



Australian Government

Department of Education, Employment and Workplace Relations

PMAOPS390B Operate a biochemical process

Revision Number: 1

PMAOPS390B Operate a biochemical process

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	In a typical scenario, a plant uses a biochemical process to produce chemical or biological materials which are the product of that plant. The process may use enzymes such as amylases, moulds such as yeasts and/or bacteria such as e coli. The product may be a chemical compound such as alcohol (which may be able to be produced by chemical synthesis) or biochemical products such as enzymes or proteins.
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Application of the Unit

Application of the unit	This unit includes the operation of all associated pumps, dosing pumps, agitation, aeration (if appropriate), temperature control and similar equipment which is integral to the operation of the biochemical process. While biochemical processes are often batch, this unit also applies to continuous biochemical processes. This unit does not apply to ambient temperature biotreating such as might be typical of a waste stream biotreater - see <i>PMAOPS290B Operate a biotreater</i>. This unit does not require the operation of a central control panel. Where the operation of a central control panel is part of the job, <i>PMAOPS305B Operate process control systems</i> is relevant. The plant technician would: • identify and rectify operational problems • predict the potential impact of changes from other plant sections on biochemical process • facilitate output changes.
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		
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Employability Skills Information

Employability skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for work.	1.1. Identify work requirements 1.2. Identify and control hazards 1.3. Coordinate with appropriate personnel
2. Monitor and control the biochemical processes.	2.1. Get information relevant to the operation of the biochemical process 2.2. Identify changes in key variables 2.3. Keep conditions within the optimum range 2.4. Check performance of ancillaries such as agitation and heat exchange 2.5. Recognise and interpret trends in bioreactor data/appearance 2.6. Recognise the signs of potential and actual problems 2.7. Identify the consequences to the bioreactor processes of the identified changes, trends and problems 2.8. Take appropriate action to minimise the impact on safety, health, the environment and the business of potential and actual problems.
3. Ramp output up/down.	3.1. Predict from rates and schedule when a change will be required 3.2. Give advanced notice of change to work team 3.3. Prepare plant for the change 3.4. Predict the required amount of adjustment to cause the required change 3.5. Make the change in a controlled manner without excessive variation 3.6. Monitor the progress of the change and make minor adjustments as required.
4. Maintain effectiveness of bioreactor system.	4.1. Frequently and critically monitor bioreactor system throughout shift 4.2. Use measured/indicated data and smell, sight, sound and feel as appropriate 4.3. Identify critical equipment and processes 4.4. Identify issues likely to impact on the whole plant performance and take appropriate action 4.5. Predict impact of a change in the bioreactor system on other plant units/areas and communicate this to relevant people 4.6. Predict impact of a change in the processing plant on the bioreactor

ELEMENT	PERFORMANCE CRITERIA
	4.7. Take appropriate action
5. Shut down reaction systems.	5.1. Determine type of shut down required 5.2. Give advance warning of shut down where possible 5.3. Change over individual items of equipment 5.4. Shut down individual items of equipment and the entire bioreactor system 5.5. Shut down to a stand-by condition if required 5.6. Shut down for maintenance when required. 5.7. Shut down in an emergency when required
6. Clean reactors/vessels.	6.1. Identify cleaning requirements 6.2. Clean to requirements according to procedures 6.3. Retain micro-organisms contained in the plant and prepare for reuse as appropriate 6.4. Dispose of waste materials according to procedures.
7. Isolate and de-isolate plant.	7.1. Isolate plant 7.2. Make safe for required work 7.3. Check plant is ready to be returned to service 7.4. Prepare plant for return to service.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills

- efficient and effective operation of plant/equipment
- hazard analysis
- completing plant records
- communication
- problem solving

Required knowledge

Competence includes an understanding of the bioreactor system and its integral equipment to the level needed to control the system and recognise and resolve problems. In particular it includes the ability to:

- identify all items on a schematic of the bioreactor system and describe the function of each
- describe the nature/condition of materials entering and leaving each stage of the process, the changes which have occurred in that stage and why they have occurred
- state the biochemical changes which are occurring in each stage and the methods of controlling them
- describe methods of ramping up/down in to change output and the advantages and disadvantages of each.

