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Hydrogen Sulphide in Rotorua, New Zealand: Personal Exposure Assessment and Health Effects

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Ruth Hinz

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Abstract

Long-term exposure to low level hydrogen sulphide (H₂S) may be a health risk. However, research on this has been scarce. Rotorua offers a unique opportunity for such an investigation as its population is regularly exposed to geothermal H₂S and few co-pollutants are present.

To date, only ambient H₂S concentrations have been investigated. The current study aimed to measure personal exposure levels and to assess potential health effects. In particular, the study involved:

1. Method development to measure exposure, including the adaption of a personal sampler
2. Analysis of personal exposure levels including personal and ambient air measurements
3. Identification of the main determinants of exposure
4. Assessment of the association between personal exposure and health effects involving the respiratory, the circulatory and the nervous systems.

The Chemcassette® tape was found to be a suitable and cost effective personal sampler. More than 75% of participants had exposure levels below 5 parts per billion (ppb). The group of remaining participants had exposure levels between 5 and 90 ppb, which were five times higher than those measured in the other two groups (CI: 3.71-6.73). Those participants had frequented a 1-2 km wide north-south corridor in central Rotorua for longer than 2 hours. Previously, the corridor had been identified as an area of elevated H₂S concentrations in geological and ambient air surveys. However personal exposure levels were considerably lower than air monitoring data in this area. Whether this is attributable to the mobility of participants or the sheltering effect of buildings is unclear. Personal samplers with readings above 90 ppb were associated with proximity to geothermal sources and/ or buildings with H₂S intrusion. Personal exposure levels varied between trials in the central corridor, while western and eastern Rotorua consistently showed low levels (<5 ppb). Higher H₂S concentrations (up to 3.5 times CI

2.07-5.76) in the central corridor were associated with north-north-easterly to easterly winds carrying additional H₂S from the Sulphur Bay geothermal area on the eastern margin of the corridor (effect estimate coefficient: 3.5, CI 2.07-5.76). An indication of an increased asthma risk was found for the southern part of the corridor (OR: 2.9, CI: 1.17-7.18), but the association needs further investigation.

In conclusion, this study found elevated personal H₂S levels along a central corridor in Rotorua and the possibility of an association with asthma.

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The following statement is included at the request of the Massey University Human Ethics Committee:

“This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University’s Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Ethics & Equity), telephone 06 3505249, e-mail humanethics@massey.ac.nz”

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Rotorua Caldera



(Source: Geological and Nuclear Sciences (GNS))