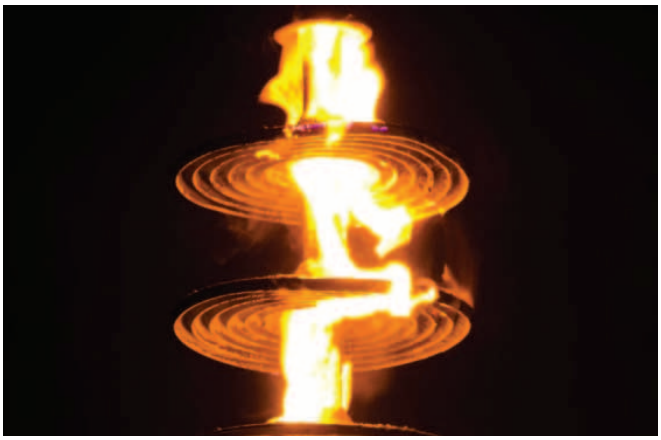
Assessing Impacts of Volcanic Ashfall

Volcanic ash may not be the most spectacular or lethal product of an explosive volcanic eruption, but it is the most widespread, and the most likely to affect towns, cities and farmland in the North Island. Freshly-erupted ash contains a range of potentially toxic soluble elements, which are released either rapidly or more slowly upon contact with water or body fluids. Following an eruption, it is normal for the public, civil authorities and agricultural producers to have concerns about the effects of ashfalls on human and animal health, drinking water supplies, crops and soils. In addition, ashfalls can interfere with the functioning of critical lifelines such as electricity and drinking water supplies.

Our group has an overall goal of increasing New Zealand's preparedness for volcanic ashfall. We carry out reconnaissance trips to areas impacted by ashfall, backed up by testing the properties of the ash in laboratories at University of Canterbury and Massey University. We have developed a particular focus on central Patagonia, because of the frequency of explosive eruptions there and the similarity of the landscape and climate to New Zealand, meaning that lessons are readily transferable here. Following the 2011 eruption of Puyehue-Cordón Caulle (Chile), towns downwind of the eruption in

The NZ field team (l to r): Heather Craig, Tom Wilson, interpreter David Dewar and Carol Stewart) on Chile/Argentina border, February 2012. This area was covered in up to 50 cm pale grey pumice fragments from the June 2011 eruption of Puyehue-Cordon Caulle volcano. Photo: Carol Stewart, University of Canterbury.

Argentina continue to be severely affected by fine airborne ash. The extremely arid and windy conditions have also prolonged the effects of the eruption, as the deposited ash is unconsolidated and easily resuspended in windy conditions. The eruption has also had severe effects on livestock farming in the region, with stock losses of 40-60 percent.



Testing of electricity network components in high voltage lab in the University of Canterbury's electrical engineering facility. The purpose of this work is to increase our understanding of the factors that can lead to electricity outages following volcanic ashfall. PhD student Johnny Wardman has used a dual approach of both carrying out post-eruption impact assessment studies, and laboratory-based testing. Photo: Grant Wilson and Johnny Wardman, University of Canterbury.

Eruption at Te Maari crater, Mt Tongariro

Following the Te Maari eruption on 6 August, we documented the infrastructural impacts and liaised with infrastructure managers. The eruption deposited ash up to a maximum thickness of 2.5 mm over a small area to the northeast and east of the vent.

The closest infrastructure to the vent was the water supply catchment for Tongariro/Rangipo Prison, which is located on the northeast slopes of Mt Tongariro right under the area of maximum ashfall. Although a substantial quantity of ash was deposited in the stream feeding the plant, the plant had sufficient storage capacity to be able to be shut down for seven days while testing for water contamination was carried out by the local Public Health Unit, and also to protect the plant from damage caused by suspended ash entering the intake.

