Australian Government

Department of Education, Employment and Workplace Relations

PMAOPS220B Monitor chemical reactions in the process

Revision Number: 1

PMAOPS220B Monitor chemical reactions in the process

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit covers an operator looking after a production process which includes a chemical reaction. The vessel in which this reaction is occurring may be a purpose built 'kettle' or other reaction vessel, or it may simply be a stirred tank in which a reaction is occurring. Processes may be batch or continuous.

Application of the Unit

Application of the unit	The reaction is not just incidental to the operation (eg where the reaction is simply dissolution or dissociation; in which case *PMAOPS202 Operate fluid mixing equipment* would be appropriate). The reaction, which itself may be simple, is a key step in the process, and the operator needs to monitor and control this reaction in order to produce the desired product. The reaction may, or may not, include the use of catalyst (either homogeneous or heterogeneous phase). The reactor or reaction vessel includes types of vessels such as: • kettles • stirred tanks. The operator would: • identify and rectify operational problems • monitor the reactor operation, making adjustments as directed or to procedure • adjust product properties as directed or to procedure. This reactor and its control would be relatively simple, operated in a stand alone manner and typically might be found in a small batch plant, although appropriate examples might also exist in larger plants. For more complex reactions/reactors see *PMAOPS302B Operate reactors and reaction equipment*. It is expected that the operator would usually be liaising and cooperating with other members of the shift. The operator might also need to be competent in operating a control panel - see appropriate control unit

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units	

Employability Skills Information

Employability skills	This unit contains employability skills.

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.

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. Prepare reactor.	2.1. Perform preliminary checks 2.2. Charge materials as required by procedures 2.3. Bring the reactor contents to the specified conditions steadily and within specified time frame.
3. Monitor and control the reaction process.	3.1. Monitor plant frequently and critically throughout shift using measured/indicated data and senses (sight, hearing, etc) as appropriate. 3.2. Take appropriate action 3.3. Discharge vessel as required 3.4. Clean vessel and prepare for next batch/product 3.5. Complete required reports.
4. Isolate and de-isolate plant.	4.1. Isolate plant 4.2. Make safe for required work 4.3. Check plant is ready to be returned to service 4.4. 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

- reading recipe/formula sheets
- weighing, measuring, controlling the addition of reactants and other materials
- monitoring and controlling reaction conditions.

Required knowledge

Competence includes an understanding of the reactions and equipment integral to the operation of the reactor 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 reactor and describe the function of each
- distinguish between elements, compounds and mixtures in raw materials and products
- describe the nature/condition of materials at each stage of the reaction, the changes which have occurred in that stage and why they have occurred
- describe reactions in chemical terms, including the effect of changing reaction variables such as temperature, concentration, pH
- describe the reaction using basic chemical equations
- state the type of reactor(s) used and its/their characteristic/s
- describe the methods of controlling the reaction, including rate and yield
- describe the causes and remedies of common problems such as those selected in the Range Statement.

Competence also includes the ability to isolate the causes of problems to an item of equipment within the reaction system and to distinguish between causes of problems/alarm/fault indications such as:

- raw materials variations
- instrument failure/wrong reading
- equipment failure (electrical/mechanical)
- mechanical failure
- operational problems.

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

EVIDENCE GUIDE	
	their solution. 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. It will frequently also be appropriate to assess this unit concurrently with units dealing with: • measurements and readings • housekeeping • preparing materials • fluid mixing • heat exchange • using computers • packaging • local control system.
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 if 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 competency unit includes all minor items of equipment which are integral to the reaction process.
Typical problems	Typical problems include: • variations in material composition • variation in ambient conditions • control of reaction temperature • adjustments to meet product specifications. All operations are performed in accordance with procedures.
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.
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. Operators should be able to determine safe working practice using the relevant materials safety data sheets.

Unit Sector(s)

Unit sector	Operational/technical

Competency field

Competency field	

Co-requisite units

Co-requisite units	