Unit 54: Monitoring and Analysing Engineering Activities

Unit code: M/600/0346

QCF Level 3: BTEC Nationals

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit aims to give learners the knowledge and skills they need to monitor a range of engineering activities in order to identify and rectify potential problems and risks.

Unit introduction

Engineers need to be able to monitor whatever they are doing, identify any problems and report their findings. Most engineering companies have standard approaches to monitoring and reporting on activities. If a problem is identified, engineers should know what to do to rectify the problem within a reasonable time frame whilst complying with relevant regulations, standards and guidelines. Because there are risks involved in any engineering activity, it is also important that engineers are aware of these risks and can make judgements about what to do based on outcomes of a risk analysis.

This unit will enable learners to monitor an engineering activity and know how to rectify any associated problems. The activity can be set in a variety of engineering contexts to meet the needs of individual learners and can include production, installation, operational, maintenance or capability/performance measurement. The problems encountered will vary according to the engineering activity undertaken, but may cover such things as equipment malfunction, environmental issues or be design related.

Learners will know about the correct use of monitoring and rectification related documentation, from reporting methods to ensuring compliance with relevant regulations, standards and guidelines.

Finally, learners will have an opportunity to carry out and report on a risk analysis of an engineering activity.

Learning outcomes

On completion of this unit a learner should:

1 Be able to monitor an engineering activity

2 Know how to rectify an engineering problem

3 Be able to use documentation for monitoring and rectification purposes

4 Be able to conduct and report on a risk analysis for an engineering activity.

Unit content

1 Be able to monitor an engineering activity

Monitoring process: ensuring effective supply and use of resources eg equipment, people, facilities, materials; verifying materials to be used are within specification eg documentation (such as work orders, contracts, memos, plans/designs, purchase orders), standard operating procedures (such as process control sheets/charts, quality standards), equipment or materials supplier information, schedules; recording any deviations; reporting problems which occur during the monitoring process; measuring the outputs of the engineering process and comparing these with specifications; confirming compliance with relevant regulations and guidelines; methodology eg observation, sampling, data collection

Activity: in engineering context eg production (such as processing materials, fabrication, finishing, assembly, joining), installation (such as commissioning/decommissioning, site preparation, equipment installation), operational (such as movement of materials, quality systems and audit, scheduled safety audits and risk assessments), maintenance (such as planned preventive maintenance (PPM), part or sub-assembly exchange, breakdown response maintenance records systems, line setting), equipment capability/ performance measurement

2 Know how to rectify an engineering problem

Rectification process: consulting relevant people about the extent of the problem and its impact on the engineering activity; gathering all appropriate information to help identify or clarify the problem; evaluating possible solutions eg temporary, short term, long term; selecting the most appropriate solution to rectify the problem; communicating the proposed solution to the relevant people (obtaining feedback where appropriate); preparing a plan of action for implementation of the agreed solution; ensuring the agreed solution is implemented correctly and promptly; monitoring outcomes of the rectification activity and making any necessary revisions to the plan of action; ensuring that the problem is rectified to the agreed level of acceptability

Engineering problems and disciplines: problems eg component/assembly, material handling devices, deviation from component/product specification, equipment malfunction, ergonomically related, utilities supply (such as gas, electricity, water, air), scheduling, safety related, lack of resources/materials, environmental (such as pollutants, temperature, irritants, waste materials), customer request, design related, deviation from departmental procedure(s); discipline eg production engineering, manufacturing operations, quality engineering, installation engineering, maintenance/plant engineering

3 Be able to use documentation for monitoring and rectification purposes

Monitoring report: confirming that the engineering methods used are appropriate; confirming that the outputs and materials used are within the required specification

Methods of reporting: verbal; other methods eg email, computer-based presentation, written or typed, company-specific form

Rectification information and solution: data sources eg statistical data, historical records, quality audits, operational procedures/manufacturing manuals, health and safety information, environmental documents; solution's compliance to relevant regulations, standards and guidelines eg international, national, manufacturer specific, company policy and procedures, industry specific, statutory bodies; solution within agreed time frame eg temporary, short term, long term

4 Be able to conduct and report on a risk analysis for an engineering activity

Analysing risks: equipment related eg process complexity, ergonomics, instructions, procedures, safety functions, guarding and aids, transportation and handling, substances and materials, power failure; environment related eg ventilation, equipment condition, lighting, housekeeping; people related eg competency, team working, physical demands, mental demands, training, stress; actions eg implement a risk reduction process, allow a period to reduce risks, implement a special monitoring process, implement an interim containment action, do nothing (risk is acceptable), suspend operation and rectify immediately

Engineering activity: carry out a risk analysis eg production (such as processing materials, fabrication, finishing, assembly, joining), installation (such as commissioning/decommissioning, site preparation, equipment installation), operational (such as movement of materials), maintenance (such as planned preventive maintenance (PPM), part or sub-assembly replacement)

