



22 November 2019



Dear 

Reference: OIA-2019/20-0172

Official Information Act request for all information related to emergency management plans for volcanic eruption Auckland

Thank you for your Official Information Act 1982 (the Act) request received on 25 September 2019. You requested:

- *All current reports, plans, strategies and fact-sheets etc regarding or related the plans for emergency management in the event of a volcanic eruption in Auckland. (For example, this could include current documents outlining the steps to be taken in the event of an eruption in Auckland and what MCDEM believes would happen in the event of a volcanic eruption).*
- *All briefings, emails, meeting minutes, memos and other communications in 2018 and 2019 to date regarding emergency management in the wake of a volcanic eruption in Auckland.*

The time frame for responding to your request was extended under section 15A of the Act by an additional 30 working days because it necessitated a search through a large quantity of information, and consultations to be undertaken before a decision could be made on the request. Following this extension, I am now in a position to respond.

Auckland is at risk from a volcanic eruption from the Auckland Volcanic Field, as well as volcanic activity from other volcanic activity (e.g. through ash fall). Please note that we have interpreted your request as referring to an eruption from the Auckland Volcanic Field.

Specific planning for an eruption from the Auckland Volcanic Field is led at the local level, by [Auckland Council](#), [Auckland Emergency Management](#) and [DeVoRA \(Determining Volcanic Risk in Auckland\)](#). In the broadest sense, this planning is supported at the national level by generic arrangements able to support management of the consequences from any hazard source. The Ministry of Civil Defence & Emergency Management (MCDEM), is the lead agency for volcanic activity at the national level for all-of-government coordination of the operation/response to volcanic hazards, and informs the broader National Security System.

MCDEM works closely with other national agencies (including the Department for Conservation, Ministry for the Environment, and the Treasury) and Crown Research Institutes and state-owned enterprises (including GNS Science and MetService) to prepare for volcanic hazards anywhere in New Zealand. MCDEM chairs the New Zealand Volcanic Science Advisory Panel (NZVSAP), which aims to ensure the provision of authoritative readiness, reduction, response and recovery science advice when volcanic activity is affecting New Zealand, through trans-disciplinary and multi-institution collaboration. MCDEM also maintains standard information for the public on what to do in the event of volcanic activity (including looking after pets and livestock).

These national response and recovery arrangements are publically available, within the following plans and guidelines:

- [Coordinated Incident Management System \(CIMS\)](#)
- [National Civil Defence Emergency Management Plan](#)
- [Guide to the National Civil Defence Emergency Management Plan](#)
- [National Disaster Resilience Strategy](#)
- [CDEM Director's Guidelines:](#)
 - [CDEM Exercises](#) [DGL 10/09];
 - [Response Planning in CDEM](#) [DGL 19/15];
 - [Mass Evacuation Planning](#) [DGL 07/08];
 - [Response Management](#) [DGL 06/08];
 - [Emergency Movement Control](#) [DGL 18/15];
 - [Volunteer Coordination in CDEM](#) [DGL 15/13];
 - [Logistics in CDEM](#) [DGL 17/15];
 - [Lifeline Utilities and CDEM Groups](#) [DGL 16/14];
 - [Public Information Management](#) [DGL 14/13];
 - [Welfare Services in an Emergency](#) [DGL 11/15];
 - [Recovery Management](#) [DGL 4/05];
 - [Strategic Planning for Recovery](#) [DGL 20/17].
- [Working from the same page: consistent messaging for CDEM](#)
- [New Zealand Volcanic Science Advisory Panel \(NZVSAP\) Terms of Reference](#)

In terms of specific information on planning for an Auckland volcanic eruption, please find attached all information MCDEM has received or produced in 2018 until 25 September 2019 relating directly to the Auckland Volcanic Field. Please note that some information has been withheld in part or in full under the following sections of the Act:

- section 6(a), to protect the security or defence of New Zealand or the international relations of the Government of New Zealand
- section 9(2)(a), to protect the privacy of individuals
- section 9(2)(ba)(i), to protect the supply of similar information in the future.

Regarding the volcanic ash impact posters, that I have withheld in full from the release documents, please note, that we have been advised that the final versions of these should be published and publically available in the coming months. A link to the current posters can be found here: <https://www.gns.cri.nz/Home/Learning/Science-Topics/Volcanoes/Eruption-What-to-do/Ash-Impact-Posters>. It is expected that the new posters will be published in the same location online.

In making my decision, I have taken the public interest considerations in section 9(1) of the Act into account.

You have the right to ask the Ombudsman to investigate and review my decision under section 28(3) of the Act.

Finally, for your information, this response will be published on DPMC's website during our regular publication cycle. Typically, information is released monthly, or as otherwise determined. Your personal information including name and contact details will be removed for publication.

Yours sincerely



Sarah Stuart-Black
Executive Director, MCDEM

From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Joshua Hayes
<josh.hayes@pg.canterbury.ac.nz>
Sent: Wednesday, 24 January 2018 10:43 AM
To: volcano-devora-list@lists.gns.cri.nz
Subject: [Volcano-DEVORA-list] DEVORA geophysical eruption scenario review invitation

Hi all!

I am a PhD student from the University of Canterbury conducting research on clean-up and restoration of Auckland after a volcanic eruption, as part of the Determining Volcanic Risk in Auckland programme (DEVORA). As part of my PhD I (along with other DEVORA researchers from UC, GNS, and UoA) have worked to develop a suite of volcanic eruption scenarios for the Auckland Volcanic Field. The original intended use of these scenarios was for volcanic impact and risk studies, but it became apparent 12 months ago that various stakeholders had a need for scenarios which were based on recent volcanological research on the Auckland Volcanic Field. The scenarios are multi-hazard and are intended to demonstrate a credible range of possible eruptions within the Auckland Volcanic Field. We intend to publish the scenarios as a publically available GNS report along with all relevant geospatial datasets (hazard layers etc).

To ensure that the scenarios are robust and that all relevant potential users and stakeholders can have confidence in them we are hoping to get a wide selection of experts to review the scenarios. To this end, we have proposed the following review process:

Expert Peer-Review

Firstly, to ensure key disciplinary areas are appropriately covered, we are hoping to obtain reviews from an expert in each of the following areas:

- * AVF hazards: expertise in AVF eruption styles, range of AVF-specific hazard severity, and AVF-specific eruption characteristics
- * AVF geochemistry: expertise of geochemical constraints of AVF magma ascent and eruptive activity
- * AVF unrest: expertise in geophysical processes associated with volcanic eruptions and geophysical volcano monitoring
- * Monogenetic volcanic processes: expertise in monogenetic processes, drawing on studies from around the world

So far we have three experts confirmed across geochemistry, AVF unrest, and monogenetic hazards.

Entire DEVORA community review

We would now also like to open up the review process to the entire DEVORA community. We realise we are asking for quite a large commitment, so to reflect this we would acknowledge this by adding you as a co-authorship to the report – if you choose to contribute. There are seven scenarios and we expect reviews to take around 1-2 hours per scenario. Reviewers will be listed after the main report authors in alphabetical order.

If you were to accept, your task would involve reviewing the full report, with emphasis on your disciplinary area. We would greatly appreciate your review including relevant figures, data, examples and citations where practical to support your review comments.

Your submission should include your name, email, organisation, and area(s) of expertise. The deadline for submissions is 5pm on 15 March 2018. Lateness will limit the consideration given to the submission, and late reviews will not be eligible for co-authorship.

Uncertainty Survey

We are also keen to understand and communicate the large uncertainty associated with building scenarios and that the scenarios have been deliberately designed to extend across the full credible range of geophysical possibilities from an AVF eruption (excluding a failed eruption), rather than being weighted to the more likely future scenario. As a way to express the collective scientist's perceptions of the scenarios' representativeness and likelihood, we will include a short survey for the reviewers to complete.

Publication

A final draft report with the required revisions will be circulated for final approval before being submitted to the GNS review / publication system.

We also reserve the right to publish a scientific paper on the scenario development process and this is likely to be with a smaller author list than the GNS Report. Paper publication plans will be communicated with all report authors.

Important dates

1st February 2018 – Reviewer pack becomes available. Pack includes:

- * Draft report
- * Relevant shapefiles

15th March 2018 – Deadline for reviewer reports to be submitted. Note: lateness will limit the consideration given to the submission, and late reviews will not be eligible for co-authorship.

If you're interested please fill out the linked googleform and I will be in touch at the start of February.

<https://goo.gl/forms/GWBkN3KtJJypLd4q2>

Note: if you have already responded to this invitation, there is no need to respond again.

If you have any questions or concerns about the project, please feel free to contact me or any of my supervisors.

Many thanks for your consideration to participate in this project. We look forward to hopefully working with you

With kind regards, Josh Hayes, Tom Wilson, Natalia Deligne, Graham Leonard, and Jan Lindsay

Josh Hayes - PhD Candidate

Chem 311 Rutherford Building - Department of Geological Sciences University of Canterbury

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Volcano-DEVORA-list mailing list

Volcano-DEVORA-list@lists.gns.cri.nz

<http://lists.gns.cri.nz/mailman/listinfo/volcano-devora-list>

From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Elaine Smid
<e.smid@auckland.ac.nz>
Sent: Wednesday, 31 January 2018 6:21 PM
To: volcano-devora-list@lists.gns.cri.nz
Subject: [Volcano-DEVORA-list] DEVORA Quarterly Report and VolcanoCup Sci Comm Opportunity
Attachments: 2017-18_DEVORA_1stQtrRpt.pdf; ATT00001.txt

Hi All,

Hope you are all enjoying your summers!

We have two items to share:

1. The 1st quarterly report covering progress made July - Sept 2017 is attached for your perusal.
2. The first-ever 'Volcano Cup' on Twitter is starting tomorrow, during which people will vote for their favourite volcanoes and share why. The Auckland Volcanic Field (AVF) has a spot in the New Zealand bracket, with tough competition from Taupo, Tongariro, and Ruapehu. For those of you on Twitter or considering joining, this is a great science communication and public education opportunity. We encourage you to participate by explaining your research on the AVF, and casting a vote for the AVF if you are so inclined. I (Elaine) am also happy to share your AVF text and photos via my Twitter account (which will transform into the AVF account for the competition)-just send them through anytime to e.smid@auckland.ac.nz<mailto:e.smid@auckland.ac.nz>.

For the announcement and bracket, see our Facebook page:

<https://www.facebook.com/DEVORAProject/posts/833476493506191> and the Twitter post:

<https://twitter.com/janinekruppner/status/958081006799609856>

For details about how VolcanoCup will work, see here:

<https://twitter.com/janinekruppner/status/958319683689746432>

All the best,
Elaine

Elaine Smid
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DEVORA
First Quarter Report (Jul - Sept) 2017/18

GNS Science

January 2018



DEVORA

First Quarter Report 2017/18 (Jul - Sept)

GNS Science

January 2018

Released under the Official Information Act 1982

EXECUTIVE SUMMARY

Performance

During this quarter, good progress was made overall on the research programme objectives. This 1st quarter report of the 2017-2018 year discusses progress from 1 July to 30 September 2017.

Expenditure

Expenditure this quarter consisted of \$50,000 of EQC DEVORA funding and \$25,000 of Auckland Council funding. The year to date total expenditure of \$75,000 represents 25% of the full year's budget. Some tasks are co-funded or funded in-kind through additional funding streams from EQC and AC, as well as from GNS Science, University of Auckland, Massey University, Canterbury University, and the USGS. Please see the 'Partnerships' and 'Financial Report' sections of this report for more details.

Program highlights

Highlights from the first quarter of 2017-2018 are listed below with detailed reviews of activities in each Programme Outcome given in following sections.

- Seven DEVORA manuscripts and an affiliate manuscript were submitted, in review, or published this quarter.
- Publications included two describing the relationships and order of AVF eruptions from Ar-Ar ages and tephrochronology, which garnered significant press attention.
- Two new PhDs, Nicole Allen and Boglarka Nemeth, were introduced to DEVORA. They are working on building multi-hazard impact assessments and volcanic geoheritage, respectively.
- DEVORA researchers were featured in an episode of Xploration Station's *Awesome Planet*, which partly focused on the Auckland Volcanic Field and DEVORA's efforts to prepare the city for an eruption. The episode aired in over 100M US households.
- Six local presentations were made by DEVORA researchers, to the Auckland GeoClub, UoA School of Environment, and at the QuarryNZ conference.
- DEVORA researchers contributed 12 presentations to the international IAVCEI conference in Portland, Oregon. The conference had over 1,300 registrants.
- Results from U-Th-Ra analyses of the lava flow at the base of the Rangitoto core were obtained. The flow is more likely to be ~600 years than 6,000 but further analyses are needed to confirm.
- The Auckland eruption SIM was held successfully at the Auckland Council Emergency Management Coordination Centre. The whole-day exercise involved 43 UoA students, who took on the roles of the scientists and emergency managers, as well as media, who provided realistic communication interactions.
- The DEVORA Outreach Group, along with others, worked to bring earth science and natural hazard education to over 400 Year 4 and 5 students, their parents, and their teachers on 4 September as a part of the UoA's 'Incredible Science Day.'
- A graphic designer and an illustrator were hired to help DEVORA researchers produce Fact Sheets about the AVF and DEVORA.

INTRODUCTION

This report outlines progress and expenditure against key outcomes in the “DEVORA: DEtermining VOLcanic Risk in Auckland” Programme for the first quarter in FY2017-18 from 1 July to 30 September 2017. Section I summarises progress made on continuing DEVORA Phase I and DEVORA-affiliated projects; Section II describes progress made on the milestones described in the current work plan.

SECTION I: SUMMARY OF PROGRESS ON DEVORA PHASE I AND DEVORA-AFFILIATED PROJECTS

This section summarises progress made during this quarter on continuing DEVORA Phase I and DEVORA-affiliated projects, organized by topic (see Section II for progress on milestones as described in the current FY’s work plan).

Geology

- UoA MSc Megan Ferguson is working with Drs Michael Rowe and Manuela Tost (both UoA) to investigate the relationships between crystallinity and cooling rate during basaltic eruptions, with emphasis on the transition from phreatomagmatic (wet) to magmatic (dry) eruption style. She is examining deposits from Motukorea and North Head, as these sites exhibit ideal characteristics for this study based on previous work by DEVORA and IIOF researchers. Sample analysis at Motukorea is nearly completed, with processing to begin shortly on North Head samples.
- To determine xenocryst residence time and magma ascent rates in the AVF, Dr Marco Brenna (Otago) has collected a dataset consisting of major, trace element and water measurements from olivines from Pupuke volcano. He presented this work at the IAVCEI conference, held in Portland, Oregon, USA, in August, and a manuscript on this work is being finalized for submission.
- Marco continues to work on a preliminary model for the spatio-temporal development of the mantle source for the AVF.
- Postdoctoral researcher Dr Jenni Hopkins (VUW) was awarded 18 months of funding from the Earthquake Commission to undertake a project entitled, "Coupled eruptions in the Auckland Volcanic Field: are we underestimating the threat to our city?". Please see section 3.1 for more details.

Volcanic Hazards

- Dr Marco Brenna continues work on Three Kings volcano in order to determine chemical and physical characteristics throughout the eruption sequence.
- Two manuscripts describing the order of AVF eruptions from Ar-Ar ages and tephrochronology were published: one led by Dr Jenni Hopkins in Bulletin of Volcanology and another led by Graham Leonard in Journal of Volcanology and Geothermal Research (see ‘Project Publications,’ below).

SECTION II: PROGRESS MADE ON DEVORA PHASE II MILESTONES

This section details progress made during this quarter on milestones for the FY2017-2018 for the second phase of the project.

OUTCOME 1: We are confident in knowing the Auckland Volcanic Field (AVF)

The following milestones are associated with Outcome 1 for the 2017-2018 year:

1.1 We understand the likelihood of a future eruption in time and space

We know the sequence of eruptions

Milestone	Cost
Orakei tephra stratigraphy from Marsden core (CF Marsden)	\$0 (carried over)

Partners involved: UoA; GNS Science; VUW

Dr Paul Augustinus (UoA) was awarded a Marsden grant to (re)drill into the ash and sediment in the Orakei basin, with cofunding from DEVORA and GNS Science. DEVORA's aim in this project is to refine the tephra record for the AVF. The Orakei Basin core work is ongoing with the micro-XRF and X-ray density scanning of the whole core now complete. PhD candidate Leonie Peti is working on production of a complete composite record of maar lake sedimentation which we expect to extend from 12,000 to ca. 130,000 years. This work will be completed in the next quarter, and is essential for subsequent detailed work on the tephra contained therein and their significance for volcanic hazards in the Auckland region.

Postdoc Dr Jenni Hopkins (VUW) has been analysing the data from the deeper portion of the Orakei 'A' core with regards to identifying new basaltic tephra horizons. A number of potential deposits have been highlighted for further investigation.

We know the age of the every volcano

Milestone	Cost
Paleomagnetic investigation of Rangitoto core	\$0 (carried over)

Partners involved: UoA

The successful Rangitoto drilling project took place in February 2014. There are a few anomalies in some of the age determinations in the core thus far, and paleomagnetic investigations are underway to help resolve the issue. Around half of the 52 flows encountered in the Rangitoto core have been sampled and paleomagnetic analyses undertaken at Lund and Liverpool Universities. However the significant gaps in the record do not allow a reliable match to the Holocene magnetic secular variation record developed for New Zealand. Consequently, where possible (constrained by core quality) the remaining flows have been sampled and are presently at Lund University awaiting analysis.

1.2 We have fully characterised the source

We know what and where the source is

Milestone	Cost
Investigate mantle source heterogeneity in the monogenetic AVF.	\$2,000
Timm further analysis of isotopes data collected by Hopkins	\$10,000

Partners involved: UoA, VuW, GNS

PhD candidate Elaine Smid (UoA) is analysing melt inclusions in AVF olivines to examine source characteristics. This work continues, with an aim to finish sample analyses and draft a manuscript during this financial year.

Drs Christian Timm and Jenni Hopkins (GNS) collated all pre-existing data from the older volcanic fields (South Auckland, Ngatutura and Okete) into a usable geochemical database in order to further investigate the relationships between the AVF and older fields. Thirty Pb, Sr, Nd isotopic analyses and 15 major and trace element analyses were obtained during the last financial year and are in the process of being interpreted.

We know whether the source is primed and what triggers ascent

Milestone	Cost
Investigate link between past tectonic events and AVF eruptions/triggers for magma ascent? Host workshop in 2017-18	\$1,500

Partners involved: UoA, VuW, GNS

During this quarter, planning for a cross-disciplinary volcanic-tectonic workshop commenced. The workshop will feature presentations from several expert researchers from across NZ and take place just before the 2017 Geoscience Society of New Zealand conference, to be held in Auckland in November.

1.3 We understand magma ascent

We understand how ascent works and have a handle on ascent rates.

Milestone	Cost
Investigate ascent rates through diffusion	Costed elsewhere
Investigation of olivine in AVF volcanoes and implications for ascent rates	Costed elsewhere

PhD candidate Elaine Smid (UoA) is using melt partially trapped in AVF olivines to examine magma ascent rates in the AVF. Additional funding for this project was secured from The Earthquake Commission via a University Postgraduate Grant. This grant was submitted in conjunction with another successful, complementary ascent rate project, led by Marco Brenna (see 'Section I,' above). During this quarter, Elaine continued to pick and grind olivines to find suitable melt embayment samples for this work.

1.4 We have a good understanding of the crust and how it affects magma rising through it

We have integrated data from different geophysical methods

Milestone	Cost
Use ambient noise to see into the crust and mantle--Link to crustal attenuation model	\$5,000

Partners involved: UoA, GNS

In previous quarters, Josiah Ensing (UoA) investigated ambient noise in Auckland with the goal of improving knowledge of geologic variations and seismic velocities under the city. He has since started a PhD to expand this work, adding city noise and other methods to increase model resolution and depths. During this quarter, Josiah used ambient seismic noise to estimate the orientation of the horizontal components of all the seismometers in the Auckland Volcano Seismic Network and the University of Auckland seismometer on Rangitoto Island (KBAZ). This information will be vital for further seismic studies that involve the three orthogonal components of the wave field. For the 8 borehole seismometers, no estimates of the orientation of the sensors existed yet. In the process, we found that KBAZ and WTAZ have reversely polarised vertical channels, and EPAZ has one reversely polarised horizontal channel. Station MBAZ has a horizontal channel that is not performing correctly (and station WTAZ is only a vertical component seismometer). Our results agree well with a more conventional method based on knowledge of the hypocentre of regional earthquakes. The standard deviations for estimates made using ambient seismic noise

were, on average, slightly smaller than for the more conventional earthquake method. This work is currently being written up in a manuscript.

We have carried out volcano-specific structural studies

Milestone	Cost
Geophysical Investigation of subsurface Rangitoto based on Rangitoto Seismic Observatory	\$3,000

Partners involved: UoA, GNS

The Rangitoto seismometer working group (for the seismometer station, RBAZ, installed February 2014) continues to collect data. PhD student Josiah Ensing and Research Fellow Kate Lewis Kenedi (UoA) are using the station data to analyse whether small earthquakes happen under Rangitoto and to produce a 3D ambient noise analysis of Auckland as a part of Josiah's PhD. They are in the process of preparing a report to initiate discussions with GeoNet over the future of the site.

UoA MSc Gugi Ganefianto is working with Dr Kasper van Wijk using RBAZ data and modelling to see what kind of resolution can be expected for body wave tomography from regional and teleseismic earthquakes.

We have an improved understanding of the role of the Hauraki Rift

Milestone	Cost
Investigation of interplay between stress regime, time and volcanism in AVF + Investigate faulting associated with Hauraki Rift in context of AVF tectonic setting. What is driving the rift?	\$8,000

Partners involved: UoA, GNS

PhD candidate Robert Pickle, working with Dr Jennifer Eccles, Assoc Prof Julie Rowland (all UoA) and Dr Sigrun Hreinsdottir (GNS), is investigating the structure and current level of activity of the Hauraki Rift using seismology, geodesy and pre-existing gravity and magnetic data. The third and final year of geodetic surveying has been completed totaling >45 sites. This data provides a critical datum for all future surveying throughout the northern North Island. Additionally, the crustal offsets of the November 2016 Kaikoura earthquake have been calculated for the greater Auckland and Hauraki Rift regions and found to be several times larger than the average yearly strain. The timing and magnitude of this earthquake amidst the three year survey has led to an unexpected study of the far field effects of large earthquakes but does not prevent a clear new image of the current rift activity within a larger northern New Zealand context. The rift appears to be widening ~1mm/yr but

it may be accommodated across several faults to the west and parallel to the Kerepehi Fault, previously assumed to be its sole rift axis. This work will be presented at the upcoming DEVORA Forum, DEVORA volcanic-tectonic workshop, and NZ Geosciences Conference in the next quarter.

We have a good handle on faults and structure

Milestone	Cost
Develop 3D model of crustal structure by integrating gravity, borehole, and field data.	\$15,000

Partners involved: UoA, GNS

MSc student Caleb Gasston completed his thesis this quarter. He worked with Drs Jan Lindsay (UoA), Jenninifer Eccles (UoA), Martin Brook (UoA), Matt Hill (GNS), and John Begg (GNS) at UoA to create a 3D model of a section of Auckland's crust by integrating borehole, geomorphological and field data with gravity surveys. He built on Jill Kenny's previous work to confirm the presence of the previously proposed Te Puru, Turanga and Waikopua North faults and reveal two new faults (the Motukaraka and a small intersecting fault). He is in the process of writing up his results as a manuscript for submission to Natural Hazards and Earth Systems Science and will soon take up PhD at UoA looking at fault-triggered landslides in Kaikoura. This milestone complements GNS Science's Urban Mapping Project.

The Regional Geology Team at GNS Science are working on new urban maps in the Auckland Region using existing geological maps, aerial photography, LiDAR elevation data and geophysical surveys. The team are currently building on the DEVORA drill hole database and digitising geological records from borehole logs into a geotechnical database for 3D modelling. They are working closely with the New Zealand Geotechnical Society, Auckland Council and technicians from the New Zealand Geotechnical Database to ensure that the data is captured in an internationally recognised format (AGS4) that will support a wide range of future studies. The urban mapping in Auckland, which is currently focusing on the South Auckland region, will use this database of drill hole data to build 3D geological models, and along with geomorphic mapping, drive the geological mapping process. Currently, GNS is working with AC to finalize the data capture information for a new surface outcrop layer within the NZGD. This layer will make outcrop information and photography from engineering sites around the city more widely available and will enhance the development of the new geomorphic map of Auckland. Pending finalization of the data capture process, the layer is expected to go into development during the next quarter.

1.6 We understand the importance of Rangitoto

Milestone	Cost
Further chemistry on Rangitoto core, mineral chemistry	\$0 (carried over)

Partners involved: UoA

U-Th-Ra isotope analyses were completed at Macquarie University for two samples from the base of the new Rangitoto core. Results indicate that the U-Th and Th-Ra ratios from samples from the base of the core are unlikely to be 6,000 years old, as suggested. They instead are very similar to those previously obtained for the c. 550 yrs BP eruption published in McGee et al. 2011, and are likely to be a similar age to the previously analysed alkalic and subalkalic eruptions. This milestone is considered complete and researchers are currently forming manuscript ideas based on this data.

1.7 International Benchmarking

Milestone	Cost
Workshop with experts in monogenetic fields, involving CDEM.	\$7,000
Investigate the tipping point for surges based on analogue fields	\$10,000

Partners involved: UoA, AC, Otago, GNS, Others as identified

Prof. James White (Otago) is studying the evolution of monogenetic eruptions by examining the exposed roots of the magma plumbing systems in the Hopi Buttes Volcanic Field. This will allow us to better understand the potential for explosive episodes in future eruptions in the Auckland Volcanic Field.

1.8 We have built useful databases that are well maintained and accessible
DEVORA aligns with the NZGD

Milestone	Cost
DEVORA aligns with the NZGD and uploads borehole information to the Auckland area wherever possible. DEVORA maintains linkages with the Urban Mapping Project, regularly shares data, and maintains datasets in compatible formats.	\$16,000

Partners involved: UoA, GNS, MBIE, NZTA, EQC, Kiwirail

Database manager Tracy Howe is now working as part of MBIE's New Zealand Geotechnical Database (NZGD) project. While she mainly works in data management and resourcing, Tracy is also responsible for administrating the North Island sector of the NZGD. Currently, the database contains >19,000 records from across the Auckland region. Efforts to increase the amount of data on the system are continuing via funding grants from MBIE, NZTA, Kiwirail, and EQC. During this quarter, Tracy formatted and uploaded >1000 data points across Auckland, mostly in the eastern regions of the city. She also spent 3 days in Wellington collecting geotechnical reports and drawings related to Kiwirail projects from around New Zealand. In addition to her current role, Tracy continues to provide training sessions on how to use the NZGD to consultancies around Auckland. Tracy continues to work closely with the Urban Mapping Team at GNS and is assisting in the development of the NZGD surface outcrop layer. This layer is the brainchild of a meeting held by Ross Roberts at Auckland Council, which focused on ways to speed up the urban mapping of the Auckland region.

