

Cambridge TECHNICALS LEVEL 3

APPLIED SCIENCE

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Unit 16

Waste management

R/507/6163

Guided learning hours: 60

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Essential resources required for this unit: A functioning laboratory for purposes of carrying out water and air emission testing. It may also be useful to have access to water test kits and water quality analysis equipment such as meters, oxidising and non-oxidising biocide test kits, comparator tests, corrosion monitoring services, portable incubators, microbiology monitoring equipment, hand held electronic meters, test strips, titration tests.

This unit is internally assessed and externally moderated by OCR.

UNIT AIM

Waste management is the collection, transport, processing or disposal of waste materials, usually ones produced by human activity, in an effort to reduce their effect on human health or local aesthetics or amenities. The aim of this unit is for you to develop knowledge and understanding of management of solid waste, air emissions and water discharges and to gain an understanding of the processes used by people in industry to minimise waste.

You will carry out air and water tests safely using industry scientific techniques. You will collect and analyse your own data

TEACHING CONTENT

The teaching content in every unit states what has to be taught to ensure that learners are able to access the highest grades.

Anything which follows an i.e. details what must be taught as part of that area of content. Anything which follows an e.g. is illustrative, it should be noted that where e.g. is used, learners must know and be able to apply relevant examples in their work, although these do not need to be the same ones specified in the unit content.

For internally assessed units you need to ensure that any assignments you create, or any modifications you make to an assignment, do not expect the learner to do more than they have been taught, but must enable them to access the full range of grades as described in the grading criteria.

Learning outcomes	Teaching content
The Learner will:	Learners must be taught:
1 Understand how to manage waste	<p>1.1 Waste disposal, methods i.e.:</p> <ul style="list-style-type: none"> • landfill • incineration • biological reprocessing <p>1.2 Factors and considerations of waste disposal i.e.:</p> <ul style="list-style-type: none"> • biodegradability of waste types • amount of land used • costs (e.g. Landfill tax, amenity value of former landfill sites) • nuisance (e.g. from transport and seagulls) • pollutants (e.g. ground water contamination, gas production) • approved designs • incineration with and without energy recovery <p>1.3 Biological reprocessing e.g. composting of food waste</p> <p>1.4 The contribution of waste management strategies to sustainability.</p> <p>1.5 The application waste hierarchy in context (5 steps) i.e.:</p> <ul style="list-style-type: none"> • prevent • reuse • recycle • recover • dispose <p>1.6 Appropriate storage i.e.:</p> <ul style="list-style-type: none"> • segregation • choice of storage area

Learning outcomes	Teaching content
The Learner will:	Learners must be taught:
	<p>1.7 Administration of industrial waste disposal i.e.:</p> <ul style="list-style-type: none"> • duty of care • classification (e.g. hazardous/non-hazardous) • contractors for moving and disposing of waste • description of waste • hazardous waste disposal (e.g. biohazard, radioactive) • non-hazardous waste (e.g. transfer notes/season ticket system)
<p>2 Understand how to manage air emissions</p>	<p>2.1 Industrial sources of emissions e.g. stacks, flues, vents</p> <p>2.2 Pollutant type i.e.:</p> <ul style="list-style-type: none"> • particulate • gas <p>2.3 Approved methods for measuring air emissions of given pollutants i.e.:</p> <ul style="list-style-type: none"> • Environment Agency of England & Wales (EA) Monitoring Certification Scheme (MCERTS) • Operator Monitoring Assessment (OMA) <p>2.4 Methods used to minimise specific types of emissions (e.g. combustion, particulates, dust, toxic gas) i.e.:</p> <ul style="list-style-type: none"> • electrostatic precipitator • fabric filter • wet scrubber • adsorption tower • thermal incineration • catalytic combustion <p>2.5 The use of environmental permits i.e.:</p> <ul style="list-style-type: none"> • specific permits on the public register (e.g. process descriptions, methods of minimising pollution, specific limits for pollutants, how monitoring will be carried out and reported)

Learning outcomes	Teaching content
The Learner will:	Learners must be taught:
<p>3 Understand how waste water is managed</p>	<p>3.1 Properties of typical discharges to controlled waste waters i.e.:</p> <ul style="list-style-type: none"> • flow rate • total volume • variability of composition • pH • dissolved solids • conductivity • chemical oxygen demand (COD) • suspended solids • metals especially Hg and Pb • total organic carbon (TOC) • phenols • phosphorus compounds <p>3.2 How effluent is treated i.e.:</p> <ul style="list-style-type: none"> • effluent treatment on site • treatment by Water company • skimming off oils and greases • sedimentation to remove solids • activated sludge treatment to digest organic • filtration • oxidation <p>3.3 The need for companies to have a consent to discharge to sewer where appropriate</p> <p>3.4 Wastewater management strategies i.e.:</p> <ul style="list-style-type: none"> • measurement of water consumption • reusing water in applications where lower quality is acceptable (e.g. reuse cooling water, rainwater) • segregation of waste discharges to prevent to clean water contamination • use of an effluent pit to allow suspended solids to settle <p>3.5 Benefits of minimising water use i.e.:</p> <ul style="list-style-type: none"> • reduction in charges for using less water • reduction in waste water treatment charges

