

1904.

NEW ZEALAND.

SANITARY ARRANGEMENTS IN QUARTZ-MINES AT REEFTON

(REPORT ON).

Presented to both Houses of the General Assembly by Command of His Excellency.

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Dr. Mason, Chief Health Officer.

Department of Public Health, Head Office, Wellington, 22nd August, 1904.

I BEG to present the following report on the sanitary conditions of the quartz-mines at Reefton:—

As directed by you, I proceeded to Reefton, arriving on the 20th June, and was there met by Captain Richards (Assistant Inspector of Mines) and Mr. Betts (on behalf of the Miners' Union). I got from Mr. Betts a statement as to the complaints which the union preferred against the sanitary condition of the mines, and arranged to visit those which he considered most in need of attention.

Accompanied by Captain Richards and Mr. Betts I visited the following mines: Golden Fleece, Progress, Wealth of Nations, Energetic, Keep-it-Dark, New Inkerman. We went to those parts of the workings considered by the miners' representative as being most insanitary, saw the privy accommodation provided in each, examined the atmosphere in drives immediately after explosives had been used, and paid special attention to those places where the rock-drills were at work. I also made inquiries into an accident which occurred some months ago at the Energetic Mine, in which two miners were overcome by noxious gases. I interviewed Mr. Tennent, Chief Inspector of Mines at Westport, and got much helpful information from him. After my return to Wellington I received a series of suggestions from the Inangahua Miners' Union as to the sanitary precautions which they considered should be adopted.

I propose to divide my report under the headings of the matters complained of by Mr. Betts, and give the remedies suggested by the union, and the evidence of the Inspector of Mines, with my own comments on each subject, and conclude with a general summary of my recommendations.

1. PRIVY ACCOMMODATION.

Mr. Betts complained that the men have to go too far to the privies, that the privies were not, in many cases, kept in good condition, and that in some cases the nightsoil was buried underground in the levels. The suggestions of the union on the subject are—(1.) "That no human excrement should be permitted to be buried underground in a mine." (2.) "That proper pans should be provided at each level in the mine." (3.) "The pans to be used to be prescribed by regulation, and disinfectants and earth to be kept close to the pans in suitable quantities." (4.) "The pans to be emptied at least once in each week." (5.) "That no wooden boxes be permitted to be used, but that iron pans be provided with proper covers, as, in our opinion, iron pans can be more effectively cleaned than wooden boxes." (6.) "Regulations should be made for the punishment of any mine-owner who does not provide suitable privy accommodation as may be prescribed, and also for the punishment of any workman who defecates at any other place than at the pans, and who is guilty of dirtying the pans or the place adjacent to the pans."

In all but the Progress Mine I found privy accommodation provided below ground. These privies generally had a perforated seat placed over an oil-drum. In the New Inkerman the privy was on the long level, was a movable affair on wheels, and was drawn to the surface by a horse when it required emptying. In the Wealth of Nations wooden boxes were used. At the Progress Mine two privies were at the pit-head, and the cages were running so constantly that the management did not think it too much to expect the men to come to the surface when necessary. In two—the Wealth of Nations and Keep-it-Dark—privies were placed near the shaft on each level. In the latter the pans were in the shaft-chamber, and here some slight smell was noticeable. In all others they were placed in unused "dead-ends," which appeared to me the preferable arrangement. In no mine was there any evidence that the nightsoil was being buried below ground.

Captain Richards informed me, as also the various mine-managers, that (as has been found in other countries) the great difficulty was to get the men to make a proper use of the privies and to clean them regularly, and where a man was detected defecating elsewhere than in the privy he was often discharged; but the management rather shrank from such a course, and, of course, the offender was often undetected. In one or two instances the pans, &c., had been deliberately destroyed. On account of this difficulty of having them properly attended to the manager objected to a privy on each level. In the two mines mentioned where each level was so provided the miners employed were mostly family men permanently residing in the district, who took an interest in the sanitation of the mines. The difficulty was with the young hands and casual employees.

The Inspectors found the managers always willing to make any arrangement as regards privies which the Department might request, and under the Act of 1898 the Inspectors have ample powers to compel mine-owners to make all sanitary improvements.