Geochemical sample database is maintained

Milestone	Cost
Maintain a system for receiving, processing, analysing and archiving samples from geotechnical companies, and adding to AVF geochem database and Petlab.	Costed elsewhere

Partners involved: UoA, GNS

Drs Jenni Hopkins and Christian Timm (GNS) are currently interpreting new data from the AVF. Only three of the field's 53 volcanoes are now unrepresented in the geochemical database. Jenni has updated the AVF geochemistry database and PETLAB with the latest AVF data. It is now available for project use via PETLAB.

Material continues to be collected to expand and refine our age-dating and geochemistry databases. Tracy and Elaine obtained a core from the geotechnical consultancy, Pattle Delamore Partners, that may relay age information for some of the volcanoes in the East

Tamaki area. A DEVORA intern is working to obtain XRF analyses on several lapilli layers found within the core. Dr. Hopkins is being consulted for geochemical expertise.

Tracy Howe continues to build linkages with the consultancies regarding access to drill core samples. Tracy and Elaine Smid have created a GIS-made base map to show consultancies the areas of interest for DEVORA projects and received feedback on its layout, design, and usefulness from consultants. Tracy advertised the need for AVF samples from specific areas depicted on the map to Pattle Delmore Partners during an in-house talk and to the New Zealand Geotechnical Society during their latest Auckland branch meeting.

1.9 We know likely impacts of eruption outcomes

We have developed hazard models

Milestone	Cost
Determine gas dispersal over AKL in selected eruption scenarios	\$10,000
Develop plan for quantitative consideration of gas dispersion	Costed elsewhere
Run complex lava flow model in-house, or determine another approach	\$8,000
Explore effects of lava on buried infrastructure	Costed elsewhere

Partners involved: UC, GNS, UoA

Graham Leonard, Carol Stewart, and Tom Wilson, in conjunction with University of Hawai'i personnel and the USGS, met to discuss volcanic hazard management, including volcanic gas. This collaboration has already yielded a revamped website for ash hazards (See https://volcanoes.usgs.gov/volcanic_ash/) and increased New Zealand involvement in an international ash impacts working group through IAVCEI. Sophia Tsang is building on these collaborations following her field visit to Hawai'i last quarter (see next paragraph). A plan is being formulated to determine gas dispersal over Auckland in eruption scenarios.

UoA PhD candidate Sophia Tsang is working with Drs Jan Lindsay (UoA), Giovanni Coco (UoA), Tom Wilson (UC), Ben Kennedy (UC), and Natalia Deligne (GNS) to examine the impacts of lava flows on the built environment. During this quarter, Sophia finished analysing her data from interviews and focus groups in Hawai'i about the 2014-2015 Pahoehoe lava flow. Her results have been written into a report and are currently being reviewed by co-authors. She also undertook preliminary modelling of heat transfer from lava flows into the soil below to prepare for her labwork at The Lava Project at Syracuse University, Syracuse, New York.

Outcome 2. Our diverse society knows, understands, and trusts our science

The following milestones are associated with Outcome 2 for the 2017-2018 year:

2.6 World-class communication products are available for all target audiences

Milestone	Cost
Oblique air photos of all volcanoes and geological features	\$0 (carried over)
RA support for Fact Sheet production	Costed elsewhere
Hire professional for Fact Sheets design.	\$10,000
Partnership with Maunga Authority and other stakeholders to develop interpretive signage.	Costed elsewhere
Addition of 10 AVF GeoTrips. + Videos for GNS Youtube Channel	Costed elsewhere

A series of 'Fact Sheets' are being produced as a part of DEVORA. These will aim to convey up to date research findings and information about various AVF topics to the public. Fact Sheet #1, City of Volcanoes, is in advanced draft form. This fact sheet provides an overview of the AVF and serves as a design template for the rest of the series. Gavin Mouldey, an internationally renowned illustrator from the Wellington region, and Katy Kelly, a graphic designer (GNS), have joined the fact sheet team and are currently working on a style guide for the Fact Sheet series. A timeline to complete the next 4 DEVORA Fact Sheets by February 2018 has also been set in place. Fact Sheet #2, Hidden Eruptions, is currently in draft form and undergoing illustration development, and Tracy Howe and Elaine Smid are working to finalize the text of the Fact Sheets #3 - #6. As a part of this effort, new aerial photos of the volcanoes and key geologic features will be taken by GNS staff and owned by DEVORA to be used by DEVORA researchers without any copyright concerns.

In this quarter Bruce Hayward has come on board as Geotrips author and has uploaded approximately 30 GeoTrips related to the AVF. In the future we hope to add some geotrips that include matauranga in collaboration with the Maunga Authority.

Outcome 3. People will behave appropriately in a volcanic crisis

The following milestones are associated with Outcome 3 for the 2017-2018 year:

3.1 We support CDEM crisis management

We fill Information needs

Milestone	Cost
Hold annual role-play exercise involving a simulated AVF eruption with Auckland Council Emergency Control Centre.	Costed elsewhere

Partners involved: UoA, UC

A simulated role-play exercise involving an AVF eruption has taken place annually over the last five years at the Auckland Council Emergency Operations Centre. On 4 September, students from the University of Auckland's geohazards course participated in a simulation of an Auckland Volcanic Field eruption. The simulation allowed students to experience firsthand the level of communication and decision making required to keep the population safe during an eruptive event. A social media component was added to the simulation this year. DEVORA also teamed up with members of the journalism school to provide realistic media interaction during the simulation. Several Emergency Management staff also participated during the day, providing advice and challenging the students. One noteworthy outcome is that we are starting to see graduates of this course take up positions at Auckland (and other) Council's in emergency management roles.

We provide impacts and mitigation support

Milestone	Cost
Lava flow redirection; Hawaiian information gathering June 2015, write up with recommendations; Pahoehoe vs Pylons/poles, buried infrastructure, roads, buildings	Costed elsewhere
Gas Monitoring and Advice; Hawaiian information gathering June 2015 (with lava above)	Costed elsewhere
Look at health considerations for volcanic gas, in conjunction with the exploratory gas hazard work.	Costed elsewhere
Maintain link with VISG through N. Deligne, risk task leader	Costed elsewhere
Contribute to the annual VISG workshop (November)	Costed elsewhere

Partners involved: UoA, UC, GNS

See Outcome 1.9, above, for outcomes from the Hawaiian information gathering trip, which focused on discussing and gathering ideas around volcanic gas and lava flow redirection mitigation strategies. Sophia Tsang followed up on outcomes from this trip during her visit to Hawai'i, and has written a report that is currently being reviewed by co-authors.

Dr Natalia Deligne (GNS) is coordinating the linkage between DEVORA and the Volcanic Impacts Study Group (VISG), a subcommittee of the Auckland Lifelines Group. DEVORA researchers contributed updates to the VISG newsletter, curated and edited by Natalia. The most recent newsletter was published in September 2017, and featured research by UoA PhD student Sophia Tsang.

We provide decision support

Milestone	Cost
Develop workplan to look at both magma ascent rate outcomes and geochemistry vs volcano size outcomes in relation to emergency planning considerations	Costed elsewhere
Multi-hazard evacuation models built and simulations run in conjunction with CDEM requirements	\$0 (carried over)
Further develop decision-making model for evacuation in the event of an eruption	\$8,000

Partners involved: UoA, UC, VUW, GNS, CDEM

With the completion of several PhDs concerning volcano ages, the possible link of mantle source geochemistry to volcano size, and the ongoing and future planned work on mantle sources and ascent rates in the AVF, we can now start to investigate these linkages in relation to emergency planning considerations. A draft work plan for implementation in future years will be discussed and created during this financial year. GNS post doc Dr Jenni Hopkins was awarded 18 months funding from the Earthquake Commission to undertake a related project entitled, "Coupled eruptions in the Auckland Volcanic Field: are we underestimating the threat to our city?". This work will investigate previous eruptions that have occurred close in both space and time. It will detail their geochemical relationships, and aims to use these relationships to investigate the mantle mechanisms responsible for the AVF eruptions.

Funding from DEVORA will assist in the development of an app that can be used for 'citizen science' evacuation planning and modelling. This effort is underway for tsunami evacuation, with a new (Oct/Nov 2017) NHRP contestable project for the next two years. Funds from DEVORA will allow the project to expand to additional hazards in the future. The design of the tsunami safer schools project is critical here.

UoA PhD Alec Wild is working with Jan Lindsay, Mary Anne Thompson (both UoA), Tom Wilson (UC), and Mark Bebbington (Massey) to study the application of cost-benefit analysis in a framework for evacuation decision-making in volcanic crisis management, to be applied to the AVF once completed. During the course of his PhD, he will assess appropriate tools, methods, and frameworks available, consult with decision-makers and stakeholders, and then develop an appropriate application framework to explain the level of uncertainty, including spatially and temporally, and the volcanoes' behaviour. During this quarter, Alec started writing his PhD proposal and developing the hazard model selection criteria, partly based on a comprehensive literature review.

3.2 DEVORA research supports the warning system

We inform monitoring

Milestone	Cost
Geonet future workplan aligned with DEVORA supporting capability as needed.	CF GNS
Feasibility and benefit statement for novel earlier detection of magma ascent, including indicative costs	\$0 (carried over)

Partners involved: UoA, GNS

This milestone is this year rephrased as: Scoping of any novel monitoring techniques that might assist with earlier or more certain detection of magma rising. Steve Sherburn and Art Jolly (GNS) have proposed a workshop, to take place in this financial year, as the best avenue to accomplish this milestone. The workshop and follow up work would be summarised in a report.

3.3 We contribute to a coordinated science response

We participate in the NZVSAP – NZ Volcano Science Advisory Panel

Milestone	Cost
DEVORA scientists on NZVSAP	In kind

Partners involved: all

We participate in AVSAG – Auckland Volcano Science Advisory Group

Milestone	Cost
DEVORA scientists on AVSAG	In kind

Partners involved: all

Jan Lindsay and Graham Leonard, DEVORA co-leaders, and several other DEVORA colleagues and researchers are involved in AVSAG and the NZ Volcano Science Advisory Panel (NZVSAP).

Carol Stewart (supported by Tom Wilson, Daniel Blake and Josh Hayes at UC) has finalised new guidelines produced on behalf of the NZVSAP health impacts subgroup on 'Respiratory Protection in Ashfall' and is in the process of finalising a new guideline on 'Volcanic ash clean-up advice to households' and leading development of new guideline on 'Protecting Home and Farm Water Supplies'. She has also begun work on revising MCDEM's consistent messaging guideline on volcanic eruptions.

Tom Wilson has had discussions with MCDEM and MPI about development of “Infrastructure” and “Agriculture” sub-groups of the NZVSAP. Their appetite is probably best assessed as a combination of interested/bemused/needing stronger justification--both would like to see draft terms of reference. It is hard to progress this without NZVSAP Terms of Reference confirmed nor operating regularly.

Outcome 4. People have access to risk and consequence information in formats that suit their needs

The following milestones are associated with Outcome 4 for the 2017-2018 year:

4.1 Our research is fully integrated into Riskscape

Exposure/asset datasets are developed

Milestone	Cost
Improve remaining four ArcGIS collected data sets to Riskscape, contingent upon additional parameters being added to each	\$8,000
Improve electricity, telecommunications and pipelines as available from lifelines agencies.	Costed elsewhere
Improve attributes for each asset category with respect to volcanoes	Costed elsewhere
Prepare report summarising state of the Riskscape exposure database for Auckland vs 2012.	Costed elsewhere

Partners involved: GNS, UC

Hazard module in RiskScape is improved

Milestone	Cost
Improve key hazard models into riskscape	Costed elsewhere

Partners involved: GNS, UC

Vulnerability modules in RiskScape are improved

Milestone	Cost
Improve fragility curves in Riskscape	\$41,000
Infrastructure: Investigate fragility for unique critical sites	Costed elsewhere
Indirect/Intangible/Economic: Scope out fragility for deprivation index or wider social vulnerability	Costed elsewhere
Quantify volcanic hazard impacts to buildings	\$15,000

Partners involved: GNS, UC

The development of RiskScape volcano modules for Auckland and New Zealand continued this quarter.

Natalia is finishing a GNS Science report that provides information about all the parameters used for on-the-fly tephra dispersion modeling in RiskScape, including legacy parameters used prior to her revisions. This is expected to be complete by the end of the next quarter, if all goes well.

Fragility/vulnerability models developed by UC and GNS researchers to date include (note: not all of these are within RiskScape yet):

- critical infrastructure (electricity transmission, electricity distribution, water supply, waste water + stormwater, road transport, rail transport) for tephra fall, PDC, lava flow, lahar:
 - transportation vulnerability models have been further refined by Daniel Blake
 - work is progressing on considering vulnerability models for water, wastewater and storm water
 - buildings for tephra fall (including ballistics)
- clean up of pyroclastic deposits - including geospatial processing of Auckland urban area.
- agriculture (pastoral, horticulture, forestry) for tephra fall

Nicole Allen at UC (new DEVORA PhD, co-funded with UC) will take on responsibility for addressing buildings more fully and approaching multi-hazard impact assessment. Sophia Tsang at UoA is addressing lava flow vulnerability models, with focus on buried assets, through empirical and numerical modelling.

During this quarter, we have had a series of manuscripts accepted, led by former DEVORA PhD candidates Dr Grant Wilson and Dr Daniel Blake and involving a number of DEVORA researchers. Former DEVORA MSc student George Williams has also published work, again involving some DEVORA researchers. A further manuscript first authored by Daniel Blake remains in review.

Carol Stewart has completed analysis of volcanic ash samples from the 2015 eruption of Calbuco volcano, Chile, and is preparing a GNS Science report on the findings. This analysis was done in conjunction with the GNS NZ Geothermal Analytical Laboratory at Wairakei, and is also a useful test of rapid ash analysis methods for eruption preparedness.

The UC team organised a research workshop for early November to analyse a quantitative dataset on building impacts following the 2015 Calbuco eruption in Chile. This workshop will involve three international researchers (Rodrigo Calderon - Sernageomin, Chile; Dr Susanna Jenkins and George Williams – NTU, Singapore) flying to New Zealand to work on the internationally significant database and undertake broader networking/collaborative opportunities. This will involve DEVORA researchers from UC, Massey and GNS Science. Semi-independently, a GNS Science report has been drafted of the impact assessment undertaken following the 2015 Calbuco eruption in Chile and is expected to be submitted by the end of the year.

We have ensured that Auckland as a location in RiskScape is functional for all hazards

Milestone	Cost
Estimate how accurate RiskScape is at estimating losses from natural hazards using recent events to check calibration	Costed elsewhere

Partners involved: GNS, UC

Natalia Deligne (GNS) is coordinating with the RiskScape personnel to ensure real-life losses from recent natural hazard events match those forecasted by the software, in order to calibrate and check the accuracy of the programme.

4.3 We have developed DEVORA scenarios

We can run lava, ash, edifice, pyroclastic density current and ballistics on the DEVORA grid

Milestone	Cost
Draft pub on scenario parameterisation & probabilities	Costed elsewhere
DEVORA grid scenario data for 8 nodes-calibrate Riskscape	Costed elsewhere
Consider disruption for 7 scenario nodes as time permits	Costed elsewhere
Eruption scenario development for RiskScape to support multi-hazard debris disposal research	\$7,000

Partners involved: GNS, UC, UoA

Eight eruption scenarios are being developed, with the aim of providing final hazard footprint and intensity "data" for impacts students to work on. A complete scenario has been developed for "Mangere Bridge" in collaboration with the Economics of Resilient Infrastructure program. Carol Stewart is preparing another manuscript (with co-authors Natalia Deligne and Tom Wilson) exploring the consequences of the Mangere Bridge eruption scenario for Auckland's water supply and wastewater networks, and subsequent impacts on public health. This will be the third paper in this series.

The remaining 7 scenarios are under development, led by UC PhD Josh Hayes. Rebecca Fitzgerald (UC PhD) and Sophia Tsang (UoA PhD) are also providing input into this work through modelling of ballistic projectile and lava flow hazards respectively. These scenarios will allow impact assessments of different styles of volcanic eruptions at different locations. Preliminary scenarios were presented at a workshop held in Auckland in November 2016. This workshop identified a number of areas for further refinement of the scenarios. The scenarios have been refined and modelling of eruption hazards have largely been completed. A manuscript detailing the scenario development process and scenarios is in preparation. Josh also continues work focusing on clean-up and restoration of the urban environment after volcanic eruptions. He will assess how clean-up operations vary based on different eruption styles and locations within the AVF based on the various scenarios.

4.5 We have developed other risk products

Milestone	Cost
Workplan draft to support use of risk outputs w/ stakeholders (Richard Woods)	\$2,000

Partners involved: GNS, UC

Work on this milestone has been delayed until later quarters to match the release of RiskScape 1.0.

Outcome 5. Auckland Council, Businesses and individuals have anticipated, prepared for and are able to respond and recover - planning appropriately

The following milestones are associated with Outcome 5 for the 2017-2018 year:

5.1 Planning at all levels is supported by science and best practice

Milestone	Cost
Develop effective evidence-based crisis hazard maps, w/ stakeholders	\$4,000

Partners involved: GNS, UoA, AC

Dr Mary Anne Thompson (UoA) was invited to present her hazard map research at the M9 research group meeting at the University of Washington in Seattle, Washington, USA. She also helped co-lead a hazard map workshop at the international IAVCEI conference in Portland, Oregon, USA. She is currently preparing to collect data for her project "Building a better hazard map". She also wrote and designed the first DEVORA fact sheet, which will be published and circulated in the next quarter.

Outcome 6. DEVORA supports sustainable development and expansion of 'Resilient Auckland'

The following milestones are associated with Outcome 6 for the 2017-2018 year:

6.1 We support land use planning

Geoheritage and Future Land Use

Milestone	Cost
Geoheritage map of important sites for land-use planning.	\$32,000
Scope wider support for land use planning at AC.	Costed elsewhere

Partners involved: GNS, UoA, AC

Massey PhD Boglarka Nemeth, working with Dr Karoly Nemeth, is modelling AVF geoheritage sites for geoconservation purposes. Urbanisation can cause environmental degradation therefore the preservation of the geoheritage sites with high intrinsic value is crucial. During this quarter, Boglarka systematically reviewed of all the available methods currently used for geosite assessment and examined the adequacy of these techniques for monogenetic volcanic fields. In coming quarters, spatial data will be collected on AVF geoheritage sites to create a GIS database.

Natural Resources and Future Land Use

Milestone	Cost
Share data on potential aggregate and other natural resources identified during the DEVORA project with GNS	Costed elsewhere

Partners involved: GNS, UoA, AC

Matt Hill from GNS Science attended the annual Aggregate and Quarry Association conference held in Auckland this year. Matt presented results of buried basalt aggregate potential in South Auckland to more than 100 conference delegates. GNS have almost completed their compilation of the subsurface geology from borehole records in the NZGD. These identify basalt and scoria intersected in the boreholes and can be used for thickness mapping in the region.

Outcome 8. Our science is well managed and has wider benefits

The following milestones are associated with Outcome 8 for the 2017-2018 year:

8.7 There is collaboration and trust between partners

DEVORA hosts an annual research forum for exchange of ideas and results

Milestone	Cost
Annual DEVORA Research Forum	\$2,500

Partners involved: All

The 10th Annual DEVORA Research Forum will take place at UoA on Tuesday, 7 November.

Outcome 9. Auckland is linked in to other major hazard programmes, aligned to DEVORA

The following milestones are associated with Outcome 9 for the 2017-2018 year:

9.4 National Science Challenges

Resilience to Nature's Challenges

Milestone	Cost
Facilitate and evaluate stakeholder engagement in the NSC and align DEVORA to this	Costed in 5.1 above

Partners involved: UoA, GNS

Prof Shane Cronin is the Director of the National Science Challenge – Resilience to Nature's Challenges (RNC), which includes a new stream of work focusing on the resilience of the City of Auckland to all natural hazards it faces. Amongst a large multi-disciplinary team, Jan Lindsay is working within the "Resilient Cities" programme, providing a conduit between hazards researchers and the largely Engineering-based "Resilient Cities" team led by Suzanne Wilkinson.

As a part of the RNC, Dr Mary Anne Thompson (UoA) is carrying out a longitudinal research project investigating stakeholder and researcher perspectives of the transdisciplinary co-created research process.

Outcome 10. We are confident in knowing other volcanic threats to Auckland

The following milestones are associated with Outcome 10 for the 2017-2018 year:

Milestone	Cost
Continue to evaluate tephra models – see Outcome 1.10 -	Costed elsewhere

Partners involved: GNS, UC

Work to further test the new HYSPLIT ashfall forecast model with MetService by Tony Hurst and Natalia Deligne is underway.

DEVORA MEETINGS AND WORKSHOPS

Dr Hopkins Presents New AVF Ages

On 19 September, Dr Jenni Hopkins gave a talk at the University of Auckland entitled, "The secret life of volcanic ash in uncovering the eruptive history of the Auckland Volcanic Field." The talk covered the findings of her PhD research and recent publications. It was very well received with >20 people in attendance. Dr Hopkins also delivered the talk to the Auckland Branch of the GSNZ community that evening.

International Hazard Map Workshop

On 12 and 13 September, Drs Mary Anne Thompson and Jan Lindsay led a 'State of the Hazard Map 3' workshop at the 2017 IAVCEI conference.

DEVORA PUBLICATIONS (JUL - SEPT 2017)

Blake DM, Wilson TM, Cole JW, Deligne NI, Lindsay JM, 2017: Impact of volcanic ash on road and airfield surface skid resistance. *Journal of Transportation Research Part D: Transport and Environment*, 9(8): 1389. DOI:10.3390/su9081389

Ensing JX, van Wijk K, Spörli KB, 2017. Probing the subsurface of the Auckland Volcanic Field with ambient seismic noise. *New Zealand Journal of Geology and Geophysics*. 29: 1-2. DOI: 10.1080/00288306.2017.1337643

Gravis I, Németh K, Procter JN, 2017. The role of cultural and indigenous values in geosite evaluations on a quaternary monogenetic volcanic landscape at Ihumātao, Auckland volcanic field, New Zealand. *Geoheritage*, 9(3): 373-93. [Affiliated]

Hopkins JL, Wilson CJN, Millet MA, Leonard GS, Timm C, Mcgee LE, Smith IEM, Smith EGC. 2017: Multi-criteria correlation of tephra deposits to source centres applied in the Auckland Volcanic Field, New Zealand. *Bulletin of Volcanology*, 79 (55). doi:10.1007/s00445-017-1131-y

Leonard GS, Calvert AT, Hopkins JL, Wilson CJN, Smid ER, Lindsay JM, Champion DE, 2017: High-precision $^{40}\text{Ar}/^{39}\text{Ar}$ dating of Quaternary basalts from Auckland Volcanic Field, New Zealand, with implications for eruption rates and paleomagnetic correlations. *Journal of Volcanology and Geothermal Research*. DOI: 10.1016/j.jvolgeores.2017.05.033

Thompson MA, Owen S, Lindsay JM, Leonard GS, & Cronin SJ, 2017: Scientist and stakeholder perspectives of transdisciplinary research: early attitudes, expectations and tensions. *Environmental Science & Policy*, 74: 30-29.

Williams GT, Kennedy BM, Wilson TM, Fitzgerald RH, Tsunematsu K, & Teissier A, 2017: Buildings vs. ballistics: Quantifying the vulnerability of buildings to volcanic ballistic impacts using field studies and pneumatic cannon experiments. *Journal of Volcanology and Geothermal Research*, 343: 171-180. DOI: 10.1016/j.jvolgeores.2017.06.026

Wilson G, Wilson TM, Deligne NI, Blake DM, and Cole JW, 2017: Framework for developing volcanic fragility and vulnerability functions for critical infrastructure. Journal of Applied Volcanology, 6:14. DOI: 10.1186/s13617-017-0065-6

DEVORA PRESENTATIONS

University of Auckland Presentations

Hopkins J, 2017: The secret life of volcanic ash in uncovering the eruptive history of the Auckland Volcanic Field (September 19)

Smid E, 2017: Volatile Life of Auckland Magmas (September 28). School of Environment Research Presentation.

Kenedi and Lindsay: The volcano beneath our feet. Presented at the Ground Beneath our Feet Research Symposium. 12 September.

GSNZ Auckland Geoclub Meeting: Auckland, NZ

Hopkins J, 2017: The secret life of volcanic ash in uncovering the eruptive history of the Auckland Volcanic Field (19 September)

Pickle R, 2017: New results from the on-going geodetic surveys of the Hauraki Rift (July 18)

QuarryNZ Annual Conference, August 19 – 21, Auckland, NZ

Deligne, N, 2017: Hypothetical AVF eruption scenarios and their possible implications and impacts.

Hill, M, 2017: Towards a 3D model of South Auckland: Implications for resource development.

IAVCEI 2017, 14-18 August, Portland, Oregon, USA

Brenna M, Cronin S, Smith I, Scott J, and Smid E, 2017: Rapid magma ascent following complex storage in the monogenetic Auckland Volcanic Field. Abstract 591.

Dohaney J, Kennedy B, Wilson TM, Brogt E, and Gravley D, 2017: Simulating a volcanic crisis to teach students emergency management, volcanic forecasting concepts, and communication skills. Abstract 454.

Fitzgerald R, Kennedy B, Wilson T, Leonard G, Jeffrey A, and Mcsporrán A, 2017: Ballistic hazard and vulnerability quantification using a pneumatic cannon. Abstract 739.

Handley H, McGee L, Didonna R, Nemeth K, Griffis R, Turner M, 2017: Multiple vent eruptions at monogenetic volcanoes: Waitomokia volcano, Auckland Volcanic Field, New Zealand. Abstract 627.

Hayes J, Wilson T, Deligne N, and Leonard G. Embracing deep uncertainties to transparently develop plausible scenarios for volcanic impact and risk assessment. Abstract 973.

