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**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

In accordance with Regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Standards Generating Body (SGB) for

Mining and Minerals

registered by Organising Field 06 – Manufacturing, Engineering and Technology, publishes the following qualification and unit standards for public comment.

This notice contains the titles, fields, subfields, NQF levels, credits, and purpose of the qualification and unit standards. The full qualification and unit standards can be accessed via the SAQA web-site at www.saga.org.za. Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the qualification and unit standards should reach SAQA at the address below and **no later than 73 April 2007**. All correspondence should be marked **Standards Setting – Mining and Minerals** and addressed to

The Director: Standards Setting and Development
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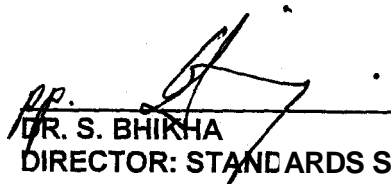
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SOUTH AFRICAN QUALIFICATIONS AUTHORITY

QUALIFICATION:**Further Education and Training Certificate: Sulphuric Acid Production**

SAQA QUAL ID	QUALIFICATION TITLE		
58228	Further Education and Training Certificate: Sulphuric Acid Production		
SGB	PROVIDER		
SGB Mining and Minerals			
ETQA			
QUALIFICATION TYPE	FIELD	SUBFIELD	
Further Ed and Training Cert	6 - Manufacturing, Engineering and Technology	Fabrication and Extraction	
ABET BAND	MINIMUM CREDITS	NQF LEVEL	QUAL CLASS
Undefined	146	Level 4	Regular-Unit Stds Based
REGISTRATION STATUS	SAQA DECISION NUMBER	REGISTRATION START DATE	REGISTRATION END DATE
Draft - Prep for P Comment			

PURPOSE AND RATIONALE OF THE QUALIFICATION

Purpose:

The purpose of this qualification is to build competence required by employees within the Sulphuric Acid Production field, and add value to the qualifying learner in terms of enrichment, learning and application of this competence within the workplace.

The key skills, knowledge and understanding reflected in this qualification are those of conducting the essential operations associated with efficient and safe operation of the Sulphuric Acid Production plant. This qualification is designed to be flexible and accessible and empowers the learner to acquire and demonstrate knowledge, skills, attitudes and values required to work safely and effectively in a Sulphuric Acid Production plant.

This qualification is aimed at persons who work or intend to work within a Sulphuric Acid Production plant and who seek recognition for essential skills in this area.

It is intended that qualifying learners are able to:

- o Maintain and support procedures to solve a variety of problems, both familiar and unfamiliar, within a sulphuric acid production process.
- o Apply mathematical principles in practical applications also aiding in understanding of and solving of problems as well as understanding business principles and their application.
- o Sustain Occupational Health and Safety in the workplace through the understanding of how to control a Sulphuric Acid production process and meet the associated environmental specifications.
- Commission process control operations within Sulphuric Acid production.

Rationale:

Sulphuric Acid Production focuses on oxidation of sulphides and catalytic conversion of the sulphur dioxide gas to sulphur trioxide gas, which is absorbed by water to form sulphuric acid.

This is the third qualification in a learning pathway designed for learners in the mining and minerals sector who want to follow a career in Sulphuric Acid Production. The learning pathway commences with the National Certificate in Sulphuric Acid Production: NQF level 2, progresses to NQF level 3 and culminates in this FETC for candidates learning and working in a Sulphuric Acid Production plant. The qualification reflects the skills, knowledge and understanding required to function effectively within Sulphuric Acid Production.

This qualification will enhance the status, productivity and employability of the learner within the Mining and Minerals and related chemical manufacturing industries, as well as contribute to the quality, production rate and growth of these industries. Knowledge acquired will be of benefit by allowing learners to identify operational errors sooner and by reducing the number of incidents and accidents should enhance the overall contribution of the learner to the productivity of the industries. It will also add to the learners' status, recognition, licensing and improve their marketability and employability. The qualification opens access to additional learning at NQF level 5.