Learning outcomes	Teaching content
The Learner will:	Learners must be taught:
<p>4 Be able to test air and water emissions</p>	<p>4.1 Emissions i.e.:</p> <ul style="list-style-type: none"> • air (e.g. gas, particulate) • water (e.g. dissolved solids, suspended solids, phenols, nitrates, phosphates) <p>4.2 To apply safe working practices in the field and laboratory i.e.:</p> <ul style="list-style-type: none"> • health and safety (risk assessment) <p>4.3 Data collection techniques i.e.:</p> <ul style="list-style-type: none"> • sampling • qualitative and quantitative laboratory techniques <p>4.4 Recording Information i.e.:</p> <ul style="list-style-type: none"> • qualitative and quantitative data • systematic recording

GRADING CRITERIA

LO	Pass	Merit	Distinction
	The assessment criteria are the Pass requirements for this unit.	To achieve a Merit the evidence must show that, in addition to the Pass criteria, the candidate is able to:	To achieve a Distinction the evidence must show that, in addition to the pass and merit criteria, the candidate is able to:
1. Understand how to manage waste	*P1: Describe the waste disposal methods available to a business	M1: Explain the benefits of using waste management methods	D1: Analyse the environmental impact of the waste produced by an organisation
	*P2: Describe factors and considerations when disposing of waste		
	*P3 Identify ways a business could minimise waste		
2. Understand how to manage air emissions	*P4: Describe the types of air pollutants from a business	M2: Explain how a specific environmental permit is used	D2: Evaluate the roles of regulators in minimising the impact on the environment
	*P5: Describe methods used to minimise emissions to the atmosphere by businesses		
3. Understand how waste water is managed	*P6: Describe how water is used and discharged by a business	M3: Explain the strategy used by a business to control water consumption and minimise harmful discharges	
	*P7: Identify how a business may reduce water consumption and discharges		
4. Be able to test air and water emissions	*P8: Carry out an environmental investigation, to include field and laboratory work which produces both qualitative and quantitative data	M4: Analyse results from the investigation	.

ASSESSMENT GUIDANCE

Learners must base their evidence on the practice at one or more specific businesses that they have researched and, ideally also visited. The businesses do not require to have laboratories or to be based on science. Suitable businesses are likely to be involved in manufacturing. It would be advisable to concentrate on smaller businesses in order to reduce the complexity of the detail observed.

LO1 This outcome relates to waste that goes in bins, rather than up chimneys or down drains. To achieve P1, learners must understand the manufacturing process in sufficient detail to allow the waste streams to be described. To achieve P2, learners must describe the steps involved in disposing of waste at the site, including hazardous waste if this is appropriate. Learners should consider the process that the waste manager uses in order to comply with legislation. To achieve P3, the learner must identify areas where he/she has noticed that waste could be minimised. If the learner judges that waste minimisation has been optimised, he/she should identify that is the case. To achieve M1, the learner must explain why strategies, such as audit, quantifying waste and setting targets for its reduction, identifying waste streams, including packaging, assigning ownership are likely to be of benefit to the company. Classifying waste as hazardous or non-hazardous is not necessarily straightforward as there are usually instances where both types of waste are produced by a company. To achieve D1, the learner must analyse the environmental impact of the waste produced by a company. This could include analysis of the amounts and trends in the amounts sent to landfill and to landfill specialising in hazardous waste, and whether waste is disposed of by other methods such as composting or incineration. The learner must include the advantages and disadvantages of these disposal methods and an analysis of whether the method with least impact on the environment is being used in each case.

LO2 This outcome is based on emissions to air. It may be necessary for the learner to research a different company in order to tackle this outcome. Once again, the learner must describe practice in a specific business with a permit in relation to air emissions. The learner must describe the pollutants that may be emitted and from where (stack, vent etc.) they may be emitted in order to achieve P4. To achieve P5, he/she must describe the specific control measures adopted by the business to minimise emissions and must also describe how the permitting process is a control measure. To achieve M2, the learner should have access to a specific permit from the public register. He/she must explain how it is laid out in terms of its sections and the information provided on the operation of the process and the limits, controls and monitoring requirements. To achieve D2, learners will appreciate the benefits of regulators on minimising air emissions.