Hopkins JL, Leonard G, Wilson CJN, Millet MA, Timm C, McGee LE, 2017: Reconstructing the evolution of the monogenetic Auckland Volcanic Field, New Zealand, using a multi-criteria approach to correlate tephra deposits to their source centres. Abstract 382.

Hurst T, Davis C, Deligne N, 2017: Handling uncertainties in volcanic ash forecasts from HYSPLIT atmospheric modelling. Abstract 268.

Lindsay JM, Calder E, Thompson MA, Ewert J, Leonard G, 2017: State of the Volcanic Hazard Map: Development and preliminary results of a world-wide survey of official volcanic hazard maps. A presentation on behalf of the IAVCEI Hazard Mapping Working Group. Abstract 135.

Smith IEM, 2017: The Geochemical Behaviour of small scale basaltic systems: the example of intraplate monogenetic systems. Abstract 111.

Stewart C, Deligne N, Wilson T, Davies A, Perera P, Buxton R, and Grace E, 2017: Investigating volcanic eruption impacts on water infrastructure using a scenario approach: damage to networks, outage maps and potential public health consequences. Abstract 459.

Tsunematsu K, Fitzgerald R, Kennedy B, Gomez C, Falcone JL, Chopard B, 2017: Open Source 3D Multiparticle Ballistic Simulator "Ballista". Abstract 29.

Wilson T, Stewart C, Deligne N, Leonard G, Jenkins S, Hayes J, Blake D, and Wild A, 2017: Assessing Volcanic Impacts to Society. Abstract 1291.

PROJECT PUBLICITY

AVF Eruption History Decoded

During this quarter, two papers concerning the age order of volcanic eruptions in the AVF were published. Forty-eight of Auckland's 53 volcanic centres can now be placed in order. To do this, researchers devised new and improved techniques to match tephra in lake cores to dated volcanic deposits. Both papers garnered significant media attention and have vast implications for our understanding of the AVF evolved over time.

- Scientists reveal Auckland's explosive history (NZ Herald 18/7/2017): http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11892070
- Decoding Auckland's Volcanic Past (Radio NZ 18/7/2017)
- Auckland's volcanic eruptions surprisingly recent, study reveals (Newshub 18/7/2017): <http://www.newshub.co.nz/home/new-zealand/2017/07/auckland-s-volcanic-eruptions-surprisingly-recent-study-reveals.html>
- Auckland volcanoes temperamental, unpredictable: studies (XinhuaNet 18/7/2017): http://news.xinhuanet.com/english/2017-07/18/c_136453669.htm
- Rate of Auckland volcanic eruptions increasing, scientists say (Stuff 18/7/2017): <https://www.stuff.co.nz/national/94864777/rate-of-auckland-volcanic-eruptions-increasing-scientists-say>
- Science Deadline: Auckland's unpredictable volcanoes (Business Scoop 21/7/2017): <http://business.scoop.co.nz/2017/07/21/science-deadline-aucklands-unpredictable-volcanoes/>
- Studies reveal Auckland Volcanic Field's past (Radio Live 23/7/2017): <http://www.radiolive.co.nz/home/audio/2017/07/studies-reveal-auckland-volcanic-fields-past.html>

UC Ballistics Research Gets Media Attention

Researchers at the University of Canterbury are exploring the consequences of flying volcanic rocks ("ballistics") on building materials. Their research received TV and radio coverage in June/July.

- Will your roof withstand flying volcanic rocks? (Radio NZ, 15/6/2017)
- How safe is your house if a volcano erupts nearby? (TVNZ 30/7/2017): <https://www.tvnz.co.nz/one-news/new-zealand/watch-safe-your-house-if-volcano-erupts-nearby>

DEVORA & Researchers Featured on Xploration Station's 'Awesome Planet' Episode

Last year, Dr Kasper van Wijk, Josiah Ensing, and Elaine Smid (all UoA) were interviewed on camera by Jacques Cousteau's grandson, Philippe Cousteau, Jr, for an episode of 'Awesome Planet,' an Emmy-nominated, educational television series. This New Zealand-themed episode aired in 100 million households across the US starting on 25 September, and is currently available to stream online via Hulu, Amazon Prime, Yahoo View, and Roku in the US. The Auckland portion of the episode focused on the DEVORA programme and the research scientists are doing to understand the inner workings of the Auckland Volcanic Field.

UoA Students Experience a Simulated Eruption

Every year, a group of University of Auckland students participate in an AVF eruption simulation. As part of the exercise, the students help guide the city through several months of preparation and an eruption event. This year, the exercise was discussed on Radio New Zealand by Prof. Kathy Campbell:

- <http://www.radionz.co.nz/national/programmes/ninetoonoon/audio/201857490/science-commentator-kathy-campbell>

END-USER ENGAGEMENT

AVF Eruption Simulation

On September 4th, students from the University of Auckland's hazards course participated in a simulation of an Auckland Volcanic Field eruption. Hosted in the CDEM control center at Bledisloe House, the simulation allowed students to experience firsthand the level of communication and decision making required to keep the population safe during an eruptive event. This year, DEVORA again teamed up with members of the journalism school to provide realistic media interaction during the simulation.

EQC Newsletter Feature

UoA PhD Sophia Tsang was interviewed by EQC about her AVF lava flow hazard and mitigation project for a feature in an EQC internal newsletter. The feature generated a lot of interest within EQC.

Incredible Science Day

On 5 July, The University of Auckland hosted an 'Incredible Science' Day, in which Faculty of Science students and staff shared their exciting science with students aged 10 – 12 from primary and intermediate schools across Auckland. The DEVORA Outreach Group and their partners, AUGA and QuakeCoRE, once again teamed up to provide hands-on demonstrations geared toward teaching the kids concepts about volcanoes, earthquakes, and their associated hazards. Over 400 students, teachers, and parents attended.

DEVORA Fact Sheet Development is now in full swing

On September 21st, the DEVORA team had our first fact sheet meeting with Gavin Mouldely, our new illustrator, and Katy Kelly, our new head of graphic design. During the meeting, we agreed on a working structure and set a timeline for completing 5 fact sheets by February 2018. Fact Sheet #1 is in advanced draft form and will be ready for distribution in the next quarter.

Update on DEVORA Field Notes

Last quarter, the finished DEVORA field notes were made available on the website. In the past 3 months, the field notes have been downloaded an average of 90 times each. With the help of Shreya, our DEVORA intern, seven more field notes are in draft form.

DEVORA Researchers Get Schooled on GeoTrips

Julian Thompson (GNS Science) visited UoA to provide a tutorial on how to add content to GeoTrips, an online resource dedicated to making geology accessible to NZ's public. The website lists major geological features of New Zealand and describes each in layman's terms. Members of the public can tour the geology online or use the website as a field guide of sorts to visit the sites themselves. DEVORA aims to get all 53 volcanoes listed on the site, as well as add any other suitable prominent volcanic features in Auckland for the public to enjoy.

DEVORA works with a Royal Society Teaching Fellow

Jude Hancock, an intermediate school teacher, is visiting the University for the next few months as part of a scholarship from the Royal Society. As part of the 'Science Teaching Leadership Programme', Jude will experience science first hand and take her new found knowledge back to the classroom. During this quarter, she spoke with Elaine Smid about her PhD research and was given a tour of what her lab work involves.

DEVORA PhD Entered the NZ Royal Society Emerging Researcher Competition

In September, Josh Hayes, a DEVORA PhD based in Canterbury, entered the Royal Society competition. In his video, Josh took a tongue in cheek approach of presenting his PhD research on the Auckland Volcanic Field in the form of a mock movie teaser trailer. You can view the video on the DEVORA facebook page: <https://www.facebook.com/DEVORAProject/videos/771969899656851/>.

DEVORA PhD Featured in the VISG Newsletter

The most recent VISG newsletter was published in September 2017, and featured research by UoA PhD student Sophia Tsang. Sophia is studying the potential impacts of lava flows in the build environment. The newsletter featured highlights from her recent trip to Hawai'i to investigate lava flow impacts.

RESEARCH IMPLEMENTATION

This section was added to the DEVORA Quarterly reports in the 2017-2018 financial year by request of stakeholders. It will be used to show how DEVORA researchers are putting science into practice by working with Auckland Council and other stakeholders. During this quarter,:

- Following another successful class Auckland eruption SIM exercise, and interest from a film crew, DEVORA researchers decided to host an updated mock eruption exercise with participants from Auckland Council Emergency Management and GNS Science scientists. This exercise is scheduled to take place in the next quarter, on 27 November, and will be filmed for *Prime NZ* and *The Discovery Channel*.

PARTNERSHIPS

Earthquake Commission

EQC contributes \$200,000 to the annual cost of DEVORA, and supports research capability in volcanic risk at University of Auckland. EQC provided funding to support UoA post-doctoral fellow Dr Mary Anne Thompson, who is focused on "Building a Better Hazard Map" and VUW post-doctoral fellow Dr Jenni Hopkins who is investigating "Coupled eruptions in the Auckland Volcanic Field: are we underestimating the threat to our city?" The EQC also provides funding for two affiliated, joint projects: one led by Marco Brenna and Elaine Smid, entitled, "How long have we got to act? Magma ascent rates in the Auckland Volcanic Field," and another led by Elaine and Michael Rowe: "Countdown to Eruption: Timescales of Magmatic Processes in the Crust." The latter funds a part of Elaine's PhD project on AVF ascent rates. Sophia Tsang's PhD is being funded 50% from Jan Lindsay's EQC building capability fund.

Auckland Council

The Auckland Council contributes \$100,000 to the annual cost of DEVORA and has also contributed borehole and building asset information from Auckland to researchers. They have provided input to the preliminary cost benefit analysis for evacuation of Auckland. The Auckland CDEM Group participated with University of Auckland postgraduate Hazards students and instructors in an eruption simulation exercise adapted by University of Canterbury researchers, and has committed to the refining of the exercise in future years.

University of Auckland

The University provides time for Jan Lindsay and co-funding of \$15.5k per year in the form of a part-time PhD scholarship for Elaine Smid.

Geological Hazards Programme at GNS Science

The Geological Hazards Programme (as part of the Natural Hazards Research Platform) at GNS Science provided support for Graham Leonard's Ar-Ar analytical work at the USGS and for maar drilling projects.

RiskScape and Surveillance Programme at GNS Science

Staff from the RiskScape and Surveillance Programme (as part of the Natural Hazards Research Platform) at GNS Science are engaged with DEVORA researchers to determine the best way to include volcanic hazards models and fragility functions into preliminary risk models within RiskScape.

Massey University

Massey hosts Boglarka Nemeth for her PhD, which is supervised by Massey-based Associate Professor Karoly Nemeth. Affiliate research is also taking place via integration of ongoing outputs and the development of probabilistic hazard and economic models (as part of renegotiated Natural Hazard Research Platform and Resilience to Nature's Challenge research programmes) that can be tested on the AVF. Additionally, Associate Professor Gert Lube is leading affiliated research synthesizing pyroclastic density currents in large-scale experiments.

United States Geological Survey

USGS (Menlo Park) have provided Ar-Ar dating facilities for a nominal charge to the project.

Canterbury University

Volcanic ash testing takes place at UC's VATlab, which allows DEVORA access for all applied ash impacts research milestones.

FINANCIAL REPORT

A total cost of \$75,000 was recognised for the first quarter (1 July to 30 September 2017), representing 25% of the full year's budget of \$300,000. Table 1 provides the annual budget allocations for each objective and the year-to-date expenditure recognized in this quarter.

Outcome/Obj	2017-18 Budget	1st Quart Recognised	1st Quart % of FY Budget	YTD Recognised	YTD % of FY Budget
Outcome 1 Obj 1*	\$0	\$0		\$0	
Outcome 1 Obj 2	\$13,500	\$3,375		\$3,375	
Outcome 1 Obj 3	\$0	\$0		\$0	
Outcome 1 Obj 4	\$31,000	\$7,750		\$7,750	
Outcome 1 Obj 6*	\$0	\$0		\$0	
Outcome 1 Obj 7	\$17,000	\$4,250		\$4,250	
Outcome 1 Obj 8	\$16,000	\$4,000		\$4,000	
Outcome 1 Obj 9	\$18,000	\$4,500		\$4,500	
Outcome 2 Obj 6	\$10,000	\$2,500		\$2,500	
Outcome 3 Obj 1	\$8,000	\$2,000		\$2,000	
Outcome 3 Obj 2*	\$0	\$0		\$0	
Outcome 3 Obj 3*	\$0	\$0		\$0	
Outcome 4 Obj 1	\$64,000	\$16,000		\$16,000	
Outcome 4 Obj 3	\$7,000	\$1,750		\$1,750	
Outcome 4 Obj 5	\$2,000	\$500		\$500	
Outcome 5 Obj 1	\$4,000	\$1,000		\$1,000	
Outcome 6 Obj 2	\$32,000	\$8,000		\$8,000	
Outcome 8 Obj 7	\$2,500	\$625		\$625	
Outcome 9 Obj 4*	\$0	\$0		\$0	
Outcome 10 Obj 1*	\$0	\$0		\$0	
Project & Database management	\$75,000	\$18,750		\$18,750	
TOTALS	\$300,000	\$75,000	25%	\$75,000	25%

Table 1. DEVORA Project annual budget allocations for each objective and the year-to-date expenditure recognized in this quarter.

*Costed elsewhere, carried over, or in-kind funding.

VARIATION REQUESTS

There are no variation requests this quarter.

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www.gns.cri.nz

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Wairakei
Private Bag 2000, Taupo
New Zealand
T +64-7-374 8211
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National Isotope Centre
30 Gracefield Road
PO Box 31312
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Volcano-DEVORA-list mailing list
Volcano-DEVORA-list@lists.gns.cri.nz
<http://lists.gns.cri.nz/mailman/listinfo/volcano-devora-list>

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NZ VOLCANIC SCIENTIFIC ADVISORY PANEL MEETING AGENDA:

DATE: Wednesday 15 August 10:00 – 16:00 hours

VENUE: MCDEM, L4, Conference Room, Bowen House, Wellington

ATTENDEES	
Peter Kreft	Metservice
Graham Leonard	GNS Science
James White	Otago University
Tom Wilson	University of Canterbury
Nico Fournier [<i>tentative</i>]	GNS Science
Shane Cronin	Massey/ Auckland
Richard Smith	EQC
Brad Scott	GNS Science
Cory Davis	MetService
Mark Bebbington	Massey University
Jonathan Procter [<i>tentative</i>]	Massey University
Jan Lindsay	Auckland University
Richard Turner	NIWA
Carol Stewart	Massey University
Sarah-Jayne McCurrach	MCDEM
Kim Wright	MCDEM
Jonathan Jull	MCDEM
Miles Jones	National Risk Unit, DPMC
APOLOGIES	
Colin Wilson	VUW
Stuart Moore	NIWA

Agenda

	Item	Action/Lead
10:00 - 10:10	Welcome & housekeeping Introductions	Chair
10:10 – 10:40	Introduction to national risk assessment process	Miles & Sarah-Jayne
10.00 -12.30	s6(a) 	Kim & Sarah Jayne
12:30 - 13:00	Lunch	
13.00 – 15.15	Assessment workshop <i>continued</i>	
15.15 – 15.55	General matters for discussion/planning for next meeting: <ul style="list-style-type: none">Interagency framework for volcanic hazard maps [15 min]	All Graham & Jan
15.55 – 16.00	Confirm actions & wrap up	Chair

NZVSAP MEETING NOTES

DATE: Wednesday 15 August 10:00 – 16:00 hours

VENUE: MCDEM, L4, Conference Room, Bowen House, Wellington

ATTENDEES	
Peter Kreft	Metservice
Graham Leonard	GNS Science
James White	Otago University
Tom Wilson	University of Canterbury (from 11.15 am)
Richard Smith	EQC (to 12.30 pm)
Brad Scott	GNS Science
Cory Davis	MetService
Mark Bebbington	Massey University
Jan Lindsay	Auckland University
Richard Turner	NIWA
Carol Stewart	Massey University
Ian Schipper	Victoria University
Sarah-Jayne McCurrach	MCDEM
Kim Wright	MCDEM
Jonathan Jull	MCDEM
Miles Jones	National Risk Unit, DPMC (to 12.30 am)
APOLOGIES	
Colin Wilson	Victoria University
Shane Cronin	Auckland University
Stuart Moore	NIWA
Brad Scott	GNS Science
Nico Fournier	GNS Science
Jonathan Procter	Massey University

Agenda

	Item	Action/Lead
10:00 - 10:10	Welcome & housekeeping Introductions	Chair
10:10 - 10:40	Introduction to national risk assessment process	Miles & Sarah-Jayne
10:40 - 12:30	s6(a)	Kim & Sarah Jayne
12:30 - 13:00	Lunch	
13:00 - 15:15	Assessment workshop <i>continued</i>	
15:15 - 15:55	General matters for discussion/planning for next meeting:	All
15:55 - 16:00	Confirm actions & wrap up	Chair

Undertaking this workshop was the primary task of the meeting. Miles and Sarah-Jayne outlined the purpose and background for national risk assessments as part of the National Security System arrangements. Important to note is that this work is being undertaken as “Confidential- Not Government Policy” until such time as the governance levels within the System have fully endorsed it.

Kim Wright led the group through a process s6(a)

Actions: *Kim to write-up the outputs of the workshop and distribute for review*

Jonathan and Kim to organise a date for second half day workshop coupled with a general business meeting of the group (see discussion below).

2 General matters for discussion –planning for next meeting

ToR & Membership of the Panel

The ToR were discussed at and revised after the last Panel meeting in 2016, though have not yet been formally adopted. At that meeting there was also several other matters relating to the Panel’s role and operational arrangements, namely:

1. Clarifying the standard operating procedures for when activated in response to a volcanic event. This work is timely in that the new 24/7 GEONET duty system is due to go live in December.
2. Being clear about the BAU role and functions. The primary role of the Panel is to provide science advice support in national significant events. Other than preparing in readiness for an event, there are a range of other activities that the Panel could undertake. However, to be a national forum or ‘clearing-house’ for wider matters of volcanic research and management requires ensuring have the right mandate, representation and administration.
3. The relationship of the Panel to the regional volcanic advisory groups (CPAG, CASL, DEVORA Taranaki) with suggestion that representatives of each be invited to the Panel meetings. Jonathan suggested perhaps is the other way round, whereby relevant members of Panel are also members of the advisory groups, and attend their meetings and can report each way on relevant matters. The reason for this relates to points 1 & 2 above i.e. the focus and manageability of the Panel’s role.
4. There was also previously discussion about promoting the Panel. However picking up on this again requires that the ‘what & how’ of its role is clarified first.

Actions: *Jonathan to review draft ToR and circulate for discussion ahead of next meeting.*

Jonathan to work with Nico and Graham on aligning Panel’s response SOP with the GEONET duty system arrangements

Use of Google Drive for event management

A Google Drive is now available, hosted by GNS, to support one point, real-time information sharing in an event. The Drive replaces the Wiki previously used, and was successfully used during the Kaikoura earthquake response. Emily Lambie has revised and extended it to cover all 4 perils – earthquake, volcanic, tsunami & landslide- with open access pages for posting public messages and closed membership ‘behind the scenes’ pages for science discussions.

The Drive is managed under the 24/7 duty system arrangements, and access given to all members who request it. .. A new folder series would be set up for each event to accumulate relevant information throughout the event and make it available to all with access. This folder can be archived afterwards, while any standard, ongoing information otherwise remains in the drive in readiness for future events.

Action: All members to email Graham about getting access to the Google Drive.

Table top exercise

Previously it had been suggested to hold a table top exercise to test the Panel's role and procedures in a response. In discussion, it was decided to that first need to understand and link with the new GEONET duty system, and also as to what may come out of the Government's response to the CDEM Technical Advisory Group's recommendations. Jonathan also noted that for an exercise to be most effective, requires good development and support. Possible is that MCDEM's operation team that carries out national exercises could assist if provided with sufficient notice.

Consistent Messaging

Kim stated that work on updating the *Working from the same page: Consistent messages for CDEM* was progressing slowly led by the MCDEM Communications team. The current format of a loose-leaf ring-binder to being solely online digital to enable quick updating. This is intended to be completed by end of the calendar year. The main changes to the volcanic hazard section concerns health messages based on the Health Subgroup's contributions.

Detection of Volcanic Eruptions and Ash

Cory provided an update on expanded capability of the Himawari-8 geo-stationary satellite for providing wider wavelength band information that, coupled with VOLCAT software, enables improved detection of the signature of eruptive volcanic material. Coupling this information to HYSPLIT ash dispersion models enables more accurate and timely mapping of the ash hazard. The capability was tested with the Ambae event. Graham suggested that field investigations showed a close alignment with the modelled ash dispersal.

Interagency framework for volcanic hazard mapping

Action: Kim to provide NZVSAP meeting notes (once finalised) to regional groups and the Health impacts sub-group members and invite these groups/sub-groups to send representation to future meetings

NZVSAP subgroups:

Carol and Graham outlined how the the Volcano Health Impacts Sub-group (HIS) has remained active meeting on average once a year. A key output has been updated advice for the Consistent Messaging update project. The experiences of Ambae have been useful in terms of developing some advice on volcanic gases as compared with particulates.Kim pick up anything else???

Other sub-groups:

Discussion noted that neither the Infrastructure nor Agricultural sub-groups have been established. MPI has expressed interest in the latter though, with the current *Microplasma bovis* response, it may be a lesser priority for now.

Most work on volcanic impacts to infrastructure has been undertaken in Auckland through VISG and at University of Canterbury, coordinated by the Auckland Engineering Lifelines Group. To support a national infrastructure sub-group under NZVSAP would require making links to the National Lifelines Group process, and is something that MCDEM may follow-up in-house once the newly arrived Lifelines Advisor (Ajay Makhija) is fully inducted to his role.

For both of these sub-groups, it was noted that the outcomes of the risk assessment outcomes will likely provide good basis as to why understanding volcanic risk and science in response matters for them.

Action: *Once outcome of the risk assessment process is available, MCDEM will discuss relevance of Infrastructure with Lifelines Coordinator, and also approach MPI again on Agriculture sub-group proposal.*

3 Next steps and next meeting date

Agreed to hold another meeting sooner than later to further business , and this is combined with half day to finalise the risk assessment. Possible timing is after the Cities and Volcanoes Conference in September.

Action: *Jonathan and Kim to look at dates/timings that fit with MCDEM schedule, and organise Doodle Poll of options.*

From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Elaine Smid
<e.smid@auckland.ac.nz>
Sent: Friday, 12 October 2018 12:26 PM
Subject: [Volcano-DEVORA-list] Fw: Your Invitation to the 11th Annual DEVORA Forum
Attachments: 2018 DEVORA Research Forum Programme_2018.10.11.pdf; ATT00001.txt

Hi All!

Just a reminder to RSVP for this year's DEVORA Research Forum by next Friday, 19 October, if you would like to attend but haven't already reserved your place. This is important for catering and room capacity requirements.

Link to RSVP and more information can be found in the link and in the message below.

<http://devoraforum11.rsvpify.com>

The (close to) final Forum programme is attached and also can be found at this link:
<http://tiny.cc/DEVORAForum11Info>

Please forward on to your respective groups (VISG/ALG; NSC Urban Resilience; AC; EM; workshop invitees; etc.).

All the best,
Elaine

Elaine Smid

Research Scientist (devora.org.nz)
Doctoral Researcher
Geology - School of Environment
The University of Auckland

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e.smid@auckland.ac.nz

From: Elaine Smid
Sent: Wednesday, August 29, 2018 1:53 PM
Subject: Your Invitation to the 11th Annual DEVORA Forum

Dear All,

DEVORA is celebrating its 10th Anniversary this year with an expanded, 2-day Research Forum, jointly hosted by Auckland Council Emergency Management!

You are warmly invited to attend our 11th Annual DEVORA Research Forum on 25-26 October 2018 in Auckland.

The Forum is an opportunity for the research team to share and discuss recent findings with each other, other geoscientists, lifelines and stakeholder representatives, and emergency, business continuity, and risk managers.

DETAILS

Dates: Thursday - Friday, 25 -26 October 2018

Times: 9:30 am - varies (there are optional afternoon programmes, see 'Programme' below for details)

Venues:

Day 1, 25 October: Pioneer Women's Hall, 1 Freyberg Place, Auckland

Day 2, 26 October: Auckland Town Hall, Council Chambers, 301 Queen Street, Auckland

Parking: Parking is very limited near the venues as they are in inner city Auckland. See here for options: <https://at.govt.nz/driving-parking/find-parking/parking-in-central-auckland/>.

Cost: This event is FREE, thanks to our partners at the Earthquake Commission and Auckland Council. Lunches and teas are provided.

Restrictions: Attendance is limited to 100. It is imperative to reserve your spot by Friday, 19 October, due to room capacity and catering requirements.

PROGRAMME

The final programme will be sent closer to the event. A sampling of confirmed presenters and topics, as well as optional afternoon event descriptions, can be found at this link: <http://tiny.cc/DEVORAForum11Info>.

The programme consists of a series of 10 - 15 minute oral presentations, along with 5 minute 'pop up' presentations for shorter updates. Those with posters will give a 5-minute 'pop up' presentation that explains their poster, followed by a tea- or lunch-time poster session. The Forum will conclude with a discussion session.

A novel monitoring techniques workshop and 2 sessions of the Auckland Emergency Management Recovery Walk Through will comprise the optional afternoon programmes. Descriptions of these events can be found in the link above. Please indicate if you plan to attend one of these events in your RSVP.

As usual, the programme focuses strongly on student research, and Forum attendees are encouraged to create and maintain a supportive and interactive environment.

RSVPs

To reserve your place, click on this link and enter in your details by Friday, 19 October:

<http://devoraforum11.rsvpify.com>

Please forward this invitation to those who may be interested.

Thank you!

