

## **SQA Advanced Unit Specification**

### **General information for centres**

**Unit title:** Hazard and Plant Safety Engineering

**Unit code:** HV64 47

**Unit purpose:** This Unit is designed to enable candidates to gain knowledge and understanding of hazard and plant safety engineering and apply that knowledge to industrial situations.

On completion of this Unit the candidates should be able to:

- 1 Explain the hazards associated with flammable dusts and flammable gases.
- 2 Explain the effects of wind, temperature and pressure on flammable dusts and flammable gases.
- 3 Minimise risk by site planning and staff training.

**Credit points and level:** 1 SQA Credit at SCQF level 7: (8 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 National 1 to Doctorates.*

**Recommended prior knowledge and skills:** Access to this Unit will be at the discretion of the centre and the following recommendations are for guidance only. Candidates should have a basic knowledge of Measurement and Control Engineering. This may be evidenced by the possession of Higher Process Measurement or Higher Process Control or NQ units in Measurement and Control or NC Measurement and Control or NC Multidisciplinary Engineering.

**Core Skills:** There are opportunities to develop the Core Skills of Written Communication (Writing) and Written Communication (Reading) 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.

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**Assessment:** All assessments could be assessed holistically with an integrated end test lasting three hours consisting of a balance of short answer, restricted response and structured questions. Alternatively, individual assessments of one hour duration could be used for each Outcome consisting of a balance of short answer, restricted response and structured questions. The assessments should be conducted under controlled supervised conditions. A case study could be used for Outcome 3.

**Unit specification: statement of standards**

**Unit title:** Hazard and Plant Safety Engineering

**Unit code:** HV64 47

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 the hazards associated with flammable dusts and flammable gases

**Knowledge and/or skills**

- ◆ Flammability diagrams
- ◆ Ignition sources
- ◆ Vapour cloud explosions
- ◆ Explosion pressures

**Evidence Requirements**

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions.

Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above.

In any assessment three out of the four knowledge and/ or skills should be sampled.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of three out of the four knowledge and/ or skills is required each time the Outcome is assessed.

Candidates must provide a satisfactory response to all three items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

- ◆ compare flammability diagrams for different substances
- ◆ explain some measures taken to prevent ignition of flammable dusts and flammable gases
- ◆ explain the properties of a vapour cloud explosion
- ◆ compare explosion pressures for different substances

Evidence should be generated through assessments undertaken in controlled supervised conditions.

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### **Assessment guidelines**

Assessments should be conducted under closed book conditions and as such candidates must not be allowed any text books, handouts or notes in the assessment.

Questions used to elicit candidate evidence may take the form of short answer, restricted response and structured questions.

The assessment for Outcome 1 could be integrated with Outcomes 2 and 3 into an end of Unit assessment of no more than three hours. Alternatively, an individual assessment of one hour duration could be used for Outcome 1.

### **Outcome 2**

Explain the effects of wind, temperature and pressure on flammable dusts and flammable gases

#### **Knowledge and/or skills**

- ◆ Effect of pressure and temperature on flammability limits
- ◆ Effect of temperature on rate of heat generation
- ◆ Liquid and vapour phase

#### **Evidence Requirements**

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions.

Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above.

In any assessment two out of the three knowledge and/or skills should be sampled.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of two out of the three knowledge and/or skills is required each time the Outcome is assessed.

Candidates must provide a satisfactory response to both items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

- ◆ compare the effects of pressure and temperature on flammability limits for different substances
- ◆ explain the effect of temperature on the rate of heat generation
- ◆ explain a liquid/vapour phase diagram for a given substance

Evidence should be generated through assessments undertaken in controlled supervised conditions.

## **SQA Advanced Unit Specification**

### **Assessment guidelines**

Assessments should be conducted under closed book conditions and as such candidates must not be allowed any textbooks, handouts or notes in the assessment.

Questions used to elicit candidate evidence may take the form of short answer, restricted response and structured questions.

The assessment for Outcome 2 could be integrated with Outcomes 1 and 3 into an end of Unit assessment of no more than three hours. Alternatively, an individual assessment of one hour duration could be used for Outcome 2.

### **Outcome 3**

Minimise risk by site planning and staff training

#### **Knowledge and/or skills**

- ◆ Site plan structures
- ◆ Toxic gas release
- ◆ Effect of wind on dispersion of toxic gases
- ◆ Vent design parameters
- ◆ Safe start up/shut down procedures
- ◆ Energy and rescue teams
- ◆ Personal safety

#### **Evidence Requirements**

It should be noted that the candidates must achieve all the minimum evidence specified in order to pass the Outcome.

Candidates will require evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ analyse a given site plan
- ◆ explain the hazards associated with a toxic gas release
- ◆ explain the effect of atmospheric conditions and wind on toxic gas dispersion
- ◆ explain the importance of design in reducing explosion damage
- ◆ explain the importance of safe start up/shut down procedures
- ◆ explain the requirements for a rescue team
- ◆ explain the requirements for personal safety

Evidence should be generated through assessments undertaken in controlled supervised conditions.

## **SQA Advanced Unit Specification**

### **Assessment guidelines**

Assessments should be conducted under closed book conditions and as such candidates must not be allowed any text books, handouts or notes in the assessment. Questions used to elicit candidate evidence may take the form of short answer, restricted response and structured questions.

The assessment for Outcome 3 could be integrated with Outcomes 1 and 2 into an end of Unit assessment of no more than three hours. Alternatively, this Outcome may be assessed by means of a case study and candidates answer questions based on it.

