SQA Advanced Unit Specification

General information for centres

Unit title: Environmental Sampling and Analysis

Unit code: HV0V 48

Unit purpose: This Unit is designed to give candidates the knowledge and skills necessary to enable them to design, perform, and report investigations into environmental pollutants. It is intended for candidates who expect to take up technician level posts in environmental science or progress to higher level courses.

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

1 Design an investigation analysing the impact of a selected environmental pollutant on a particular area.
2 Perform a range of experiments investigating environmental pollution and analyse the results.

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: Access to this Unit is at the discretion of the centre, however it would be beneficial if candidates had successfully completed the first year of the SQA Advanced Diploma in Environmental Sciences. When this unit is delivered as a stand alone unit candidates should have achieved a minimum of Higher Chemistry (SCQF level 6) or equivalent.

Core Skills: There may be opportunities to gather evidence towards Core Skills of Problem Solving and Working with Others at SCQF level 6 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.

Assessment: Outcome 1 should be assessed by means of a case study. Outcome 2 will be assessed using a range of practical activities. Candidates should be assessed both on their practical ability and on the quality of their reports. The assessment of this Unit may be integrated with the assessment of Environmental Chemistry.

SQA Advanced 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

Design an investigation analysing the impact of a selected environmental pollutant on a particular area

Knowledge and/or skills

- sampling schemes
- sample collection, handling and storage
- sample analysis
- legislation
- descriptions of pollutants

Evidence Requirements

Candidates will need to provide evidence to show that they can design an investigation to analyse the impact of a selected pollutant on a particular area.

Examples of suitable topics for investigation are given in the support notes.

The evidence should include:

- design of a suitable sampling scheme
- methods for sample collection, handling and storage
- suitable methods of analysis, including sample pre-treatment if appropriate
- legislation relating to the pollutant under investigation
- brief description of pollutant under investigation, including the main sources, effects and methods of control

The candidate will be required to demonstrate his/her knowledge and/or skills by providing a response of approximately 1,000 words, relating to a contextualised case study of a selected environmental pollutant. The case study should offer sufficient information to allow candidates to present an informed solution and analysis. This may include a map of the survey area, giving details of topography and current and former land use as appropriate.

The assessment of this Outcome should be undertaken by a case study. Candidates are permitted to complete the assessment in their own time under non-controlled conditions.

The assessment of this Outcome may be integrated with the assessment of Environmental Chemistry.

Assessment guidelines

The assessment of this Outcome should encourage the candidate to develop skills in information collection and presentation. Candidates may make use of any appropriate reference material to complete the case study, however a bibliography detailing all reference material used in completing the assessment must be included, and the case study must be the individual work of the candidate.

The case study should be structured to give information both on the sources of the selected environmental pollutant and details of the area under investigation, for example, giving topographical details and current and/or former land uses in order to allow the candidates to reach an informed decision, and devise an appropriate investigation covering all aspects of the Evidence Requirements.

The assessment of Outcome 1 may be integrated with the assessment for Environmental Chemistry.

Outcome 2

Perform a range of experiments investigating environmental pollution and analyse the results

Knowledge and/or skills

- Pollution — air, land, water
- Planning
- Environmental sampling
- Sample transport
- Samples analysis
- Reporting
- Data analysis

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can perform a minimum of four experiments investigating environmental pollution, and analyse the results. These should include one technique each for air, land and water. Examples of experiments suitable for inclusion in this Unit are given in the support notes.

Candidates should be assessed on both their performance in completing the practical work and on their ability to produce satisfactory reports of each experiment. The reports should be approximately 500 words and should include an analysis of the results.

Candidates will need evidence to demonstrate their knowledge by showing that they can:

- plan experimental work in order to answer the investigation aims
- use sampling techniques appropriate to the pollutant under investigation
- transport samples using containers and techniques appropriate to the pollutant under investigation
- analyse samples using methods appropriate to the pollutant under investigation
- critically analyse results and relate them to the investigation aims
- relate results to legislative limits, where appropriate

A checklist and record of results should be used to assess performance in completing the practical aspects of the investigation. A report of each investigation should be produced to assess the candidate's ability to plan, analyse and discuss experimental work. The report should be in an appropriate scientific format and should include an analysis of the results, in terms of the conclusions that can be drawn from them.