Many of the levels are not being worked, or perhaps only one or two hands are there engaged. It is obvious that on these no privy is required, and too many might well lead to neglect and so result in serious nuisance. It might be well to provide that where a certain number of men work at one level—say, a shift of twenty or more—a privy shall be placed on that level; but the arrangement can well be left to the discretion of the Inspector. It is very necessary, however, that Inspectors should have power to prosecute men detected in misusing a privy or defecating elsewhere, and to this extent No. 6 of the suggestions of the Miners' Union might well be adopted. Suggestions 1, 3, 4, and 5 are also to be recommended—*i.e.*, prohibiting deposit or burial of night-soil in the mine, the provision of iron pans to be cleansed once a week, and the regular use of dry earth or sawdust.

2. GENERAL CLEANLINESS.

Mr. Betts complained of the stagnant waters lying along the levels, and thought that they should be better drained. In this direction the union makes the following suggestion: (7.) "That all levels where work is carried on should be cleared up at least once in each month."

It did not appear to me that this was exactly a sanitary question. Of course, to walk through wet and mud is disagreeable, but unless the drives are passing through naturally dry strata it is unavoidable. In wet ground the drives have trenches at the side to carry off the water.

Inspector Richards pointed out one direction in which improvement might be made—*i.e.*, that the men be prevented from throwing paper and scraps of food about those parts of the levels at which they take their meals, as such refuse accumulating and decaying may cause a nuisance. It would be well to provide a box for such scraps and compel the men to use it.

3. VENTILATION.

Mr. Betts complained that the mines were not sufficiently ventilated, so that the air in some of the workings became polluted and overheated, especially in the working-faces of the drives which were "dead-ends" (that is, before circulation of air had been made by connecting them with other levels by means of the stopes). In these places the men suffered from the fumes left after explosives of the nitro-glycerine type had been used in blasting. He considered the temperature too high also in some places, and thought that the health of the men suffered. He thought it necessary that fresh air driven by means of fans be conveyed to these places by means of wooden chutes, and this is embodied in the following suggestion by the union: (9.) "We would suggest that pure air be conducted to each working-face in 'dead-ends,' in addition to the compressed air that may be used to work the drilling-machine."

In all these quartz-mines the ventilation is chiefly natural, though sometimes where a long level is being driven with no connection to other levels a fan is used, but usually the managers then rely on the waste air from the rock-drilling machines. This air is at a pressure of 260 lb. to the square inch, and is conveyed in a 4 in. pipe, a rapid series of jets discharging as the machine works. At such a pressure there is probably more air carried into the face than there would be by a fan-and-box arrangement; but the miners have a notion that compressed air is not so pure or respirable as air carried in the ordinary way. It probably is drier, but otherwise there is nothing to alter or pollute it during the process of compression. The general arrangement is that the main shaft acts as a downcast for the air; the current, produced by differences of temperature and aided by the exhaust from the rock-drills, passes along the drives and up through the workings to the upper levels, and thence to the open air by another shaft. There did not appear to be any elaborate system of baffle-doors, &c., to direct the current in the required direction, but the drives are comparatively short, and there is therefore not the difficulty of ventilating which exists in coal-mines with perhaps many miles of underground workings, nor is there the danger from noxious gases. In one or two places I noticed doors were provided where there was special need for diverting the air-current. It is to be regretted that owing to an accident to the apparatus I was unable to test samples of the air in various parts of the mines; however, Mr. Betts handed me a series of analyses taken on behalf of the Miners' Union by the School of Mines authorities, and these appear on the whole satisfactory. Thus the highest return of carbonic acid is 0.44 per cent., which is not excessive comparing it with a series of analyses prepared by Dr. Haldane of the return-air in mines. It must be remembered that 3 per cent. or 4 per cent. of CO₂ must be present before any symptoms whatever show themselves in men breathing such an atmosphere. Certainly, judging merely by sensation while passing through the mines, I nowhere found the air oppressive, and my impression was that the ventilation was satisfactory.