Sulphuric Acid Production operations require a sound knowledge of materials transporting, handling and process control of gas generation, cleaning, drying, conversion and absorption associated with Sulphuric Acid Production. The mining sector puts emphasis on safety and a healthy working environment within Sulphuric Acid Production plants.

The Further Education and Training is designed to meet the needs of learners in the Mining and Minerals sector (or those who wishing to enter the Mining and Minerals sector) who require the technical expertise and the essential knowledge needed to earn a formal qualification and thus satisfy the Mining and Minerals industry requirements. The qualification facilitates access from previously disadvantaged groups.

The FETC will produce knowledgeable, skilled learners able to contribute to improved productivity and efficiency within the industries discussed above. It will also provide the means for current workers to receive recognition of prior learning, to upgrade their skills and receive a nationally recognized qualification. The qualification provides a benefit to society and economy through enhanced citizenship, increasing social and economic productivity, providing specifically skilled people and transforming and redressing the legacies of inequity.

This qualification allows for access, progression, portability and mobility within and between the different Sulphuric Acid Production areas in the Mining and Minerals industry, or the Chemical Manufacturing industry.

RECOGNIZE PREVIOUS LEARNING?

Y

LEARNING ASSUMED TO BE IN PLACE

It is assumed that candidates embarking on learning programs towards this qualification are already competent in the following areas:

- Communication and Mathematical Literacy at **NQF** Level 3.

Recognition of Prior Learning:

This qualification can be achieved wholly or in part through recognition of prior learning.

Evidence can be presented in a variety of forms, including international or previous local qualifications, reports, testimonials mentioning functions performed, work records, portfolios, videos of practice and performance records.

All such evidence should be judged according to the general principles of assessment described in the note to assessors.

Access to the qualification:

This qualification is open bearing in mind learning assumed to be in place.

QUALIFICATION RULES

All the Fundamental unit standards are compulsory:

- 35 Communications credits for both the First and Second Language.
- 15 credits for Mathematical Literacy.

The fundamental component complies with the requirement for an FETC.

All the Core unit standards are compulsory:

- 76 credits from the list specified.

Elective:

- A total of 20 credits to be obtained for this qualification must be selected from the elective component of the qualification.

A minimum of 146 credits is required to complete the qualification.

EXIT LEVEL OUTCOMES

1. Maintain and support procedures to solve a variety of problems, both familiar and unfamiliar, within a sulphuric acid production process.

2. Apply knowledge and understanding to control a Sulphuric Acid Production process and the ability to meet occupational safety, health and environmental specifications.

3. Commission processes in a Sulphuric Acid Production plant.

Critical Cross-Field Outcomes:

- Identifying and solving problems in which responses display that responsible decisions using critical thinking have been made.
 - Exit Level Outcomes 1, 2 and 3.
- Working effectively with others as a member of a team, group, organization and community.
 - Exit Level Outcomes 1, 2 and 3.
- Organising and managing oneself and one's activities responsibly and effectively.
 - Exit Level Outcomes 1, 2 and 3.
- Collecting, analyzing, organizing and critically evaluating information.
 - Exit Level Outcomes 1, 2 and 3.
- Communicating effectively using visual, mathematical and/or language skills.
 - Exit Level Outcomes 1, 2 and 3.
- Using science and technology effectively and critically, showing responsibility toward the environment and health of others.
 - Exit Level Outcomes 1, 2 and 3.

- o Demonstrating an understanding of the world as a set of related systems by recognizing that problem contexts do not exist in isolation.
- o Exit Level Outcome 1.

ASSOCIATED ASSESSMENT CRITERIA

1.

- o Solutions to production problems are based on a clear analysis of information gathered through diagnostic procedures.
- o Procedures are modified to respond to unfamiliar problems where appropriate.
- o Can respond to questions and discuss issues related to familiar and unfamiliar problems arising in a sulphuric acid production process.
- Measures related to problem solving are accurately recorded for future reference.

