PLANNING FOR AN ERUPTION FROM THE AUCKLAND VOLCANIC FIELD

BY JANE OLSEN, HAZARD ANALYST, AUCKLAND REGIONAL COUNCIL, AND ANN WILLIAMS, SENIOR ENGINEERING GEOLOGIST, ASSOCIATE. BECA INFRASTRUCTURE LTD

All New Zealand cities face natural hazards, but one that is unique to Auckland is the potentially active volcanic field on which it is built

Like many other natural hazards including cyclone, tornado and tsunami, the infrequent nature of each event, and uncertainty of location pose difficulties for planners attempting to reduce risk. This article discusses how the Auckland Regional Council addresses the risk from volcanic eruption, and the linkages between planning approaches of the RMA (avoid, remedy and mitigate), and Civil Defence Emergency Management Act (risk reduction, readiness, response and recovery).

Auckland Volcanic Field

The Auckland Volcanic Field (AVF) covers about 100 km^2 of the Auckland urban area and includes Rangitoto, Browns and Puketutu islands (Edbrooke 2001). The first eruption occurred as much as 140,000 years ago; the most recent, Rangitoto, as little as 600 years ago (Smith and Allen 1993). During its life the AVF has produced at least 49 volcanoes, most of these in the last 20,000 years (Smith and Allen 1993). What makes the AVF unique in New Zealand is that each volcanic eruption can appear in a new location. Eruptions do not seem to occur in any clear time-geographic distribution as can be seen from figure 1, however, the volcanic field does seem to be restricted to the central part of the region, with the northern most volcano in Takapuna and the southern most volcano in Manurewa.

The AVF erupts basaltic magma, which has low viscosity (relatively thin and runny). Consequently, once magma starts rising it is expected to move at around 5 km/hr and reach the surface quickly (Auckland Regional Council 2002).

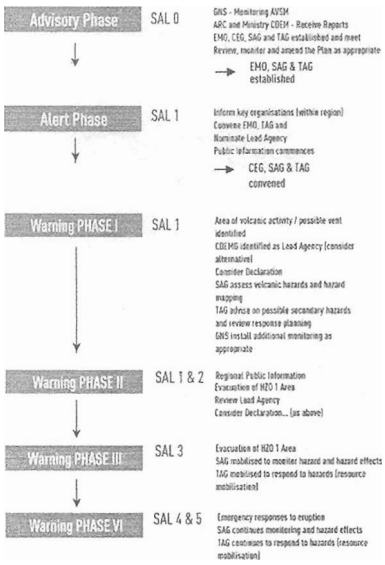
Compared to other New Zealand volcanoes, Auckland's are very small but they have the potential to cause total devastation in an area of up to 5 km from the vent (explosion craters, fire fountaining, base surges, shock waves and lava flows), while areas beyond this (especially in the down wind direction) could be affected by volcanic ash fall. Given the high population density, economic value of property and employment centres within the volcanic field, the impact of a volcanic eruption on the community, physically, socially and economically could be severe (Auckland Regional Council 2002).

Planning Dilemma

The Resource Management Act gives regional councils responsibility for: 30 (5)(c)(iv) The control of the use of land for the purpose of avoidance or mitigation of natural hazards.

While these provisions are suitable for dealing with hazards that occur more frequently such as flooding and coastal hazards, the unpredictable location and infrequent nature of AVF eruptions mean these provisions are not appropriate, or suitable, for reducing the risk posed by these hazards. The successful management of Auckland's volcanic hazards is inextricably linked with the Civil Defence Emergency Management (CDEM) Act 2002 which promotes a continuum of risk management techniques to ensure hazards are addressed through the most appropriate means. The CDEM planning advocates a 4Rs approach to risk management; risk reduction, readiness, response and recovery.

Because magma will probably rise quickly to the surface the amount of warning time may be as short as days or even hours. Consequently, the risk management technique developed for the Auckland Volcanic Field involves a combination



LEFT:: Figure 1

*BELOW:: **Table 1***

of monitoring, readiness and response planning. Once volcanic activity is detected all decisions and response activities need to be made quickly and sensibly, therefore prior planning is vital.

