Title	**Demonstrate knowledge of geothermal processes and equipment in an energy and chemical plant**		
Level	**4**	**Credits**	**10**

Purpose	This unit standard is intended for people working as boiler operators and energy and chemical process operators in an energy and chemical plant. People credited with this unit standard are able to demonstrate knowledge of: geothermal energy and reservoirs; implications of geothermal fluid chemistry; and steam-field equipment and processes, in an energy and chemical plant.

Classification	Energy and Chemical Plant > Operation of Energy and Chemical Plant

Available grade	Achieved

Guidance Information

1 Legislation relevant to this unit standard includes but is not limited to:
- Health and Safety at Work Act 2015;
- Hazardous Substances and New Organisms Act 1996;
- Resource Management Act 1991;
  and any subsequent amendments.

2 Definitions
Energy and chemical plant may be in – petrochemical, agri-nutrient, power generation, dairy processing, meat processing, and wood fibre manufacturing, or other plants that operate with a combination of high temperatures, pressures, steam and/or chemicals in gas, liquid or solid form.
Organisational requirements – documented policies and procedures. These may include: equipment manufacturers' procedures; plant procedures; suppliers' instructions; site signage; codes of practice; company health and safety plans; on site briefings; and supervisor's instructions. This includes all regulatory and legislative obligations that apply to the plant.
Plant – the operational unit, equipment and/or workplace at which the person is working.
Wellhead – the component at the surface of a geothermal, oil or gas well that provides the structural and pressure-containing interface for the drilling and production equipment and includes all equipment included to the start of the branch line.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of geothermal energy and reservoirs in an energy and chemical plant.

Performance criteria

1.1 Describe geothermal reservoirs in terms of their characteristics.

Range characteristics include but are not limited to – feed zone, cold inflow, permeability, resistivity, reinjection return.

1.2 Describe geothermal steam at a plant in terms of its thermodynamic characteristics.

Range thermodynamic characteristics include but are not limited to – temperature phases, pressure, enthalpy.

1.3 Describe the extraction of energy from geothermal wells in terms of plant data.

Range data includes but is not limited to – total energy content, well pressure, ratio of steam to water, well depth, well temperature, flow rates, well output curves.

1.4 Describe techniques used to optimise the mechanical equipment of geothermal wells at a geothermal plant in terms of best performance.

1.5 Describe reinjection, management of ponds, and discharges to water and ground in terms of operating requirements.

1.6 Describe causes of problems experienced with geothermal wells in terms of their effects.

Range problems include but are not limited to – subsidence, cold water infiltration, slug flow, deposition, formation, well casing fractures, rock permeability, energy output.

Outcome 2

Demonstrate knowledge of the implications of geothermal fluid chemistry for an energy and chemical plant.

Performance criteria

2.1 Describe geothermal fluids at a plant in terms of chemical components and health and safety implications.

Range geothermal fluids include but are not limited to – water, non-condensable gases, dissolved gases, dissolved solids, suspended solids, heavy metals.

2.2 Identify hazards arising from geothermal fluid components and describe their controls.

Range hazards include but are not limited to – hydrogen sulphide (H_2S) hazard, as gas build up in low lying areas and well cellars, H_2S cap build up in shut in wells, venting of H_2S cap; carbon dioxide ($CO_{2);}$ heavy metals in pipe work and vessel depositions.

2.3 Describe precautions to protect steam-field and power station equipment from geothermal fluid chemistry and thermodynamic properties in terms of the actions required.

Range precautions may include but are not limited to – steam and/or water delivery chemistry limits, scrubbing pipelines, separators, separator wash water, scrubbers, acid dosing of produced/separated/reinjected water;
evidence of four precautions is required.

Outcome 3

Demonstrate knowledge of steam-field equipment and processes in an energy and chemical plant.

Performance criteria

3.1 Describe steam-field wellhead equipment in terms of its design.

Range equipment includes but is not limited to – casing, cellar, support structure, isolation valve.

3.2 Describe steam-field wellhead equipment in terms of its operation.

Range operation includes but is not limited to – shut in well shut monitoring, placing on bleed, controlled warm up, abandonment of the well, down hole well monitoring and measurement.

3.3 Describe steam-field pipe work and fittings in terms of their design and operating concepts.

Range pipe work includes but is not limited to – lagging, drains, steam traps, expansion control, valve types, orifice plate, pressure relief, pipeline anchoring, pipeline expansion, pipeline low points, two phase fluid pipeline requirements, multiple well connection to single pipelines.

3.4 Describe plant steam field separation equipment in terms of its design and operating concepts.

Range plant separation equipment may include but is not limited to – separators, separator wash water, scrubbers, water vessels and accumulators, silencers, pressure reducing stations, steam vent stations;
evidence of two different pieces of equipment is required.

3.5 Describe plant steam-field control and protection systems in terms of their design and operating concepts.

Range plant steam-field control and protections systems may include but are not limited to – separator level protection, scrubber level protection, pipeline drain pot protection, pressure relief equipment, reinjection low/ reverse flow, dump station activation, pond level alarming;
evidence of two different systems is required.

Replacement information	This unit standard was replaced by skill standard 40446. This unit standard and unit standard 28160 replaced unit standard 17607.

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	24 October 2014	31 December 2022
Review	2	27 February 2020	31 December 2026
Review	3	24 April 2025	31 December 2026

Consent and Moderation Requirements (CMR) reference	0079

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