Required knowledge also includes:

- principles of operation of plant/equipment
- physics, chemistry, biochemistry and microbiology relevant to the process unit and the materials processed
- process parameters and limits, eg temperature, pressure, flow, pH
- duty of care obligations
- hierarchy of control
- communication protocols, eg radio, phone, computer, paper, permissions/authorities
- routine problems, faults and their resolution
- relevant alarms and actions
- plant process idiosyncrasies
- correct methods of starting, stopping, operating and controlling process
- corrective action appropriate to the problem cause
- function and troubleshooting of major components and their problems
- types and causes of problems within operator's scope of skill level and responsibility.

Evidence Guide

EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

Overview of assessment

Assessment of this unit should include demonstrated competence on actual plant and equipment in a work environment. The unit will be assessed in as holistic a manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.

Simulation may be required to allow for assessment of parts of this unit. Simulation should be based on the actual plant and will include walk-throughs of the relevant competency components. Simulations may also include the use of case studies/scenarios and role plays.

This unit of competency requires a significant body of knowledge which will be assessed through questioning and the use of what-if scenarios both on the plant (during demonstration of normal operations and walk-throughs of abnormal operations) and off the plant.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action. The emphasis should be on the ability to stay out of trouble rather than on recovery from a disaster.

Consistent performance should be demonstrated. In particular look to see that:

- early warning signs of equipment/processes needing attention or with potential problems are recognised
- the range of possible causes can be identified and analysed and the most likely cause determined
- appropriate action is taken to ensure a timely return to full performance
- obvious problems in related plant areas are recognised and an appropriate contribution made to their solution.

EVIDENCE GUIDE	
	These aspects may be best assessed using a range of scenarios/case studies/what-ifs as the stimulus with a walk-through forming part of the response. These assessment activities should include a range of problems, including new, unusual and improbable situations which may have been generated from the past incident history of the plant, incidents on similar plants around the world, hazard analysis activities and similar sources.
Context of and specific resources for assessment	Assessment will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability over a range of situations. A bank of scenarios/case studies/what-ifs will be required as will a bank of questions which will be used to probe the reasoning behind the observable actions.
Method of assessment	In all plants it may be appropriate to assess this unit concurrently with relevant teamwork and communication units.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

Range Statement

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the Performance Criteria, is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Codes of practice/ standards	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.
Context	This unit of competency includes all such items of equipment and unit operations which form part of the bioreactor system. For your plant this may include (select relevant items): • pumps (feed and dosing pumps) • utilities and services such as air • agitators • air/gas supply/removal • temperature control equipment such as heaters, coolers, heat exchangers • other equipment integral to the operation of the bioreactor system.
Typical problems	Typical problems for your plant may include: • sudden changes in feed (rate, composition, concentration) • changes in required production rate • changes in ambient conditions, eg summer to winter operation • handling a plant shutdown without allowing the micro-organisms to die • control of degree of agitation • settling/removal/recycling of micro-organisms. • feed variations • instrument failure/wrong reading • electrical failure • mechanical failure • operational problem.
Key variable	Key variables include: • feed • desired output • temperature • agitation • aeration (if appropriate) • microorganism/enzyme

RANGE STATEMENT	
Appropriate action	Appropriate action includes: • determining problems needing action • determining possible fault causes • rectifying problem using appropriate solution within area of responsibility • following through items initiated until final resolution has occurred • reporting problems outside area of responsibility to designated person.
Procedures	Procedures may be written, verbal, computer-based or in some other form. They include: • all work instructions • standard operating procedures • formulas/recipes • batch sheets • temporary instructions • any similar instructions provided for the smooth running of the plant. For the purposes of this Training Package, 'procedures' also includes good operating practice as may be defined by industry codes of practice (eg Responsible Care) and government regulations.
Health, safety and environment (HSE)	All operations to which this unit applies are subject to stringent health, safety and environment requirements, which may be imposed through State or Federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence.

Unit Sector(s)

Unit sector	Operational/technical
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Competency field

Competency field	
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Co-requisite units

Co-requisite units		
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