Volcanic Monitoring (AVSN)

Fortunately for Auckland, as magma forces its way to the earth's surface preceding an eruption, it will cause subtle ground shaking and small earthquakes. This provides an opportunity to detect an impending eruption and evacuate affected areas. The Auckland Regional Council established the Auckland Volcano Seismic Monitoring Network (AVSN) in the mid-1980s. The AVSN has since been significantly expanded and now consists of 5 seismic monitoring stations positioned around the Auckland Volcanic Field. This network is monitored continuously and if any activity is detected, a 24 hour duty officer will be notified.

Volcanic Contingency Planning

In addition to volcanic monitoring, the Volcanic Contingency Plan was developed in 2002 to clearly establish response activities including:

- Warning protocols
- Public Information and Communication
- Roles and Responsibilities
  Declaration considerations
- Evacuation

Warning Protocols and Public Information

Because the location and timing of eruptions are unknown, and warning periods are likely to be short, it is important to thoroughly plan for the provision of public information and warnings in advance. The Volcanic Contingency Plan uses a simple system to help deal with these circumstances utilising:

- Scientific Alerts Levels (Scott 2001)
- Warning Phases
- Hazard Zone Overlay

Scientific Alert Levels were developed by Scott in 2001, however, because warning periods are likely to be short in Auckland, warning phases have been developed and associated with each level to guide response activities as volcanic activity escalates (see table *1* and ***figure1***).

A Hazard Zone Overlay (HZO) has also been developed to enable a quick assessment of the area that may be affected by various volcanic hazards. The HZO is a transparency overlay that assumes a uniform distribution of hazard, eruptive volume 0.01 km^3 and an eruption column of 6 km (see *figure 2*). The HZO can be placed over maps once a likely vent area has been identified from seismic assessments, and used to plan evacuation and response.

Scientific Alert Level	Indicative Phenomena	Volcano Status	Warning Phase	*Period
0	Typical background surface activity; deformation, seismicity, and heath flow at low levels.	Usual dormant or quiescent state.	Advisory Phase	Not applicable.
1	Apparent seismic, geodetic, thermal or other unrest indicators.	Initial signs of possible volcano unrest. No eruption threat.	Alert/Warning Phase I or II	A few days and up to a few weeks
2	Increase in number or intensity of unrest indicators (seismicity, deformation, heat flow etc).	Confirmation of volcano unrest. Eruption threat.	Warning Phase II	Up to 1 to 3 days
3	Minor steam eruptions. High increasing trends of unrest indicators, significant effects on volcano, possible. beyond	Minor eruptions commenced. Real possibility of hazardous eruptions.	Warning Phase III	A few hours to 1 day
4	Eruption of new magma. Sustained high levels of unrest indicators, significant effects beyond volcano.	Hazardous local eruption in progress. Large-scale eruption now possible.	Warning Phase IV	Up to a few hours
5	Destruction with major damage beyond active volcano. Significant risk over wider areas.	Large hazardous volcanic eruption in progress.	Warning Phase IV	Not applicable

*Warning periods assessed for the Auckland Volcanic Field. Periods have been assigned to Scientific Alert Levels (SALs) as a tool for planning purposes only. The SAL may rise to 1 and then return to 0 and is not intended to be a predictive tool.

Declaration

For an AVF eruption, declaration of a Local Civil Defence Emergency is likely to coincide with Warning Phase II, however a number of circumstances may trigger a declaration:

- Alert Phase notification issued (atypical seismicity inferred to be associated with volcanic activity identified, Scientific Alert Level 1)
- HZO indicates an urban or strategic area may lie within 5 km of the eruption centre
- Scientific Advisory Group and Coordinating Executive Group identify potential risk to life and functioning of government is significant, and evacuation is necessary.