Risk analysis report: recommended action(s) to take; a description of the risk(s) and their ranking; implication of a risk occurring; identification of regulations and or guidelines applicable; company health and safety policy relative to the risk; verbal communication of the report; other communication methods eg written/typed, email, group presentation

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 carry out a monitoring process for a given engineering activity [IE1]	**M1** explain the importance of carrying out a monitoring process in an effective manner	**D1** evaluate how monitoring an engineering activity contributes to rectifying a problem
P2 describe the rectification process for two engineering problems for a given engineering discipline	**M2** compare a verbal and one other method of communicating a monitoring report.	**D2** compare two actions to take when analysing risks within a given engineering activity.
P3 produce a report of the monitoring process carried out for a given engineering activity [RL3]		
P4 communicate a monitoring report both verbally and using one other method		
P5 use data from two sources for a given engineering discipline to suggest a solution that meets compliance needs and a specific timeframe [IE4]		
P6 analyse the risks associated with a given engineering activity		
P7 produce and communicate a risk analysis report.		

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Much of the assessment of this unit could culminate in the production of several reports associated with learning outcome 3. However, it is important that learners have opportunities to develop and practise the skills needed to monitor an engineering activity and show that they know how to rectify an engineering problem. A practical delivery approach could therefore be used to introduce learners to a range of monitoring activities that would involve finding solutions to problems. This approach would need to be supported by classroom-based activities to develop the underpinning knowledge required by all the learning outcomes.

The learning outcomes can be delivered in any order. Learning outcome 1 includes a wide range of activities, giving centres ample opportunity to demonstrate the monitoring processes in a variety of settings. It is therefore important that centres ensure learners are able to comment and make reference to supply of resources, verify to specification, record deviations, ensure problems are reported, measure outputs and confirm compliance. It may be best to use a practical demonstration on a particular engineering activity to show learners all these aspects. It is important that learners practise carrying out the monitoring of an engineering activity.

Similarly, learning outcome 2 involves a wide range of problems and disciplines, giving ample opportunity for centres to demonstrate the rectification process in a number of settings. The requirements of the rectification process are clearly laid out in the unit content and centres should ensure that all aspects of this are covered in any practical activity. However, learners only need to demonstrate that they know how to rectify an engineering problem, rather than physically carry out a rectification process.

For learning outcome 3 learners should have access to good examples of monitoring and rectification reports. Time needs to be set aside to ensure learners can not only produce a report but also communicate their report, both verbally and using another method. Learners must therefore be encouraged to discuss what they do in both monitoring an activity and rectifying a problem. Some classroom time could be spent looking at the different types of data sources and relevant regulations, standards and guidelines. It may be best to restrict coverage to those regulations and standards applicable to the context learners are likely to come across during their assessment.

For learning outcome 4 learners will need to carry out and report on a risk analysis. Again, there is a wide range of possible engineering activities, giving centres ample opportunity to demonstrate and practise risk analysis and reporting in a variety of settings. During the risk analysis learners should be aware of any health, safety and environmental requirements applicable to the engineering activity being analysed. The risks to be analysed must relate to equipment, environment and people and must also involve an action or range of actions to be identified during the analysis. Learners must also have opportunities to develop report writing skills that again have specific requirements as laid out in the unit content. It is important that learners practise conducting and reporting on a risk analysis of an engineering activity to confirm they have these skills.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Whole-class teaching: • introduction to unit, scheme of work and method of assessment • explain how to ensure the effective supply and use of resources and verifying the materials to be used • explain and demonstrate methods of recording deviations and reporting problems • demonstrate how to measure output of an engineering process and compare and confirm compliance with specifications, regulations and guidelines. *Practical session:* • monitoring an engineering activity.
Whole-class teaching: • explain who to consult in the event of a problem and the appropriate information that should be gathered to identify/clarify the problem • explain how to evaluate, select and communicate the most appropriate possible solution • explain how to plan for and implement the solution, monitor activities and ensure the problem is rectified. *Group activity:* • investigate the different processes that should be followed when rectifying an engineering problem.
Whole-class teaching: • explain and demonstrate the use of a monitoring report • explain and discuss the different methods of reporting • explain and demonstrate the use of the different forms of information used/needed for rectification and solution. *Individual learner research:* • investigate the different forms of documentation and information used for monitoring and rectification processes.
Prepare for and carry out **Assignment 1: Monitoring Engineering Processes** (P1, P2, P3, P4, P5, M1, M2 and D2)
Whole-class teaching: • explain and discuss the different equipment related, environment related and people related risks that can affect an engineering activity • explain the actions that can be taken to monitor and reduce risks • explain how to produce a risk analysis report and the methods that can be used to communicate the report. *Practical activity:* • analyse an engineering activity for risks. *Group work:* • in small groups practise giving verbal reports on the risk analysis for an engineering activity.
Prepare for and carry out **Assignment 2: Risk Analysis** (P6, P7 and D2)
Unit evaluation and close.

