principles and operational technologies
- ◆ Uses and impacts of the products to the wider community and environment
- ◆ Contribution to sustainable resource management and the wider community and environment

Higher National Unit specification: Statement of standards (cont)

Unit title: Fundamentals of Sustainable Resource Management: Science and Technologies (SCQF level 7)

Outcome 4

Explain the function and role of landfills.

Knowledge and/or Skills

- ◆ Design, operation and management of landfills
- ◆ Contribution of landfill as a waste and sustainable resource management technique and its position within the wider environment

Outcome 5

Research and evaluate emerging technologies within the wastes and sustainable resource management sector.

Knowledge and/or Skills

- ◆ Emerging technologies
- ◆ Potential advantages and disadvantages upon the public and wider environment

Evidence Requirements for this Unit

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes by showing that they can:

Outcome 1

- ◆ identify the key methods and technologies used for the collection, separation and recycling, re-processing or re-use of three municipal (domestic) and three industrial (non-domestic) waste materials.
- ◆ discuss the potential uses and advantages and disadvantages of three recycled, reprocessed or re-used products.
- ◆ discuss the contribution of recycling to sustainable resource management and the wider community and environment.

Written and/or recorded oral evidence is required from learners to demonstrate this.

Assessment will be completed under open-book conditions

Higher National Unit specification: Statement of standards (cont)

Unit title: Fundamentals of Sustainable Resource Management: Science and Technologies (SCQF level 7)

Outcome 2

- ◆ identify and discuss the main stages of the processes of composting and anaerobic digestion (AD).
- ◆ identify the need for effective process management, monitoring and control.
- ◆ discuss the roles composting and anaerobic digestion can play in sustainable resource management.
- ◆ identify the potential uses and advantages and disadvantages of the products — compost, biogas, digestate and liquor.

Written and/or recorded oral evidence is required from learners to demonstrate this.

Assessment will be completed under open-book conditions.

Outcome 3

- ◆ define pyrolysis and gasification and identify the key operational stages.
- ◆ define two energy from waste or thermal treatment technologies and identify the key operational stages.
- ◆ Identify the potential uses and advantages and disadvantages of three products from any combination of pyrolysis and gasification, energy from waste or thermal treatment technologies.
- ◆ Identify and discuss the contribution of pyrolysis and gasification and two energy from waste or thermal treatment technologies to sustainable resource management and the community.

Written and/or recorded oral evidence is required from learners to demonstrate this.

Assessment will be completed under open-book conditions.

Outcome 4

- ◆ identify the major design features and operational practices of contemporary landfills.
- ◆ discuss the need for proper management of landfills in both the short and long-term and how this may be achieved.
- ◆ discuss the contribution of landfill to sustainable resource management and the wider community and environment.

Written and/or recorded oral evidence is required from learners to demonstrate this.

Assessment will be completed under open-book conditions.

Higher National Unit specification: Statement of standards (cont)

Unit title: Fundamentals of Sustainable Resource Management:
Science and Technologies (SCQF level 7)

Outcome 5

- ◆ demonstrate evidence of both structured research and evaluation (potential advantages and disadvantages) upon a topic within the sphere of ‘the science and technology’ of sustainable waste and resource management, which can reasonably be considered to be innovative or novel — an emerging technology.
- ◆ demonstrate through structured research and evaluation of any emerging technology the appreciation of the concept of the evolving nature of the sustainable resources management sector.

Written and/or recorded oral evidence is required from learners to demonstrate this.

Assessment will be completed under open-book conditions.



Higher National Unit Support Notes

Unit title: Fundamentals of Sustainable Resource Management: Science and Technologies (SCQF level 7)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 80 hours.

Guidance on the content and context for this Unit

In this Unit learners will be given the opportunity to study and explore a wide range of waste and sustainable resource management technologies. Learners will be introduced to the fundamental science and technology of composting and anaerobic digestion, pyrolysis and gasification, energy from waste/thermal treatment systems, landfills and recycling facilities. Learners will learn to identify and describe the distinguishing features of such systems. The exploration and evaluation of emerging technologies and methodologies will enable learners to appreciate the continuing evolution of the sector.