The question of dangerous gases can practically be left out of account. There is no evidence that firedamp is produced in these quartz-mines, thus making their ventilation of less importance than when coal-seams are being worked. Apparently two gases have occasionally to be reckoned with—*i.e.*, carbon-dioxide and sulphuretted hydrogen. The carbon-dioxide probably occurs in the form of "black damp," which is a mixture of CO₂ and nitrogen. There are times when in some of the mines at Reefton the air is irrespirable, the lamps will not burn, and the work has to be stopped. These occasions are rare, and are probably the outcome of some peculiarity in the barometric pressure, causing an inrush of the residual gases found in the interstices of rocks; but the evidence as to the season and weather providing the necessary conditions was not very definite. Apparently the condition does not last many hours, and the mine clears itself very rapidly. There is little or no danger to life from the appearance of this gas, for the failure of the lights is a sufficient warning of the presence of "black damp," and the lamp would be extinguished long before the air was irrespirable by man.* The occurrence is so rare as to make the matter of small importance.

* "A man may penetrate without harm into an atm. sphere containing four times as much black damp as would extinguish a lamp."—Report by Haldane on causes of death in colliery-explosions: Home Office Report, 1896.

Sulphuretted hydrogen appears to arise when certain ores are being worked, but it is present in appreciable quantities only in the form of a solution in water standing for long periods in winzes and shaft-wells. When these waters are disturbed the gas is given off, and under exceptional circumstances may be in such quantity as to prove dangerous to life. This probably was the cause in the accident at the Energetic Mine in March last, and on inquiry I heard of one other case (also after discharging an accumulation of water in a winze) when a miner was overcome by gas, the circumstances pointing also to HS_2 being the agent at work.† The possibility of accident from this cause is, however, remote, and cannot well be guarded against by elaborating the ventilation system in the mines. A memorandum to mine-managers asking them to warn the men as to this danger when any long-standing accumulation of waters is being disturbed would probably meet the case.

The After-effects of Explosions.

Mr. Betts complained that on returning to the face after the use of explosives of the nitro-glycerine series the men suffered from the fumes which lingered about, the symptoms being headache, loss of appetite, and sometimes vomiting. To guard against this he advocated a current of fresh air being pumped into the face. I had no opportunity to examine the atmosphere immediately after an explosion in the "dead-ends" of a drive—only in the "stopings," where there was a certain amount of air circulating. Here, certainly, there was nothing to complain of. In conversation with several miners and the managers I concluded that they did not regard this as a very serious trouble. In the first place, there was no compulsion to return to the face at once, as they were always allowed to wait till the fumes had cleared—say, in half an hour, generally less. The compressed air from the rock-drill pipe could always be turned on if needful to assist in the clearing of the atmosphere. Again, the noxious fumes are only marked when charges have burned slowly instead of exploding. These are known as "burners" or "stinkers," the fumes from which produce smarting of the eyes, headache, &c. These fumes are nitrous oxide and nitric peroxide, and certainly their inhalation would be accompanied by very unpleasant effects; but as there is no necessity to work in the presence of such fumes their occasional occurrence does not demand any special system of ventilation.

To sum up, I have no recommendation to make as to ventilation, save, perhaps, as to issuing a warning of the danger occasionally arising when accumulations of water are being dealt with.

4. DUST FROM ROCK-DRILLS.

Mr. Betts complained of the damage to health suffered by the men employed at the rock-drills owing to the inhalation of dust, a large amount of which is produced while these machines are working in hard rock. The Miners' Union recommend on this subject as follows: (8.) "We would also urge the necessity of compelling the use of water-jets where rock-drilling machines are at work to keep down the dust, and in the event of a jet of water not being provided the working of the rock-drilling machine be prohibited."

Dr. Conlon, of Reefton, informed me that he met a very large number of cases of phthisis among the miners, and he thought that it was commonly of the fibroid type.

I have obtained, through the courtesy of the Registrar-General, a return of deaths in the Reefton district during the past five years, and the following table, comparing them with deaths over the whole of New Zealand, shows that the percentage of phthisis in Reefton is extremely high:—

Percentage of Deaths from Phthisis to Total Deaths from all Causes.

Locality.			Both Sexes and all Ages.	Males only.	Females only.
New Zealand	7.7	7.0	8.5
Reefton	16.5	18.3	12.0

It must be noted that the high rate at Reefton is not confined to males, but that for females it is half as high again as for the whole colony; but the influence of the miners' work can be conjectured from the fact that while in New Zealand generally males suffer less than females from phthisis, at Reefton the position is markedly reversed, the percentage for males being 50 per cent. higher than for females.