Assessment guidelines

It is recommended that candidates perform a variety of experiments from the list provided in the support notes, but only four should be used for assessment purposes.

Candidates are permitted to work as part of a group in order to plan, and complete the sampling and analysis aspects of the experiment, but should produce an individual report of each experiment.

Administrative Information

Unit code: HV0V 48

Unit title: Environmental Sampling and Analysis

Superclass category: QC

Date of publication: November 2017

Version: 01

Source: SQA

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

FURTHER INFORMATION: 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: Environmental Sampling and Analysis

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

Outcome 1

Candidates will receive underpinning knowledge on:

- theoretical and practical sampling techniques, including subjective and random (simple, stratified and systematic)
- methods of air, water and soil sampling
- sample collection, handling and storage
- sample analysis
- overview of the legislative framework relevant to pollution as well as specific legislation relating to various pollutants (drinking water, air, land)
- descriptions of selected pollutants, including the sources, effects and methods of control

Suitable environmental pollutants for inclusion in the case study could include either a selected organic pollutant (eg pesticides, dioxins, pcb's, VOC's, endocrine disruptors) or an inorganic pollutant (eg nitrate, phosphate, heavy metals).

Outcome 2

Candidates should be introduced to a variety of practical field based and laboratory-based techniques for analysing environmental samples. These should include portable meters (pH, conductivity, chemical test kits, portable spectrophotometer), atomic absorption spectroscopy, uv/vis spectroscopy, ion chromatography, gravimetric analysis, B.O.D and C.O.D analysis.

Suitable experiments could include:

- nutrient levels (nitrate and phosphate) in freshwater
- lead levels in drinking water
- sulphur dioxide levels in air
- metal levels in urban soil/vegetation
- B.O.D in freshwater
- C.O.D in freshwater
- airborne dust
- determination of solvents in effluent samples
- analysis of trace organic compounds in waste water

Where appropriate candidates should be encouraged to work as part of a group when collecting environmental samples.

Further evidence may be generated while undertaking the Environmental Chemistry Unit.

Guidance on the delivery and assessment of this Unit

This Unit forms part of the SQA Advanced Diploma in Environmental Sciences, which is primarily designed to prepare candidates for employment in a science related post. The emphasis should be on encouraging students to develop practical skills in environmental sampling and analysis and to encourage the development of critical analysis of the results, including the limitations placed upon the interpretation of results due to sampling and analysis errors.

While independent study should be encouraged within the limitations of carrying out environmental analysis by using candidate-centred, resource based methodologies where appropriate, candidates should be encouraged to carry out the practical aspects of the experiments as part of a group.

Outcome 1 is assessed using a contextualised case study, requiring a candidate response of approximately 1,000 words. In Outcome 2 the candidate should be assessed on both their ability to plan and carry out experimental work, as well as report results. Reports should include a critical analysis of the results. Should a candidate fail to carry out 4 experiments to the required standard, further attempts can be offered. Ideally candidates will participate in a variety of experiments with only four required for assessment purposes.

Open learning

If this Unit is delivered by open or distance learning methods, additional planning 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.

For further information and guidance, please see Assessment and Quality Assurance of Open and Distance Learning (SQA, February 2001, publication code A1030).

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: Environmental Sampling and Analysis

This is a one-credit SQCF level 8 unit intended to be delivered as part of the SQA Advanced Diploma in Environmental Sciences.

On completion of this unit you should be able to:

1 Investigate procedures for analysing environmental pollutants.

You will complete a case study relating to the sampling and analysis of a selected environmental pollutant.

2 Take and analyse various environmental samples.

You will carry out a series of four practical experiments which will involve planning, sampling and analysing real environmental samples. These will come from a variety of sources (air, water, soil, vegetation), and will be analysed for the presence of environmental pollutants for example nitrates and phosphates, lead, sulphur dioxide.

3. Report on the experiment and evaluate the results.

You will produce a series of reports of the experiments carried out in which you will describe the procedures used and evaluate to results obtained.

As part of this Unit you will receive underpinning knowledge on sampling techniques, methods of sampling, sample collection and storage, methods of analysis, and descriptions of selected pollutants and details of legislation relating to pollutants and levels permitted in the environment.