This Unit provides learners with the opportunity to investigate and evaluate a wide range of science and technologies used within wastes and sustainable resources management sector for the sustainable management of materials arising from both domestic and industrial sources. Historically many societies have employed science, technology and engineering to effectively and efficiently treat waste and recycle resources; learners will gain knowledge and understanding of a range of established and emerging technologies employed for this purpose.

The technologies employed at recycling facilities for the reprocessing and reuse of a wide range of domestic and industrial source materials will be studied. Source and non-source separated recyclables should be investigated. Specialist recycling and reprocessing facilities for example, soils, aggregates, hydrocarbons and other chemicals or industrial waste and by-products will be studied. The function and role of recycling facilities as a waste and sustainable resource management technique and their position within the wider community and environment will be evaluated.

The science and technology of composting (both open and in-vessel) and anaerobic digestion will be investigated. The importance of good process management and product control will be demonstrated. The uses and properties of compost, bio-gas, digestate and other end/by-products of composting and anaerobic digestion will be studied and evaluated.

The science and technology of pyrolysis and gasification, energy from waste/thermal treatment systems (eg incineration, autoclaving, biomass, biofuels, biodiesel, etc) will be investigated. The function and role of such technologies and operations within both the context of the wastes/sustainable resource management sector and the wider community and environment will be studied.

Higher National Unit Support Notes (cont)

Unit title: Fundamentals of Sustainable Resource Management: Science and Technologies (SCQF level 7)

The science, engineering and technology involved with the design, operation and management of landfills will be investigated. Landfills for the management of a wide range of waste types (not only municipal solid wastes but also, construction and demolition and nuclear wastes etc) will be considered. The function and role of landfill as a waste and sustainable resource management technique and its position within the wider environment will be studied.

The waste/sustainable resources management industry is not static — novel and improved technologies and methodologies are continuously evolving. Learners will have the opportunity to research and describe a range of emerging technologies, these may be linked to or independent of technologies studied in Outcomes 1 to 4. The value and uses of novel technologies to the waste and sustainable resources management sector will be investigated. The impact of emerging technologies upon the public and wider environment will be considered.

Guidance on approaches to delivery of this Unit

A range of delivery techniques can be employed:

- ◆ When delivered within a class-room setting it is possible to devise lectures, small group workshops and investigative activities to support the learning process.
- ◆ When this Unit is delivered by distance-learning, the use of a virtual-learning environment (VLE) utilising on-line lectures and activities; the employment of video and audio clips, social-media and other online tools is encouraged.
- ◆ It is suggested that Outcomes 1 to 4 are delivered first, to give learners knowledge and understanding of existing technologies before they study Outcome 5 upon emerging technologies.
- ◆ Field trips and site visits are encouraged to highlight the importance of real-world or industrial scenarios.
- ◆ Learners should be encouraged to use the Internet as a research tool in addition to traditional library based resources. Independent study should be encouraged by using learner-centred, resource based methodologies.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of instruments of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Integration of Outcomes 1–4 is encouraged. Where integrated assessment is used this could take the form of a case study investigation or the production of a portfolio or blog under open-book conditions. Where an integrated assessment is used, an overall word count of approximately 2,000–2,500 words could be envisaged. Each Outcome could be assessed separately. Outcomes 1, 2, 3 and 4 could be assessed by use of directed studies (eg essays, structured questions or preparing a technical magazine article) (written and/or orally recorded) under open-book conditions. Outcome 5 could involve some form of research activity followed by a ‘conference’ poster or report under open-book conditions. Where individual instruments of assessment for each Outcome are used a word count of approximately 500–650 words per Outcome could be expected.

Higher National Unit Support Notes (cont)

Unit title: Fundamentals of Sustainable Resource Management: Science and Technologies (SCQF level 7)

As with any Unit, centres should ensure they can authenticate learners' assessments. This may be done by questioning learners about their work, by viewing drafts of partially completed assessments or by using an online anti-plagiarism tool.