State of Readiness

Through the development of the Volcanic Contingency Plan, and operation of the Auckland volcano seismic monitoring network, the Auckland Regional Council and the Auckland Civil Defence Emergency Management Group are prepared for a volcanic eruption from the Auckland Volcanic Field. In addition to planning undertaken by local government and emergency services, the Auckland Engineering Lifelines Group (AELG) have also undertaken the following planning for AVF eruptions including:

Volcanic Hazard Assessment – Identified vulnerable components of the lifeline network, estimated impacts and recovery times.

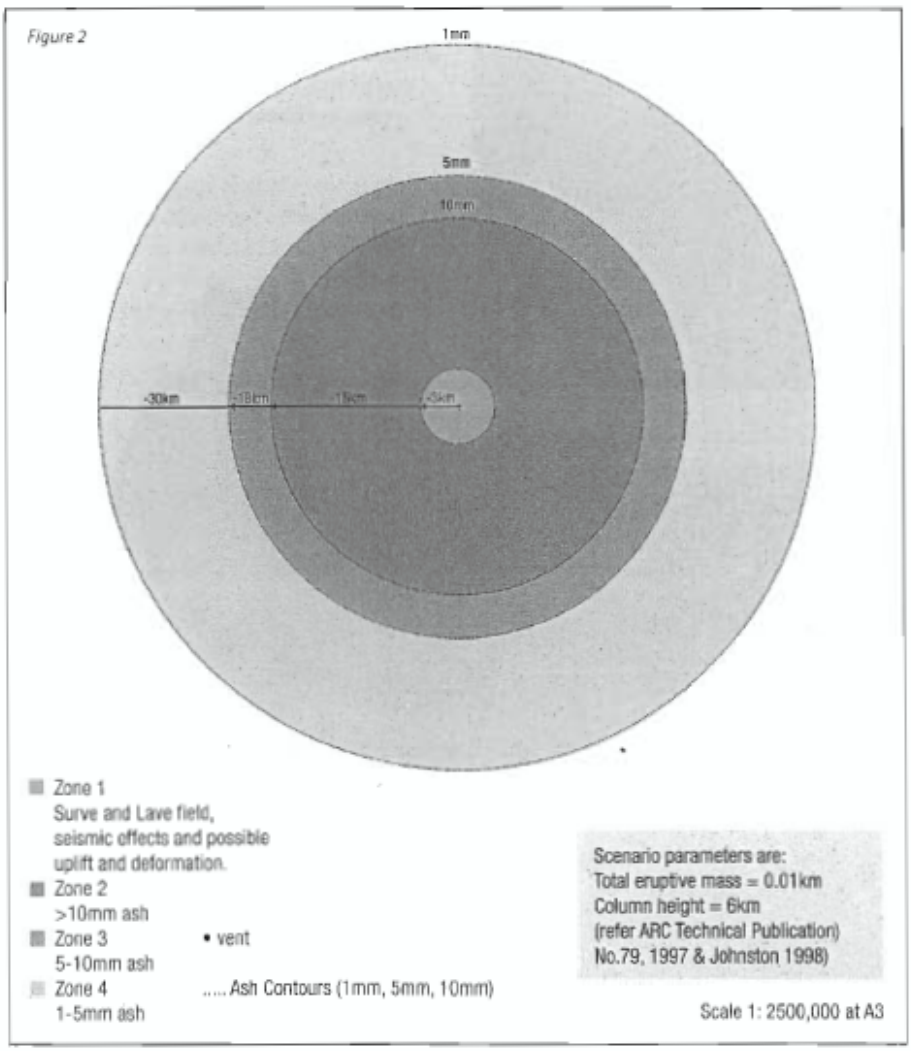
- Volcanic Research

Coordinated response plans including "Priority Emergency Routes Project" a hazard assessment on major roads

Impacts of Volcanic Ash on Water Supply

Through establishment and briefing of these groups and the above work, the Auckland CDEM Group, Emergency Services and lifeline utility organisations are preparing to respond to an AVF emergency. This preparation will continue to evolve and develop as our understanding of volcanic hazard to Auckland evolves. Aucklanders can be confident that should volcanic eruption occur now, an informed, co-ordinated and managed response can ensue, significantly reducing the risk to life and infrastructure, and to social and economic well-being. ⁘

Figure 2



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