



Higher National Unit specification

General information for centres

Unit title: Wastes Industry: Applying Environmental Science to the Management of Wastes

Unit code: FOVM 34

Unit purpose: This Unit will allow candidates to develop knowledge of the scientific concepts and issues underlying the theory and practice of Wastes Management. The Unit is intended for candidates studying Wastes Management.

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

- 1 Explain key scientific factors in the Management of Wastes.
- 2 Explain the principles of pollution monitoring.
- 3 Explain the principles of pollution control.
- 4 Evaluate a Pollution Control Wastes Management system.

Credit points and level: 2 HN credits at SCQF level 7: (16 SCQF credit points at SCQF level 7*)

**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.*

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the centre. However, prior knowledge of chemistry and biology studied to SCQF level 5 would be an advantage.

Core 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 Technology* at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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.

General information for centres (cont)

Assessment: It is recommended that this Unit be assessed by a single instrument of assessment that requires candidates to produce a report that assess Outcomes 1–4. This report could consist of approximately 2,000 words. However, the Outcomes may be assessed as separate assessment events. If this approach is used it is recommended that the candidates' response should be:

Outcome 1 — approximately 600 words

Outcome 2 — approximately 400 words

Outcome 3 — approximately 400 words

Outcome 4 — approximately 600 words

The report (or reports) involves the candidate producing an evaluation of a Pollution Control Wastes Management System with a description and explanation of the scientific principals underpinning the system.

Higher National Unit specification: statement of standards

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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 key scientific factors in the management of Wastes

Knowledge and/or Skills

- ◆ Chemical toxicity
- ◆ pH scale
- ◆ Solvents and Detergents as pollutants
- ◆ Chemical (COD) and Biological (BOD) Oxygen Demand
- ◆ Biological organisms (including microbial succession and growth factors)
- ◆ Algal bloom
- ◆ Biodegradation
- ◆ Mutagenic effects
- ◆ Noise
- ◆ Environmental Cycles

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing they can select, and apply the scientific concepts appropriate to a pollution control waste management system.

Evidence will be generated by sampling; candidates will select and apply four of the ten scientific factors listed in the knowledge and/or skills to a pollution control waste management system.

Candidates will need evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe each scientific factor applied to the pollution control wastes management system
- ◆ describe why the selected scientific factor is applicable to the pollution control wastes management system

Higher National Unit specification: statement of standards (cont)

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On each assessment occasion a different sample of the knowledge and skills from Outcome 1, should be chosen. Evidence should be generated through assessment under supervised conditions.

Assessment Guidelines

This Outcome can be assessed on its own or in conjunction with Outcomes 2, 3 and 4, the details of which are given under Outcome 4. Candidates may bring one sheet of A4 paper to the assessment event.

Outcome 2

Explain the principles of pollution monitoring

Knowledge and/or Skills

- ◆ Causes of Pollution (including Noise Pollution)
- ◆ Sampling methods
- ◆ Analytical methods
- ◆ Chemical Monitoring
- ◆ Biological Monitoring
- ◆ Noise Monitoring
- ◆ Analytical methods

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing they can:

- ◆ describe the potential causes of pollution
- ◆ describe the sampling methods and analytical regime
- ◆ explain the relevance of one of the following to a pollution control wastes management system:
 - chemical monitoring
 - biological monitoring
 - noise monitoring

On each assessment occasion a different sample of the knowledge and skills from Outcome 2, should be chosen. Evidence should be generated through assessment under supervised conditions.

Higher National Unit specification: statement of standards (cont)

Unit title: Wastes Industry: Applying Environmental Science to the Management of Wastes

Assessment Guidelines

This Outcome can be assessed on its own or in conjunction with Outcomes 1, 3 and 4, the details of which are given under Outcome 4. Candidates may bring one sheet of A4 paper to the assessment event.

Outcome 3

Apply the principles of pollution control

Knowledge and/or skills

- ◆ Control and Management of sources of pollution
- ◆ Pre-treatment control
- ◆ Methods of pollutant reduction
- ◆ Noise control
- ◆ Control of Non Municipal Wastes
- ◆ Control of Municipal Wastes
- ◆ Management of sewage
- ◆ Management of effluent discharge

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing they can:

- ◆ describe a control/management system
- ◆ describe the relevance of two of the following knowledge and skills items to a pollution control wastes management system:
 - Methods of pollutant reduction
 - Noise control
 - Control of Non Municipal Wastes
 - Control of Municipal Wastes
 - Management of sewage
 - Management of effluent discharge

Assessors must be satisfied, that based on the solution presented by the candidate, they can infer the candidates knowledge of the pollution control waste management system.

On each assessment occasion a different sample of the knowledge and skills from Outcome 3, should be chosen. Evidence will be generated by sampling; candidates will apply two concepts to a pollution control wastes management system.