LO3 relates to management of water in a specific business. This business may be different from that/those investigated for air emissions and waste. To achieve P6, the learner must describe where water is used in the business and also what happens to the water after it is used – reuse/discharge to controlled waters or sewer? To achieve P7, the learner must identify ways in which water may be used more efficiently in terms of consumption and discharge. To achieve M3, the learner should have identified that the business that has been researched, plans its water use and discharge and must be able to explain the effects of the strategy adopted. If the strategy is not effective, the learner would be expected to explain why that strategy has not been effective.

LO4 The learner is expected to carry out a realistic waste audit for a business and report in an appropriate style back to the business on their findings.

Feedback to learners: you can discuss work-in-progress towards summative assessment with learners to make sure it's being done in a planned and timely manner. It also provides an opportunity for you to check the authenticity of the work. You must intervene if you feel there's a health and safety risk.

Learners should use their own words when producing evidence of their knowledge and understanding. When learners use their own words it reduces the possibility of learners' work being identified as plagiarised. If a learner does use someone else's words and ideas in their work, they

must acknowledge it, and this is done through referencing. Just quoting and referencing someone else's work will not show that the learner knows or understands it. It has to be clear in the work how the learner is using the material they have referenced to inform their thoughts, ideas or conclusions.

For more information about internal assessment, including feedback, authentication and plagiarism, see the centre handbook. Information about how to reference is in the OCR Guide to Referencing available on our website: <http://www.ocr.org.uk/i-want-to/skills-guides/>.

SYNOPTIC LEARNING AND ASSESSMENT

It will be possible for learners to make connections between other units over and above the unit containing the key tasks for synoptic assessment. Please see Section 6 of the Qualification Handbook for more details. We have indicated in the unit where these links are with an asterisk.

Name of other unit and related LO	This unit:
Unit 1 Science fundamentals LO5 Understand the importance of inorganic chemistry in living systems	LO1 Understand how to manage waste (P1, P2, P3) LO2 Understand how to manage air emissions (P4, P5) LO3 Understand how waste water is managed (P6, P7)
Unit 2 Laboratory techniques LO1 Understand the importance of health and safety and quality systems to industry LO2 Be able to separate, identify and quantify the amount of substances present in a mixture LO3 Be able to determine the concentration of an acid or base using titration	LO4 Be able to test air and water emissions (P8)
Unit 3 Scientific analysis and reporting LO1 Be able to use mathematical techniques to analyse data LO2 Be able to use graphical techniques to analyse data LO4 Be able to analyse and evaluate the quality of data LO5 Be able to draw justified conclusions from data LO6 Be able to use modified, extended or combined laboratory techniques in analytical procedures LO7 Be able to record, report on and review scientific analyses	LO4 Be able to test air and water emissions (P8)

Name of other unit and related LO	This unit:
Unit 10 Testing consumer products LO1 Understand the influence of regulatory bodies on development of consumer products LO2 Understand how product testing determines the development of consumer products LO3 Be able to use quantitative titration techniques on consumer products LO4 Be able to use extraction and separation techniques on consumer products LO5 Be able to test the effectiveness of consumer product tests	LO4 Be able to test air and water emissions (P8)
Unit 13 Environmental surveying LO1 Understand environmental impacts of human activity and natural processes LO2 Understand environmental surveying LO3 Be able to use field and laboratory techniques to conduct an environmental investigation LO4 Be able to analyse and present and environmental survey findings	LO1 Understand how to manage waste (P1, P2, P3) LO2 Understand how to manage air emissions (P4, P5) LO3 Understand how waste water is managed (P6, P7) LO4 Be able to test air and water emissions (P8)
Unit 14 Environmental management LO1 Understand principal characteristics of environments LO2 Be able to identify pollution in the environment LO3 Understand how legislation, regulation and agreements impact on managing natural and built environments LO4 Understand environmental management assessments LO5 Be able to carry out an environmental management study	LO1 Understand how to manage waste (P1, P2, P3) LO2 Understand how to manage air emissions (P4, P5) LO3 Understand how waste water is managed (P6, P7) LO4 Be able to test air and water emissions (P8)
Unit 17 Food technology LO1 Understand the main features of food manufacturing operations	LO1 Understand how to manage waste (P1, P2, P3) LO2 Understand how to manage air emissions (P4, P5) LO3 Understand how waste water is managed (P6, P7) LO4 Be able to test air and water emissions (P8)

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