BOOK REVIEW

Reactions of Mines-Rescue Personnel to Work in Hot Environments. By A. R. Lind, J. S. Weiner, R. F. Hellon, R. M. Jones, and D. C. Fraser. (Pp. 68.) London: National Coal Board (Medical Research Memorandum No. 1).

In recent years various physiologists have studied man's tolerance of heat, but they have generally been concerned with the ability to withstand heat for considerable periods, *e.g.*, for a working spell of four hours or for a full industrial shift. When men must work in such great heat that the body cannot maintain thermal equilibrium, as happens during mines-rescue operations, it is important to know for how long they should be expected to work in conditions of given severity. Hitherto the only relevant information has been that provided a few years ago by Roantree from experience with mine fires at the Kolar Gold Field in India.

In this memorandum Lind and his colleagues describe experiments carried out by them for the National Coal Board. The main series of experiments were done in Oxford and in Doncaster, but the results of further experiments made at the Institute of Aviation Medicine, Farnborough, are included.

The experimental subjects were 36 miners, half of whom were aged 19 to 31 years and half 39 to 45 years, and the members of the two age-groups were equally matched as regards stature and body weight. In each group one-third of the men were accustomed to severe underground work, one-third were deputies, and the rest were described as "mixed" workers. Half had been trained in the use of the "proto" breathing apparatus, while the other half were accustomed to the "aerophor" apparatus. During experiments each man wore the apparatus to which he was accustomed.

In the Oxford experiments the intrinsic individual variations in the subjects were measured, the reactions of the men in the two age groups, without the complication of the wearing of apparatus, were compared, and the experiments also served to ensure that none of the men would be exposed to unwarranted danger in the later Doncaster experiments. The work routine in Oxford comprised alternating spells of resting and step-climbing, so that over the experimental period the average energy cost was 111 Kcal./m.²/hr.

In the Doncaster experiments the work routine was designed to represent a mines rescue task. It included a spell of walking and carrying a 50-lb. sandbag, and another spell of building a sandbag stopping, so that over the 65 minutes of the test the rate of energy expenditure averaged 200 Kcal./m.²/hr.

In the first series this work routine was carried out in atmospheres saturated with water vapour at temperatures ranging from 85 to 100° F. In the second, with the same routine, the atmosphere was relatively dry. In three of

the four standard environments the dry-bulb temperature was 120° F. and the wet-bulb temperature was 79°, 85°, or 94° F., and in the fourth the dry-bulb temperature was 100° and the wet-bulb temperature 88° F.

From consideration of the periods over which the men could tolerate the various degrees of heat, and from the physiological reactions observed, charts were prepared showing, for the various environmental conditions, the exposure times which it was thought would be safe for all mines-rescue personnel. In considering the unsaturated environments the effective temperature scale was not regarded as reliable for estimating equivalent environments, and instead the figure given by the expression $0.85w + 0.15d$, where *w* and *d* represent the wet-bulb and the dry-bulb temperatures respectively, was used. In the experiments the men were exposed to an effective air speed of about 150 feet per minute, and tentative corrections are suggested for air speeds below 100 or above 200 feet per minute. It is emphasized that the tolerance times shown on the charts apply only to men engaged in operations in which the work is of a similar nature to that performed during the tests. The vigilance tests led to similar conclusions as to the time over which men could perform rescue tasks in saturated environments before they showed obvious signs of deterioration.

The tolerance times did not appear to be affected by age, and it is concluded that for short-term exposures an upper age limit of 45 is reasonable. The men of the three occupational groups reacted similarly so that there appears to be no particular advantage or disadvantage associated with any particular type of occupation.

In an appendix there is a reproduction of an information bulletin on precautions to be taken when rescue personnel operate in hot and humid atmospheres which is based on the conclusions drawn from the work described in the memorandum. It includes tables showing the maximum safe periods for work under specified conditions of temperature and humidity, separate tables being given for each of the two types of breathing apparatus used.

The work described in this memorandum is of considerable interest from the standpoint of climatic physiology, and it is of great importance to the mining industry. From Appendix II it is evident that no time has been lost in making available the results of the research to those who may have to apply them. The memorandum is nicely produced, but it is regrettable that insufficient care seems to have been given to the checking of proofs. In a list of references on page 49 the names of three authors are spelt incorrectly, and the name of one of the authors of the Memorandum is spelt in one way on the title page and in another at the beginning of Appendix I.

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