Title	**Generate chlorine dioxide for wood pulp bleaching**		
Level	**5**	**Credits**	**15**

Purpose	People credited with this unit standard are able to: explain fundamentals of chlorine dioxide generation; operate and maintain equipment for generating chlorine dioxide efficiently; and monitor and control the efficient performance of process and equipment for generating chlorine dioxide.

Classification	Wood Fibre Manufacturing > Pulp and Paper - Chemical Plants

Available grade	Achieved

Guidance Information

1 Definition
Worksite documentation refers to instructions to staff on policy and procedures (including the application of legislation to worksite situations) which are formally documented, and are available for reference at the worksite. Examples are standard operating procedures, specifications, manuals, and manufacturer's information.

2 Evidence of the outcomes of this unit standard must be presented for either an integrated plant or a single vessel process.
- a Integrated plant includes:
  equipment – filters, generator, absorber, chiller and tank, evaporator, blower, dilution air compressor, acid rotameters, storage tank, air sparges;
  materials – water, hydrochloric acid, dilution air, process air, sodium chlorate, steam.
- b Single vessel process may include but is not limited to:
  equipment – single vessel process generation system, condensate system, generator condenser, chlorine dioxide absorber, process ejector, jet condenser, chlorine absorber and seal pot, hypo seal tank, salt cake filter system, filter jet, hypo scrubber, environmental scrubber, black liquor system;
  materials – sulphuric acid, R2 solution, brine, steam, catalyst.

3 The following apply to the performance of all outcomes of this unit standard:
- a All work practices must meet recognised codes of practice and documented worksite health and safety and environmental procedures (where these exceed code) for personal, product, and worksite health and safety, and must meet the obligations required under current legislation, including the Health and Safety in Employment Act 1992, the Resource Management Act 1991, the Hazardous Substances and New Organisms Act 1996, and their subsequent amendments.
- b All work practices must meet documented worksite operating procedures. This includes the recording (by electronic or non-electronic means) of activities, events, and decisions.

c All communications made in relation to this unit standard must be made in accordance with worksite procedures for content, recipient, timing, and method.

Outcomes and performance criteria

Outcome 1

Explain fundamentals of chlorine dioxide generation.

Performance criteria

1.1 Operating principles of chlorine dioxide generating plant are explained in accordance with worksite documentation.

Range principles may include but are not limited to – chemical reaction, evaporation, absorption, vacuum control, pressure control, quenching, aeration.

1.2 Operating parameters and capability of chlorine dioxide generating plant are explained in accordance with worksite documentation.

Range parameters – pressures, chemical flows, air flows, temperatures, chemical concentrations, storage levels.

1.3 Operating components and process controls of chlorine dioxide generating plant are identified, and their purpose is explained, in accordance with worksite documentation.

1.4 Hazards associated with chlorine dioxide generation are identified and actions to be taken to isolate, minimise, or eliminate the hazard are described in accordance with worksite documentation.

Range hazards include but are not limited to – decompositions, loss of absorption water, loss of process control and pressurised storage tanks, ruptured lines, chemical concentration changes, transportation, steam, loss of steam, organic substances.

1.5 Hazards associated with chemicals used in the generation of chlorine dioxide are identified, and management of the risks to materials, plant and people are explained, in accordance with worksite documentation.

Range chemicals may include but are not limited to – chlorine dioxide, chlorine, sulphuric acid, sodium hypochlorite, sodium dichromate, hydrochloric acid, black liquor, sodium hydroxide, sodium hydrosulphite, saltcake.

1.6 Consequences of non-conformance with worksite operating procedures are described in accordance with worksite documentation.

1.7 Roles and responsibilities of the chlorine dioxide plant operator are described in accordance with worksite documentation.

Outcome 2

Operate and maintain equipment for generating chlorine dioxide efficiently.

Performance criteria

2.1 Safe work practices associated with operating equipment to generate chlorine dioxide are identified and used in accordance with worksite documentation and legislative requirements.

Range practices may include but are not limited to – plant entry procedures, isolation procedures, lock-outs, emergency stops, machine guarding, wearing appropriate safety equipment.

2.2 Chlorine dioxide plant is set up, started up, operated, and shut down efficiently in accordance with worksite documentation.

2.3 Chemicals are assembled in accordance with worksite documentation.

2.4 Setting and timely adjustment of operating parameters enables production requirements to be achieved in accordance with worksite documentation.

Range operating parameters – temperatures, gas and liquid concentrations, pressures, flows, purity;
production requirements – chemical strength.

2.5 Preventative maintenance and cleaning requirements are carried out in accordance with worksite documentation.

Range preventative maintenance may include but is not limited to – basic care checks and plant inspections.

Outcome 3

Monitor and control the efficient performance of process and equipment for generating chlorine dioxide.

Performance criteria

3.1 Monitoring and interpretation of feedback information and the timely adjustment of control parameters enable product quality, efficient plant performance, and process and legislative requirements to be maintained in accordance with worksite documentation.

Range control parameters may include but are not limited to – temperatures, gas and liquid concentrations, pressures, flows, purity;
process requirements – customer demand, storage levels, production priority.

3.2 Operating and equipment faults and malfunctions are identified, and corrective action is taken, in accordance with worksite documentation.

Range operating faults and malfunctions – decompositions, steam loss, water loss, gas circuit upsets, leakages, blockages, contamination; equipment faults and malfunctions – electrical, mechanical, hydraulic, pneumatic, instrumentation, distributed control system.

3.3 Output product meets the requirements of worksite documentation for chemical strength.

3.4 Production rate is regulated in accordance with worksite documentation and process requirements.

3.5 Production, maintenance, and quality records are explained and completed in accordance with worksite documentation.

Replacement information	This unit standard replaced unit standard 16293 and unit standard 16294.

This unit standard is expiring. Assessment against the standard must take place by the last date for assessment set out below.

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	18 December 2006	31 December 2025
Review	2	24 October 2014	31 December 2025
Review	3	30 November 2023	31 December 2025

Consent and Moderation Requirements (CMR) reference	0173

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.