Centres are reminded that prior verification of centre devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

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* at SCQF level 6, *Problem Solving* at SCQF level 6, *Numeracy* at SCQF level 5 and *Information and Communication Technology (ICT)* at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

History of changes to Unit

Version	Description of change	Date

© Scottish Qualifications Authority 2014

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.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Business Development and Customer Support team, telephone 0303 333 0330.

General information for learners

Unit title: Fundamentals of Sustainable Resource Management: Science and Technologies (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 provides you with the opportunity to investigate and evaluate a wide range of technologies used within wastes/sustainable resource management for the sustainable management of materials arising from both domestic and industrial sources. Despite the recent interest in sustainable living, historically many societies have employed science, technology and engineering to treat wastes and recycle resources; you will gain knowledge and an understanding of a range of established and emerging technologies employed for this purpose. These will cover methods for treating both organic and in-organic materials.

The technologies employed at recycling facilities for the reprocessing and reuse of a wide range of domestic and industrial source materials will be studied. Source and non-source separated recyclables will be investigated. Specialist recycling and reprocessing facilities for example, soils, aggregates, hydrocarbons and other chemicals or industrial wastes and by-products will be studied. The function and role of recycling facilities as a waste and sustainable resource management technique and their position within the wider community and environment will be evaluated.

The science and technology of composting (both open and in-vessel) and anaerobic digestion will be investigated. The importance of good process management and product control will be demonstrated. The uses and properties of compost, bio-gas, digestate and other end/by-products of composting and anaerobic digestion will be studied and evaluated.

The science and technology of pyrolysis, gasification and energy from waste/thermal treatment systems (eg incineration, autoclaving, biomass, biofuels, biodiesel, etc) will be investigated. The function and role of such technologies and operations within both the context of the wastes/sustainable resources management sector and the wider community and environment will be studied.

The science, engineering and technology involved with the design, operation and management of landfills will be investigated. Landfills for the management of a wide range of waste types (not only municipal solid wastes but also, construction and demolition and nuclear waste for example) will be considered. The function and role of landfill as a waste and sustainable resource management technique and its position within the wider environment will be studied.

The technologies employed at recycling facilities for the reprocessing and reuse of a wide range of domestic and industrial source materials will be studied. Source and non-source separated recyclables will be investigated. Specialist recycling and reprocessing facilities for example, soils, aggregates, hydrocarbons and other chemicals or industrial wastes and by-products will be studied. The function and role of recycling facilities as a waste and sustainable resources management technique and their position within the wider community and environment will be evaluated.

General information for learners (cont)

Unit title: Fundamentals of Sustainable Resource Management: Science and Technologies (SCQF level 7)

The waste/sustainable resource management industry is not static — novel and improved technologies and methodologies are continuously evolving. You will have the opportunity to research and discover a range of emerging technologies, these may be linked to or independent of technologies stated above. The value and uses of new technologies to the waste and sustainable resources management sector will be investigated. The impact of emerging technologies upon the public and wider environment will be considered. This will help you to assess the future needs of a rapidly changing industry.

On successful completion of the Unit you will be able to:

- 1 Explain the function and role of recycling facilities.
- 2 Explain the function and role of anaerobic digestion and composting.
- 3 Explain the function and role of pyrolysis and gasification, energy from waste/thermal treatment systems.
- 4 Explain the function and role of landfills.
- 5 Research and evaluate emerging technologies within the wastes and sustainable resource management sector.

You will be expected to and encouraged to do self-study and independent research during this Unit. You will need to achieve all the Outcomes to pass this Unit. Assessment of the Unit will be varied, but will include written/oral assessment, research activity and portfolio development. Assessment of this Unit will be open-book in nature.

Over the course of this Unit, there may be opportunities for you to develop Core Skills in the areas of *Communication* at SCQF level 6, *Problem Solving* at SCQF level 6, *Numeracy* at SCQF level 5 and *Information and Communication Technology (ICT)* at SCQF level 5, although there is no automatic certification of Core Skills or Core Skills components.