Elaine Smid

Elaine Smid

Research Scientist - Volcanic Hazards (devora.org.nz) Doctoral Researcher - Geochemistry

The University of Auckland

Geology - School of Environment

Room 541, Building 302

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* 11th Annual **DEVORA** Research Forum *

Determining **V**olcanic Risk in **A**uckland

~~A Joint Auckland Council Emergency Management-DEVORA Event~~

Day 1, Thursday 25 October 2018: 1 Freyberg Place, Pioneer Women's Hall

Day 2, Friday 26 October 2018: 301 Queen St, Auckland Town Hall Council Chambers
Auckland, New Zealand

Day 1 Programme

9:30 – 9:40	<i>Forum Welcome & Introduction to Day 1</i>	
	Session I: Auckland's Mantle and Crustal Structure & Magma Ascent	
9:40 – 9:55	Josiah Ensing (PhD) – Auckland's Mantle & Crustal Structure from Recent Research	
9:55 – 10:10	Robert Pickle (PhD) – Crustal Strain Measurements via Geodesy: Evidence for Episodic Deformation	
10:10 – 10:25	Dr Marco Brenna – Olivine Xenocryst Diffusion Reveals Rapid Monogenetic Basaltic Magma Ascent Following Complex Storage at Pupuke Maar, Auckland Volcanic Field, New Zealand	
10:25 – 10:40	Alisha Coote (PhD) – Ascent of Magmas Beneath Monogenetic Volcanoes in the Bay of Islands and Auckland	
10:45 – 11:00	Pop Up Presentations (See Back of Page)	
11:00 – 11:25	Morning Tea + Poster Session	
	Session II: Understanding Auckland's Volcanic Hazards	
11:25 – 11:40	Dr Stuart Mead – Modelling Small Base Surges	
11:40 – 11:55	Prof Shane Cronin – The Emergence of Rangitoto Recorded by Base-Surge Deposits	
11:55 – 12:10	Dr Jenni Hopkins – Coupled Eruptions in the Auckland Volcanic Field	
12:10 – 12:25	Elaine Smid (PhD) – Gas Emissions from Auckland Volcanic Field Eruptions	
12:25 – 12:40	Prof James White – Ubehebe Craters – Multiple Vents, Scoria Falls & Maar Excavation Formed a Monogenetic Complex	
12:40 – 12:55	Dr Art Jolly – Monitoring in a Noisy Auckland-Type Environment	
12:55 – 1:45	Lunch + Poster Session (Cont'd)	
Afternoon Programme Option 1: 1:45 – 5 pm, Novel Monitoring Techniques Workshop (Pioneer Women's Hall)*		Afternoon Programme Option 2: 1:45 – 2:45, AEM Recovery Walk Through (20 p limit); Room TBD*
3:00 Afternoon Tea		

DAY 1: Pop Up Presentation & Poster Titles

Presenter	Title
Fee Arens (PhD)	<i>Thermomechanical Modelling of Magma Ascent under Auckland: Testing the Short Unrest Hypothesis (Poster)</i>
Marco Brenna	<i>Summary of Findings from Three Kings Volcano Research</i>
Matt Hill	<i>Urban Mapping, a New Generation of Data, Maps, and 3D Models for Our Growing Cities</i>

Posters will be left up through morning tea and lunch

AFTERNOON PROGRAMME OPTIONS

DAY 1: Novel Monitoring Techniques Workshop

Day 1, 1:45 – 5 pm. Main Venue. This workshop will brainstorm ‘sky’s the limit’ possible tools and methods for AVF monitoring, with the aim of reducing uncertainty, improving accuracy, and ensuring reliability. A particular focus will be to improve lead times prior to an eruption in Auckland. The tools and methods don’t need to be operational in the near term, but the aim is to explore those that might be implementable (or worked towards) in the intermediate term. Forum content on Day 1 will provide some background knowledge for workshop discussions.

DAYS 1 & 2: AEM Recovery Walkthrough

Day 1, 1:45 – 2:45 pm; Day 2, 2:15 – 3:15 pm. Adjacent Venue (TBD). The Auckland Council Emergency Management Recovery Walkthrough is an interactive session allowing participants to learn about the challenges of disaster recovery by moving through different learning spaces. The Walkthrough asks participants to consider how their work could contribute to successful recovery in Auckland as they move through 3 stations: 1) The concept of disaster recovery, 2) Recovery in an Auckland context, and 3) Recovery case studies. It is designed to build capacity, collaboration and leadership in disaster recovery. ***Note*** There is capacity for just 20 people in each day’s session—last minute sign-up sheets are available at registration desk. Each session runs for about an hour & will be held in an adjacent room (TBD).



* 11th Annual **DEVORA** Research Forum *

Determining **V**olcanic Risk in **A**uckland

~~A Joint Auckland Council Emergency Management-DEVORA Event~~

Day 1, Thursday 25 October 2018: 1 Freyberg Place, Pioneer Women's Hall

Day 2, Friday 26 October 2018: 301 Queen St, Auckland Town Hall Council Chambers
Auckland, New Zealand

Day 2 Programme

9:30 – 9:40	<i>Forum Welcome & Introduction to Day 2</i>
Session III, Part I: From Eruption Planning to Recovery in Auckland	
9:40 – 9:50	Richard Woods – <i>Recent Advancements in Natural Hazard Risk Tool Development in New Zealand & Future Opportunities</i>
9:50 – 10:00	Drs Graham Leonard & Natalia Deligne – <i>Ambae, Vanuatu: Lessons in Impacts and Eruption Management for Auckland</i>
10:00 – 10:20	Josh Hayes (PhD) – <i>Timber-Framed Building Damage from Tephra Fall: 2015 Calbuco Eruption, Chile</i>
10:20 – 10:30	Nicole Allen (PhD) – <i>Quantitative Experimentation on Multi-Volcanic Hazard Impacts</i>
10:30 – 10:50	Pop Up Presentations, Part I (See Back of Page)
11:00 – 11:25	Morning Tea + Poster Session, Part I
Session III, Part II: From Eruption Planning to Recovery in Auckland	
11:25 – 11:35	Robert Cardwell (PhD) – <i>Modelling the Growth and Change of Auckland Land Use</i>
11:35 – 11:45	Boglarka Nemeth (PhD) – <i>A Geoheritage Assessment Tool</i>
11:45 – 11:55	Dr Jan Lindsay for Sophia Tsang (PhD) – <i>How Communities Prepare for and Respond to Impending Lava Flows</i>
11:55 – 12:05	Alec Wild (PhD) – <i>Development of a Decision-support Framework for Volcanic Crisis Management</i>
12:05 – 12:15	Dr Mary Anne Thompson – <i>Insight into How People Read and Make Decisions with Volcanic Hazard Maps</i>
12:15 – 12:25	Paige Sims (Auckland Emergency Management) – <i>Inter-Agency Communication Throughout the Disaster Cycle</i>
12:25 – 12:35	Senior Sergeant Russell Mitchell (NZ Police) – <i>Mass Evacuation Planning for Tāmaki Makaurau</i>
12:35 – 12:50	Pop Up Presentations, Part II
12:50 – 1:25	Lunch + Poster Session (Cont'd)
1:25 – 2:00	<i>Wrap-Up Discussion (Facilitated by DEVORA Co-Leaders Drs Graham Leonard and Jan Lindsay)</i>
*** Afternoon Programme Option*** 2:15 – 3:15: AEM Recovery Walk Through (20 p limit); Room TBD	

DAY 2: Pop Up Presentation & Poster Titles

Part I	
Presenter	Title
Josh Hayes (PhD)	AVF Eruption Scenario Updates (Poster)
Snehalata Thakur (PhD)	Understanding Evacuation and Travel Behaviour Under Emergency Situations in Auckland (Poster)
Dr Natalia Deligne	Volcanic Impacts Study Group (VISG) Update (Posters)
Dr Heather Craig	Probabilistic Risk Assessment for Agriculture and Tephra Fall (Poster)
Part II	
Dr Vivienne Bryner	Knowledge Transfer to Boost Auckland's Resilience to Volcano-Triggered Events
Dr Liam Wotherspoon	Resilience to Nature's Challenges (RNC) Infrastructure Research Update
Prof Suzanne Wilkinson	RNC Urban Resilience Research Updates

Posters will be left up through morning tea and lunch

DEVORA OUTCOME STATEMENTS

1. We are confident in knowing the AVF.
2. Our diverse society knows, understands, and trusts our science.
3. People will behave appropriately in a volcanic crisis.
4. People have access to risk and consequence information in formats that suit their needs.
5. Auckland Council, businesses, and individuals have anticipated, prepared for, and are able to respond and recover from a volcanic eruption (i.e. planning appropriately).
6. DEVORA supports sustainable development and expansion of a 'Resilient Auckland.'
7. Auckland continues to thrive following any NZ eruption.
8. Our science is well managed and has wider benefits.
9. Auckland is linked in to other major hazard programmes through alignment with DEVORA.
10. We are confident in knowing other volcanic threats to Auckland.

Volcano-DEVORA-list mailing list
Volcano-DEVORA-list@lists.gns.cri.nz
<http://lists.gns.cri.nz/mailman/listinfo/volcano-devora-list>

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From: Angela Doherty s9(2)(a)
Sent: Wednesday, 7 November 2018 12:37 PM
Subject: Auckland Volcanic Field eruption crisis management decision-making workshop
Attachments: Workshop Information - Organisation.pdf; Workshop information - participant.pdf

Follow Up Flag: Follow up
Flag Status: Completed

You are invited to attend the 'Auckland Volcanic Field eruption crisis management decision-making' workshop to be held at Auckland Council on behalf of University of Auckland PhD candidate Alec Wild in early December. Before we send the formal details, we ask you to please let us know your availability in the first 2 weeks of December via the attached Doodle Poll:

<https://doodle.com/poll/s72e7zhau25mg6wg>

Your attendance will aid in the development of a risk framework to support decision-making in an Auckland volcanic crisis. The workshop will discuss the decision-making process currently in place, information and communication pathways between the various organisations involved, and review how a decision-support framework could support decision-makers during a crisis. The workshop aims both to engage with stakeholders involved in the decision-making process and support ongoing research being conducted by PhD students at the University of Auckland. A short summary report will be sent out discussing the workshop findings. There is additional information included in the attached information sheets.

We understand that you may be on this list as you registered your interest during the recent DEVORA forum held in Auckland and may no longer be able to participate.

Angela Doherty PhD | Principal Science Advisor
Auckland Emergency Management
s9(2)(a)

Level 1 South, Bledisloe House, 24 Wellesley St, Auckland 1010



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QUANTITATIVE HAZARD AND RISK MODELLING APPROACHES FOR VOLCANIC CRISIS MANAGEMENT



ORGANISATION PARTICIPANT INFORMATION SHEET - FOCUS GROUP

Around the world, many volcanic areas are populated, putting the local population at risk of being impacted by natural disasters. Auckland, New Zealand is at risk from volcanic hazards produced during an Auckland Volcanic Field eruption. This project investigates how quantitative risk models can be applied for crisis management and support decision-making.

My name is Alec Wild, and I am currently pursuing my PhD in geology in the School of the Environment at The University of Auckland in Auckland, New Zealand. As part of my PhD, I am conducting a focus group with organisations that contribute to crisis management decision-making in the event of an Auckland Volcanic Field eruption. My primary supervisor is Associate Professor Jan Lindsay at the University of Auckland, and my secondary supervisor is Mary Anne Thompson.

ALEC WILD

PhD Candidate

E | awil302@aucklanduni.ac.nz

DR JAN MARIE LINDSAY

Associate Professor

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T | +64 9 373 7599 ext. 88678

DR MARY ANNE THOMPSON

Research Fellow

E | m.thompson@auckland.ac.nz

T | +64 9 373 7599 ext. 87173

Mailing Address:

School of Environment

Private Bag 92019

Auckland 1142 | NZ

Aims & Benefits of this Project

This study is interested in discussing methods to support decision-makers during a volcanic crisis with the use of quantitative volcanic hazard and risk models. At this stage it is proposed the output of this research will help Auckland plan for a future eruption in the Auckland Volcanic Field.

This portion of the project will include a focus group with personnel, who, during a volcanic crisis, will provide information to decision-makers. The focus group will investigate the decision-making process currently in place, review how a decision-support framework could provide information during a crisis, and help guide the Auckland case-study for an scenario-based version of the model. The focus group for this project will be conducted in October 2018 in Auckland, while the larger project has a three-year time line.

Risks to Participants

This study is interested in discussing crisis management decision-making. The results of this research will be used to assess the applicability of quantitative frameworks and approaches to support decision-making in Auckland, New Zealand.

This research poses very few risks. Your employee(s) may be subjected to recalling upsetting memories relating to other crises they may of been a part of. If your employee feels uncomfortable at any point during the focus group, they may leave the room without reason.

Summary of Findings

If you would like a summary of findings from this study, please indicate by providing an appropriate email addresses on the consent form. A summary of findings will then be emailed to you upon conclusion of this study.

Invitation to Participate

Your employees are invited to participate in this research due to your organisation's role in providing support and/or information to decision-makers during a volcanic eruption in Auckland. To find potential participants, I have contacted relevant organisations to ask permission to conduct this focus group. Upon returning your consent form, I will contact your company to request the distribution of information about my study. If there are other companies you suggest approaching, please send them a copy of this information sheet.

Participation in this project is voluntary. Your employee(s) may choose not to participate in this project without giving a reason. Your employee(s) may pause or end their involvement in the focus group at any time without providing a reason.

Your employee(s) will likely encounter colleagues while participating in this focus group. If you believe that a specific employee can provide more information in a private setting, please contact the student researcher. An interview may be possible, although the focus group format would be preferable.

You are being approached to ask for permission to include your employees in a focus group. I seek your assurance that the participation or non-participation of your employees' will have no effect on their relationship or employment with the organisation. You have the option to request a summary for the results of this research, but such a summary will not include any personal information that could identify your employee(s) specifically. You will not have access to any of the data your employees' provide in the focus group. The decision to participate relies solely with your employee without any consequences related to their decision.

How to Participate

If your employees would like to participate in this study, your employees should contact the student researcher. I do not expect the focus group to last more than two hours. Participants will be notified when and where the focus group will be held. If at any point in the focus group, the line of questioning makes your employee(s) uncomfortable, they do not have to respond and may leave the room while others respond. Your employee may pause or end their involvement in the focus group at any point without providing a reason.

Your employee(s) may withdraw their participation from this study at any point within two months of the date of this focus group. Their decision to withdraw will not have any negative consequences. Upon acknowledgment that they would like to withdraw, all data to the extent possible held about the withdrawing employee will be destroyed. If your employee withdraws after the focus group has met, what your employee said during the focus group will not be deleted to maintain the context of other comments made in the focus group.

Data Collection, Storage & Usage

I will be taking notes during the focus group. The data collected during the focus group will be stored in a secure location at The University of Auckland. Soft data will be stored on a University of Auckland password protected computer, backed up by a server. Personally identifiable data, such as your consent form, will be stored separately from any other data collected. The data will be stored for up to six years at which time it will be destroyed.

The results of this study will be published (e.g. in the student's PhD dissertation and likely in academic articles and presentations).

Withdrawing Your Participation

Your employee may pause or end their involvement in the focus group at any point without providing a reason. Your employee has the right to withdraw from this research at any point during the focus group without providing a reason. Your employee may withdraw from this research within two months of the focus group without providing a reason.

Confidentiality

All participants of the focus group will be requested not to share information from the focus group with anyone outside of the focus group. Since there will be other people in the focus group, it is not possible to preserve your employees' confidentiality. The information your employee(s) provide in this focus group will be shared with the researchers named on page 1. All personally identifiable information will be removed from the information your employee(s) provide before the information your employee(s) provided is shared with the other researchers on this project.

If the information your employee(s) have provided is published or reported in any form, the researchers will endeavour to ensure that your employee(s) will not be identifiable. While all possible measures will be taken to maintain your employees' privacy, this cannot be guaranteed in studies with a small sample size or if they have already expressed their opinion publicly.

Contacts

For more information or questions about the research, please feel free to contact:

Student Researcher:

Alec Wild
awil302@aucklanduni.ac.nz

Supervisors:

Associate Professor Jan Lindsay
j.lindsay@auckland.ac.nz
+64 9 373 7599 ext 88678

Dr Mary Anne Thompson
m.thompson@auckland.ac.nz
+64 9 373 7599 ext 87173

Head of School:

Professor Paul Kench
p.kench@auckland.ac.nz
+64 9 923 8440

For any queries regarding ethical concerns, you may contact:

Chair of the University of Auckland Human Participants Ethics Committee
The University of Auckland
Research Office, Private Bag 93029
Auckland, 1142, New Zealand.
+64 9 373 7599 ext 83711
ro-ethics@auckland.ac.nz

QUANTITATIVE HAZARD AND RISK MODELLING APPROACHES FOR VOLCANIC CRISIS MANAGEMENT



PARTICIPANT INFORMATION SHEET - FOCUS GROUP

Around the world, many volcanic areas are populated, putting the local population at risk of being impacted by natural disasters. Auckland, New Zealand is at risk from volcanic hazards produced during an Auckland Volcanic Field eruption. This project investigates how quantitative risk models can be applied for crisis management and support decision-making.

My name is Alec Wild, and I am currently pursuing my PhD in geology in the School of the Environment at The University of Auckland in Auckland, New Zealand. As part of my PhD, I am conducting a focus group with organisations who contribute to crisis management decision-making in the event of an Auckland Volcanic Field eruption. My primary supervisor is Associate Professor Jan Lindsay at the University of Auckland, and my secondary supervisor is Mary Anne Thompson.

ALEC WILD

PhD Candidate

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Research Fellow

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Aims & Benefits of this Project

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This portion of the project will include a focus group with personnel, who, during a volcanic crisis, will provide information to decision-makers. The focus group will investigate the decision-making process currently in place, review how a decision-support framework could provide information during a crisis, and help guide the Auckland case-study for an scenario-based version of the model. The focus group for this project will be conducted in October 2018 in Auckland, while the larger project has a three-year time line.

Risks to Participants

This study is interested in discussing crisis management decision-making. The results of this research will be used to assess the applicability of quantitative frameworks and approaches to support decision-making in Auckland, New Zealand.

This research poses very few risks to you. It is possible discussion questions or exercises could trigger memories related to other crises you may have been involved with. At any point during the focus group there is an activity which makes you uncomfortable, you may excuse yourself without reason.

Summary of Findings

If you would like a summary of findings from this study, please indicate by providing an appropriate email address on the consent form. A summary of findings will then be emailed to you upon conclusion of this study.

Invitation to Participate

You are invited to participate in this research due to your organisations role providing support and/or information to decision-makers during a volcanic eruption in the Auckland Volcanic Field. To find participants, like you, I have contacted your management to ask permission to conduct a focus group with staff from your organisation. Your employer has given an assurance that your participation or non-participation will have no effect on your relationship or employment with the organisation.

Participation in this project is voluntary. You may choose not to participate in this project without providing a reason. You may pause or end your involvement in the focus group at any point without providing a reason. You may also withdraw your participation from this research at any point within two months of the date of the focus group. If you would not like to participate or decide to withdraw at any point within the given time frame, all data to the extent possible held about you will be destroyed upon receiving your decision. Data provided by you during the focus group cannot be destroyed since it could affect the context of other participants' responses.

You have been asked to be part of a focus group. Thus, you are likely to encounter colleagues while participating in this study. If you believe that you can provide more information in a private setting, please contact the student researcher. An interview may be possible, although the focus group format would be preferable. Your manager has been approached prior to this focus group to ask for their permission for the organisations staff involvement. They have had the option to request a summary of the results of this research, but you will not be personally identifiable in the result summary they are provided. Your manager will not be informed of or have access to any of the data you provide in this focus group.

Both of my supervisors and I will have access to any data that you have provided or that I have collected in this focus group. While there are other researchers involved with this project, they will not have access to any information that could identify you.

How to Participate

If you would like to participate in this study, please contact the student researcher to attend the focus group. I do not expect the focus group to last more than two hours. Participants will be notified when and where the focus group will be held. If at any point in the focus group, the line of questioning makes you uncomfortable, you may refuse to answer the question and/or leave the room while others answer the question. You may also pause or end your involvement in the focus group at any time without providing a reason. You may withdraw your participation from this study at any point within two months of the date of this focus group. Your decision to withdraw will not have any negative consequences. Upon acknowledgment that you would like to withdraw, all data to the extent possible held about you will be destroyed.

Data Collection, Storage, & Usage

I will be taking notes during the focus group. The data collected during the focus group will be stored in a secure location at The University of Auckland. Soft data will be stored on a University of Auckland password protected computer, backed up by a server. Personally identifiable data, such as your consent form, will be stored separately from any other data collected. The data will be stored for up to six years at which time it will be destroyed. The results of this study will be published (e.g. in the student's PhD dissertation and likely in academic articles and presentations).

Withdrawing Your Participation

You may pause or end the focus group at any point without providing a reason. You have the right to withdraw from this research at any point in time during this focus group without providing a reason. You may withdraw from this research within two months of this focus group without providing a reason.

Confidentiality

All participants of the focus group will be requested not to share information from the focus group with anyone outside of the focus group. Since there will be other people in the focus group, it is not possible to preserve your confidentiality. The information you provide in this focus group will be shared with the researchers named on page 1. All personally identifiable information will be removed from the information you provide before the information you provided is shared with the other researchers on this project.

If the information you have provided is published or reported in any form, the researchers will endeavour to ensure that you will not be identifiable. While all possible measures will be taken to maintain your privacy, this cannot be guaranteed in studies with a small sample size or if you have already expressed your opinion publicly. A summary of the findings from this research will be sent to you if you would like. Please indicate an appropriate email address (or other form of contact if you do not have an email address) on your consent form.

Contacts

For more information or questions about the research, please feel free to contact:

Student Researcher:
Alec Wild
awil302@aucklanduni.ac.nz

Supervisors:
Associate Professor Jan Lindsay
j.lindsay@auckland.ac.nz
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Research Office, Private Bag 93029
Auckland, 1142, New Zealand.
+64 9 373 7599 ext 83711
ro-ethics@auckland.ac.nz

From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Elaine Smid
<e.smid@auckland.ac.nz>
Sent: Monday, 12 November 2018 11:07 AM
To: volcano-devora-list@lists.gns.cri.nz
Subject: [Volcano-DEVORA-list] DEVORA Forum presentations available

Hi All,

Thank you to all of you that attended our recent DEVORA Research Forum, co-hosted by Auckland Emergency Management. We had approximately 70 attendees each day, with great participation in our Novel Monitoring Techniques workshop and Forum discussion session. We very much appreciate you taking time out of your schedules to attend, and I extend gratitude to our wonderful presenters and to the Forum organising team for a job very well done, especially in my absence!

For those that did not get a chance to attend, we have started to populate our website with PDFs of the presentations and posters:

http://www.devora.org.nz/presentations_and_posters/

Please share and forward to your networks if they would be interested.

Thank you!

Nga mihi
Elaine

Elaine Smid

Research Scientist (devora.org.nz)
Doctoral Researcher
Geology - School of Environment
The University of Auckland

+64 (0)9 923 7232
e.smid@auckland.ac.nz

Volcano-DEVORA-list mailing list
Volcano-DEVORA-list@lists.gns.cri.nz
<http://lists.gns.cri.nz/mailman/listinfo/volcano-devora-list>

From: Daniel Blake <daniel.blake@canterbury.ac.nz>
Sent: Thursday, 18 April 2019 5:10 PM
Subject: Review of International Volcanic Ash Impact Posters
Attachments: Ash posters for review x6.zip

Hi all,

You are receiving this email after agreeing to review the new international series of volcanic ash impact posters – thank you again for this!

I have now received the first 6 posters from the graphic designer (see attached), and these are ready for you to review.

We hope that the other 3 posters will be ready for you to review within the next two weeks and I will forward these in due course.

Any feedback or suggestions (as comments on the pdf versions and/or by email) are welcome – this includes feedback related to content, technical details, relevance for the target audience and international applicability, as well as layout and design.

Due to the unexpected delay and upcoming public holidays in many countries, the timeframe for review of these 6 posters has been extended to 3 weeks.

As such, I would be grateful if you could respond with all feedback before the end of Friday 10 May 2019. Please let me know if you think this will be difficult.

Many thanks in advance,
Daniel

Daniel Blake, PhD
RNC/QuakeCoRE Postdoctoral Fellow



Room 324, 'West' Building
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University of Canterbury
Christchurch
New Zealand

+64 33692946 (UC: 92946)
daniel.blake@canterbury.ac.nz

www.resiliencechallenge.nz
www.quakecore.nz

From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Elaine Smid
<e.smid@auckland.ac.nz>
Sent: Wednesday, 14 August 2019 5:44 PM
To: volcano-devora-list@lists.gns.cri.nz
Subject: [Volcano-DEVORA-list] 2019 DEVORA Forum dates announced! 20-21 Nov
@UoA

Dear All,

I'm very pleased to announce that the dates and venue for the 12th Annual DEVORA Research Forum have been confirmed!

Please block these dates off in your calendar:

Dates:

Wednesday 20 November (Main Forum presentations--TBC)

Thursday 21 November (Potential Workshop/Meetings Date--TBC)

Venue:

Sir Owen Glenn Building, Building 260, Basement Lecture Theatre 5, Room 051

University of Auckland City Campus

12 Grafton Rd

Auckland 1010

Please do not RSVP to this email. A programme and invite with more details will be sent out prior the event.

The breakdown of the event (main presentations vs workshops) is subject to change.

Other Events of Note:

* A National Science Challenge, Resilience to Nature's Challenges, Urban Resilience Theme (Tranche 2) research event may take place at the same venue on Friday 22 November. More details about that event will be sent through to the DEVORA email list, as well as the RNC Urban Resilience Theme email list, as they are confirmed.

* The 2019 GSNZ conference takes place nearby in Hamilton on Sun - Weds, 24-27 November. This is a good chance to combine trips!

Hope to see you there!!

Nga mihi
Elaine

Elaine Smid

Research Scientist (devora.org.nz)
Doctoral Researcher
Geology - School of Environment
The University of Auckland

+64 (0)9 923 7232
e.smid@auckland.ac.nz

Volcano-DEVORA-list mailing list
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<http://lists.gns.cri.nz/mailman/listinfo/volcano-devora-list>

Released under the Official Information Act 1982

From: Daniel Blake <daniel.blake@canterbury.ac.nz>
Sent: Friday, 3 May 2019 2:59 PM
Subject: Review of International Volcanic Ash Impact Posters (2)
Attachments: image001.png; image002.png; May2_Airport Poster.pdf; May2_Transmission Poster.pdf; May2_Power Plant.pdf

Hi all,

Thank you to those who have already provided feedback on the initial 6 volcanic ash impacts posters. We appreciate the quick response and will work through this soon.

Further to my email below, please find attached the international versions for the final 3 posters, which I received from the designer at the USGS today. We have allocated 2 weeks for the review of these new posters, although would appreciate responses as soon as you get a chance. However, I realise that some feedback may apply to all posters, **so please now reply with feedback for all 9 posters before the end of Friday 17 May 2019.**

Please let me know if you think this will be problematic, or if there are any questions at any time.