Assessment Guidelines

This Outcome can be assessed on its own or in conjunction with Outcomes 1, 2 and 4, the details of which are given under Outcome 4.

Higher National Unit specification: statement of standards (cont)

Unit title: Wastes Industry: Applying Environmental Science to the Management of Wastes

Outcome 4

Evaluate a Pollution Control Wastes Management system

Knowledge and/or Skills

- ◆ Pollution control waste management systems
- ◆ Advantages/disadvantages
- ◆ Costs/benefits
- ◆ Efficacy of application

Evidence Requirements

Candidates will need to provide evidence to demonstrate their understanding of all of the Knowledge and Skills from Outcome 4.

A candidate's response will be judged satisfactory where the evidence shows that the candidate can, for any selected waste management pollution control system:

- ◆ describe a pollution control wastes management system
- ◆ describe the advantages/disadvantages of the system.
- ◆ describe in general terms both the capital and the operational costs of the system
- ◆ evaluate efficacy of the system

Evidence should be generated through assessment under controlled conditions.

Assessment Guidelines

The assessment for this Outcome can be combined with Outcomes 1, 2, and 3. Candidates may provide evidence to demonstrate their knowledge and/or skills by producing a report describing a pollution control wastes management system.

If a single assessment event is used to cover Outcomes 1, 2, 3 and 4, the candidate's response should be in the form of a report of approximate 2,000 words.

Candidates may bring one sheet of A4 paper to the assessment event.

If separate assessment events are chosen for learning Outcomes 1, 2, 3 and 4 the candidates' response should be:

- Outcome 1 — approximately 600 words
- Outcome 2 — approximately 400 words
- Outcome 3 — approximately 400 words
- Outcome 4 — approximately 600 words

A checklist may be used to ensure that all the required knowledge and skills have been appropriately and accurately included in the report.

Administrative Information

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Higher National Unit specification: support notes

Unit title: Wastes Industry: Applying Environmental Science to the Management of Wastes

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 80 hours.

Guidance on the content and context for this Unit

The aim of this Unit is to give candidates sufficient knowledge so that they will be able to understand and explain the scientific concepts and issues underlying the theory and practice of Wastes Management. Candidates will also have the opportunity to study one or more Pollution Control or Wastes Management system in depth and to report on the scientific principles underpinning the system and evaluate the systems effectiveness in applying these scientific principles to the control of pollution or Wastes Management.

Outcome 1

Candidates should gain knowledge of fundamental chemical and biological concepts which underlie pollution control and Wastes Management systems. This should include some knowledge of a representative selection of the biological organisms (including growth factors and microbial succession) and chemicals that have an environmental effect (including LD50 data etc.), as well as noise pollution, that may be monitored and controlled as part of Pollution Control and Environmental Management systems. The emphasis and context should be on the application or relevant importance of these concepts to Wastes Management and the control of pollution. An introduction to the concept of environmental cycles, particularly the Water Cycle should be given. At the end of this Outcome candidates should be able to explain the scientific principals and concepts detailed in the knowledge and skills.

Outcome 2

Candidates should gain a knowledge of, and be able to discuss, the causes of pollution and the techniques used to sample solids, liquids and gasses. A simple treatment of sampling strategy is sufficient. Systems used to monitor Chemical, Biological and Noise pollution should be covered. A simple treatment of a selection of modern analytical methods should be discussed such as spectroscopic and chromatographic techniques and the uses to which such analyses may be put, should be given. At the end of this Outcome candidates should be able to give a brief outline explanation of the causes of pollution, the importance of sampling and details of sampling methods and a brief explanation of the science underpinning pollution monitoring.

Outcome 3

Sources of pollution should be covered as should the way in which effluents and wastes may be pre-treated to mitigate their environmental impact. Pollution reduction should include a detailed study of the wastes treatment methods available and currently used by the Wastes Industry to reduce pollution. Delivery should focus on reduction and treatment methods uses to deal with both domestic and industrial wastes including incineration and landfill. Methods used for the control of noise should be included. At the end of this Outcome candidate should be able to explain the principals behind pollution control methodologies.

Higher National Unit specification: support notes

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Outcome 4

Candidates should be supported and advised in selecting one, or at the most, two, Pollution Control method(s) and/or Wastes Management System(s) as a topic for their report. They should investigate the system in such depth that they can report on and describe the system as it is used in the Wastes Industry. Candidates should also be able to describe and explain the underlying chemistry and/or biological principles on which the system relies. In so doing, the candidate will use at least four of the knowledge and skills items from Outcome 1 and at least two of the knowledge and skills items from Outcomes 2 and 3 and all of the knowledge and/or skills from Outcome 4. The report should also evaluate the Cost/Benefit of the chosen system and its effectiveness.