The following table, showing the distribution according to sex and age-period in Reefton compared to the whole of New Zealand, further brings out the influence of the mines. The figures refer to the percentage of deaths from phthisis of the total deaths at each age-period:—

Ages.	Whole of New Zealand.		Reefton.	
	Males.	Females.	Males.	Females.
0-10 years	0.5	0.7	0	0
10-30 "	25	28.6	31.2	40
30-50 "	16.6	18.5	34.7	25.6
50 and over	3.5	2.4	19.2	16.7

† In an interesting paper on sulphuretted hydrogen in quartz-mines in the *New Zealand Mines Record* of the 16th May Mr. R. M. Aitken mentions this case.

All the percentages for Reefton are, no doubt, unduly high, owing to the small numbers dealt with; but we see that at Reefton there is after the age of thirty an increase in the number of cases of consumption among males, whereas among the females in Reefton and among both sexes over the whole of New Zealand there is a marked drop after that age. The unusually high proportion of male to female cases of phthisis during the period of thirty to fifty also suggests the influence of the mines, as the results of the work would show chiefly at that age.

I visited a good many of the places where the drills were at work. It appeared that it was only when specially hard rock was being worked that the dust was very marked, and then only if the bore were directed upward. When the hole sloped down it was possible to keep a little water in it to prevent the dust flying out; but it seemed to me that the dust produced by the actual boring was not nearly so serious as that stirred up during the process of loading the trucks with the dirt loosened after a blast.

As regards a remedy for this serious danger to which the men are exposed, a spray (as suggested by the Miners' Union) was brought into use some years ago in the New Inkerman Mine, the management going to considerable expense to make a reservoir and lay water on to all the working-faces. It was found, as is often the case in dealing with dangerous work, that the principal obstacle came from the men themselves, who neglected to make use of the spray on the ground that it made everything wet and muddy. Any regulations enforcing the provision of sprays would therefore have to be supplemented by a penalty on the miners who neglected to make use of the apparatus provided.

This matter of dust from rock-drills is engaging the attention of the Home Office at present as regards the mineral-mines in Cornwall. A report of the Commission thereon will be published shortly, and meanwhile I do not propose to make any recommendation until I have seen this report; but this question of dust-prevention is, to my mind, the only sanitary matter on which any great improvement is required in the Reefton mines. One valuable suggestion has been made by Captain Richards—*i.e.*, that dressing-rooms be provided at the mine-head where the men may wash and change to dry clothing on leaving their work. This proposal, curiously enough, met with some opposition from the men, who thought it might be taken as a reflection on their honesty—in other words, that it meant a system of preventing the possibility of "specimen stone" being taken from the mine. This is, of course, absurd. The men should have lockers for their things, and advantage could be taken of the proximity of the engine to furnish means of drying the wet clothing and supplying hot water for washing. Such places are provided at many mines in England, where they are technically known as "dries." I believe, with Captain Richards, that such conveniences would go far to lessen the amount of lung-trouble among the men.

My recommendations generally are as follows:—

1. That no nightsoil be buried in the mines (already enforced).
2. That watertight iron pans be used in the privies, to be emptied at least once each week, and the use of dry earth or sawdust as a deodorant be enforced.
3. That the privies be placed on any level on which the Inspector of Mines may, on considering the number of hands there employed, deem such a convenience necessary.
4. That the mine-manager may be given power to prosecute any miner found misusing privies, or found defecating elsewhere in the mine than in such a privy.
5. That receptacles be provided in which the men are compelled to place waste scraps from their meals.
6. That mine-managers be warned as to the danger which sometimes arises from the evolution of gas when underground accumulations of water are disturbed.
7. That the matter of dealing with dust from rock-drills be left in abeyance till the action of the Home Office in the matter be learned.
8. That dressing-sheds with bathing facilities be provided at each mine-head.

Before concluding I should put on record the fact that the mine-managers in general readily gave me every facility in making my investigations, and appeared willing to adopt any suggestions towards improving the conditions under which their employees worked. So long as the safety and comfort of the workers are in the hands of one with so extensive a grasp of his subject, both in theory and practice, as Mr. Tennent, the Chief Inspector, and of so experienced a man as Captain Richards, Sub-Inspector, I do not think any very serious sanitary defects will be permitted in the mines.

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Approximate Cost of Paper.—Preparation, not given; printing (2,200 copies), £3.

By Authority: JOHN MACKAY, Government Printer, Wellington.—1904.

Price 3d.]