2.

- The process is monitored and controlled according to Sulphuric Acid Production specifications.
- A clean, safe and healthy work environment is maintained at all times.
- Problems relating to the Sulphuric Acid Production process are solved using sector acceptable processes and procedures.

3.

- o The processes are commissioned according to Sulphuric Acid Production specifications.
- A clean, safe and healthy work environment is maintained at all times.
- Problems relating to the commissioning of processes are solved using sector acceptable procedures.

Integrated Assessment:

Integrated assessment at the level of the qualification provides an opportunity for learners to show they are able to integrate concepts, actions and ideas achieved across a range of unit standards and contexts.

Integrated assessment must evaluate the quality of observable performance as well as the thinking behind the performance, and must be based on a summative assessment guide. The guide will spell out how the assessor will assess different aspects of the performance and will include:

- Observing the learner at work (both in the primary activity as well as other interactions).
- Asking questions and initiating short discussions to test understanding.
- Looking at records and reports in the portfolio and reviewing previous assessments.

In some cases inference will be necessary to determine competence depending on the nature and context within which performance takes place.

It is necessary to ensure that the fundamental part of the qualification is also targeted to ensure that while the competence may have been achieved in a particular context, learners are able to apply it in a range of other contexts and for further learning. The assessment should also ensure that all the critical cross-field outcomes have been achieved.

The learner may choose in which language s/he wants to be assessed. This should be established as part of a process of preparing the learner for assessment and familiarizing the learner with the approach being taken.

INTERNATIONAL COMPARABILITY

South Africa has a world class and highly sophisticated Mining and Minerals Sector. In selecting countries for international comparability it is important to consider countries where Mining occurs on a similar scale or in countries where processes that can be used within mines exist. It is also important to benchmark against countries with similar or higher levels of expertise.

An intensive search was conducted via the Internet to establish whether comparable courses and qualifications related to Sulphuric Acid Production existed and, if so, whether the content is comparable in terms of level, scope and competencies covered in this National Qualification.

A number of sites were visited in order to search for information from various countries. While no evidence was found of qualifications specific to Sulphuric Acid Production, evidence of advanced training in Process Control was found in various countries:

- Australia has a vocational based qualifications system, which shows a great deal of similarity to that of South Africa.
 - Countries like the USA, Canada and the United Kingdom have international institutions and consultancy companies that are involved in commissioning and optimising Manufacturing, Metallurgical, Chemical and other process driven systems all over the world. These agencies often offer advanced training and development of operators, chemical engineers, metallurgists and other operations staff. However this training is seldom formalised and therefore no formal qualifications could be found.
 - Searches in other countries (Scotland, Ireland, Germany) also have vocational education and training systems but no comparable qualifications could be found.

At NQF Level 4, the competencies (knowledge and skills) required are of an advanced nature. Learners have to acquire advanced knowledge of the products, processes and equipment in the industry, and in most cases have a major impact on production.

Australia (www.ntis.org.au):

Like South Africa, Australia has a dual education and training system. Other conditions in the two countries are also very similar:

- Australian Certificate III in Metalliferous Mining Operations (Processing) has unit standards approximately at the same level as the proposed South African qualification at Level 4. It is organised into various categories or specialisation areas which correlate with some of the outcomes in the proposed FETC in Sulphuric Acid Production (L4).

The Australian Certificate IV is not suitable for comparison as is the case with the Certificates I, II and III. The core unit standards of the FETC Sulphuric Acid Production L4 relate to advanced process control competencies, while there is a greater emphasis on specialist and Supervisory competencies in the Australian Certificate IV.

Some of the units of competence in the Australian Metalliferous Mining Operations qualification are thus relevant (as in the case of NC Sulphuric Acid Production L3) but the requirements for process control and monitoring are more stringent.

