

# New Zealand Whakaari volcano eruption and occupational hygiene responses

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A unique adventure tourism experience offered in New Zealand was a visit to an active volcanic island—Whakaari (White Island). Visitors could walk on the uninhabited live volcano, located a short boat ride from the coast of New Zealand. On 9 December 2019, about 100 people were on or near the island when it erupted without warning. Steam, rock and ash shot 3.6 km into the air. Sadly, 20 people died and 25 are still in hospital, some in critical condition. The victims suffered severe burns from super-heated geothermal fluids and highly corrosive ash. Skin banks from around the world have contributed millions of square centimetres of skin for the multiple skin grafts needed for the survivors, many of whom will require months of surgery and rehabilitation.

Immediately following the eruption, tour boat operators and local helicopter pilots ferried injured people back to the mainland. One civilian helicopter that was on the island during the eruption was so badly damaged by ash it could not be flown. After the initial evacuation, the island and nearby water were closed due to the high risk of further eruptions and the unknown atmosphere and ground conditions. Drones were deployed to identify any remaining people; sadly, the images showed that it was unlikely anyone on the island survived the initial eruption.

## IDENTIFIED HEALTH RISKS

In addition to projectiles and super-heated fluids, gases likely to have been present at high levels at the time of the eruption were carbon dioxide, sulphur dioxide, hydrogen sulphide and halides of hydrogen (hydrogen chloride, hydrogen fluoride and hydrogen bromide). The halides produced acidic liquids and resulting ash was high in fluorides. In addition, heavy metals such as mercury, lead and arsenic were released during the eruption of the volcano.

Although the island's volcanic activity had been monitored for many decades by volcanologists, and in-situ monitoring equipment was still functioning, the equipment was located in areas remote from where the recovery team had to venture, and was designed for assessing volcanic activity, not assessing health risk. People had been visiting the island for decades, usually without respiratory protection, and the atmospheric concentrations of hazardous aerosols following the eruption were unknown. Eyewitness reports indicated that gas and airborne particulate exposure caused health effects during and immediately after the eruption. To provide additional information before going onto the island, air monitoring equipment with remote sensing was deployed using drones.

Risks to first responders, ambulance staff, hospital staff and post-mortem workers included exposure to hazardous chemicals through cross contamination of ash and hydrothermal fluids on patients. Early responders attempting to recover bodies from the island were at risk of an additional eruption and exposure to unknown hazardous particulates, gases and hot acidic fluids. In addition, the ground was covered in ash and difficult to walk over, and was also hot and shaking with tremors.



**Rescuers working in testing conditions on Whakaari Island after the volcano eruption** Source: NZDF. <https://www.stuff.co.nz/national/118185646/whakaari-white-island-nzdf-shows-absolute-courage-in-an-unpredictable-environment>

## RISK MANAGEMENT

To recover the deceased safely, and minimise the risk of further loss of life or health, a multi-disciplinary team, led by the New Zealand Police, gathered to pool knowledge and resources to develop a plan. This involved various scientists (occupational hygienists, volcanologists), medical specialists, search-and-rescue specialists, victim-identification specialists, and the New Zealand military.

The risk management plan depended not only on the right timing, personal protective equipment (PPE), gas monitors, health surveillance and decontamination, but—most critically—the operation had to be carried out by the right people. Given the high heat load from wearing impervious chemical suits (to prevent contact with corrosive gas, liquid or particulate matter), rebreather closed-circuit breathing apparatus (in case of toxic gases), and the heat from the volcano itself, heat stress was a critical risk. The people selected for this operation had been highly trained in the assessment of their own physiological state at the extremes of physical effort, and could hold their nerves under very testing conditions. These people comprised the New Zealand Defence Force specialist bomb disposal team.

Fortunately, recovery operations were successful and no additional injuries occurred. Travel to the island has been discontinued as the Whakaari volcano remains active. The newly created National Emergency Management Agency was responsible for coordinating more than 20 government and support agencies. WorkSafe New Zealand, for which this author works, will continue to be involved and work to investigate worker exposures and outcomes.

## REFERENCES

1. RNZ. New Zealand. Whakaari/White Island rescue: 'Nothing can really prepare you for an eruption like this'. Available from: <https://www.rnz.co.nz/news/national/405185/whakaari-white-island-rescue-nothing-can-really-prepare-you-for-an-eruption-like-this> (accessed 23 Jan 2010).