

## VI. VENTILATION AND HYGIENE.

With the attainment of considerable depth in metal-mining operations, and consequent increasing underground temperatures, together with the more extensive use of rock-drills and explosives, the necessity for a stricter standard of ventilation than that at present established by statute appears to be necessary, and this view has been taken by the Royal Commission on Mines, which presented its report during the early part of the current year.

Samples of mine-air taken by officers of the Mines Department from the most important mines throughout the Dominion, and analyzed by the Dominion Analyst, have shown that, as regards purity of the air, the conditions are generally satisfactory in New Zealand metal-mines. It was found that under the most unfavourable mining conditions—namely, when shovelling commenced after blasting—the maximum quantity of carbon-monoxide obtainable was—at the Waihi Mines, 0.0025 per cent., and from the Reefton Mines, 0.008 per cent.; and as Dr. Haldane, the recognized British authority, has stated that noticeable symptoms of carbon-monoxide poisoning were never produced with less than 0.02 per cent., since absorption ceased when the blood became saturated to a comparatively slight extent, it may reasonably be concluded that this gas is not produced in our metal-mines, under normal conditions, in hurtful quantities, and is never produced unless accompanied by carbon-dioxide.

The highest percentage of carbon-dioxide—namely, 3.31 per cent.—was obtained at Thames from a sample taken at the 1,000 ft. crosscut, where this gas occasionally issues from the rocks in considerable quantity. The maximum percentage of carbon-dioxide obtained elsewhere was 0.97 per cent., being less than the standard, 1.25 per cent., recommended by the British Royal Commission on Mines as a proportion up to which men may be permitted to work.

It will be seen, therefore, that from the point of view of noxious gases, New Zealand metal-mines are generally satisfactory.

The question of underground temperatures, however, is, on the Hauraki Goldfield, becoming of more importance as depth is attained. It has been found that the rock-temperature at Thames and Waihi is high, equal, in fact, to that of Comstock, United States America, being at the 1,000 ft. level about 83° Fahr., and the increment of temperature about 1° Fahr. for every 33 ft. descended.

As regards humidity, official observations taken at the surface over an extended period show the atmosphere at Waihi and Thames to be often highly saturated, and observations taken underground by officers of the Mines Department show the mine-air to be generally saturated to the extent of 90 per cent. or more. On occasions when the air at the surface is saturated to a similar extent, the impossibility of reducing the humidity in the mine is apparent.

For the purpose of reducing the temperature of rock-surfaces, a greater volume of air is necessary than is required to produce, from a quality standpoint alone, adequate ventilation; but the extent to which underground temperature may be reduced by this means has its limits, although, if the upcast shaft is centrally situated with regard to the mine-workings, much may be attained. The beneficial effect of constant mechanically produced ventilation has been amply proved by the reduction in the temperature of the rock-surfaces in the lowest levels of the Grand Junction Mine, Waihi, where a Sirocco fan, having a capacity of about 40,000 cubic feet of air per minute, was recently installed to supplement intermittent natural ventilation; similar beneficial results have also been obtained at Thames Goldfield deep levels, where there has been installed a Roots blower, of 12,000 ft. capacity.

For the reduction of humidity at the Comstock mines, in addition to the introduction of large volumes of fresh air, the underground crosscuts and levels in which water existed were frequently lined with timber, and the drainage-water was conveyed in boxes, which measures were found beneficial. With the attainment of depth it may eventually be found necessary to adopt similar methods here.

The following proposed standard of ventilation has been recommended by the Royal Commission for metal mines in New Zealand:—

“An adequate amount of ventilation shall be constantly produced in every mine to dilute and render harmless noxious gases to such an extent that all shafts, crosscuts, levels, stopes, stables, and all working-places shall be in a fit state for working and passing therein.

“The quantity of air in the main current and in every split, and at such points as may be determined by the Inspector, shall at least once in every month be measured and entered in a book to be kept for the purpose at the mine, and the ordinary number of persons and horses in each split at one time shall also be entered in such book.

“For the purposes of this section a place shall not be deemed to be in a fit state for working or passing therein if the air contains more than 1 per cent. of carbon-dioxide or less than 19 per cent. of oxygen: Provided that the Minister of Mines may exempt any mine or mines from the foregoing provision on the ground that they are liable to unavoidable vitiation by carbon-dioxide from the rocks during the early stages of development.

The maximum temperature of the air in any working-place, measured by a wet-bulb thermometer, shall not exceed 80° Fahr., unless firing of explosives has occurred in such place not more than twenty minutes previous to the observation of the thermometer, but the Inspector may, in writing, allow a higher limit of temperature if satisfied that it is impracticable to maintain the temperature below the above-mentioned standard, in which case the Inspector shall notify the manager in writing to reduce the temperature of the air below the standard, and if such is not complied with within seven days he shall determine the number of hours, not exceeding six, for which any person shall be employed in any such working-place within eight consecutive hours, and the number of hours so determined shall not be exceeded for a period of three calendar months whatever the temperature may be during that period.

“Regulations under the Mining Act shall provide for the classification of mines according to the amount of noxious gases in the working-places and to the temperature of the surrounding rocks, and the amount of air passing into a mine shall be such amount proportionate to the number of men and animals employed underground in the mine as may be prescribed by the regulations respecting mines of the class to which the mine belongs.