- Perform process control room operations.
- Calibrate testing equipment and assist with its maintenance.
- Conduct filtering process.
- Conduct flotation process.
- National Certificate III in Process Plant Operations offers a number of relevant competencies for comparison. However the Australian Level 4 competencies are of a higher standard than the South African L4. Some of the Australian standards relevant to the South African context are:
 - Minimise environmental impact of process.
 - Analyse equipment performance.
 - Develop work priorities.

These are however not in the South African qualification and therefore the qualifications did not compare favourably at NQF Level 4.

USA:

One of the leading international manufacturers and suppliers of chemical raw materials. It uses Sulphuric Acid in fertilizers, chemicals, dyes, petroleum refining, etching and in making iron, steel and industrial explosives.

o <http://catalog.asme.org/Education/ShortCourse/Essentials-Chemical.cfm>

Offer a short course in Essentials of Chemical Engineering for Non-Engineers. Some of the outcomes are included in the level 2 qualification:

- Short Course Number: CH710.
- CEU's: 2.25.
- Number of days: 3.

You should attend if:

You work in a chemical-processing facility and need an overview of the basic mechanics and chemistry behind the process equipment you work with on a daily basis. This course will help operations personnel communicate effectively with the process engineers and technical managers they collaborate with by gaining a basic understanding of the operational factors and design equations that are used by chemical engineers.

You can expect to:

- o Familiarize yourself with the chemical, physical principles, and design equations that form the basis for the design of equipment at your site.
- o Learn the terminology used at your facility.
- o Understand the functions of key unit operations within your facility's processes.

Gain a basic understanding of key concepts such as:

- Mass and energy balances.
- Reaction kinetics.
- o Variable affecting heat transfer.
- Fluid flow.
- o Evaporation and crystallization.
- Distillation.
- o Absorption and extraction.
- o Humidification.
- o Drying.
- Crystallization.
- o Filtration and separation.
- o Process control.

Note: This course is recommended for individuals with no technical background and up to 3 years' experience in a plant or working with chemical engineers.

Some of the key concepts that are covered in this course are covered in the various 12-3 Sulphuric acid qualifications as embedded knowledge. These key concepts give learners basic understanding that contributes towards effective production of Sulphuric Acid.

Outcomes from the 3 qualifications could be similarly clustered by training providers for the teaching of learners towards achievement of qualifications.

University and Technical Institute Courses:

A number of universities and technical institutes offer related certificate, undergraduate and postgraduate courses. These are however mostly highly theoretical in nature and do not compare well to vocational education and training.

Some of these institutions are:

- o British Columbia Institute of Technology (Canada) - (www.bcit.ca).
- University of Alabama (www.ua.edu) USA - Certificate course in Metallurgy and Metals Engineering.
- o Society of Manufacturing Engineers (Michigan USA) - (www.sme.org).
- University of Birmingham (www.eng.bham.ac.uk).
- o Milwaukee Area Technical College - Metallurgical Technician certificate (www.milwaukee.tec.wi.us).
- Materials Information Society (www.asminternational.org).
- Metallurgical Services International (www.metallurgicalservicesinternational.com).

Entry to the NC Sulphuric Acid Production L4:

In the case of the South African qualification, there is a progression of qualifications from an introductory (NC Sulphuric Acid Production L2) to an advanced level (FETC Sulphuric Acid Production L4). The entry point for this qualification (Level 4) is thus ideally the Level 3 qualification or equivalent.

In the case of the Australian qualifications, there is also a natural progression and similarly the entry level to a qualification would be competence (knowledge and skill) at an appropriate level, typically the learner will have the qualification at the level below that of the qualification he/she intends doing.

Conclusion:

It is more evident at this level that the clustering of the competencies in the NC Sulphuric Acid Manufacturing qualification (L4) is unique in terms of the countries surveyed.

Again, the explanation for this seems to be in the specific way the various Skills Development systems are structured (Manufacturing and Mining being in different sectors). Sulphuric Acid Production in this instance takes place in a mixed context, i.e. an industrial chemical being produced in a metallurgical process within the mining industry.

