40446 Recognise geothermal processes and equipment in an energy and chemical plant

Kaupae | Level	4
Whiwhinga | Credit	10
Whāinga | Purpose	This skill standard is intended for people working as energy and chemical process operators in an energy and chemical plant. People credited with this skill standard are able to: identify the production and use of geothermal energy and reservoirs; explain implications of geothermal fluid chemistry; and recognise steam-field equipment and processes, in an energy and chemical plant. This skill standard can be used in the New Zealand Energy and Chemical qualifications at Level 4 and above.

Hua o te ako me Paearu aromatawai \| Learning outcomes and assessment criteria

Hua o te ako | Learning outcomes	**Paearu aromatawai** | Assessment criteria
1. Identify the production and use of geothermal energy and reservoirs in an energy and chemical plant.	a. Describe geothermal reservoirs in terms of their characteristics.
	b. Describe geothermal steam at a plant in terms of its thermodynamic characteristics.
	c. Describe the extraction of energy from geothermal wells in terms of plant data.
	d. Explain techniques used to optimise the mechanical equipment of geothermal wells at a geothermal plant in terms of best performance.
	e. Describe reinjection, management of ponds, and discharges to water and ground in terms of operating requirements.
	f. Explain causes of problems experienced with geothermal wells and reservoirs in terms of their effects.

Hua o te ako | Learning outcomes	**Paearu aromatawai** | Assessment criteria
2. Explain the implications of geothermal fluid chemistry for an energy and chemical plant.	a. Explain geothermal fluids at a plant in terms of chemical components and health, safety and environmental implications.
	b. Identify hazards arising from geothermal fluid components and describe their controls.
	c. Outline precautions to protect steam-field and power station equipment from geothermal fluid chemistry and thermodynamic properties in terms of the actions required.
3. Recognise steam-field equipment and processes in an energy and chemical plant.	a. Identify steam-field wellhead equipment in terms of its design and describe its operation.
	b. Identify steam-field pipe work and fittings in terms of their design and describe their operating concepts.
	c. Identify plant steam field separation equipment in terms of its design and describe its operating concepts.
	d. Identify plant steam-field control and protection systems in terms of their design and describe their operating concepts.

Pārongo aromatawai me te taumata paearu | Assessment information and grade criteria

Assessment specifications:

- 1a: characteristics include but are not limited to – feed zone, cold inflow, permeability, resistivity, reinjection return.
- 1b: thermodynamic characteristics include but are not limited to – temperature phases, pressure, enthalpy.
- 1c: plant 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.
- 1f: problems include but are not limited to – subsidence, cold water infiltration, slug flow, deposition, formation, well casing fractures, rock permeability, energy output.
- 2a: geothermal fluids include but are not limited to – water, non-condensable gases, dissolved gases, dissolved solids, suspended solids, heavy metals. Implications include but are not limited to – health, safety, environmental, community, RMA breaches.
- 2b: 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.
- 3a: equipment includes but is not limited to – casing, cellar, support structure, isolation valve; 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.

- 3b: 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.

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.

Ngā momo whiwhinga | Grades available

Achieved

Ihirangi waitohu | Indicative content

- Precautions to protect steam-field and power station equipment such as – 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.
- Plant separation equipment such as – 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.
- Plant steam-field control and protections systems such as – 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.

Rauemi | Resources

Legislation relevant to this skill 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.

Pārongo Whakaū Kounga | Quality assurance information

Ngā rōpū whakatau-paerewa | Standard Setting Body	Hanga-Aro-Rau Manufacturing, Engineering and Logistics Workforce Development Council
Whakaritenga Rārangi Paetae Aromatawai | DASS classification	Manufacturing > Energy and Chemical Plant > Operation of Energy and Chemical Plant
Ko te tohutoro ki ngā Whakaritenga i te Whakamanatanga me te Whakaōritenga | CMR	0079

Hātepe | Process	**Putanga** | Version	**Rā whakaputa** | Review Date	**Rā whakamutunga mō te aromatawai** | Last date for assessment
Rēhitatanga | Registration	1	24 April 2025	N/A
Kōrero whakakapinga | Replacement information	This skill standard replaced unit standard 28159.		
Rā arotake | Planned review date	31 December 2029		

Please contact Hanga-Aro-Rau Manufacturing, Engineering and Logistics Workforce Development Council at qualifications@hangaarorau.nz to suggest changes to the content of this skill standard.