

## ***Geothermal Power - Video answers for Friday 3 March, 2006***

### 1. f01-power-from-power-station-to-grid

You are on the outside of the fence surrounding the switchyard at the Wairakei Power Station. Electrical Engineer Murray Hill takes you through the power flow from the Power Station supply (at 11,000 volts) to the National Grid (at 220,000 volts).

- What are the five devices that the power flows through as it comes out of the generator in the Power Station on its way to the national grid? 1. Metering equipment (stainless cabinet) 2. transformer 3. measurement transformers 4. power circuit breakers (Y shaped) 5. isolators.

### 2. f02-monitoring-and-controlling-g1

You are in the control room of Station A at the Wairakei Power Station. Electrical Engineer Murray Hill describes the controls and meters for Generator 1 (G1).

- What (real) power is being generated at the moment? 11MW
- What current is being generated at the moment? 600 Amps

The side panel describes the magnetism that is being produced for the generator in the excitor (a small generator attached to G1).

- What current is being used in the excitor? 300 Amps
- What voltage is being used in the excitor? 120 Volts
- What are the two **main** components in the generator that must be controlled and how are they controlled? 1. Power (from the steam supply) through the governor and 2. voltage through the automatic voltage regulator.

### 3. f03-recreating-pink-and-white-terraces

You are at a tourist destination near Taupo called the Wairakei Terraces. Geochemist Ed Mroczek talks to Donald about the artificial geyser behind them and what it can tell us about the chemistry of this area.

- What depth does this water come from? 2km
- What temperature is the water at that depth? 260 degrees c
- What pressure is the water at that depth? 46 times atmospheric pressure
- What does the water have in it because of these high temperatures and pressures? Dissolved solids

When the water comes to the surface the steam is flashed off and the remaining cooler water exceeds the solubility of the dissolved minerals.

- What is the mineral that is deposited here on these terraces? Silica
- Why is silica a problem for geothermal power production? Blocks wells.

### 4. f04-meet-Ed-a-geochemist

Ed Mroczek is a geochemist with GNS Science. Here he talks to Donald about his role with geothermal power production.

- What can Ed find out by looking at the composition of the geothermal fluids and gases? The history of the fluids, how old they are and where they come from.

#### 5. f05-reinjection-of-hot-water

You're standing beside a re-injection well where waste hot geothermal water is put back into the ground.

- What are the two problems that have to be considered when re-injecting waste water back into the ground? 1. deposition of silica that blocks up the well .2. cool water getting back into the production reservoir and cool the hot fluids.

#### 6. f06-bioremediation-bugs-at-work

The Wairakei Power Station was built in 1950s by the Waikato River so the river water could be used in the condenser. You are beside the station outlet with Ed Mroczek talking about using bacteria to help purify the water.

- Which dissolved gas in the water from the power station (the condensate), is Contact Energy trying to reduce? Hydrogen sulfide
- How much of this gas does the condensate have in it now? Up to 1 milligram per kilogram (= 1 litre) of water.
- Where do the bacteria used in the bio reactor come from? Naturally found in the water
- What do the bacteria do? Oxidize the sulfur in the water converting it to sulfates or sulfuric acid.
- How much of this gas does the condensate have in it when it leaves the bioreactor? 20 micrograms per kilogram (= 1 litre) of water.