Global Assessment Report
on Disaster Risk Reduction

Global volcanic risk

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Global Volcanic Risk

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Volcanic disasters have been prominent in 2010 due to two very different events, namely the disruption to air traffic over Europe in April and May 2010 due to the eruption of Eyjafjallajokull in Iceland and the eruption of Merapi in Indonesia. The former highlighted the potential of severe economic and social disruption in the globalised world with losses to the airline industry being estimated at $200 million per day, at least $5 billion of total losses. There was likely associated loss of life and injury too as about a million travellers were stranded and many decided to drive home, increasing their risk from travel-related accidents greatly. The estimated 140 deaths and 200,000 people evacuated during the eruptions of Merapi in October and November 2010 highlights the vulnerability of people who live close to active volcanoes as well as the large impact of volcanic emergencies in the developing world.

There are at least 550 historically active volcanoes on Earth and at least 1300 that are to have erupted in the last 10,000 years (1). 154 erupted in the 1990-1999 decade and approximately 20 are erupting at any one time. 9% of the world's population (approximately 600 million) is estimated to live within 100 km of historically active volcanoes and 12% (approximately 800 million) live within 100 km of a volcano believed to have been active during the last 10,000 years (2). There is no compelling evidence to think that rates of volcanism are changing, but there is significantly natural variability, especially in large infrequent eruptions with decade or greater return periods. Increased global volcanic risk derives from factors that are increasing exposure and vulnerability, such as population growth, environmental degradation, urbanization, inequality and increasing independencies in a globalised world. One emerging trend may also be the decrease in societal resilience that arises due to fragmentation of the way society is organized and the increasing complexities of mechanisms to respond to emergencies, especially where natural events have impacts that extend beyond national boundaries. These latter points have been emphatically illustrated by the Iceland ash emergency where passengers were trapped for several days in Hong Kong or Johannesburg, Kenyan farmers lost income for their fresh products to Europe and Heads of State had to cancel key meetings.

Historically loss of live from volcanic eruptions has been modest compared to other natural perils (about 300,000 deaths since 1500 AD). However, volcanoes have the potential for great disasters and indeed about 50% of the historic deaths can be related to just five eruptions. A disaster on the scale of the Band Aceh earthquake and tsunami in 2004 was narrowly averted during the 1991 eruption of Mount Pinatubo in the Phillipines when tens of thousands of people were evacuated just prior to one of the most powerful eruptions of the last century. Very large volcanic eruptions are the only natural hazard, apart from meteor impact, to have truly global reach and even cause severe threat to global civilization. Eruptions capable of causing global climate effects that might in turn effect global food security probably have return periods of around 100 years. The last one to have happened was in 1815 when Tambora volcano, Indonesia caused the deaths of an estimated 70,000 mostly through famine and diseases and caused severe summer frosts in New England in 1816, leading to mass migration to the west. There is a 30% chance of an eruption on this scale or greater in the 21st Century.

There are several different kinds of volcanic hazards with diverse impacts, making the

assessment of volcanic risk at a particular volcano quite challenging. Pyroclastic flows and lahars (volcanic mudflows) are the main agents of death and injury, but wind-blown ash has considerable potential to cause economic losses, deprivation and societal disruption. There has been a steady improvement in the ability of scientists to forecasting eruptions, provide early warning and assess their evolution, largely driven by technological innovations and increasing computer power. Developments in remote sensing in particular have enabled improved terrain models, ways of detecting and tracking volcanic ash, and observations of ground deformation, gas emissions and thermal anomalies. Many volcanoes, however, remain poorly monitored on the ground with inadequate information on their geology from which to assess the hazards from future eruptions. This knowledge deficit and inadequate instrumental monitoring capacity is disproportionately distributed in the developing world.

While the improvement in science are helping to reduce risk the main problems in management of volcanic risk in emergencies relate to issues such as human responses to the risk and communications between scientists, decision-makers and affected citizens. Most volcanic disasters can be related to the complexity of societal responses, and include matters such as poor communications, political and social tensions that inevitably arise during a crisis, lack of preparedness, different attitudes to risk in a community and by authorities, problematic governance issues, robustness of evacuation plans and adequacy of temporary accommodation for evacuees, land-use planning, inappropriate locations of key infrastructure such as hospitals, airports and escape routes, and inadequate attention to cultural dimensions which can strongly affect community responses. Recently some governments have seen permanent relocation of communities rather than temporary evacuation as the preferred option for reducing risk. Such policies can introduce new issues such as human rights, good governance and tensions between local communities and national governments.

In the past responses to volcanic risk have been largely viewed as involving technological advances to enable better early warning, prediction and assessment of danger zones. Volcanic risk has also been mostly seen as defined by loss of live and reduction of risk through evacuation in emergencies and improved land-use planning. While these approaches will continue to be important, attention is increasingly broadening to consider other aspects of risk, such as critical infrastructure, economic losses and adverse affects on well-being of communities. Additionally strategies to reduce volcanic risk are increasingly being aimed at increasing society resilience and so understanding the human and societal aspects of volcanic risk are becoming more prominent.

1. Figures based Global Volcanism Programme of the Smithsonian Institution
2. Based on the assessment for 1990 by Smalley and Naumann (Environmental Hazards, 2002) using 2009 World Bank population data.