Thanks again for your support,
Daniel

Daniel Blake, PhD
RNC/QuakeCoRE Postdoctoral Fellow



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University of Canterbury
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daniel.blake@canterbury.ac.nz
www.resiliencechallenge.nz
www.quakecore.nz

From: Daniel Blake <daniel.blake@canterbury.ac.nz>
Date: Thursday, 18 April 2019 at 5:09 PM
Subject: Review of International Volcanic Ash Impact Posters

Hi all,

You are receiving this email after agreeing to review the new international series of volcanic ash impact posters – thank you again for this!

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Many thanks in advance,
Daniel

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Released under the Official Information Act 1982

From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Elaine Smid
<e.smid@auckland.ac.nz>
Sent: Monday, 5 August 2019 4:38 PM
To: volcano-devora-list@lists.gns.cri.nz
Subject: [Volcano-DEVORA-list] Fw: Proposed Tupuna Maunga Authority Integrated Management Plan Strategies
Attachments: image001.png; IMP Strategies cover letter July 2019.pdf; ATT00001.txt

This may be of interest to some of you.

Ngā mihi
Elaine

Elaine Smid

Research Scientist (devora.org.nz)
Doctoral Researcher
Geology - School of Environment
The University of Auckland

+64 (0)9 923 7232
e.smid@auckland.ac.nz

From: Dominic Wilson s9(2)(a) On Behalf Of Maunga Authority
Sent: Monday, 8 July 2019 12:18 PM
Subject: Proposed Tūpuna Maunga Authority Integrated Management Plan Strategies

Tēnā koe

I attach a cover note on the Proposed Tūpuna Maunga Authority Integrated Management Plan Strategies<<https://www.aucklandcouncil.govt.nz/about-auckland-council/how-auckland-council-works/kaupapa-maori/comanagement-authorities-boards/tupuna-maunga-tamaki-makaurau-authority/Pages/tupuna-maunga-integrated-management-plan.aspx>> (see link to strategies).

Noho ora mai
Dominic

[Tupuna Maunga Authority]<<http://www.maunga.nz/>>

Dominic Wilson
Head of Co-governance / Te Pou Mana Whakahaere www.maunga.nz<<http://www.maunga.nz/>>

[Auckland's future in progress. See what people think about it at [ourauckland.nz/futureauckland](https://ourauckland.aucklandcouncil.govt.nz/news/futureauckland/?utm_source=ac_footer&utm_medium=email&utm_campaign=Future%20Auckland)]<https://ourauckland.aucklandcouncil.govt.nz/news/futureauckland/?utm_source=ac_footer&utm_medium=email&utm_campaign=Future%20Auckland>

CAUTION: This email message and any attachments contain information that may be confidential and may be LEGALLY PRIVILEGED. If you are not the intended recipient, any use, disclosure or copying of this message or

attachments is strictly prohibited. If you have received this email message in error please notify us immediately and erase all copies of the message and attachments. We do not accept responsibility for any viruses or similar carried with our email, or any effects our email may have on the recipient computer system or network. Any views expressed in this email may be those of the individual sender and may not necessarily reflect the views of Council.

Released under the Official Information Act 1982

5 July 2019

PROPOSED TŪPUNA MAUNGA INTEGRATED MANAGEMENT PLAN STRATEGIES

The Tūpuna Maunga Authority is pleased to provide the proposed Tūpuna Maunga Integrated Management Plan Strategies (IMP Strategies) for your feedback.

Background

In June 2016, the Authority adopted the Tūpuna Maunga Integrated Management Plan (IMP), available online at www.maunga.nz.

The IMP replaced the separate and individual legacy reserve management plans and as the overarching policy setting, laid the foundations for how the Tūpuna Maunga (ancestral mountains) of Tāmaki Makaurau / Auckland are valued, protected, restored, enhanced and managed.

The IMP Strategies are the next level of substantive policy development for the Tūpuna Maunga and give effect to the Values and Pathways in the IMP.

IMP Strategies Feedback

The Proposed Strategies can be viewed online at www.maunga.nz, at local libraries and at Auckland Council Service Centres from 6 July to 16 August 2019. Email submissions by **5pm 16 August 2019** to: MaungaStrategies@aucklandcouncil.govt.nz.

All written feedback will be considered by the Tūpuna Maunga Authority (there are no in-person hearings).

Find out more: visit www.maunga.nz or phone 09 301 0101

Tūpuna Maunga Authority

Volcano-DEVORA-list mailing list
Volcano-DEVORA-list@lists.gns.cri.nz
<http://lists.gns.cri.nz/mailman/listinfo/volcano-devora-list>

Released under the Official Information Act 1982



Tūpuna Maunga Authority

Released under the Official Information Act 1982

From: Daniel Hill [DPMC]
Sent: Wednesday, 15 May 2019 9:37 AM
To: Alistair Davies [DPMC]
Subject: RE: Review of International Volcanic Ash Impact Posters (2)

Hi Alistair,

Please see below. No need to forward as green, just so you can see the suggestions.

Cheers
Daniel

Daniel Hill | Senior Hazard Risk Management Advisor
Ministry of Civil Defence & Emergency Management Te Rākau Whakamarumaru
s9(2)(a) | www.civildefence.govt.nz
Level 4, Bowen House, Parliament Buildings | PO Box 5010, Wellington 6145, New Zealand

Ministry of Civil Defence & Emergency Management is a business unit of the Department of the Prime Minister and Cabinet



From: Alistair Davies [DPMC] s9(2)(a)
Sent: Thursday, 9 May 2019 11:22 AM
To: Daniel Hill [DPMC] s9(2)(a)
Subject: RE: Review of International Volcanic Ash Impact Posters (2)

[UNCLASSIFIED]

Hi Dan,

Comments on the new posters:

Airports

- Not clear why >1mm ash will close the airport itself? Runway? Hangar? Ground aircraft? Might be better terms?
- . instead of , in third bullet. Third bullet also smaller than other bullets.
- Would consider reordering impacts to aircraft – engine failure I imagine is more important than abrasion to exterior surfaces
- The “u” in “ash falling to ground” looks larger in size.
- The italicised names of other posters look larger and like a different font?
- There’s no suggestion on what to do if ash is ingested/causes abrasion etc
- The link under how to prepare is too long, fiddly, and looks out of place (should come directly after the : Maybe consider switching the paras with Fig 2?)
- I would suggest to pull out key H&S info, rather than just link to IVHHN.
- Inconsistent use of hyphens (ASH CLOUD FORECAST -- (airborne ash): vs ASHFALL FORECAST (ash falling to ground):))

Transmission

- Third bullet point in the first set of bullet points "... systems can block intakes leading to reduced performance, and affecting dependent systems: should read "... systems can block intakes leading to reduced performance, and **affect** dependent systems:"
- Strange to have one inset bullet under third bullet. Would suggest this can just be a final sentence.
- Third bullet might want to link to generator (filter etc) advice
- Fourth bullet point is repeated in fifth. Also, no close bracket on end.
- No colon after "earth potential rise"
- Again, following bullet should just be another sentence.
- Would "outdent third bullet under insulation flashover, and pull up and indent fourth bullet
- Unclear what the specialist inspection and cleaning procedure for substations are
- Full stops are randomly used/not used on ends of paras throughout poster
- The wording under "how to prepare" largely doesn't make sense. E.g. "standardised ash fall clean-up procedures" doesn't make sense as a standalone sentence, and doesn't explain what you have to do. Same for bullets five and six.
- Bullet seven should be outdented
- *"Earth Potential Rise Ash may reduce the resistivity of substation ground gravel cover, reducing tolerable step and touch voltages:"* is repeated in both Transmission and Substation areas

Power plant

- No close bracket on bullet 3
- No colons on bullets 4 and 5
- Consider linking to other poster for HVAC covers etc
- "-3" should be superscript?
- Extra hyphen after the above, after the word 'dust'
- Should '*suspended solid*' be '*suspended solids*' in bullet point 7 of 'How to Prepare'

Cheers,

Ali and Daniel

From: Daniel Blake <daniel.blake@canterbury.ac.nz>

Sent: Friday, 3 May 2019 2:59 PM

Subject: Review of International Volcanic Ash Impact Posters (2)

Hi all,

Thank you to those who have already provided feedback on the initial 6 volcanic ash impacts posters. We appreciate the quick response and will work through this soon.

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Please let me know if you think this will be problematic, or if there are any questions at any time.

Thanks again for your support,
Daniel

Daniel Blake, PhD

RNC/QuakeCoRE Postdoctoral Fellow



University of Canterbury
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From: Daniel Blake <daniel.blake@canterbury.ac.nz>
Date: Thursday, 18 April 2019 at 5:09 PM
Subject: Review of International Volcanic Ash Impact Posters

Hi all,

You are receiving this email after agreeing to review the new international series of volcanic ash impact posters – thank you again for this!

I have now received the first 6 posters from the graphic designer (see attached), and these are ready for you to review.

We hope that the other 3 posters will be ready for you to review within the next two weeks and I will forward these in due course.

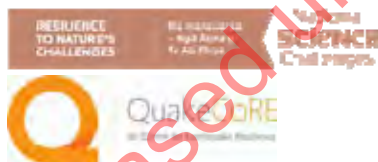
Any feedback or suggestions (as comments on the pdf versions and/or by email) are welcome – this includes feedback related to content, technical details, relevance for the target audience and international applicability, as well as layout and design.

Due to the unexpected delay and upcoming public holidays in many countries, the timeframe for review of these 6 posters has been extended to 3 weeks.

As such, I would be grateful if you could respond with all feedback before the end of Friday 10 May 2019. Please let me know if you think this will be difficult.

Many thanks in advance,
Daniel

Daniel Blake, PhD
RNC/QuakeCoRE Postdoctoral Fellow



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From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Elaine Smid
<e.smid@auckland.ac.nz>
Sent: Tuesday, 4 June 2019 6:21 PM
To: volcano-devora-list@lists.gns.cri.nz
Subject: [Volcano-DEVORA-list] 'Beneath NZ' episodes to air starting this Sunday, 9 June

Hi All,

Set your DVRs: Prime TV will start airing the 'Beneath NZ' episodes starting this Sunday, 9 June at 8:30 pm. There are 3 episodes listed on the website, all focused on NZ's volcanism, past, present, and future:
<https://www.primetv.co.nz/beneath-nz>

The series features quite a few DEVORA researchers and findings, and the third episode focuses on Auckland:
https://www.primetv.co.nz/-/prime_beneathnz_ep3 .

Happy viewing!

Ngā Mihi Nui | Many Thanks

Elaine

Elaine Smid
Research Scientist – Volcanic Hazards (devora.org.nz) Doctoral Researcher – Geochemistry

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Volcano-DEVORA-list mailing list
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<http://lists.gns.cri.nz/mailman/listinfo/volcano-devora-list>

From: Cory Davis s9(2)(a)
Sent: Friday, 7 June 2019 2:56 PM
To: Alistair Davies [DPMC]
Cc: Peter Kreft
Subject: Re: NZ Volcano Science Advisory Panel

Hi Alistair,

Since the last meeting we have gained some new capabilities regarding satellite-based eruption detection and volcanic ash dispersion modelling that might be of interest. I can talk briefly about these.

Cheers,

Cory.

From: Alistair Davies [DPMC] s9(2)(a)

Sent: Thursday, June 6, 2019 4:50 PM

To: M.Bebbington@massey.ac.nz; Brad Scott; colin.wilson@vuw.ac.nz; Cory Davis; Graham Leonard; Ian Schipper; James White; Jan M. Lindsay; Nico Fournier; Peter Kreft; Procter, Jonathan; Richard Turner; Shane Cronin; Stewart, Carol; stuart.moore@niwa.co.nz; Thomas Wilson; richard.smith@gns.cri.nz; Jo Horrocks [DPMC]; Danielle Charlton; Geena Campbell

Cc: Jonathan Jull [DPMC]; Kim Wright [DPMC]

Subject: NZ Volcano Science Advisory Panel

[UNCLASSIFIED]

Kia ora all,

We have received a few requests for items to discuss with the NZ Volcano Science Advisory Panel, so thought it was about time to hold another meeting! Having had a chat with a few of you, we agreed that the last couple of weeks in August would work best.

Please fill out the following Doodle poll by Friday 14th June so we can confirm a date:

<https://doodle.com/poll/6k8g6399yfzrsipd>

If you have any items you would like to discuss at the meeting, please let me know and I will start compiling an agenda.

Best wishes,

Alistair

Alistair Davies | Hazard Risk Management Advisor

Ministry of Civil Defence & Emergency Management Te Rākau Whakamarumarū

s9(2)(a) | www.civildefence.govt.nz

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From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Elaine Smid
<e.smid@auckland.ac.nz>
Sent: Thursday, 13 June 2019 2:57 PM
To: volcano-devora-list@lists.gns.cri.nz
Subject: [Volcano-DEVORA-list] FW: VISG newsletter - June 2019
Attachments: image001.png; VISG_newsletter_n16_June2019.pdf; ATT00001.txt

Dear all,

Please find attached the latest Volcanic Impacts Study Group (VISG) newsletter; a description and link to the online version can be found below. Very informative and enjoyable, as usual!

Cheers,
Elaine

From: Natalia Deligne s9(2)(a)
Sent: Thursday, 13 June 2019 1:57 p.m.
Subject: VISG newsletter - June 2019

Good afternoon,

Attached is the quarterly Volcanic Impact Study Group (VISG) newsletter for June 2019. The newsletter features a Research Spotlight by University of Canterbury PhD student Alana Weir on her work involving stakeholders and volcanologists to characterize the vulnerability of critical infrastructure in the Taranaki region. The newsletter also has a special one-off feature by Te Papa Experience Developer Ralph Upton, who provides a behind the scenes look into how the Whakarūaumoko | Active Land portion of new Te Papa exhibit Te Taiao was designed.

As a reminder, all VISG newsletters are available at <http://www.alg.org.nz/volcanic-impacts/visg-newsletters/>. In consideration of your inboxes, I email a low-res version of the newsletter; if you wish to have the higher-res version (5 MB), please download it from the ALG website. Note: there have been some delays in uploading newsletters, if you more urgently wish to have a high res version of a recent newsletter please email me directly.

Please share this newsletter with your colleagues, and ask those who would like to be added to the distribution list to email me. Alternatively, if you wish to be removed from the list let me know.

Cheers,
Natalia

Dr Natalia Deligne | Volcanic Hazard and Risk Modeller GNS Science | Te Pū Ao
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[cid:image001.png@01D2386E.E476BAB0]<<http://www.gns.cri.nz/Home/News-and-Events/Social-Media-Communities>>

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VISG CO-ORDINATOR'S NOTE



Natalia Deligne,
GNS Science

Last week I was able to attend the second day of the Resilience to Nature's Challenges – National Hazards Research Forum, hosted at Te Papa. It was great to learn of research across New Zealand's perils, with a strong focus on resilience, infrastructure, communities, and deep partnerships between the research community and stakeholders. VISG is proud to do our bit in building and maintaining a strong partnership between the lifeline sector and volcanologists.

Speaking of partnership, this quarter's **Research Spotlight** by **Alana Weir** recounts how being based at Taranaki Civil Defence for two months at the start of her PhD shaped the direction of her research concerning critical infrastructure in the shadow of Mt Taranaki.

Over the past 6 months I've played an extremely tiny role in the design of the newly-launched **Te Taiao | Nature zone at Te Papa**. I had the pleasure of working with Te Papa Experience Developer Ralph Upton, who in this quarter's one-off Special Feature provides a behind the scenes look into how the **Whakarūaumoko | Active Land** portion of Te Taiao was designed. Thank you Ralph for contributing to the VISG newsletter!

And finally, after two years (8 newsletters!) of keeping us well informed of eruptions from around the world, **Sophia Tsang** (University of Auckland) has passed the **Global Eruption Roundup** baton to **Nicole Allen**, a PhD student at the University of Canterbury. Thank you Sophia for your contribution to VISG over the last two years –good luck with the final months of your PhD – and welcome Nicole!

NEWS

Dr. Daniel Blake (Resilience to Nature's Challenges / QuakeCoRE Postdoctoral Fellow) is coordinating efforts to **adapt the VISG posters for an international audience** due to high overseas interest. These internationalised versions are being developed in collaboration with NZ and USA science teams as well as numerous peer reviewers. This project is supported by funding from the United States Geological Survey and Volcano Disaster Assistance Programme.

VISG researcher **Dr Carol Stewart** attended the biennial World Association of Disaster and Emergency Medicine (WADEM) Congress in Brisbane in May 2019. Carol gave an invited talk, **Volcanic Health Hazards of the Southwest Pacific**, at an Oceania chapter special session on Pacific Islands and Disasters. She also contributed to a conference legacy statement entitled Developing a Framework for Assessing and Managing Health Consequences of Disasters. This effort is closely linked to the World Health Organisation led 2019 Global Platform for Disaster Risk Reduction's new Health Emergency and Disaster Risk Management symposium.

VISG researchers provided scientific expertise to the newly-launched **Te Taiao | Nature zone at Te Papa**. See the **Special Feature** by Te Papa experience developer Ralph Upton to learn more about how Te Taiao was put together.



Whakarūaumoko | Active Land. Photo credit: Te Papa

RESEARCH SPOTLIGHT

Stakeholders, volcanologists, and the vulnerability of critical infrastructure



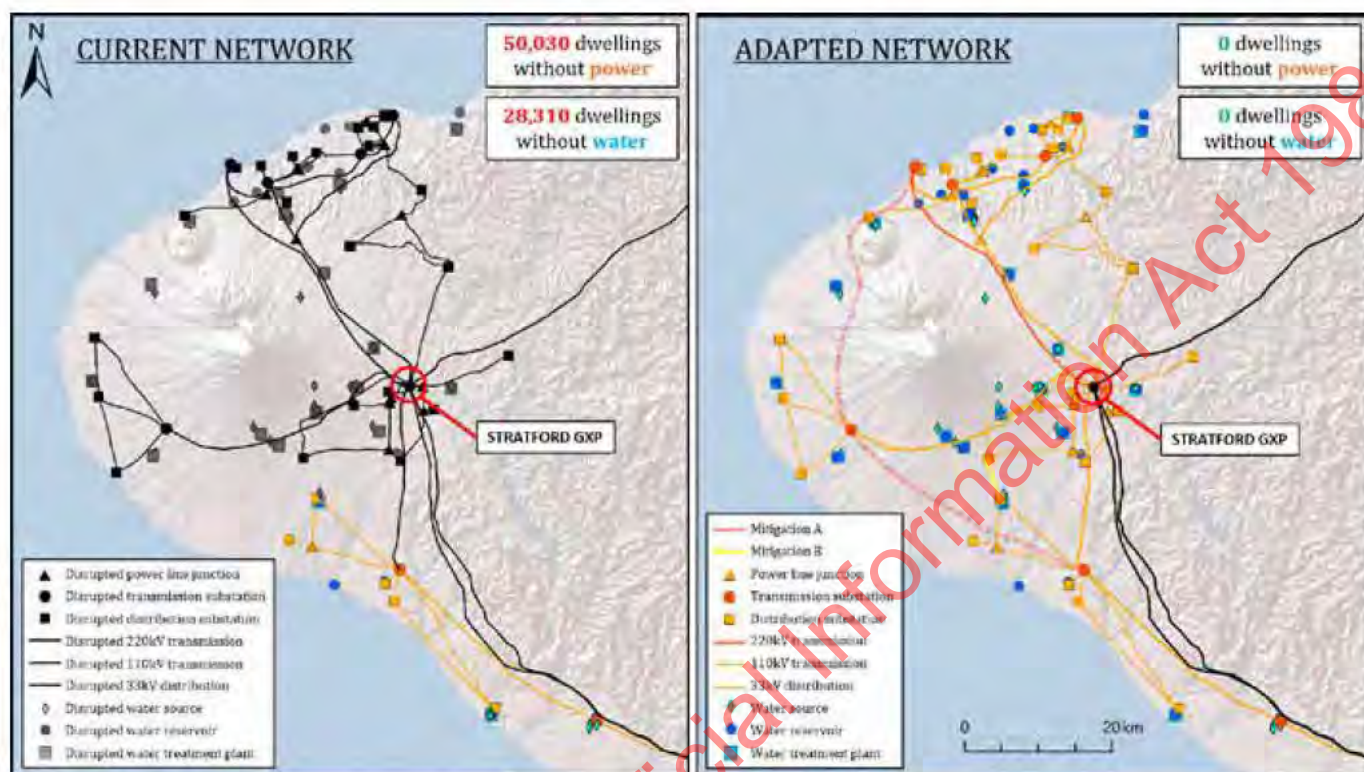
*Alana Weir,
University of Canterbury*

During ex-Cyclone Gita last autumn, one tree fell on one water pipe, and within 24 hours, 10,000 homes in the Taranaki region were without water. A further 26,000 homes were under a boil-water notice, and the economic impact on the community was estimated at \$4.5million. This one tree has prompted the review of all water asset management data, an update of emergency plans, and a study of appropriate infrastructure resiliency levels. Now consider, if one tree could provoke such disruption, what might a nearby volcanic eruption do?

The Taranaki region has its own nearby volcano: the topographically dominant Mt Taranaki, which is surrounded by dairy production and processing facilities, oil and gas operations, and supporting infrastructure. Mt Taranaki has an eruption likelihood of 33 – 42% within the next 50 years. This combination of hazard potential and high exposure prompted the question that underpins my PhD: what impact would a Mt Taranaki eruption have on the surrounding infrastructure and agriculture? In addressing this question, my main focus is developing decision-support tools that are useful, useable and used by local stakeholders. My primary stakeholder is the Taranaki Civil Defence and Emergency Management (CDEM) Group, whose extensive and well-maintained stakeholder network ensures the dissemination of relevant research outputs to the wider user community.

As a novice in the field of disaster management, an early objective of my PhD was to immerse myself in day-to-day civil defence operations and long-term resilience objectives. Taranaki CDEM kindly hosted me for 2 months at the Taranaki Emergency Management Office, where I shadowed Taranaki CDEM Analyst Teresa Gordon. I attended local council and advisory group meetings, and had many informative informal discussions about the potential outputs of my PhD. Ex-cyclone Gita hit Taranaki in the 2nd week of my immersion. Being part of the CDEM response team dealing with the ensuing water outage inspired my main research question: how interdependent are critical infrastructure networks, and how can we include this information quantitatively in vulnerability models and impact assessment frameworks?

Over the past 6 months, I've worked with open-access datasets, and industry and council representatives to collate data from



Left: Map showing disruption (black and grey) to critical infrastructure due to failure of Transpower Stratford Grid Exit Point (GXP) given current networks. Right: Map showing disruption (black) to critical infrastructure due to failure of Stratford GXP given the addition of 220 kV transmission (dashed red line) and 33 kV distribution (dashed yellow line) power lines.

all critical infrastructure sectors in Taranaki, and have found a strong dependence of all sectors on the Stratford power grid exit point (GXP). This isn't surprising, considering this is the primary power transmission entry point for the region. What I didn't expect was the strong dependence of the majority of potable water and waste water customers on only a handful of water treatment plants. This has considerable implications for industry and agriculture in the region, where potable water supply and effective waste water networks are essential for their daily operations. By identifying and quantifying these interdependencies, I can now identify the most systemically vulnerable infrastructural assets in the Taranaki region. In my infrastructure model, I can quantify the change in customer loss of service with the theoretical implementation of 'hard' (e.g. the construction of additional infrastructure) and 'soft' (e.g. tactical shut down of assets) mitigation measures.

Mt Taranaki has the potential to produce spatially and directionally distinct volcanic hazards (such as volcanic ash, lahars and pyroclastic flows) with different physical behaviours. The response of the infrastructure system will therefore vary depending on the type of volcanic activity. My goal is to continue to work closely with Taranaki CDEM and infrastructure managers to identify the optimal mitigation measures under different eruption regimes. My model has the potential to inform planning and policy pre-volcanic event, but perhaps more importantly, inform an adaptive response during a period

of complex, prolonged volcanic activity.

My continued engagement with Taranaki CDEM throughout my PhD is integral in my work towards providing useable, useful and used research products to local stakeholders and end-users. The Taranaki CDEM group's enthusiasm, flexibility and local knowledge is invaluable, and as a result, I hope to provide local stakeholders with relevant, effective decision-support tools for planning and responding to the next eruption at Mt Taranaki.

My PhD is part of a larger collaboration between Taranaki CDEM and the Natural Hazards Research Platform funding program, involving practitioners and researchers from many institutions across New Zealand.

- A. Weir

GETTING INVOLVED

Contact details for **Alana Weir**:
alana.weir@pg.canterbury.ac.nz



SPECIAL FEATURE

Active Land, Active Visitors

Ralph Upton, Te Papa



Young visitors using the tsunami tank. Photo credit: Te Papa

We live in an active land. To thrive here, we need to be active too.

Those are the guiding ideas behind Whakarūaumoko | Active Land, the exhibition that forms one third of the new Te Taiao | Nature zone at Te Papa. We wanted visitors to leave the exhibition with the understanding that although tectonic and volcanic forces are powerful, they have power too, through their actions.

The last thing we wanted was for people to walk away with a fatalistic view - 'if it happens, there's nothing I can do about it'. We saw our role as not only to inform people, but to prompt them to action.

But how to make to make these ideas memorable? Text and diagrams are often overlooked in museums, no matter how beautifully they are presented. How do you make an idea 'sticky'? Here are a few of the tools we made use of.

First - embody the learning. A good way to make things memorable is to connect them to a physical experience. In our hand-operated our tsunami tank, we knew that the action of making a wave, and seeing its effect, would be a strong way to bring this underappreciated hazard to light. Seeing the wave that

you made inundate low-lying houses, while buildings higher up stay safe, is more a memorable experience than just watching a video. You can see for yourself why 'Long? Or strong? Get gone' is a piece of advice worth following. When you hear families discover this idea together, you know it'll be remembered.

Similarly, we rejected an initial design for the tsunami tank that was driven by a cranking motion, in favour of one that required a shunting action more akin to the movement of an earthquake. We know that people remember things they do rather than things they read, so we wanted to connect the concept and the action as closely as possible.

Another approach is to make things personal. That's why we presented our hazard forecasts on large-scale maps of NZ. We knew that visitors always like to locate themselves on maps when they come across them in museums; it's human nature to point and say 'here's where we live'. Having three maps - one for tsunami, one for earthquakes, and one for volcanic eruptions - carries home a key message at a glance; wherever you live in Aotearoa, it pays to be prepared. There's a lot of detail there, too, for those few who read more closely - but we know that our graphics have to work at a glance.