Assessment

Evidence for many of the assessment criteria is likely to be dependent on practical activities, which will therefore need to be designed very carefully.

To achieve a pass grade, learners must be able to carry out a monitoring process for an engineering activity. They will also need to produce a report of the monitoring process, describe the rectification process and use data to suggest a solution. Learners will then need to carry out a risk analysis and produce and communicate a report.

To achieve a merit grade, learners must be able to explain the importance of carrying out a monitoring process and be able to compare methods of communicating a report.

To achieve a distinction grade, learners must evaluate the role that monitoring an activity has on rectifying a problem and be able to compare actions to take when analysing risks.

This unit could be assessed using two assignments. The first assignment could cover all the criteria associated with the first three learning outcomes. A practical activity could be given to carry out a monitoring process for a given engineering activity (P1). It is important that this activity has opportunities for making reference to the supply/use of resources, verifying materials are within specification, recording deviations, ensuring problems are reported, measuring outputs and confirming compliance with regulations/guidelines. A witness statement/ observation record supplemented by annotated photographs and notes of what the learner did would be appropriate evidence for this criterion.

If the engineering activity involved two engineering problems, a task could be set asking learners to describe suitable rectification processes (P2). A third task could ask learners to produce a report of the monitoring process and communicate this both verbally and by another method (P3 and P4). A careful record of any verbal communication will need to be made.

A further task addressing P5 could ask learners to use data from two sources to suggest a solution that complies with relevant regulations, standards and guidelines and to a specific time frame. The evidence for this is likely to be a mixture of copies of the data used and a statement about the solution. Tasks requiring a written response could be set to address each of the merit criteria and D1.

A second assignment could be set for a given engineering activity and learners asked to analyse the risks (P6). It is important that the activity has equipment, environmental and people related risks and that actions can be suggested. A second task could be set to produce and communicate a risk analysis report (P7). A further task addressing criterion D2 could be set to compare any of two actions that could be suggested for the engineering activity covered by the task for P6.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P4, P5, M1, M2 and D2	Monitoring Engineering Processes	Learners carry out a monitoring process for an engineering activity.	A practical assignment for which learners monitor an engineering activity. A written task is asks learners to describe suitable rectification processes. The assignment would also require learners to produce and communicate a report of the monitoring process and then suggest a solution.
P6, P7 and D2	Risk Analysis	Learners analyse the risks associated with an engineering activity.	A practical assignment asking learners to analyse the risks associated with an engineering activity. A further task would require the production and communication of an risk analysis report.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Engineering sector suite. This unit has particular links with the following unit titles in the Engineering suite:

Level 1	Level 2	Level 3
		Manufacturing Planning
		Engineering Maintenance Procedures and Techniques

The unit contributes towards the knowledge requirements for the following units in the Level 3 SEMTA National Occupational Standards for Engineering Leadership:

- Unit 7: Rectify Engineering Problems
- Unit 8: Monitoring Engineering Activities
- Unit 9: Conduct Risk Analysis on Engineering Activities.

Essential resources

Centres delivering this unit will require access to a variety of engineering activities to monitor and rectify. Copies of relevant documentation including reports will be useful during delivery.

Employer engagement and vocational contexts

Much of the work for this unit can be set in the context of learners' work placements or be based on case studies of local employers. Further information on employer engagement is available from the organisations listed below:

- Work Experience/Workplace learning frameworks – Centre for Education and Industry (CEI, University of Warwick) – www.warwick.ac.uk/wie/cei
- Learning and Skills Network – www.vocationallearning.org.uk
- Network for Science, Technology, Engineering and Maths Network Ambassadors Scheme – www.stemnet.org.uk
- National Education and Business Partnership Network – www.nebpn.org
- Local, regional Business links – www.businesslink.gov.uk
- Work-based learning guidance – www.aimhighersw.ac.uk/wbl.htm

Indicative reading for learners

Textbook

Dingle L and Tooley M – *BTEC National Engineering* (Newnes, 2007) ISBN 9780750685214

Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Independent enquirers	identifying questions to answer and problems to resolve when monitoring an engineering activity analysing and evaluating information from different sources for a given engineering discipline, judging its relevance when suggesting solutions
Reflective learners	reviewing progress during monitoring of an engineering activity and acting on the outcomes.

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Team workers	collaborating with others in small groups when producing and communicating risk analysis report
Self-managers	organising time and resources and prioritising actions when monitoring an engineering activity.

Functional Skills – Level 2

Skill	When learners are ...
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	communicating a monitoring report and a risk analysis report.
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	