Another factor hampering comparability is that the interpretations across the levels are not the same. In Australia, for instance, a Certificate IV indicates a high level of competence and specialisation, more so than at NQF Level 4 in a South African qualification like the FETC Sulphuric Acid Production L4.

Another reason for the uniqueness of the qualification and the absence of qualifications elsewhere is that much of process related training in the world is given either by process consultants or by experts working for the providers of equipment, particularly process control systems, to industry. Learning thus takes place in the workplace and such learning is often incidental to process optimisation projects. It is also largely unrecognised other than internally or by the service provider "accrediting" the operator to use their equipment or processes.

ARTICULATION OPTIONS

The qualification allows for both horizontal and vertical articulation.

- Horizontal articulation can occur with the FETC Mining and Minerals Laboratory Practices, NQF Level 4. (under construction)
- Vertically with the National Certificate: Engineering Metallurgy, NQF Level 5. (under construction)

MODERATION OPTIONS

- Providers offering learning towards achievement of any of the unit standards that make up this qualification must be accredited through the relevant ETQA by SAQA.
 - Internal moderation of assessment must take place at the point of assessment with external moderation provided by the relevant ETQA according to the moderation guidelines and the agreed ETQA procedures.
 - Assessors registered with the relevant ETQA must carry out the assessment of candidates for any of the unit standards that make up this qualification.
- Any institution offering learning that **will** enable the achievement of this qualification must be accredited as a provider with the relevant ETQA.
- Anyone wishing to be assessed against this Qualification may apply to be assessed by any assessment agency, assessor or provider institution that is accredited by the relevant ETQA.
- Expertise required by the Assessor: The assessor requires the following five different types of expertise:
 - Assessment expertise.
 - Technical/contextual/occupational expertise.
 - Interpersonal and communication skills.
 - Planning and administration skills.
 - Current competency (Becomes redundant).

CRITERIA FOR THE REGISTRATION OF ASSESSORS

For Technical/contextual/occupational expertise:

Assessors should have in-depth knowledge of their subject matter. Additionally, the "assessor should demonstrate in-depth knowledge of the specific standards and knowledge as obtained in the following areas of expertise, that is, assessors should have both occupational and contextual expertise in their field of assessment."

As regards the formal qualification of the assessor, the candidate may have:

- A certificate.
- A qualification in a relevant family. This will broaden the pool of prospective assessors. This applies specifically to qualifications at the lower levels. Examples of a family include:
 - Geology, Survey and Sampling.
 - Health and Safety.
- Embarked on a process of RPL in order to gain the necessary unit standards or;
 - Have a portfolio that proves his expertise in the specific area.
- A phased in approach to occupational competence has been proposed. To determine the assessor's occupational expertise, the existing relevant experience and qualifications need to be evaluated. As the MQA generates new standards, new qualifications would become applicable. This condition would need to be re-evaluated within a specified period.

This criterion (occupational expertise) will be monitored by the MQA.

NOTES

N/A

UNIT STANDARDS

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Core	116534	Carry out basic first aid treatment in the workplace	Level 3	2

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Core	110419	Commission a catalytic converter in a sulphuric acid plant	Level 4	13
Core	243702	Control a sulphur dioxide gas cleaning system	Level 4	15
Core	15315	Control a sulphuric acid operation in a metallurgical plant	Level 4	13
Core	11105	Monitor and control a metallurgical plant from a control room	Level 4	20
Core	243706	Control a strong acid production process in a sulphuric acid plant	Level 4	13
Elective	243644	Oversee a thickening process in a metallurgical plant	Level 4	22
Elective	243703	Control a roasting process in a sulphuric acid plant	Level 4	15
Elective	243704	Control a sulphur blending process in a sulphuric acid plant	Level 4	13
Elective	243654	Control low strength sulphuric acid production by means of a tower process	Level 3	8
Elective	110462	Commission a fluidized bed roaster	Level 4	13
		evaluate spoken/signed texts		
Fundamental	119469	Read/view, analyse and respond to a variety of texts	Level 4	5
Fundamental	119470	Evaluate literary texts	Level 4	5
Fundamental	119471	Use language and communication in occupational learning programmes	Level 4	5
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Fundamental	7456	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	Level 3	5
Fundamental	9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	Level 4	6
Fundamental	9016	Represent analyse and calculate shape and motion in 2- and 3-dimensional space in different contexts	Level 4	4