Young visitor using the tsunami tank. Photo credit: Te Papa

Images speak louder than words – on the same risk map, we initially tried to describe the possible impacts of these hazards in words. That's especially hard to do given the fact that in a fully bilingual exhibition like this one, space for text is at a premium. We realised it would be better to show rather than tell, and so we used photos of the different impacts – three per hazard, showing increasing impacts. A picture's worth a thousand words, and that became obvious when we saw the layout. No description matches the impact of a real photo of deep volcanic or tsunami damage.

Finally, we wanted to make people feel empowered by letting them share their thoughts and feelings in a creative task. Alongside a real blackboard showing responses gathered in the aftermath of the 2011 Christchurch earthquake, we placed a blackboard of our own, which carries the initial prompt 'I deal with fear by ...' (the prompts will change out in the future). The responses are wide ranging, from signatures to serious reflections. The goal was to create a space for people to respond emotionally and to feel connected to others. After all, we're all living in this active land together.

Ralph Upton is an experience developer at Te Papa.

Whakarūaumoko | Active Land was developed in partnership with GNS Science and EQC.



Earthquake house. Photo credit: Te Papa

RESEARCH HIGHLIGHTS

GNS Science Reports

DEVORA novel monitoring techniques workshop, 25 October 2018

Natalia Deligne from GNS Science and coauthors from GNS Science, the University of Auckland, and Auckland Council.

Dr Natalia Deligne and coauthors summarises findings from the DEVORA novel monitoring techniques workshop, held in October 2018 as part of the annual DEVORA forum. This workshop, requested by Auckland Council, sought to identify and explore novel monitoring techniques, some of which might, through further research, development, and validation, lead to earlier detection of Auckland Volcanic Field unrest and decreased uncertainty in confirming unrest and likely future activity. The report can be freely downloaded at: https://shop.gns.cri.nz/sr_2019-21-pdf/.

Assessing the potential of a modified version of USEPA Method 1312 for use in eruption response in New Zealand

Carol Stewart from Joint Centre for Disaster Research and College of Health, Massey University, Graham Leonard from GNS Science

Drs Carol Stewart and Graham Leonard compares a customised, internationally-ratified method for determining the hazard from soluble elements in fresh volcanic ashfall to a standard, commercially-available test method. The aim is to expand the national capacity for rapid ash hazard assessment following an explosive volcanic eruption. The report can be freely downloaded from: https://shop.gns.cri.nz/sr_2018-41-pdf/.



Carol Stewart in front of Yasur volcano, Tanna, Vanuatu.

GLOBAL ERUPTION ROUNDUP

During this quarter the majority of global volcanic activity has occurred at long-term active volcanoes. Eruptions have fortunately been relatively small during the previous few months, with some long-term active volcanoes even decreasing in activity.

Note: The New Zealand Volcano Alert Level system is different from alert/warning level systems used in Mexico and Indonesia – refer to the GeoNet webpage for details on the New Zealand system.



Nicole Allen,
University of Canterbury



Life at the base of Popocatepetl during recent activity. Photo credit: Felipe Pérez

Popocatepetl, Mexico

Popocatepetl has been erupting intermittently since 1994. In late March activity at the volcano increased resulting in the alert level of the volcano being increased to Yellow phase 3. A traffic light alert level system is used for Popocatepetl where yellow phase 3 is the third highest warning level of a total of seven levels, with the next highest warning level (red phase 1) advising evacuations. During the March eruption the generated tephra plumes rose up to 3km, with ashfall being reported in numerous populated areas up to 45km from the volcano. Volcanic ballistics were ejected from the volcano, setting pastures on the flanks of the volcano

alight. The alert level has since reduced to Yellow phase 2 but activity continues with eruptions in April and late May generating smaller tephra plumes. Mexico's National Centre for Disaster Prevention (CENAPRED) are continuously advising people to remain more than 12km from the volcano, but despite this at least two groups of people have posted videos of themselves reaching the volcano's crater on social media. Despite the ongoing activity of Popocatepetl the populations surrounding the volcano have been continuing their lives as usual and appear unconcerned with the recent activity.

Featured Indonesian eruption locations



Sinabung, Indonesia

In mid-May the alert level of Sinabung was lowered to 3; the volcano had been at alert level 4 since June 2015. Exclusion zones surrounding the volcano have been reduced to 3-5km, having been set at 5-7km while the volcano was in alert level 4. Indonesia's Centre for Volcanology and Geological Disaster Mitigation (PVMBG) lowered the volcano's alert level due to decreased activity of the volcano over the previous 10 months, but noted that further eruptions and lahar generation could occur.

Agung, Indonesia

Agung has continued its activity since the last eruption round up. The volcano's alert level has remained at 3, the second highest alert level on the Indonesian scale of 1-4, and a 4km radius exclusion zone is in place. Regular small explosions and tephra plumes have been observed in the last three months. Some larger explosions that occurred in May have generated tephra plumes up to 4km high. Flights in and out of Bali's Ngurah Rai international airport were cancelled or diverted on 24th-25th May due to ashfall.

- N.Allen

UPCOMING EVENTS

Save the Date! The free 2019 **DEVORA Research Forum** will take place sometime between 20-22 November 2019 at the University of Auckland. The date(s) and details will be confirmed over the coming months and will be provided in the September 2019 VISG newsletter.

DEVORA



The **2019 Volcano Short Course** will be back in Auckland this spring – details will be provided in the September 2019 VISG newsletter.

CONTACT

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Volcanic Hazard and Risk Modeller
GNS Science - Te Pu Ao
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New Zealand

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From: Jonathan Jull [DPMC]
Sent: Tuesday, 2 July 2019 2:03 PM
To: Nico Fournier
Cc: Kevin Fenaughty [DPMC]; Dana MacDiarmid [DPMC]; Alistair Davies [DPMC]
Subject: FW: Volcanoes: changes to the guide to national CDEM plan?
Attachments: Section 25 - REVISED version 2.1 2017-03-09.docx

[UNCLASSIFIED]

Kia ora Nico

Thanks for your query. In regard to Plan/guide updates, please see below from Dana of our National Planning Team who oversees updates/review processes.

If you can keep myself, Dana and Alistair in the communication loop as you progress this.

I have emailed Kevin Fenaughty about links with the Common Alerting protocol project, and we will get back to you soon.

jj

Ngā mihi | Kind regards

Jonathan Jull | Senior Advisor: Hazard Risk Management & Analysis
Ministry of Civil Defence & Emergency Management Te Rākau Whakamarumaru
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From: Dana MacDiarmid [DPMC] s9(2)(a)
Sent: Tuesday, 2 July 2019 10:00 AM
To: Jonathan Jull [DPMC] s9(2)(a); Kevin Fenaughty [DPMC] s9(2)(a)
Cc: Alistair Davies [DPMC] s9(2)(a)
Subject: RE: Volcanoes: changes to the guide to national CDEM plan?

Kia ora JJ,

Thanks for your email update. Because the section GNS would like to update is Guide text only (i.e. from what I can see, they don't need changes made to the National CDEM Plan text), we could definitely look to update that section (Warnings and Advisories) sometime sooner rather than later.

I actually am hoping to get some other Guide sections updates (Recovery and Fire Services) over the line in the coming month, so if they could do a quick turnaround we could try to sync them all. But if they need more time we can do a second tranche later on.

The process would be that I can provide them a Word version of the Guide section (**attached**) and they propose updates via tracked changes, and then we (you as SMEs and me as custodian) would review them and do/suggest any refinements. Once finalised and agreed, I will work with Zsenai to do any technical writer magic and PDF-ing, and then it gets issued via email update to the sector and loaded onto the website.

Let me know if you've any further questions.

Cheers,
Dana

Dana MacDiarmid | Emergency Management Advisor, National Planning team
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From: Nico Fournier s9(2)(a)
Sent: Monday, 1 July 2019 6:19 PM
To: Jonathan Jull [DPMC] s9(2)(a)
Subject: Volcanoes: changes to the guide to national CDEM plan?

Hi Jonathan,

I hope this email finds you well. I am contacting you regarding the guide to the national CDEM plan and, more specifically, about the process for potential amendments.

We are currently discussing how we (GNS Science/GeoNet) communicate changes in volcanic activity to the CDEM sector and the general public, and we identified a few areas where some changes could be useful. One of these potential changes is the name of our Volcanic Alert Bulletins which could be improved as it causes some confusion with the Volcanic Alert Level. The name, however is written down in the guide to the National CDEM plan (link below to the 2015 version, p. 212 and 213). So any changes would need to be discussed and amended in the guide accordingly.

<https://www.civildefence.govt.nz/assets/guide-to-the-national-cdem-plan/Guide-to-the-National-CDEM-Plan-2015.pdf>

If we were to propose some changes (e.g. name of the bulletin/products), what would be the process to adjust the Guide to National CDEM plan accordingly? This part of the document has been static for quite a while and would probably benefit from a refresh.

As a side note, I would also be interested in hearing what may be in the pipeline from your end in terms of Common Alerting Protocol (or similar). The current vehicle for any change in Volcanic Alert Level is via our bulletins (for historic, reasons). In these day and age, there could be a scope - for instance - for splitting the notification of a change in VAL from the bulletin itself (which serves more as supportive information, attached or not to a change in VAL). Is this still something on your radar?

Thanks in advance for any info. We are keen to ensure that we are adding maximum value to MCDEM and NZ and feel that there is an opportunity to do so by refreshing our products. Of course feel free to direct me to the relevant person if this falls under someone else's portfolio at MCDEM.

Looking forward to hearing from you.

Regards,

Nico

Nico Fournier
Team leader - Volcanology
GNS Science - Te Pu Ao
Taupo, New Zealand
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25. National warnings and advisories

Summary

Warnings and advisories are used to advise agencies, authorities, and/or the public of threats, enabling them to take appropriate action.

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25.1 Introduction

Part 8 Response

National warnings and advisories

117 Introduction

- (1) *National warnings and advisories provide information about the potential or actual threat to people, property, areas, or social or economic activities.*
- (2) *National warnings and advisories do not cover—*
 - (a) *long-term or slowly evolving threats about which information is disseminated through the usual communications of relevant agencies; or*
 - (b) *the actions to be taken by agencies and the procedures for responding to national warnings and advisories.*
- (3) *The effectiveness of a warning or an advisory depends on—*
 - (a) *the timeliness of the warning or advisory; and*
 - (b) *the delivery and receipt of the warning or advisory; and*
 - (c) *the recipients' understanding of the necessary action to be taken in respect of the particular threat or threats; and*
 - (d) *the readiness and response at the national, CDEM Group, and local levels.*

25.2 Objective

118 Objectives

- (1) *The objective in respect of potential or actual threats is to issue national warnings and advisories in a timely manner so that agencies, CDEM Groups, local authorities, and people can take action to reduce loss of life, injury, and damage.*
- (2) *Warnings and advisories are to be given as quickly as practicable.*
- (3) *Where a warning is not possible, the objective is to inform the response by indicating the likely magnitude of an emergency and the extent of the affected areas.*

At the national level, warnings or advisories of an event with potentially adverse consequences are to be issued as quickly as practicable. The aim is to forewarn or inform so that authorities, agencies, and people can take appropriate readiness or response actions in relation to the potential or actual threat.

25.3 Principles

119 Principles

- (1) *Monitoring, identification, and analysis of geological and meteorological hazards and threats and subsequent issuing of hazard information is to be undertaken at all times by the following agencies:*
 - (a) *the Meteorological Service of New Zealand Limited (severe weather); and*
 - (b) *GNS Science (earthquake, volcanic activity, and landslides); and*
 - (c) *the MCDEM (tsunamis).*
- (2) *Relevant government agencies, CDEM Groups, local authorities, and lifeline utilities are to maintain arrangements to receive and respond to hazard information.*

25.4 National warning system

General

120 National warning system

- (1) The national warning system is a 24/7 process for communicating hazard information to alert recipients to the need for readiness and possible response to a potential or an imminent threat that may result in an emergency.
- (2) The MCDEM is responsible for overseeing the maintenance and function of the national warning system.
- (3) The standard operating procedure under this system specifies the principles underlying and methods of disseminating national warnings.
- (4) National warnings and advisories are provided by the MCDEM to CDEM Groups, local authorities, emergency services, agencies, lifeline utilities, and broadcasters.

CDEM Groups

- (5) CDEM Groups are responsible for—
 - (a) disseminating national warnings to local communities; and
 - (b) maintaining local warning systems.

Other agencies

- (6) If arrangements are made with the MCDEM, the national warning system can be used to issue national warnings about hazards for which warning arrangements are decided and maintained by other agencies.

25.4.1 Use of the national warning system

Warnings or advisories may be issued for any type of hazard (see Appendix 1 of the *National CDEM Plan 2015*). The type of warning or advisory to be issued will depend on the hazard type and potential impact.

MCDEM issues warnings or advisories for hazards for which CDEM is the lead agency. Warnings or advisories may be issued when:

- ♦ a hazard poses a threat or potential threat to people and/or property and may result in an emergency, or
- ♦ when MCDEM considers there is sufficient public interest to state that a hazard does not pose a threat.

The presentation and contents of warnings or advisories issued via the national warning system is tailored for the specific end users. The national warning system is illustrated in Figure 25.1.

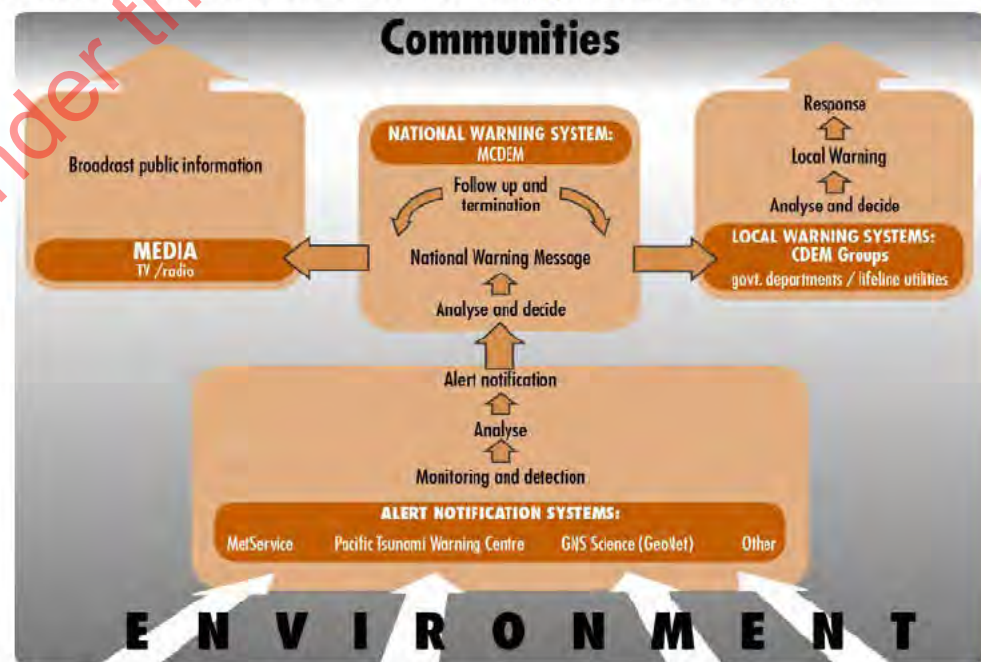


Figure 25.1 The national warning system.

25.4.2 Types of warnings and advisories issued via the national warning system

Notifications

Depending on the assessment of the information, MCDEM may issue one or more of the following notifications (warnings or advisories) via the national warning system:

- ♦ National Advisory – Earthquake
- ♦ National Advisory – [Type of Hazard]: No Threat to NZ
- ♦ National Advisory – [Type of Hazard]: Potential Threat to NZ
- ♦ National Advisory – Volcanic Activity: Minor Volcanic Eruption
- ♦ National Advisory – Large Pacific earthquake (holding message)
- ♦ National Warning – [Type of Hazard]: Threat to NZ
- ♦ National Warning – Volcanic Activity: Moderate Volcanic Eruption
- ♦ National Warning – Volcanic Activity: Major Volcanic Eruption
- ♦ National Warning – Tsunami: Beach and Marine Threat
- ♦ National Warning – Tsunami: Land and Marine Threat
- ♦ National Advisory – [Type of Hazard]: Cancellation Message
- ♦ National Warning – [Type of Hazard]: Cancellation Message, or
- ♦ National Warning – Test Message.

A National Advisory – [Type of Hazard] Potential Threat to NZ will be followed with one of the following:

- ♦ National Warning – [Type of Hazard] Threat to NZ, or
- ♦ cancellation message.

A National Advisory – Large Pacific earthquake (holding message) will be followed with one of the following:

- ♦ National Warning – Tsunami: Beach and Marine Threat
- ♦ National Warning – Tsunami: Land and Marine Threat
- ♦ National Advisory – Tsunami No Threat to NZ.

A National Warning – [Type of Hazard] Threat to NZ will be followed by either one of the following:

- ♦ for tsunami messages only, hourly update messages (except between 10pm and 5am, when updates will only be issued if there is a significant change), or
- ♦ cancellation message.

25.4.3 Recipients of warnings and advisories issued via the national warning system

Registered recipients

Warnings and advisories are issued via the national warning system to CDEM Groups and their constituent members, government agencies, and lifeline utilities registered with the national warning system. All recipients are to respond to the information in accordance with their own arrangements, including dissemination of local warnings as required.

The prerequisites for participation in the national warning system are described in the standards outlined in 25.4.4.

Agencies that meet the required standards and wish to receive warnings and advisories via the national warning system must register with MCDEM.

Media

The news media is included in the dissemination of all warning, advisory, or cancellation messages issued via the national warning system. In addition to this national arrangements are in place for the broadcast of emergency announcements via radio and television networks (for further information see Section 28, Public information management).

25.4.4 Standards for participation in the national warning system

It is the responsibility of all agencies receiving warnings and advisories via the national warning system to maintain systems to receive, disseminate, and respond to warnings.

Effective delivery of warnings and advisories is dependent on recipients meeting the performance standards specified in **Table 25.1**.

Table 25.1: Standards for registration with the national warning system.

Output	Performance standard
Capability to receive and respond to warnings and advisories	<ul style="list-style-type: none">♦ All hours.♦ Procedures are in place to facilitate an effective response to warnings and advisories.
Maintenance of communication systems	Landline telephone or cell phone, and email must be accessible at all hours.
Provision of contact details	<p>A recipient agency must, as far as possible, register a single address for the receipt of warnings or advisories. The contact address can connect to one or more individual recipients within the participant agency.</p> <p>Agencies must provide the following contact details:</p> <ul style="list-style-type: none">♦ point of contact email address♦ duty telephone number♦ duty email address♦ duty mobile number for SMS text message <p>Recipient agencies are to ensure contact details are current and correct, and are to manage the recipients under any address.</p>
Participation in national warning message tests	Participate in national warning system tests (four per year).

Note: Effective delivery of warnings and advisories is also dependant on the public telecommunication infrastructure underpinning the warning system being functional at the time. When this is not the case alternative but less effective means will be applied in order to warn agencies.

25.4.5 Monitoring and review of the national warning system

Procedures for the dissemination and receipt of warnings and advisories, via the national warning system, are subject to continuous review and improvement.

If changes occur that impact on recipients, all recipients will receive sufficient notification (at least one month) before the changes take effect.

25.4.6 Testing the national warning system

MCDEM will send a national warning system test message to all recipients four times per year. Testing includes the following:

- ♦ tests could be at any time, including out of office hours, and
- ♦ tests are conducted without prior notice.

Note: a test message is not followed up by a cancellation message.

Participants are encouraged to use national warning system tests to test/exercise their own local or agency warning arrangements.

25.4.7 Contact lists

MCDEM maintains lists of all recipients' contact details. All recipients are required to forward changes of contact details to MCDEM as they occur.

25.4.8 Procedures for the issue and receipt of warnings or advisories

MCDEM

Following instruction by the Director of CDEM or the National Controller to issue a warning or advisory, MCDEM will:

1. send the appropriate type of warning, advisory or cancellation message by email and SMS text message to those registered with the national warning system and the news media
2. contact the MCDEM Regional Emergency Management Advisors (REMAs) to advise them that a warning or advisory has been issued and allow them to call the relevant CDEM Groups to ensure they have received the message
3. send a request for broadcast message to the listed public broadcasters (for certain warnings)
4. monitor the delivery of the message, and
5. send updates (at least hourly for tsunami, except between 10pm and 5am, when updates will only be issued if there is a significant change) with further information or a cancellation message via the same system (note, a cancellation message will not be issued for a National Advisory – [Type of Hazard]: No Threat to NZ, a National Advisory – Earthquake, and National Warning – Test Message).

All recipients

Upon receipt of a warning or advisory sent via the national warning system, all recipients must respond as per their individual emergency response procedures.

25.5 Specific hazards monitoring and warning

A number of agencies are entrusted with the responsibility of monitoring specific hazards and issuing or supporting the issue of warnings or advisories for specific hazards at the national level.

25.5.1 Severe weather

Lead agency	MetService
Support agency	MCDEM
Coverage	Pre- and during event

MetService is the official source of meteorological information in New Zealand. A contract between MetService and the Ministry of Transport specifies the requirements.

Types of severe weather messages

Information about severe weather issued by MetService fall into three general groups (shown in Tables 25.2 to 25.4 on the next page):

- ♦ Outlooks, Watches, and Warnings of widespread severe weather
- ♦ Outlooks, Watches, and Warnings of local severe weather
- ♦ Advice about severe weather which is not captured by the widespread or local severe weather messages above.

Table 25.2: *Outlooks, Watches and Warnings of widespread severe weather.*

Message	Issued
Severe Weather Outlook	Every day It describes the likelihood of widespread heavy rain, heavy snow or severe gales occurring in the 3–6-day period.
Severe Weather Watch	<ul style="list-style-type: none">◆ Whenever it is likely that conditions will deteriorate to those requiring the issue of a Severe Weather Warning after the immediate 24-hour period but within 48–72 hours, or◆ Whenever it is possible that conditions will be close to severe within the next 24–48 hours, particularly if there is a high level of uncertainty.
Severe Weather Warning	<p>Whenever it is likely that widespread heavy rain, heavy snow or severe gales will occur in the next 24–36 hours. Severe Weather Forecasters discuss significant aspects of the weather situation with key stakeholders as appropriate.</p> <p>Severe Weather Watches and Warnings may be issued any time but are usually issued around 0900 and 2100 hours. The Severe Weather Outlook is published on MetService's website and the text of it is available by publicly-subscribable email list.</p> <p>MCDEM reacts to severe weather warnings by checking on CDEM readiness with the relevant REMA and CDEM Group when it is apparent that an extraordinary event is forecast.</p>
Severe Weather Outlooks, Watches and Warnings are made widely available via MetService websites, and/or smart phone apps and/or publicly subscribable email.	

Table 25.3: *Outlooks, Watches and Warnings of local severe weather.*

Message	Issued
Thunderstorm Outlook	Twice daily, usually mid-morning and mid-evening. It describes the likelihood of localised heavy rain, heavy hail or strong winds (including tornadoes) occurring in the next 24–36 hours.
Severe Thunderstorm Watch	Whenever there is a moderate or high likelihood that severe thunderstorms bringing localised heavy rain, heavy hail or strong winds (including tornadoes) will occur over the New Zealand landmass within the next 24 hours.
Severe Thunderstorm Warning	Whenever information from the MetService weather radar or some other reliable source indicates that a severe thunderstorm (bringing localised heavy rain, heavy hail or strong winds (including tornadoes)) exists within a 150 km radius of a MetService weather radar and it is possible to track and predict the expected path of the thunderstorm.
Thunderstorm Outlooks, Watches and Warnings are made widely available via MetService websites, and/or smart phone apps and/or publicly subscribable email. Thunderstorm Outlooks, Watches and Warnings are not issued for the Chatham Islands.	

Table 25.4: Advice about severe weather which is not captured by the widespread or local severe weather messages.

Message	Issued
Special Weather Advisory	Whenever a weather event is likely to cause significant disruption to the general public or specific industry groups within the following 48 hours but does not meet the criteria for issuing a Severe Weather Warning. A Special Weather Advisory may also be issued following a significant weather event which caused widespread damage and disruption in order to assist with post-storm operations.
Road Snowfall Warning	Whenever there is a likelihood of snow settling and causing disruption within the next 24 hours on the following roads: Napier-Taupo Road (SH5), Desert Road (SH1), Rimutaka Hill Road (SH2), Lewis Pass (SH7), Arthur's Pass (SH73), Porters Pass (SH73), Lindis Pass (SH8), Haast Pass (SH6), Milford Road (SH94), Dunedin to Waitati Highway (SH1).
Snow Otago Warning	Whenever heavy snow is expected to affect South Canterbury and Otago in the next 24 hours, such that snow accumulation exceeds 20 cm at or below 1500 metres within 24 hours but is not sufficient to warrant the issue of a Severe Weather Warning.
Special Weather Advisories, Road Snowfall Warnings and Snow Otago Warnings are made widely available via MetService websites, and/or smart phone apps and/or publicly subscribable email.	
Swell Warning	Whenever the swell or the combined waves (depending upon the area) on a prescribed coast is expected to reach above warning limits within the forecast period, before midnight the following day. Swell warnings are issued for selected parts of the New Zealand coast by arrangement with Regional Councils. Sent to relevant Regional Councils, but not published on the MetService website or made available to the media.
Advice of Abnormally High Sea Water	Whenever the seas level on the coast from Opotiki to the Bay of Islands is expected to be abnormally high. Sent to relevant Regional Councils, but not published on the MetService website or made available to the media.

25.5.2 Volcanic unrest or eruption

Lead agency	GNS Science
Support agencies	MCDEM, MetService, Ministry of Health, CDEM Groups, Police and Fire Service.
Coverage	Pre, during and post-event

New Zealand Volcanic Alert Level System

GNS Science, through the GeoNet Project, is the national source of volcanic monitoring. GeoNet issues notifications of any change in volcanic alert level status through Volcanic Alert Bulletins to MCDEM, other agencies, and the media. See www.geonet.org.nz.

The New Zealand Volcanic Alert Level System is illustrated in Figure 25.2.

