How long would it take to escape Auckland if a volcano was about to erupt?

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Scientists are working to understand how long it might take for people to move out of harm's way ahead of a future eruption of the Auckland Volcanic Field.

"The next eruption in the Auckland Volcanic Field could happen anywhere in the existing field, either on the land, or in the sea, so estimating how many people might be impacted carries a lot of uncertainty," says the study's lead researcher Alec Wild, Ph.D. candidate from the University of Auckland."

"An eruption is unlikely in our lifetime but we know an eruption will occur in the Auckland Volcanic Field in the future. What's difficult is that we don't know where the next eruption is going to be," says Wild.

To address the unpredictability of any future eruptions, Wild and his co-authors created a model using demographic information, like population distribution and vehicle ownership, as well as geospatial tools, to understand how many people might be at immediate risk during a volcanic eruption, and how long it would take for them to evacuate away from danger.

The research results from Wild and his co-authors were last week published in the Journal of Geothermal and Volcanology Research.

Previous work, led by Marco Brenna of the University of Otago, has suggested that Auckland may have 5-15 days warning of an impending volcanic eruption, but Wild's evacuation timelines fall well inside that window.

Wild's research shows that Auckland's residential suburban areas would require the largest and longest evacuations. Up to 320,000 residents may need to evacuate when the location of the new eruption is fairly well understood, which could take up to 49 hours to complete. However, when the location of the impacted area is less certain, both these numbers increase.

"An eruption in the Auckland Volcanic Field is one of the region's most

impactful hazards and comes with a lot of different risks," says Kate Crawford, General Manager of Auckland Emergency Management (AEM).

"Evacuations themselves can be dangerous and asking people to leave their homes during an emergency, possibly for an extended period of time, is one of the hardest calls any emergency decision-maker will have to make.

"That is why research to help us understand how much time we might have, and how long it will take to get people to safety is so valuable to us."

Crawford says that once GNS Science advises AEM of a volcanic threat, they we will be working with the New Zealand Police, who lead Auckland's Evacuation Control Team, and welfare and support agencies to help those impacted.

Unlike the big volcanoes in the central North Island, eruptions in the Auckland Volcanic Field are usually smaller, and in a new location each time. There are currently 53 identified volcanic centers, which have created the cones and some lakes we see around the city.

"As the magma that feeds a new volcano gets closer the surface, it becomes easier for scientists to estimate where the new eruption will occur," explains Dr. Angela Doherty, Principal Science Advisor at Auckland Emergency Management.

"But there would be a fine balance between waiting for clarity and leaving enough time for everyone to evacuate safely."

Wild's research assessed the time it takes to complete different stages of the evacuation process, from when decision-makers were advised of a

hazard to when the last people were clear of the evacuation zone.

"We have seen from past events around the world that the time it takes for decision-makers to analyze the information and call an evacuation is the longest part of this process," says Wild, adding that the next step in this research is to develop maps and tools to support decision-making during volcanic crises.

This research will also help refine regional emergency management and evacuation planning for volcanic eruptions.

As part of the planning Crawford says that Aucklanders can help emergency services by creating a household plan ahead of emergencies.

"This should include where you might go if you had to evacuate your home, and what you might need to take with you if you were going to be away for a long time."

Wild's research is part of the wider DEVORA program, which stands for Determining Volcanic Risk in Auckland and includes a multi-disciplinary team of scientists from around the world studying Auckland volcanoes in partnership with the Auckland Emergency Management, Auckland Council and EQC.

"We live in a country with a variety of natural hazards, so we invest heavily into research to better understand these hazards to make better decisions that can reduce the impact of any future events," says Dr. Jo Horrocks, EQC Chief Research and Resilience Officer.

Dr Adrian Pittari, Senior Lecturer, Earth and Environmental Sciences Team at the Te Aka Mātuatua - School of Science, University of Waikato says: "This study is a useful overview of the range of issues that would be faced should the risk of an eruption in Auckland be increased -

particularly regarding our ability to make a decision to evacuate, then in the time required to evacuate an area. The volcanic risk in Auckland is real; so is the uncertainty in the location of the next vent within the metropolitan area. However, there are no signs of any imminent eruption or unrest in the deep subsurface, so the risk is no different to what it has been over the last few hundred years - which is currently low."

"Knowing more about what to expect and how to plan for a possible eruption is much better than the chaos that would ensue with less knowledge. This study offers a good plan for the authorities to work with to organize an evacuation. The suggested evacuation times are a good estimate, and evacuations would be successful in situations where rising magmas are detected early and there is enough time before they reach shallow levels in the crust to erupt. There are many variables to consider, some less controllable than others, and the study has considered these."

"One aspect to remember is that - whilst we don't have any living memory of an eruption in Auckland - continued consideration and discussion amongst scientists, authorities and the public about the volcanic hazard in Auckland will ensure we are better prepared if and when an eruption occurs."

More information: A.J. Wild et al, Modeling spatial population exposure and evacuation clearance time for the Auckland Volcanic Field, New Zealand, *Journal of Volcanology and Geothermal Research* (2021). DOI: 10.1016/j.jvolgeores.2021.107282

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