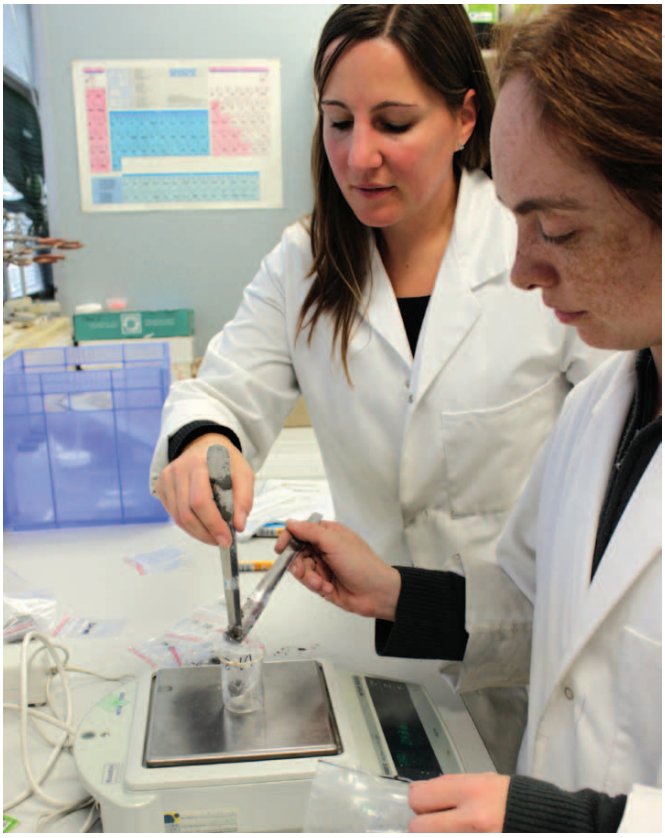
Transpower's high voltage (Bunnythorpe to Wairakei) transmission lines also cross the area in which ashfall was received, alongside the Desert Road. About 2 mm of ash fell on the insulators, but this was not enough to cause problems such as insulator flashover, which can in turn lead to power outages.

Whilst the eruption produced only a small volume of ash, its properties proved interesting. Leaching experiments to determine the soluble salt composition of the ash were carried out at Massey University on an urgent

basis to address the concerns of health and agricultural agencies. These experiments showed that the ash had high concentration of water-soluble elements, particularly calcium and sulphur, and moderate levels of potentially-toxic fluoride. This high soluble salt content also gave the ash the property of being highly conductive to electricity (the highest we have ever observed). Thus, while the ash had hazardous properties, its overall risk to infrastructure, public health and agriculture was limited by the small volume produced.

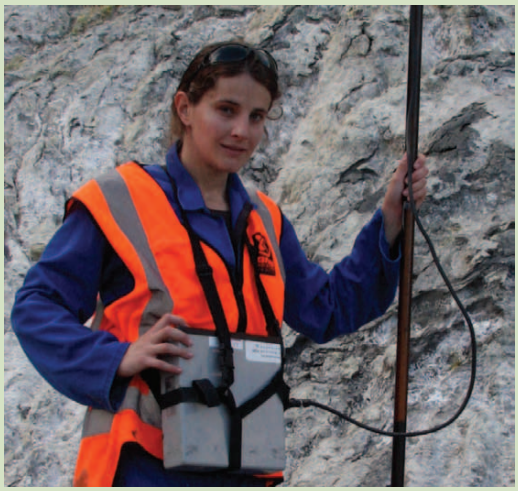
We aim to translate research findings into practical advice on ash preparedness and mitigation strategies. One of our most popular initiatives has been a poster series sponsored by the Auckland Engineering Lifelines Group, giving preparedness advice to managers of electricity networks, airports, roads, wastewater treatment plants and water supply systems. We are currently upgrading these posters, to incorporate our latest research findings from field studies. We also continue to co-lead the International Volcanic Ash Impacts Working Group, a collaboration involving University of Canterbury, GNS Science and colleagues from the United States Geological Survey, British Geological Survey and various other universities to update and coordinate volcanic ash research and communicate our findings.

The eruption may have been small, but it was a valuable test of New Zealand's volcanic ash collection and analysis capabilities, and our ash preparedness resources. It has also stimulated closer working relationships between the Natural Hazard Research Platform and a variety of key stakeholders. Not bad for a little burp from Tongariro.



Massey postdoctoral fellows Anke Zernack and Natalia Pardo test ash from the 2012 Te Maari eruption. Photo: Massey University.

➔ Carol Stewart & Tom Wilson.
Contact: Carol.Stewart@canterbury.ac.nz



Platform-funded Students

Lauriane Chardot (PhD student, Volcanology. University of Canterbury/GNS Science) - Using White Island volcano as a case study, Lauriane's research investigates how changes in volcano hydrothermal systems may explain some of the geophysical monitoring signals observed during volcanic unrest, using a multi-disciplinary dataset and a holistic numerical modelling approach. Lauriane is interested in the hydrothermal-related source of the signals observed during an unrest episode because changes within a volcano hydrothermal system may precede and/or hinder magmatic signatures in monitoring observations. The ultimate aim for this project is to improve the detection of future activity at White Island volcano.