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### Administrative information

<b>Unit code:</b>	HV64 47
<b>Unit title:</b>	Hazard and Plant Safety Engineering
<b>Superclass category:</b>	PL
<b>Original date of publication:</b>	November 2017
<b>Version:</b>	01

### History of Changes:

Version	Description of change	Date

**Source:** SQA

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**FURTHER INFORMATION:** Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

### Unit specification: support notes

#### Unit title: Hazard and Plant Safety Engineering

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

This Unit has been written in order to allow candidates to develop knowledge, understanding and skills in the following areas:

- 1 The hazards associated with flammable dusts and flammable gases.
- 2 The effects of wind, temperature and pressure on flammable dusts and flammable gases.
- 3 How to minimise risks by site planning and staff training.

The Unit is at SCQF level 7 and the Unit has been developed as part of the SQA Advanced Certificate/Diploma in Measurement and Control Engineering award. However this does not preclude the use of this Unit in other awards where award designers feel it is appropriate.

In designing this Unit, the writer has identified the range of topics that they would expect to be covered by lecturers. The writer has also given recommendations as to how much time should be spent on each Outcome. This is done to help lecturers to decide what depth of treatment should be given to the topics attached to each Outcome.

A list of topics for each Outcome is given below.

#### Outcome 1

Explain the hazards associated with flammable dusts and flammable gases (15 hours)

- ◆ flammable dusts — conditions required for dust to burn/explode
- ◆ common flammable dusts
- ◆ dangers associated with dust explosions and the need for good housekeeping to reduce dust
- ◆ venting of dust explosions and insertion of flame suppressants
- ◆ Staub classification and vent design parameters
- ◆ flammability diagrams — the importance of upper and lower flammable limits and ignition energy required and minimum ignition energy
- ◆ comparison of flammability diagrams for different substances
- ◆ potential sources of ignition — electrical equipment, hot surfaces, naked flame etc
- ◆ vapour cloud explosions — sequence of events and calculations
- ◆ discharge rate, evaluation of release rate, radiation/temperature relationship
- ◆ factors affecting formation of vapour cloud explosions
- ◆ explosion pressure and rate of pressure rise
- ◆ blast damage, effects on plant and personnel

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### Outcome 2

Explain the effects of wind, temperature and pressure on flammable dusts and flammable gases (15 hours)

- ◆ the effect of temperature and pressure on flammability limits
- ◆ the effect of temperature on rate of heat generation
- ◆ categorisation of the atmosphere
- ◆ dispersion and concentration predictions
- ◆ liquid and vapour phase — use of phase diagrams
- ◆ condensed and vapour phase properties

### Outcome 3

- ◆ site plan structures
- ◆ industrial process — chemical processing and hydrocarbon processing
- ◆ storage of chemicals/hazardous materials
- ◆ planning of site to minimise risk and to minimise damage to personnel/plant/environment in case of accident
- ◆ hazards associated with toxic gases
- ◆ toxic gas release — Probit method for toxic gas assessment
- ◆ the effect of wind on gas dispersion
- ◆ training of personnel in personal safety including correct approval COSHH regulations
- ◆ training of personnel in plant safety
- ◆ need for and training of rescue teams

Outcome 1 one hour closed book

Outcome 2 one hour closed book

Outcome 3 one hour closed book or a case study

OR Integrated assessment of Outcome 1, 2 and 3 lasting 3 hours.

## Guidance on the delivery and assessment of this Unit

It is intended that this Unit is presented in the context of applying hazard awareness to industrial situations.

In the delivery candidates should have access to industrial plant diagrams.

This Unit has been written to incorporate sufficient time to allow the lecturer to teach, in a student centred way, the factors that contribute to safety in a potentially dangerous working environment.

The content of each Outcome means that they are best delivered in order. The assessment for all Outcomes will be individual closed book papers lasting approximately one hour each. Outcome 3 may be assessed by means of a case study. All three Outcomes may be assessed using an integrated closed book assessment of approximately three hours.

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Details on approaches to assessment are given under Evidence requirements and Assessment guidelines under each Outcome in the SQA Advanced Unit specification: Statement of Standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates.

### ***Opportunities for developing Core Skills***

There are opportunities to develop the Core Skills of Written Communication (Writing), Written Communication (Reading) and Problem Solving (Critical Thinking) at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

### **Open learning**

This Unit could be delivered by distance learning, which may incorporate some degree of on-line support. With regard to assessment, planning would be required of the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that assessments were conducted under controlled, supervised conditions.

For information on open learning, please refer to *SQA guide assessment and quality assurance of open and distance learning (A1030, Feb 2001)*.

### **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](http://www.sqa.org.uk/assessmentarrangements).

### General information for candidates

#### **Unit title:** Hazard and Plant Safety Engineering

This Unit has been designed to provide you with knowledge and skills that will enable you to understand the hazards associated with flammable dusts, flammable gases and toxic gases in industrial situations. You will refer to the relevant regulations throughout this Unit. This Unit may be assessed using one written assessment covering all three Outcomes or by three separate assessments covering one Outcome each. All assessments will be undertaken under supervised conditions. You will not be allowed to take notes, handouts, textbooks, etc. into the assessment. A case study may be used to assess Outcome 3.

In Outcome 1 you will learn about flammable dusts and flammable gases. You will cover different properties of each and the hazards they can present in industrial situations. In Outcome 2 you will learn how pressure and temperature can affect the properties of the items mentioned in Outcome 1. You will also cover the phase relationship between a liquid and vapour. In Outcome 3 you will learn how site planning can be used to minimise accidents happening by appropriate risk assessment and how the effects of an accident can be minimised by site planning. You will also cover the effect of wind on the dispersion and dilution of toxic gas clouds. You will also cover the training requirements for personnel and the need for emergency and rescue teams.

If individual assessments are used, they will be taken at the end of each Outcome. If one assessment is used for the whole Unit, it will be taken at the end of the Unit.