New Zealand Volcanic Alert Level System			
	Volcanic Alert Level	Volcanic Activity	Most Likely Hazards
Eruption	5	Major volcanic eruption	Eruption hazards on and beyond volcano*
	4	Moderate volcanic eruption	Eruption hazards on and near volcano*
	3	Minor volcanic eruption	Eruption hazards near vent*
Unrest	2	Moderate to heightened volcanic unrest	Volcanic unrest hazards, potential for eruption hazards
	1	Minor volcanic unrest	Volcanic unrest hazards
	0	No volcanic unrest	Volcanic environment hazards
<p>An eruption may occur at any level, and levels may not move in sequence as activity can change rapidly.</p> <p>Eruption hazards depend on the volcano and eruption style, and may include explosions, ballistics (flying rocks), pyroclastic density currents (fast moving hot ash clouds), lava flows, lava domes, landslides, ash, volcanic gases, lightning, lahars (mudflows), tsunami, and/or earthquakes.</p> <p>Volcanic unrest hazards occur on and near the volcano, and may include steam eruptions, volcanic gases, earthquakes, landslides, uplift, subsidence, changes to hot springs, and/or lahars (mudflows).</p> <p>Volcanic environment hazards may include hydrothermal activity, earthquakes, landslides, volcanic gases, and/or lahars (mudflows).</p> <p>*Ash, lava flow, and lahar (mudflow) hazards may impact areas distant from the volcano.</p> <p>This system applies to all of New Zealand's volcanoes. The Volcanic Alert Level is set by GNS Science, based on the level of volcanic activity. For more information, see geonet.org.nz/volcano for alert levels and current volcanic activity, gns.cri.nz/volcano for volcanic hazards, and getthru.govt.nz for what to do before, during and after volcanic activity. Version 3.0, 2014.</p>			

Figure 25.2: New Zealand Volcanic Alert Level System.

Eruption imminent/occurred

MCDEM receives Volcanic Alert Bulletins about an imminent eruption from GNS Science. MCDEM forwards these via the national warning system. Additionally, the GNS Science Duty Officer may notify the MCDEM Duty Officer of significant volcanic activity by telephone. In consultation with GNS Science or if deemed appropriate, MCDEM issues an appropriate advisory or warning via the national warning system.

Volcanic Ash Advisories

Following a volcanic eruption, and in addition to Volcanic Alert Bulletins issued by GNS Science, MetService is responsible for the issue of Volcanic Ash Advisories for the civil aviation industry over an area covering New Zealand and from the Equator to the South Pole between 160E and 140W. Volcanic ash advisories forecast the distribution and spread of the airborne ash cloud from an erupting volcano for the purpose of aviation safety. They are issued directly to MCDEM, to the international aviation and meteorological communities and published on the Wellington Volcanic Ash Advisory Centre (VAAC) website (<http://vaac.metservice.com>).

25.5.3 Earthquake

Lead agency	GNS Science
Support agencies	MCDEM
Coverage	Post-event

While no reliable means exist in New Zealand for forewarning of earthquake events, GNS Science through the GeoNet Project is the national source of earthquake monitoring and notifications (including Operational Earthquake Forecasting). These notifications can assist with assessing likely consequences to inform response actions. GNS Science provides information via web service and RSS, email and smartphone apps.

GNS Science notifies MCDEM and subscribers of all felt earthquakes through earthquake reports, issued within 5 minutes of the event. Additionally, the GNS Science Duty Officer may notify the MCDEM Duty Officer of significant earthquakes by telephone. For earthquakes of maximum felt intensity of MMVI¹ and higher, MCDEM checks on damage levels in the impacted areas. Where the impact seems significant, MCDEM will issue an advisory via the national warning system.

Territorial authorities must report damage causing earthquakes to their appropriate CDEM Group Duty Manager, including a summary of damage and other effects. The CDEM Group Duty Manager must then inform their MCDEM Regional Emergency Management Advisor, who will then inform the MCDEM Duty Officer.

25.5.4 Tsunami

Distant and regional sources

Lead agency	MCDEM
Support agencies	GNS Science, PTWC, CDEM Groups
Coverage	Pre- and post-event

MCDEM and GNS Science receive tsunami information statements or tsunami threat messages from the Pacific Tsunami Warning Centre (PTWC) for earthquakes equal to or higher than magnitude 6.5 in the Pacific. GNS Science is also responsible for local sea level monitoring.

The MCDEM Duty Officer gives immediate consideration to information received from the PTWC by applying standard criteria related to the locality, magnitude and depth of the earthquake in question and by consulting with GNS Science. If time permits, GNS Science will convene a panel of national tsunami experts to give on-going advice to MCDEM as the situation develops.

Depending on the assessment of the information, a recommendation is made to the National Controller or Director of CDEM and at their direction MCDEM issues an appropriate advisory or warning via the national warning system.

CDEM Groups activate their respective local warning systems in response to warnings or advisories issued by MCDEM and decide on appropriate further action. Decisions about local responses are encouraged to be made in consultation with the neighbouring Controllers and the National Controller.

The National Tsunami Advisory and Warning Plan describes the processes, procedures, considerations and the types of warnings and advisories are sent for tsunami under the national warning system. It is available on the MCDEM website (www.civildefence.govt.nz – search for 'tsunami advisory').

¹ Modified Mercalli scale of earthquake intensity, level VI

Local source

Natural, felt signs are the primary warning for local source tsunami. If possible, MCDEM will issue official warnings as soon as practicable, noting that the first waves may arrive before these official warnings are issued.

Local source tsunami have no lead agency, as natural signs serve as the primary warning.

Support agencies CDEM Groups, MCDEM, GNS Science, PTWC, NIWA, New Zealand Police, media

Coverage Pre- and post-event

A tsunami generated in conjunction with a local large earthquake or undersea landslide may not provide sufficient time to implement official warning procedures. This is because the proximity of the tsunami source and its travel speed combine to give very little time for meaningful warnings to the areas closest to the source.

Proper public education is therefore the principal preparedness measure for local source tsunami. The recommended public message in this regard is:

People in coastal areas should not wait for an official warning. Instead, let the natural signs be the warning. They must take immediate action to evacuate predetermined evacuation zones, or in the absence of predetermined evacuation zones, go to high ground or go inland. Natural signs include:

- experience strong earthquakes (hard to stand up)
- experience weak earthquakes lasting for a minute or more, or
- observe strange sea behaviour such as the sea level suddenly rising and falling, or hear the sea making loud and unusual noises or roaring like a jet engine.

The first official warnings will be the result of a preliminary assessment only, based on initial available data. If possible, MCDEM will broadly indicate where evacuations should be undertaken. CDEM Groups may then refine this information to determine which zones to evacuate.

25.6 References and links

Other sections of the Guide

- ♦ Section 2, Hazards and risks
- ♦ Section 5, Ministry of Civil Defence & Emergency Management (MCDEM)
- ♦ Section 6, Civil Defence Emergency Management Groups (CDEM Groups)
- ♦ Section 16, Science and research organisations
- ♦ Section 24, Response
- ♦ Section 26, National Crisis Management Centre
- ♦ Section 27, Emergency information management
- ♦ Section 28, Public information management.
- ♦ Section 29, Logistics
- ♦ Section 30, Mass evacuation
- ♦ Section 31, International assistance for New Zealand
- ♦ Section 32, Recovery

Other documents

- ♦ Ministry of Civil Defence & Emergency Management (2009) (revised October 2010) *Tsunami Advisory and Warning Supporting Plan* [SP 01/09]; ISBN 978-0-478-43503-0 (www.civildefence.govt.nz – search for 'tsunami advisory')
- ♦ MCDEM National Duty System standard operating procedures

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New Zealand Volcanic Science Advisory Panel (NZVSAP)

Terms of Reference

August 2019

Purpose of the Advisory Panel

To ensure the provision of authoritative readiness, reduction, response and recovery science advice when volcanic activity is affecting New Zealand, through trans-disciplinary and multi-institution collaboration.

Members of the Panel have a strong working relationship with area-specific volcanic groups and programmes, including the Caldera Advisory Group (CAG), the Central Plateau Volcanic Advisory Group (CPVAG), Determining Volcanic Risk in Auckland (DEVORA), and the Taranaki Seismic and Volcanic Advisory Group. These groups and programmes coordinate planning for area-specific volcanic activity, but do not activate in response to volcanic activity.

Objectives

1. Ensure timely, high-quality, well-communicated and consistent science advice during volcanic activity to:
 - a) inform response agencies, and
 - b) support consistent public messaging.
2. Coordinate monitoring, science investigations and data collection during volcanic activity.
3. Act as the national focal point for international science liaison (if required) during volcanic activity.
4. Develop and maintain collaborative, trans-disciplinary, multi-institution, Standard Operating Procedures (SOPs), plans and capabilities for science monitoring, investigation and communication during volcanic activity.
5. Develop and maintain effective, collegial relationships between New Zealand-based scientists with expertise in volcanology, volcanic impacts and science communication.
6. Assist with establishing national and volcanic zone-specific priorities for planning across readiness, reduction, response and recovery.

Membership of the NZVSAP

The Chair will keep a roster of membership and will ensure this remains up to date, in line with the following principles:

- Members of the NZVSAP includes representatives from:
 - MCDEM (Chair)
 - GNS Science¹
- Normally two representatives from each of:
 - Massey University
 - University of Auckland
 - University of Canterbury
 - University of Otago
 - University of Waikato
 - Victoria University Wellington
 - MetService
 - NIWA
- And a representative from:
 - Department of Conservation (Volcanic Science Advisor)

Additional science capability and/or Mātauranga Māori advisors can be called upon as proposed by NZVSAP members in agreement with the Chair.

¹ GNS Science is at the core of the NZVSAP because it runs the GeoNet programme, has a contractual obligation to monitor the status of the volcanoes, and has a statutory obligation to provide advice on natural hazards (earthquakes, volcanoes, landslides and tsunamis) to MCDEM and the CDEM sector.

Sub-groups of the NZVSAP

- The NZVSAP may form specialist volcanic impacts sub-groups (as required). Sub-groups have two core functions:
 1. Undertake and/or identify relevant impacts research.
 2. Provide specialist advice to support emergency management.
- Sub-group membership shall be decided by the Members of the NZVSAP.
- Sub-groups will meet at least once a year, and will report back to each NZVSAP meeting.
- Current volcanic impacts sub-groups include:
 - Agriculture
 - Health
 - Lifelines

Meetings

- The Chair will encourage free and open discussions. Decisions are by consensus, if possible, and by a majority vote if consensus cannot be reached. The Chair has a casting vote.
- Regular planning meetings will be held at such frequency as agreed among the Members. The NZVSAP should meet at least annually.
- The Chair shall poll members for suitable dates and nominate the location of meetings.
- Members should aim to be present at all meetings, or assign an alternative person to attend in their place.
- Attendance of additional representatives and guests is to be agreed by the Chair.

Response to volcanic event

- A decision to convene the Panel during a response to volcanic activity, and its operating arrangements, will follow its Standard Operating Procedure (SOP).
- In line with GeoNet monitoring arrangements, GNS Science will chair the Panel during a response to volcanic activity.
- Science advice coordination may be undertaken through video/teleconferencing and access to online shared work spaces.

Responsibilities of members

- Members freely and openly exchange relevant ideas, information, expertise and experiences within NZVSAP meetings.
- Members act in a timely way on commitments made in both planning and response modes.
- Members act in accordance with the [IAVCEI best practice guidelines for volcanologists in emergencies](#).
- Members act as point-of-contact for their organisation.
- Members will inform the Chair if their contact details change and if they need to be replaced, and will provide contact details of their replacement.
- Members and their organisation will be responsible for their costs of participation in the NZVSAP, including meeting attendance.

Administration

- The Chair is responsible for distributing meeting minutes to Members.
- Any Member may seek clarity and review of the NZVSAP purpose, objectives, roles, and responsibilities. An amendment to the Terms of Reference is to be agreed by the full core membership.
- The contact list for Members of the NZVSAP will be held by the NZVSAP Chair and GNS Science. Contact details will be checked for accuracy at least annually by the Chair.
- The Terms of Reference will be hosted publicly on the MCDEM website, and will be kept up to date by MCDEM.

From: Jonathan Jull [DPMC]
Sent: Thursday, 8 August 2019 4:05 PM
To: Nico Fournier
Cc: Alistair Davies [DPMC]
Subject: NZVSAP meeting - agenda item for your consideration
Attachments: NZVSAP_ToR_2019 review v0.2.docx

[UNCLASSIFIED]

Hi Nico

Alistair Davies and I are to send out next week the agenda for the NZVSAP meeting on 21 August.

One item that MCDEM, as convenor, is proposing is to finalise the ToR (that have currently still in draft form). Part of this work has been to condense them by separating out what in effect is detail that could form an SOP on how the Panel is to function when providing definitive advice to response agencies and the public during a volcanic event (see attached draft ToR and first cut on what information might form an SOP).

As you will remember, having a table top exercise to work through this has been proposed in the past. However, we will be proposing to the Panel that it may be better to map and agree what we can on the process first, and to document this, and then test it in an exercise.

I am giving you a heads up on this proposal for two reasons:

1. As GNS is the official agency for monitoring and formally alerting on volcanic activity in the first instance, that you are able to discuss the inter-relationship of the GEONET system and the Panel's role at the meeting, and;
2. In a response, due to the above relationship, that GNS is likely the logical agency to convene the Panel to fulfil its role in providing authoritative science advice.

The need for another agency to act as convenor, other than MCDEM, recognises that MCDEM staff will have CIMS roles to perform in intelligence, planning and PIM support. In other words, we will become the conduit for receiving science advice rather than facilitating it.

In light of the two points above, and discussion at the meeting, I am thinking that an action would be for GNS to lead a project to further develop the SOP. Alistair and I would help with this, especially in terms of making links to the National Security and emergency management systems.

Are you comfortable with this proposal? I am happy to discuss this further with you by phone if need be. If you want changes to the document ahead of it being circulated, can we please have these by COP next Tuesday, 6 August.

Thanks, and otherwise see you on the 21st.

Ngā mihi | Kind regards

Jonathan Jull | Senior Advisor: Hazard Risk Management & Analysis
Ministry of Civil Defence & Emergency Management Te Rākau Whakamarumarū
s9(2)(a)

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Ministry of Civil Defence & Emergency Management is a business unit of the Department of the Prime Minister and Cabinet



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New Zealand Volcanic Science Advisory Panel (NZVSAP)

Terms of Reference

August 2019

Purpose of the Advisory Panel

Provide authoritative readiness, reduction, response and recovery science advice for volcanic activity affecting New Zealand, through trans-disciplinary and multi-institution collaboration.

Objectives

1. Ensure timely, high-quality, well-communicated and consistent science messaging during volcanic activity.
2. Coordinate monitoring, science investigations and data during volcanic activity.
3. Act as the national focal point for international science liaison (if required) during volcanic activity.
4. Develop and maintain collaborative, trans-disciplinary, multi-institution, Standard Operating Procedures (SOPs), plans and capabilities for science monitoring, investigation and communication during volcanic activity.
5. Develop and maintain effective, collegial relationships between New Zealand-based scientists with expertise in volcanology, volcanic impacts and science communication.
6. Assist with establishing national and volcanic zone specific priorities for planning across reduction, readiness, response and recovery.
7. Assist in identifying and guiding national priorities for research funding to support the above objectives.

Membership of the NZVSAP

Members of the NZVSAP includes representatives from:

- MCDEM (Chair)
- GNS Science (GeoNet)¹

A maximum of two representatives from:

- Massey University
- University of Auckland
- University of Canterbury
- University of Otago
- University of Waikato
- Victoria University Wellington
- MetService
- NIWA

And a representative from:

- Department of Conservation
- EQC Research Strategy & Investment programme
- Resilience to Nature's Challenges' science programme

Additional science capability and/or Mātauranga Māori advisors can be called upon by the Chair and/or in agreement with the NZVSAP members.

¹ GNS Science is at the core of the NZVSAP since it runs the GeoNet project and has a contractual obligation to monitor the status of the volcanoes and a statutory obligation to provide advice on natural hazards (covering earthquakes, volcanoes, landslides and tsunamis) to MCDEM and the CDEM sector.

Sub-groups of the NZVSAP

The NZVSAP may form specialist volcanic impacts sub-groups (as required). Sub-groups have two core functions:

1. Undertake and/or identify relevant impacts research.
2. Provide specialist advice to support emergency management.

Sub-group membership shall be decided by the Members of the NZVSAP.

Meetings

- Regular planning meetings will be held at such frequency as agreed among the Members. The NZVSAP should meet at least annually.
- The Chair shall poll members for suitable dates and nominate the location of meetings.
- Members should aim to be present at all meetings, or assign an alternative person to attend in their place.
- Attendance of additional representatives and guests is to be agreed by the Chair.
- The Chair will encourage free and open discussions. Decisions are by consensus, if possible, and by a majority vote if consensus cannot be reached.
- Sub-groups will meet at least as and when required by Members.

Response to volcanic event

- A decision to convene the Panel, and its operating arrangements, are to follow its Standard Operating Procedure (SOP)
- In line with GeoNet monitoring arrangements, GNS Science will lead the Panel during an event.
- Science advice coordination may be undertaken through video/teleconferencing and access to online shared work spaces.

Responsibilities of members

- Members act as point-of-contact for their organisation.
- Members freely and openly exchange relevant ideas, information, expertise and experiences within NZVSAP meetings.
- Members act in a timely way on commitments made in both planning and response modes.
- Members act in accordance with the [IAVCEI best practice guidelines for volcanologists in emergencies](#).
- Members and their organisation will be responsible for their costs of participation in the NZVSAP, including meeting attendance.

Administration

- The Chair is responsible for distributing meeting minutes to Members.
- Any Member may seek clarity and review of the NZVSAP purpose, objectives, roles, and responsibilities. An amendment to the Terms of Reference is to be agreed by the full core membership.
- The contact list for Members of the NZVSAP will be held by the NZVSAP Chair and GeoNet. Contact details will be checked for accuracy at least annually by the Chair. The contact list is included as Appendix 1.

Standard Operating Procedures (SOP) for providing science advice during volcanic activity

Decision-making during volcanic activity

GNS Science (GeoNet) is responsible for setting Volcanic Alert Levels and providing regular Volcanic Alert Bulletins, as mandated in the National CDEM Plan. GeoNet also provides 24-7 duty volcanologists.

NZVSAP members can attend GeoNet monitoring meetings at any time, either outside or during volcanic activity.

GeoNet will provide regular updates on volcanic activity to other members of the NZVSAP.

During volcanic activity, GeoNet assesses the Volcanic Alert Level. When assessing, GeoNet may choose to consult other Members of the NZVSAP. Voting on Alert Level changes is by GeoNet scientists only.

Response activation of the NZVSAP

GeoNet can request support from other Members of the NZVSAP when volcanic activity is affecting New Zealand, through the process outlined in Appendix 2. If requested, Members will provide GeoNet with additional capability to interpret monitoring data, and advice on likely hazards, impacts and social consequences.

Data collection during volcanic activity

The NZVSAP will coordinate the collection of primary data during event response for the purposes of: volcanic event understanding, advice to stakeholders, public messaging, and long-term research.

Local and international coordination

The NZVSAP will coordinate and liaise with local and international researchers, providing guidance on data collection, data sharing and collaborative science.

International researchers and advisors may be requested to, or themselves offer to, provide support to NZVSAP during volcanic events. Where possible, this support will be coordinated by the NZVSAP, through Members and their organisations. Decisions on the support provided by international agencies will be made collaboratively.

Science advice during volcanic activity

The communication pathways for information transfer during volcanic events are shown in Figure 2. Members agree to a no surprises policy.

The NZVSAP will provide clear, consistent science advice on:

- Volcanic hazards and risks.
- Forecasts and associated uncertainties.
- Actions and decision-making for emergency management, stakeholders and the public.

The NZVSAP will meet:

- To coordinate a regular release of science information (to ensure agencies respond utilising consistent science advice).
- To agree (and update) consistent event-specific public messaging. Public messaging will be shared with MCDEM, CDEM Groups and other appropriate response agencies in a timely manner.

Decision-making for science advice during volcanic activity

The NZVSAP Members will agree a formal decision-making methodology (to manage conflicting views within the group). If there are a range of views, these will be included with the science advice.

Information discussed within the NZVSAP may be freely shared with Member agencies (and other agencies as required) for effective response to volcanic events.

DRAFT

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Appendix 1. NZVSAP Members' contact details and areas of expertise

Name	Email	Organisation	Office contact phone (required)	Mobile phone (optional)	Main areas of research/expertise/responsibility relevant to the NZVSAP	Links to sub-groups
Brad Scott	s9(2)(a)	GNS Science	s9(2)(a)		Volcanic hazard monitoring and assessment, public communication, emergency planning with CDEM	CPVAG, Taranaki, CAG, VISG
Carol Stewart		Joint Centre for Disaster Research			Health impacts of ash, ash collection and analysis, liaison with health sector, public and sector education materials	Health
Colin Wilson		Victoria University of Wellington			Forensic analysis of older samples, analysis of older volcanic events	
Cory Davis		MetService			Atmospheric ash detection and ash dispersion/deposition modelling	
Graham Leonard		GNS Science			Mapping of deposits and volcanic hazard mapping, emergency planning with CDEM, warning systems, public and sector education materials	CAG, CPVAG
Ian Schipper		Victoria University of Wellington			Forensic analysis, ash analysis for respiratory impacts	
James White		University of Otago			Phreatomagmatic eruptions, sub-volcanic magma supply in volcanic fields, sub-glacial volcanism, lahars, outbreak floods, submarine volcanism, ash analysis (texture, composition); occasional media response / outreach	
Jan M. Lindsay		University of Auckland			Source mechanisms, magma rise rates, volcanic hazards and emergency planning	
Jonathan Proctor		Massey University				
Kim Wright		MCDEM			Emergency management planning, national CDEM policy and guidance, risk management, science liaison MCDEM	Health
Mark Bebbington		Massey University			Frequency magnitude modelling, mass flow models, National volcanic hazard model	
Nico Fournier		GNS Science			Volcanic hazard monitoring, public communication, volcanic hazard modelling	
Peter Kreft		MetService			Atmospheric ash detection and ash dispersion/deposition modelling	
Richard Smith		EQC			Strategic policy hazard detection and monitoring, science liaison EQC	
Richard Turner		NIWA			Ash dispersion modelling incorporating wind modelling	
Sarah-Jayne McCurrach		MCDEM			Emergency management planning, national CDEM policy and guidance, risk management, science liaison MCDEM	
Shane Cronin		University of Auckland			National science coordination and funding liaison (NSC) , hazard assessment, ash collection and analysis	Taranaki
Stuart Moore		NIWA			Ash dispersion modelling incorporating weather/wind modelling	
Tom Wilson		University of Canterbury			Impact and risk assessment of volcanic hazards for built environment, agriculture and lifelines, hazard assessment, emergency planning	(Agriculture), (Lifelines)

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New Zealand Volcanic Science Advisory Panel (NZVSAP) Meeting

Minutes

Date:	21 August 2019, 10:00 - 15:00.	
Location:	MCDEM. Level 4 Conference Room, Bowen House, Wellington.	
Chair:	Jonathan Jull	MCDEM
Attendees:	Art Jolly Brad Scott Graham Leonard Nico Fournier Carol Stewart Jonathan Procter Mark Bebbington Rosa Trancoso Alistair Davies Iona Wassilieff Stuart Moore James White Danielle Charlton Jan Lindsay Geena Campbell Tom Wilson Ian Schipper Colin Wilson Marcel Roux	GNS Science GNS Science GNS Science GNS Science Massey University Massey University Massey University MetService MCDEM MCDEM (<i>for Consistent Messages item</i>) NIWA Otago University University of Auckland University of Auckland University of Canterbury University of Canterbury Victoria University Wellington Victoria University Wellington Wellington Volcanic Ash Advisory Centre (<i>for MetService item</i>)
Apologies:	Jo Horrocks Gill Jolly Peter Kreft Richard Turner Richard Smith Shane Cronin	EQC GNS Science MetService NIWA Resilience to Nature's Challenges University of Auckland



New Zealand Guideline for volcano hazard mapping

Danielle Charlton, Jan Lindsay & Graham Leonard

Danielle discussed her project, aiming to create a usable framework (guidelines and workflows) for the production of hazard maps in New Zealand. There is a need for rapid map production during a crisis (as well as “peacetime” maps), which clearly and consistently communicate hazard and risk. Also aiming to create a transparent map development process.

- Workflows: The technical process making the maps.
- Guidelines: Best practice for the maps making process and map design.

The group individually wrote detailed answers and then discussed 13 questions:

- 1) Who are the key stakeholders making hazard maps?
- 2) How in-depth should the workflows and guidelines be?
- 3) What should the framework look like?
- 4) Where will it reside? Who is responsible for updating and evaluating?
- 5) Who decides what goes on a map, how, and at what stage?
- 6) Who stores spatial data and how is it stored?
- 7) How do we incorporate new datasets into the workflow and on maps?
- 8) What is the trigger for development of a crisis map?
- 9) How do we capture uncertainty in the workflow and on the maps?
- 10) Which volcanoes shall we develop test maps for? And why?
- 11) Who are the key stakeholders using hazard maps? How will they use the?
- 12) Existing spatial data sources or scenarios which could be used?
- 13) How do maps fit into the wider suite of hazard materials?

For more information and discussion outputs, email: danielle.charlton@auckland.ac.nz.

ACTION: *Danielle* to discuss with other stakeholders, develop the framework process further and will discuss the outcomes of this work and the proposed framework at a future NZVSAP meeting.

Terms of Reference update: scientific advice in an emergency

Chair

The Chair provided a revised draft Terms of Reference for review and editing in discussion by the Members. The revised draft clarified the core purpose of the Panel, and separates the Panel's BAU procedure from how the Panel will function when providing science advice in response to a volcanic event.

Members decided not to include funding agencies (EQC and Resilience to Nature's Challenges (RNC)) as required members of the NZVSAP, noting that core Members are closely involved with these programme and additional guests can be called upon by the Chair and/or in agreement with the NZVSAP Members. Tom Wilson noted that he would like the RNC Director to be a required member of the NZVSAP, due to the anticipated role of RNC as a science funding agency in responses. Members agreed that once the science funding arrangements during responses are confirmed, the administering agency processes can be formally linked to the NZVSAP to facilitate science provision.

Members agreed to establish a working group to develop the *Standard Operating Procedure (SOP) for providing science advice during volcanic activity*. Members agreed for this sub-group to



be coordinated by MCDEM, and to include Nico Fournier, Graham Leonard, Carol Stewart, Tom Wilson, Art Jolly, Brad Scott and a representative from MetService.