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Control a sulphur dioxide gas cleaning system

SAQA US ID		UNIT STANDARD TITLE	
243702		Control a sulphur dioxide gas cleaning system	
SGB		PROVIDER	
SGB Mining and Minerals			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Fabrication and Extraction	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 4	15
REGISTRATION STATUS	REGISTRATION START DATE	REGISTRATION END DATE	SAQA DECISION NUMBER
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SPECIFIC OUTCOME 1

Demonstrate knowledge relating to the controlling of a sulphur dioxide gas cleaning system.

SPECIFIC OUTCOME 2

Demonstrate sulphur dioxide gas cleaning system.

SPECIFIC OUTCOME 3

Control a sulphur dioxide gas cleaning system.

SPECIFIC OUTCOME 4

Complete the duties pertaining to the sulphur dioxide gas cleaning system.



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Control a roasting process in a sulphuric acid plant

SAQA US ID		UNIT STANDARD TITLE	
243703		Control a roasting process in a sulphuric acid plant	
SGB		PROVIDER	
SGB Mining and Minerals			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Fabrication and Extraction	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 4	15
REGISTRATION STATUS	REGISTRATION START DATE	REGISTRATION END DATE	SAQA DECISION NUMBER
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SPECIFIC OUTCOME 1

Demonstrate knowledge relating to the controlling of a roasting process.

SPECIFIC OUTCOME 2

Demonstrate knowledge relating to the roasting process.

SPECIFIC OUTCOME 3

Control a roasting process.

SPECIFIC OUTCOME 4

Complete the duties pertaining to the controlling of a roasting process.



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:

Control a sulphur blending process in a sulphuric acid plant

SAQA US ID	UNIT STANDARD TITLE		
243704	Control a sulphur blending process in a sulphuric acid plant		
SGB	PROVIDER		
SGB Mining and Minerals			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Fabrication and Extraction		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 4	13
REGISTRATION STATUS	REGISTRATION START DATE	REGISTRATION END DATE	SAQA DECISION NUMBER
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SPECIFIC OUTCOME 1

Demonstrate knowledge relating to the controlling of a sulphur blending process.

SPECIFIC OUTCOME 2

Demonstrate knowledge relating to the sulphur blending process.

SPECIFIC OUTCOME 3

Control a sulphur blending process.

SPECIFIC OUTCOME 4

Complete the duties pertaining to the controlling of a sulphur blending process.



SOUTH AFRICAN QUALIFICATIONS AUTHORITY

UNIT STANDARD:***Control a strong acid production process in a sulphuric acid plant***

SAQA US ID	UNIT STANDARD TITLE		
243706	Control a strong acid production process in a sulphuric acid plant		
SGB	PROVIDER		
SGB Mining and Minerals			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Fabrication and Extraction		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 4	13
REGISTRATION STATUS	REGISTRATION START DATE	REGISTRATION END DATE	SAQA DECISION NUMBER
Draft - Prep for P Comment			

SPECIFIC OUTCOME 1

Demonstrate knowledge relating to the controlling of a strong acid production process.

SPECIFIC OUTCOME 2

Demonstrate knowledge relating to the strong acid production process.

SPECIFIC OUTCOME 3

Control a strong acid production process.

SPECIFIC OUTCOME 4

Complete the duties pertaining to the controlling of a strong acid production process.