The challenge of sustained public eruption preparedness: A decade of exercises, social research and hazard mapping in Tongariro National Park

Graham S Leonard[1], David M Johnston[1], Harry Keys[2], Douglas Paton[3], Nicki Hughes[4], Gill Jolly[1]

[1]GNS Science, 1 Fairway Drive, Lower Hutt 5010, New Zealand, [2]Department of Conservation, Private Bag, Turangi 3335, New Zealand, [3]University of Tasmania, School of Psychology, Bag 1-342, Launceston, Tasmania, Australia, [4]Waikato Regional Council, P O Box 501, Taupo 3351, New Zealand

E-mail: g.leonard@gns.cri.nz

New Zealands Tongariro National Park volcanoes produce hazardous eruptions every few years to decades. The presence of high use public walking trails and routes within this World Heritage area, gives rise to risks mostly from pyroclastic density currents, lahars and ballistics. In the long term public exposure is particularly great on the Tongariro Alpine Crossing track with more than a thousand visitors on peak summer days. In 2012 the Te Maari vent at the northern end of the Crossing reawakened after a century, producing surges and ballistics in two events. We explore the public education and emergency management, hazard map development, and social science research conducted over the last decade, during quiet periods and eruption episodes to manage this risk.

At Ruapehu, an Eruption Detection System (EDS) triggers sirens and messages automatically across the ski area, because the first eruption generated lahars may reach the ski area within two minutes of an eruption. This structural measure has been complimented with volcanic hazard education in the park. This is heavily based around hazard maps, but in recent years has been diversified to accommodate surveyed on-going moderate levels of map comprehension. In order to evaluate public response to the EDS, simulated warnings have been conducted annually at the ski areas since 2001, using designated observers. Analysis of public responses has identified issues associated with a demographically diverse public, including a minority who fail to move to safety. There is a need for diverse education media and contact points and changes to warning processes and maps.

Pyroclastic density current and ballistic hazards are present on both Ruapehu and Tongariro. Timely official warning to the public away from the ski areas remains a very challenging concept, and eruptions, especially smaller ones, are difficult to forecast. Preparedness falls heavily to hazard maps and the design and content of hazard maps has received increasing consideration with recent eruptions, highlighting several complex issues that we explore: (1) background hazard maps are used across the many potentially-active vents during non-eruptive periods, but these may not match eruptive episode hazard maps and scenarios with very elevated probability compared to the background; (2) scientists need for conservatism while constraining hazards may be in serious, direct conflict with more probable short term hazards in time-sensitive situations; (3) hazards tend to grade away spatially and should ideally be shown in a gradual probabilistically-defined way, but maps need to be simple; (4) messaging covers several severe hazards and actions, needing to be a balance between simplicity to achieve high awareness and not clutter the map, but enough detail to be meaningful; and (5) the visual representation of elements (1) through (4) on a single piece of paper that can be quickly and correctly comprehended.