Guidance on the delivery and assessment of this Unit

This Unit is primarily designed to prepare candidates for employment in the Wastes Industry or related areas. The emphasis should be on encouraging the learner to think about the scientific principles underlying practice in the Wastes Industry.

Independent study should be encouraged by using candidate-centred, resource based methodologies.

It is recommended that the teaching and learning of this Unit is sequenced as in the learning Outcomes; however it may be possible to develop different and novel strategies which require a non-linear delivery of the Outcomes. If a final report is used as the instrument of assessment then it will be necessary to cover all the knowledge and skills of each Outcome before assessment takes place.

This Unit may be assessed by a report involving an evaluation of a Pollution Control or Wastes Management System. The report will allow candidates to show evidence that they can meet the requirements of Outcomes 1, 2 and 3 on a sampled basis and all of the knowledge and/or skills from Outcome 4.

The use of a checklist would be beneficial in ensuring all the required Knowledge and Skills are included accurately and appropriately in the report as detailed in the Evidence Requirements.

Evidence should be generated through assessment under controlled conditions. Candidates may bring one sheet of A4 paper to the assessment event, which contains information they will require to complete the report under controlled conditions.

Opportunities for developing Core Skills

The delivery and assessment of this Unit may contribute towards the Components *Written Communication* of the Core Skills *Communication* at SCQF level 6. This is particularly relevant if a written report was used as the instrument of assessment for the Unit since the general skill for this Core Skills component is 'Produce well-structured written communication on complex topics'.

Higher National Unit specification: support notes (cont)

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In both formative and summative assessment the candidate should be encouraged to present all essential ideas/information and supporting detail in a logical and effective order; use a structure that takes account of purpose and audience and links major and minor points in ways which assist the clarity and impact of the writing; use conventions which are effective in achieving the purpose and adapted as necessary for the target audience and use spelling, punctuation and sentence structures which are consistently accurate.

These skills can be developed through formative activities, such as short essays/reports on each theory or debate/issue, without being formally assessed for certification of Core Skill.

It is most important that candidates are encouraged to use an appropriate referencing method for their report (and for any formative work).

The delivery and assessment of this Unit could also contribute towards the component *Critical Thinking* of the Core Skill *Problem Solving* at SCQF level 6, because of the requirement 'Describe a Pollution Control Waste Management system', (Outcome 4). The general skill for this component is to 'Identify and assess the relevance of the factors involved in a situation/issue and to develop and justify an approach to deal with this situation/issue.' Thus, when describing a waste management system (situation/issue), the relevance of the various scientific factors can be evaluated to provide a solution. Similarly, a contribution may be made towards the Core Skills *Problem Solving* component 'Reviewing and Evaluating' at SCQF level 6, whilst discussing the effectiveness and benefit of the chosen solution when completing Outcome 4.

There may be opportunity to develop general Core Skills in *Numeracy* component *Using Number* whilst overtaking Outcome 1 (for example in the study of pH), and the component *Using Graphical Information* when developing the overall assessment report.

Open learning

This Unit is well suited for delivered by Open or Distance learning methods using paper based learning materials or through a virtual learning environment. Centres who wish to offer this Unit by open learning should note however the requirement for this Unit to be assessed under controlled conditions.

If this Unit is delivered by open or distance learning methods, additional planning and resources may be required for candidate support, assessment and quantity assurance.

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

General information for candidates

Unit title: Wastes Industry: Applying Environmental Science to the Management of Wastes

This is a two credit SQCF level 7 Unit intended to be delivered as part of a HNC Wastes Management qualification. It is designed to give you a basic knowledge of the scientific concepts underpinning Pollution Control and Wastes Management systems

In **Outcomes 1** you will learn about many of the fundamental scientific concepts and issues, chemicals and organisms which can have an environmental impact and are therefore controlled or used by the Wastes Industry to control pollution.

In **Outcome 2** you will learn about the causes of pollution and methods used to sample, monitor and analyse the environment, while in **Outcome 3** the focus will be on the methods currently used to control or treat the hazardous components of Wastes whether Industrial or Domestic.

Outcome 4 will give you the opportunity apply the knowledge and skills developed in Outcomes 1, 2 and 3 to describe the science behind Pollution Control and/or Wastes Management systems and to evaluate the effectiveness of the system.

Assessment

The Unit may be assessed by a report involving an evaluation of a Pollution Control or Wastes Management System. In writing this report you will incorporate much of the knowledge and skills of Outcomes 1, 2 and 3 and all of the knowledge and skills of Outcome 4. The report itself will be completed by you under controlled conditions however, you will be allowed to bring one sheet of A4 paper, containing notes and references into the Assessment event.