Tom Wilson requested the Panel runs a table top exercise to test the SOP once developed.

ACTION: Chair to distribute the revised Terms of Reference.

ACTION: Chair to invite Department of Conservation Volcanic Science Advisor to join NZVSAP as a Member.

ACTION: Chair to confirm updated contact details with Members.

ACTION: Nico Fournier to confirm whether GeoNet or GNS Science should be the named party in the Terms of Reference and Standard Operating Procedure.

ACTION: Jan Lindsay to confirm an open access link to the IAVCEI best practice guidelines for volcanologists in emergencies.

ACTION: MCDEM to investigate hosting the Terms of Reference on the MCDEM website.

ACTION: MCDEM to convene a working group to work to develop a draft SOP that will be discussed at the next NZVSAP meeting.

ACTION: MetService to provide a representative for the SOP working group.

ACTION: Graham Leonard to circulate Google Drive access details to all Members.

Hazard and impact scenario development for silicic volcanoes in New Zealand

Geena Campbell & Tom Wilson

Geena and Tom provided an overview of a scenario development framework for silicic volcanoes in New Zealand. Members provided feedback on the proposed framework.

For more information and discussion outputs, please email: geena.campbell@pg.canterbury.ac.nz.

Discussion on Consistent Messaging: Volcanic Activity and Geothermal Activity section updates

Alistair Davies and Iona Wassilieff

Alistair and Iona provided an update on the Consistent Messaging project. The volcanic section is the first hazard-specific section to be developed, and will provide a model for the other hazard-specific sub-sections. Members of the NZVSAP (Carol, Graham, Brad and Tom) have been closely involved in the development. Once completed, the messaging will be published online as a "living document".

Members discussed and edited the draft of the Volcanic Activity section. Members discussed that the form and duration of volcanic activity may require public messages to be refined or tailored for specific events. It was clarified that the messaging is designed as a starter to help CDEM and other groups to create messaging products.

ACTION: Members may provide any further edits to the volcanic activity and geothermal activity sections to alistair.davies@dpmc.govt.nz.

ACTION: MCDEM to establish a procedure for updating the Consistent Messaging advice.

Metservice satellite-based eruption detection and volcanic ash dispersion modelling

Rosa Trancoso & Marcel Roux

Rosa and Marcel provided an update on volcanic ash detection and modelling at MetService.

Pilots can manually flag volcanic activity whilst flying. This triggers an alert in Met Service.

Rader echos and satellite imagery are also being used to detect volcanic ash plumes.



The Volcanic Cloud Analysis Toolkit (VOLCAT) can now automatically generate alerts of volcanic eruptions by detecting and tracking thermal anomalies, volcanic ash and volcanic Cb. VOLCAT then automatically runs a model to predict likely volcanic ash propagation.

GeoNet's NGMC team works closely with MetService to ensure this work is integrated, and are now able to provide ash forecasts based on the new models.

VAC is moving towards quantifying risks which airlines will decide whether or not to fly based on their risk tolerance.

Health impacts subgroup

Carol Stewart provided an update on the activities of the health impacts subgroup. Activities have included:

- Working closely with MCDEM on the update to the Consistent Messaging guide.
- Continued liaison with the International Volcanic Health Hazards Network (IVHHN). Some IVHHN products have now been endorsed by WHO (<https://www.ivhnn.org/news/ivhnn-products-receive-endorsement-who>). The IVHHN is also soon to release new protocol on leachable elements.

ACTION: *Health impacts subgroup* to consider adding air quality and epidemiology experts to the sub-group.

s6(a)

Any other business

New ash impact posters for infrastructure managers are under development, and the United States has provided funding to translate these into Indonesian and Spanish. (The current posters are available here: <https://www.gns.cri.nz/Home/Learning/Science-Topics/Volcanoes/Eruption-What-to-do/Ash-Impact-Posters>).

Next meeting date: To be confirmed.



**Ministry of Civil Defence
& Emergency Management**
Te Rākau Whakamarumaru

21 August 2019: NZVSAP Agenda Item:

To	NZVSAP
From	Jonathan Jull, Convenor
Date	15 August
Subject	Terms of Reference & Operating Procedure in Response

Purpose

To discuss and finalise the NZVSAP's ToR, and to progress developing Standard Operating Procedures for use in response to significant volcanic activity.

Background

Draft ToR have been in development for some time. An earlier version has tended to confound both being a concise understanding of the Panel's role/BAU arrangements and procedure for providing science advice during significant volcanic activity.

In reviewing them, we have condensed a draft ToR by separating out the detail that may form a Standard Operating Procedure (SOP) for how the Panel functions when providing science advice to response agencies and the public during a volcanic event (see attached draft ToR & 'first cut' on the type of information that could form an SOP).

We have previously proposed to hold a tabletop exercise to work through the procedure. However, we are now proposing to the Panel that it may be better to clearly map out and agree what we can on the process first, and to document it, and then to test it in an exercise.

Recommendations

It is recommended that Panel members:

- Review the draft ToR with the aim that the Panel can adopt them at the meeting.
- Discuss the aim of having an SOP, and to establish a sub-group, supported by MCDEM staff, to undertake next steps in development.
- Agree on timeframe for the above in terms of:
 - Any ongoing GEONET developments
 - Any upcoming opportunities for an exercise
 - Other considerations?

From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Elaine Smid <e.smid@auckland.ac.nz>
Sent: Wednesday, 18 September 2019 1:20 PM
To: volcano-devora-list@lists.gns.cri.nz
Subject: [Volcano-DEVORA-list] Fw: VISG newsletter - September 2019
Attachments: image001.png; VISG_newsletter_n17_Sept2019.pdf; ATT00001.txt

Hi all!

Please see attached for the latest quarterly VISG newsletter. A description of its contents can be found below.

Nga mihi
Elaine

From: Natalia Deligne s9(2)(a)
Sent: Tuesday, September 10, 2019 11:25 AM
Subject: VISG newsletter - September 2019

Kia ora,

Attached is the quarterly Volcanic Impact Study Group (VISG) newsletter for September 2019. The newsletter features a Research Spotlight by University of Canterbury PhD student Nicole Allen on her research on syn- and post-eruption building habitability; she is making full use of the University of Canterbury's Volcanic Impacts Lab and Volcanic Ballistics Cannon Lab.

I'd like to highlight some upcoming events, all of them in Tamaki Makaurau Auckland (for more information see newsletter) - hope to see you there!

- * Annual DEVORA forum (free!), 21 November
- * 1st Annual Resilience to Natures' Challenges (2) Urban Theme Forum (free!), 22 November
- * Volcano Short Course, tentative dates 11-12 November with field trip on 13 November. This course presents a state-of-the-art assessment of volcanic hazards in Aotearoa New Zealand, and will help you better understand how your organization can better prepare for, and mitigate against, a future volcanic crisis.

As a reminder, all VISG newsletters are available at <http://www.alg.org.nz/volcanic-impacts/visg-newsletters/>. In consideration of your inboxes, I email a low-res version of the newsletter; if you wish to have the higher-res version (4 MB), please download it from the ALG website. Note: there may be a delay in uploading newsletters, if in the interim you wish to have a high res version of a recent newsletter please email me directly.

Please share this newsletter with your colleagues, and ask those who would like to be added to the distribution list to email me. Alternatively, if you wish to be removed from the list let me know.

Nga mihi,
Natalia

Dr Natalia Deligne | Volcanic Hazard and Risk Modeller GNS Science | Te P? Ao
1 Fairway Drive, Avalon 5010, PO Box 30368, Lower Hutt 5040, New Zealand Ph +64 (04) 570 4129 | Fax +64 (04) 540 4600 <http://www.gns.cri.nz/> | s9(2)(a)

[cid:image001.png@01D2386E.E476BAB0]<<http://www.gns.cri.nz/Home/News-and-Events/Social-Media-Communities>>

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Volcano-DEVORA-list mailing list
Volcano-DEVORA-list@lists.gns.cri.nz
<http://lists.gns.cri.nz/mailman/listinfo/volcano-devora-list>

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VISG CO-ORDINATOR'S NOTE



Natalia Deligne,
GNS Science

The past two months I've had the opportunity to be a visiting scientist at the US Geological Survey - Hawaiian Volcano Observatory (HVO). It's been a humbling experience. I've gasped at the devastation and profound changes to the landscape wrought by last year's eruption, which had concurrent activity at the Kilauea summit and Kilauea's Lower East Rift Zone. It was one thing to follow by watching HVO updates during my lunch hour last year, another thing to appreciate the scale of what must have happened in person. In addition to working with HVO staff, I've met local government staff in full recovery and planning mode, and with local and state civil defence personnel who worked tirelessly to keep everyone safe during the eruption. I look forward to sharing my experience when I'm back in Aotearoa.

There are numerous events coming up this quarter – see **Upcoming Events**. I hope to see many

of you at the National Lifelines Utility Forum, and encourage you to attend the back to back annual **DEVORA Forum** and in the Inaugural **Resilience to Natures' Challenges (2) Urban Theme Forum** in November. The **Volcano Short Course** will be in Auckland this spring, providing an opportunity to learn or refresh your knowledge of volcanoes and their impacts and what to prepare for in Aotearoa New Zealand.

This quarter's **Research Spotlight** by PhD student Nicole Allen provides an overview of Nicole's research on syn- and post-eruption building habitability. She is making full use of the University of Canterbury's Volcanic Impacts Lab and Volcanic Ballistics Cannon Lab – I hope you will be able to see them if you partake in the Research Day following the National Lifeline Utilities Forum.

Have a good spring!

NEWS

Around late October, **RiskScope** will be holding a series of **workshops** around the country and distributing a **survey** to **capture user requirements** for **RiskScope 2.0** – this will inform the development of the user experience. For more information, contact Kristie-Lee Thomas (k.thomas@gns.cri.nz).

Phase 2 of the **Resilience to Nature's Challenges** (RNC) National Science Challenge is now underway. This 5-year programme of work encompasses an exciting and cohesive body of research that aims to support New Zealand's resilience transformation through co-created research emphasising the needs of end-users and their unique challenges. Underpinning this holistic approach is the recognition that knowledge and understanding of New Zealand's natural hazards alone is not enough to ensure resilience. Research outputs must be targeted and functional for end-users to translate into tangible

resilience practice. The programme is divided into 10 themes, and volcanic impacts research will feature in several of these, most notably the Volcano, Built, Rural and Urban themes. For more information please visit: <https://resiliencechallenge.nz/> or contact any of the theme leaders (see website).

The **New Zealand Volcano Science Advisory Panel** (NZVSAP) met in August 2019. NZVSAP facilitates provision of authoritative, trans-disciplinary volcanic science advice integrated across agencies during a crisis, and leads collaborative planning and coordination for multiagency science research response during volcanic events. It has Health, Agriculture and Lifelines sub-groups that provide technical volcanic-hazard specific advice and research as needed during unrest and eruptions. These sub-groups are also tasked with contingency planning for the way that this advice and research activity will occur during a crisis.

RESEARCH SPOTLIGHT

How will an Auckland eruption effect building habitability?



Nicole Allen,
University of Canterbury

A functioning city requires habitable buildings to shelter residents; natural hazards can make buildings uninhabitable for the short-term or potentially permanently. As a recent example, the Canterbury Earthquake Sequence disaster resulted in a total housing stock reduction of 6.2% (11,500 buildings) in Christchurch. This resulted in a population shift, with many people moving to outer suburbs of the city or further afield. The majority of the damage caused in Christchurch was arguably due to liquefaction, rather than ground shaking, which had not been considered in pre-2010 loss assessments. This disaster highlights two main challenges with assessing the potential impacts of natural hazards: the complexities surrounding post-event building habitability, and our poor (to date) consideration of multi-hazard impacts.



Left: Volcanic ballistic projectile (VBP) penetrating clay roof tiles. Right: VBP, at velocity expected to penetrate clay tile, is cushioned by 3cm of fine ash. Experiment and image credit George Williams.

Auckland is home to around 1.6 million people and, like Christchurch, is exposed to natural hazards which have the potential to cause damage to, or destroy, Auckland's housing stock. My research concerns one such hazard (which actually consists of many hazards): a local volcanic eruption from the Auckland Volcanic Field (AVF), which is situated beneath the Auckland metropolitan area. The AVF has erupted at least 53 times in the last 190,000 years, and will erupt again, although we do not know when or where. AVF eruptions include a wide range of hazards, including potential combinations of the following: tephra fall, lava flows, volcanic ballistic projectiles (large flying volcanic rock fragments, which I will abbreviate as

VBP), pyroclastic surges, and the construction or excavation of a new edifice. All of these hazards have the potential to affect building habitability.

Traditionally, volcanic hazard impact assessments focus on the impacts of a single hazard or consider several hazards independently. Unfortunately, volcanic hazards can occur concurrently and multiple hazards can interact with each other, which can compound or minimise cumulative impacts. For example, real-world observations and laboratory testing (see photos) indicates that in isolation, buildings can be structurally damaged by high loads of volcanic ash (>2kPa, approximately



Ash load experimentation using the ash dispersal system and ash collected from the Pupuke eruption of the Auckland Volcanic Field. Experiment and image credit Nicole Allen.

10-50cm thickness depending on ash density) and by VBPs with high impact energies (>400J to perforate sheet metal). However, lower ash loads can actually cushion the structure against VBPs and hence, offer some protection to the building.

An eruption in New Zealand's largest city would render many residential buildings uninhabitable during or after an eruption. Researchers estimated that 139,900 residential properties would be affected by the Māngere Bridge DEVORA scenario, costing a total of NZD\$8.7b (see VISG newsletter 3 to learn more about the Māngere Bridge scenario and VISG newsletter 14 to learn more about the DEVORA suite of scenarios). An affected building is not necessarily uninhabitable: as we saw in Christchurch, many buildings were damaged but not red-tagged. We are still working on understanding how and why buildings are affected by volcanic hazards.

I am conducting experiments on the impacts of the interactions between ash fall and VBPs on residential buildings. The University of Canterbury has two purpose-built laboratories for testing the impacts of ash fall (Volcanic Impacts Lab) and VBPs (Volcanic Ballistics Cannon Lab). The Volcanic Impacts Lab is outfitted with a bespoke ash dispersal system, designed to simulate realistic ash loading conditions by evenly distributing ash on any experimental object. The Volcanic Ballistics Cannon Lab houses a high-pressure air cannon, which can fire VBPs into experimental objects below it. I will use both laboratories to test the vulnerability of timber-framed buildings with sheet metal roofs as well as how the interaction between ash fall and VBPs affect the overall impact sustained by a building. My experimental phase is underway in the Volcanic Impacts Lab, where I am assessing roof damage caused by vertical impact

loading of tephra. In the future I will also conduct experiments to assess damage from wet tephra, damage caused by VBPs, and damage caused by VBPs and tephra loading combined. My research will advance our understanding of how buildings are impacted by multiple volcanic hazards and what will cause housing to become uninhabitable – considering aspects such as physical damage or access to services. My research provides the required science to later decrease building vulnerability, so that houses are more resilient and remain habitable during and after a volcanic eruption. ♦

RESEARCH HIGHLIGHT

Tephra clean-up after the 2015 eruption of Calbuco volcano, Chile: a quantitative geospatial assessment in four communities

Josh Hayes from the University of Canterbury and coauthors from New Zealand and Argentina published a paper in Journal of Applied Volcanology.

This paper presents an overview of the clean-up efforts undertaken in one Chilean and three Argentinean communities after the 2015 Calbuco eruption (see the June 2018 VISG newsletter). Paper authors narratively reconstruct clean-up efforts in these four communities, and compare these volume and clean-up operation duration reconstructions with estimates based on an adapted geospatial modelling approach developed by lead author Josh Hayes. This paper demonstrates the utility of using simple geospatial data to develop assessments for tephra clean-up for use in response and recovery planning. ♦

GLOBAL ERUPTION ROUNDUP

by Nicole Allen, University of Canterbury



Stromboli, Italy

An explosive eruptive sequence occurred from Stromboli on 3rd July, tragically claiming the life of one tourist and injuring another. The eruption was preceded by low-to-medium intensity Strombolian activity and degassing from both the North and South Central crater areas. The eruption consisted of high-energy explosions, a tephra plume 4km high, lateral blasts creating two pyroclastic density currents and lava effusion. Higher than normal intensity Strombolian activity feeding lava flows has continued into August.



Eruption of Stromboli, 3 July 2019. Image credit Sengel.

The eruption ignited fires on the west flank of the island and prompted the voluntary evacuation of 100 people to the nearby island of Lipari. At least one tourist was injured, and one killed, while hiking on the flank of the volcano. The two hikers were caught by fires and hit with volcanic ballistic projectiles while making their way down the volcano. Many residents of Stromboli have lived on the island for generations and are aware of the hazards it poses, so sheltered in their homes and remained calm during the eruption. Damage caused by the eruption is estimated to have been €20 million.

Ulawun, New Britain, Papua New Guinea



An increase in seismic activity from Mt Ulawun's seismic monitoring station prompted the declaration of a stage one activity alert for the volcano on 4th June. Mt Ulawun has a four-stage alert warning system which describes the activity of the volcano as well as preparedness recommendations. Beginning on the 26th June, a large eruption occurred, producing an eruption column 19.2km high and the

volcanic activity level was raised to stage two. Volcanic ash was dispersed mostly to the south and the west, and a pyroclastic density current travelled north.

By 27th June the eruption of Mt Ulawun was decreasing in intensity with the alert level lowered to one. By 30th June, over 11,000 people had evacuated from areas impacted by the eruption (mostly within West New Britain). Despite opening at least 10 care centres to house those who had been displaced, it was reported on 5th July, that approximately 16% of displaced persons in West New Britain, and 85% in East New Britain, were staying in makeshift shelters or open spaces. Many care centres reported health concerns including lack of food and water, unsanitary conditions and disease spread. By 12th July, those evacuated from East New Britain were able to return to their homes, but many home gardens and local water sources had been destroyed or contaminated.

On 3rd August another large eruption occurred at Mt Ulawun. The eruption column again rose to over 19km high; the activity level was raised to stage three and then decreased to stage one the following day. Over 8,000 people were still displaced by the previous eruption at this time, and current reports claim 4,000 people remain in care centres as of the 16th August (although these estimates may be low). Residents of care centres are still dealing with poor conditions and lack of aid. ♦



Road covered by a lava from the 2018 Lower East Rift Zone eruption, Hawai'i. Photo credit: Natalia Deligne.

MEDIA COVERAGE

Prime TV aired **Beneath New Zealand** in June 2019, which focused on New Zealand's volcanism past, present, and future; the third episode focused on Auckland and featured a number of DEVORA researchers and findings. **RNZ**, **NewsHub**, and other outlets interviewed DEVORA researchers to learn more.

UPCOMING EVENTS

The free **12th Annual DEVORA Research Forum** will be on **21 November 2019** at the **University of Auckland**. The forum will feature updates on the latest research concerning the Auckland Volcanic Field and provides an opportunity to guide future research directions. ALG members and interested parties are welcome. For further information, contact Elaine Smid (e.smid@auckland.ac.nz).



The **1st Annual Resilience to Natures' Challenges (2) Urban Theme Forum** (part of the National Science Challenge) will be on **22 November 2019** at the **University of Auckland**. The forum will feature updates from the three research workstreams: Smart Resilient Cities, Resilient Urban Communities, and Pathways to Governing for Resilience. ALG members and interested parties are welcome and will be provided with opportunity to guide future research directions. For further information, contact Kate Kenedi (katek@auckland.ac.nz).



The **Annual Volcano Short Course** will be in Auckland this spring. For more information, contact Brad Scott ([s9\(2\)\(a\)@gns.cri.nz](mailto:s9(2)(a)@gns.cri.nz)).

CONTACT

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From: volcano-devora-list-bounces@lists.gns.cri.nz on behalf of Natalia Deligne
s9(2)(a)
Sent: Tuesday, 1 October 2019 4:41 PM
To: volcano-devora-list@lists.gns.cri.nz
Subject: [Volcano-DEVORA-list] Volcano Short Course 11-13 November in Auckland
Attachments: Volcano_Short_Course_2019.pdf; ATT00001.txt

Kia ora,

The annual volcano short course will be in Auckland at the Mercure Hotel 11-12 November with optional field trip to Rangitoto on 13 November; I've attached the brochure and the website is: <https://www.gns.cri.nz/Home/News-and-Events/Events/Volcano-Short-Course-2019>.

This course is particularly relevant for central and local government, infrastructure companies, NGOs, and anyone involved in the management of volcanic risk.

Please pass on to interested parties, and get in touch if you have questions.

Cheers,
Natalia

Dr Natalia Deligne | Volcanic Hazard and Risk Modeller GNS Science | Te Pū Ao
1 Fairway Drive, Avalon 5010, PO Box 30368, Lower Hutt 5040, New Zealand Ph +64 (04) 570 4129 | Fax +64 (04) 540 4600 <http://www.gns.cri.nz/> | s9(2)(a)

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Volcano-DEVORA-list mailing list
Volcano-DEVORA-list@lists.gns.cri.nz
<http://lists.gns.cri.nz/mailman/listinfo/volcano-devora-list>

Released under the Official Information Act 1982

Registration Details

Complete your details and post, email or phone in your registration today. Registrations are limited and close 1 November 2019.

GNS Science
Private Bag 2000, Taupo 3352, New Zealand

Contact: Fiona Buxton
Telephone: +64-7-3748211
Email: f.buxton@gns.cri.nz

Name: _____

Organisation & address: _____

Phone: _____ Fax: _____

Email: _____

Special dietary or other needs: _____

Payment Details

\$600 per person + GST including course dinner

Optional field trip: Rangitoto \$100 per person (+GST)

☐ Cheque. Enclosed is our cheque for \$ _____
(payable to GNS Science)

☐ Invoice my organisation. Order No: _____

☐ Credit card. ☐ Visa ☐ MasterCard

Name on card: _____

Card number: _____

Expiry date: _____ Security code: _____

Signature: _____

The course cost will be charged for cancellations less than 7 days before the event. However, substitutions may be made at any stage at no cost.



Cars damaged by thick ashfall in the Usu eruption 2000 Japan. Photo: Tony Hurst, GNS Science



Fumarole monitoring at White Island. Photo: Karen Britten, GNS Science

How well will your organisation cope with a future volcanic crisis?

This two day course will present a state-of-the-art assessment of volcanic hazards in New Zealand, and will help you better understand how your organisation can better prepare for, and mitigate against, a future volcanic crisis.

Volcanologists, social scientists and emergency managers form part of the multi-disciplinary team that explores relationships between the physical and social aspects of natural hazards and their management.

The course is designed for those involved in all aspects of natural hazard management: planners, educators, engineers, local and central government policy makers, insurance managers, emergency managers and business, utility and property owners.

GNS Science

2019 VOLCANO SHORT COURSE

Mercure Hotel

8 Custom St East, Auckland

11-12 November 2019

Rangitoto Island Field Trip (optional)

13 November 2019

Learn about volcanoes, their hazards, impacts to society and mitigation strategies in this interactive two-day course.



Auckland - Mt Eden in the foreground, Rangitoto in the distance on the right. Photo: K. Sowden, Auckland Council.



SPEAKER PROFILES

Carol Stewart is an Associate Professor in Environmental Health at the Joint Centre for Disaster Research, Massey University/ GNS Science, and is an expert member of the International Volcanic Health Hazards Network (www.ivhnn.org).

Dr Natalia Deligne is a Volcanic Hazard and Risk Modeller at GNS Science and a member of the GeoNet monitoring team. Her interests include societal impacts of volcanic eruptions and volcanic risk assessment. She is part of the DEVORA and RiskScape research programmes.

Brad Scott, GNS Science, is a volcanologist based at Wairakei. He has been involved in volcano monitoring and eruption responses for over 40 years and has a wealth of experience from New Zealand and other active volcanoes. He currently focuses on assessment and communication of volcanic hazards.

Dr Craig Miller is a volcano geophysicist at GNS Science, Wairakei, and part of the GeoNet monitoring team. He has built volcano monitoring networks in NZ and in the South Pacific and uses geophysical techniques to model the internal structure of volcanoes to find out what makes them tick.

Dr Graham Leonard, GNS Science. Graham's current research involves volcanic mapping, developing eruption histories, volcanic and tsunami hazard mapping, multi-agency emergency and warning response planning.

Jan Lindsay is an Associate Professor in volcanology at the University of Auckland. She has held previous positions at GNS Science in Taupo, the GeoResearch Centre in Potsdam, Germany, and the Seismic Research Centre in Trinidad. She currently co-leads the Determining Volcanic Risk in Auckland (DEVORA) research programme.

MCDEM Hazard Risk Management Team. The Ministry of Civil Defence & Emergency Management provides leadership in reducing risk, being ready for, responding to and recovering from emergencies.

PROGRAMME

DAY ONE: Monday 11 Nov 2019, 9 am – 5 pm.

Registration and welcome (coffee from 8:45 am)

- Pinatubo video and discussion
- The volcano problem and introduction to Aotearoa's volcanoes
- Near vent hazards, impacts, and mitigation
- Volcanic ash: hazards, impacts and mitigation
- Discussion

6:30pm dinner at Mercure Hotel restaurant

DAY TWO: Tuesday 12 Nov 2019, 9 am – 5 pm.

- Ash and gas impacts on health
- Fatality risks from volcanic eruptions
- Managing the volcano problem
- Monitoring Aotearoa's volcanoes
- Management of volcanic risk in Aotearoa
- Auckland volcanic impacts and risk management

DAY THREE: Wednesday 13 Nov 2019, 9 am – 4 pm.

Optional field trip to Rangitoto.

- Meet at Queens Wharf at 9 am
- Ferry departs at 9:15 am
- Explore Auckland Volcanic Field's youngest volcano
- Return at approx. 4 pm

Morning and afternoon tea, lunch, course dinner and refreshments included. Lunch included in optional field trip.



Mt Ngauruhoe, 1974
Lloyd Homer
GNS Science

GNS Science offers this course on volcanoes annually. GNS Science specialises in improving the understanding of New Zealand's geologically active landscape and assessing the risk and impact of earthquakes, volcanoes, landslides and tsunami (www.gns.cri.nz). It also runs the GeoNet monitoring project, which is cofunded by EQC (www.geonet.org.nz).

WHO IS THE COURSE FOR?

The course will be particularly relevant for:

- Central and Local Government
- Infrastructure companies
- NGOs
- Anyone involved in the management of volcanic risk

There will be plenty of interactive discussion, and you can learn from both New Zealand and overseas experiences.